

The illustration features a large, dark blue umbrella held by a hand in a dark suit sleeve, positioned over a stylized city skyline. The city includes various buildings in shades of blue, orange, and red. In the foreground, four people are depicted in a green field, celebrating with their arms raised. The background is a blue sky with white clouds and rain falling from a dark, stormy cloud at the top. The overall theme is resilience and community support during challenging times.

Quarterly Newsletter of GEF China Sustainable Cities Integrated Approach Pilot Project

Issue 14 | December 2021

PROJECT PROGRESS (As of December 15, 2021)

MOHURD

■ **GEMH-01A: “Development and Application of TOD Policies, Technical Standards, and Management Tools in Chinese Cities”** - An online expert meeting was held on the morning of November 26, 2021, to review the development of the platform’s monitoring and impact assessment modules. The output report has passed expert review. The research team attended the Hunan Housing and Urban-Rural Development Construction Industry Consultation Conference on November 30, 2021. Taking the practical experience of national TOD platform as the primary case, capacity building activities with the theme of “task-oriented thinking and sharing of case studies in smart housing construction and informatization” were carried out.

Beijing

■ **GEBJ-1A: “Research on Financing a Tianjin Urban Rail Transit Project Applying TOD Principles”** - Preliminary work for Tasks 5 and 6 have been completed. Two public participation events focusing on small/micro spaces in Beiyuan Station and Dongsi Station, one public participation event focusing on ground-based public transit, and five capacity building events were carried out. Annual completion check is expected to be conducted in December.

■ **GEBJ-2: “Corridor-Level and Station-Level Application of TOD Strategy: Research on Optimization of Rail Transit Lines and Land-Use Based on TOD Principles”** - For Task 3, the development of a comprehensive design framework for key stations along Tongzhou-Miyun Line is underway. A milestone progress conference has

been conducted in October 2021, and the project design is being carried.

■ **GEBJ-3: “District-Level Application of TOD Strategy: Urban Regeneration of Life Science Park Near Jingzhang HSR and Changping Metro Line”** - Task 2 “The Comprehensive Planning and Transformation Study of the Urban Renewal Area around Rail Transit Stations” was submitted to the World Bank in October 2021. Task 3 “The Comprehensive Assessment of Environment and Social Impact on Urban Renewal Areas around Rail Transit Stations” is advancing well with completion planned for March-April 2022.

Tianjin

■ **GEFTJ-1: “Preparation and Implementation of City-level Transit-Oriented Development (TOD) Strategy and Project Management Support for Tianjin”** - Tasks 1, 3, and 4 have been completed. The implementation of Tasks 2, 5, 6, and 7 and subsequent tasks have been affected by the pandemic. The review of the final report is planned for completion in October 2022. Work related to Task 9 “Environment and Social Security” is currently being carried out.

■ **GEFTJ-2: “Research on Financing a Tianjin Urban Rail Transit Project Applying TOD Principles”** - The revised Evaluation of Financing for Urban Rail Transit in Tianjin, Research Summary of Financing TOD Project for Main Urban Rail Transit Stations in Tianjin, and Research Summary of Financing Urban Rail Transit Corridor Applying TOD Principles were submitted to the World Bank in September 2021.

■ **GEFTJ-3: “Tianjin Jianchangdao Area Rail Station - Planning and Design Research Project based on TOD Principles”** - An expert review for the Inception Report was completed on August 29, and the revision has been completed in September. On December 2, 2021, Task 1 “Status Analysis and Assessment” and Task 2 “Market Analysis Report” were completed, and an expert review was held. The consulting agency is currently revising the report in accordance with expert opinions.

Shijiazhuang

■ **GEFSJZ-1: “Preparation and Implementation of City-Level Transit-Oriented Development (TOD) Strategy and Project Management Support for Shijiazhuang”** - Relevant work for Tasks 5-7 has been completed, expert consultation for the Final Output Report was completed on October 29. The group meeting to solicit opinions for the final report was held on December 3. The final review is expected to be completed in mid-December.

■ **GEFSJZ-2: “Land Adjustment Plan for Shijiazhuang Urban Rail Transit Line 4”** - The first drafts of the research for Tasks 1 and 2 have been completed and submitted between September and December 2021, while work for Tasks 3 is underway. The research output for the first three tasks is expected for submission by the end of 2021.

■ **GEFSJZ-3: “Research on Applying TOD Strategies on Five Stations and Three Areas Located to the North of Shijiazhuang East Station”** - The Inception Report was reviewed on September 8, 2021, and research for the first three tasks is underway.

Nanchang

■ **GENC-1A: “Preparation and Implementation of City-Level Transit-Oriented Development (TOD) Strategy and Project Management Support for Nanchang”** - Task 7 Nanchang TOD Strategic Planning Report was submitted to the World Bank on November 3, 2021. The Nanchang PMO plans to hold a public seminar before the end of the year.

■ **GENC-2A: “Study of TOD Planning and Design for Rail Transit”** - The Overall Project Program Test and Feedback Report was submitted to the World Bank on September 1, 2021, an expert review was conducted on September 28, and the revised report has been submitted to the World Bank. The first draft of the Project Intensification Plan Report (Tasks 6-7) was submitted to the World Bank on November 3. A public seminar was held on November 19 to discuss the report. The revised report was submitted on November 29.

■ **GENC-3B: “Study of TOD-based Regional Planning around Rail Transit Stations”** - A contract was signed with a consortium formed by the China Sustainable Transportation Center and Beijing Urban Construction Group Co., Ltd. on September 7, 2021. A symposium on the Inception Report was held on September 24, which was then submitted to the World Bank on October 19. Work for Task 1 (the collection and analysis of the data required for the study of the TOD of stations along Rail Line 2 East Extension Section) is currently underway. The project team has conducted field research, surveys of relevant units, online data collection, and other activities. Another round of surveys of relevant was conducted in mid-November. In order to ensure the proper integration of the three projects, the PMO shared the research reports of the contracts with all research teams.

Ningbo

■ **GENB-1: “Study on TOD Strategies in Ningbo”** - Output reports for Tasks 5-6 have been completed, for which a public seminar for solicitation of comments will be completed in December and an expert review shall be carried out. The research team shall further optimize the outlines of the social and environment impact assessment and conduct relevant research work under the guidance of experts from the World Bank.

■ **GENB-2A: “Consulting Service regarding TOD Implementation for Kaiming Street (Yaoxing Street-Zhongshan Road), Xin Street, and Shuangliang Community”** - The implementation plan of the pilot project and Task 2 project strategy report is being revised. Requirements of environment and social impact assessments will be included into the project.

■ **GENB-2B: “Research on Financing Schemes of TOD Implementation for Kaiming Street (Yaoxing Street-Zhongshan Road), Xin Street, and Shuangliang Community”** - The compilation of special bond issuance documents, project implementation plan, Value for Money, financial feasibility, and projection of revenues for Private-Public Partnership are currently underway. The Joint Venture Agreement and Articles of Association of the company responsible for project implementation have been formulated.

■ **GENB-3: “Study of TOD-based Regional Planning round Rail Transit Stations”** - A completion report for Task 4 has been submitted, for which a public seminar and solicitation for comments will be completed in December and an expert review shall be carried out.

Guiyang

■ **GEFGY-1: “Preparation and Implementation of City-Level TOD Strategy and Project Management Support for Guiyang”** - The third stage of research work Guiyang TOD Implementation Plan and Greenhouse Gas Calculation Proposal was completed and passed expert review on October 14, 2021 and has been revised and improved in accordance with expert opinions. The fourth stage of research work is currently underway, and the primary urban TOD strategy report is being formulated.

■ **GEFGY-2: “Study on the TOD Comprehensive Development Planning for Areas along the Rail Transit Line S1 Phase I and Line 3 Phase I Project in Guiyang City”** - The solicitation of opinions was completed for Phase I, and the expert review was carried out on October 14, 2021. At the corridor level, the land utilization planning and layout of the area along the Line S1 and Line 3 have been refined. At the key station level, the TOD urban design plan of Huansha Road Station and Wenquan Road Station has been refined, and an initial TOD urban design concept was formulated for Luowan Station and Shubo Avenue Station.

■ **GEFGY-3: “Study on the TOD Comprehensive Development Planning for Areas along the Ring High-speed Railway in Guiyang City”** - The comprehensive development planning and research + transit integration planning of the areas along the ring high-speed railway have been completed. Opinions from participating units on outputs have been solicited. Expert review was completed on October 14, 2021. The conceptual urban design of Baiyun North Station, PPP conceptual design for key stations, and comprehensive development land security management methods and guidelines for urban public transit stations connected to the ring high-speed rail is in progress.

■ **GEFGY-4: “Strategic Environmental Assessment and Social Impact Assessment for TOD Planning and Research”** - A contract was signed in August 2021 and revised in accordance with the requirements of the World Bank. The Stakeholder Plan has also been submitted.

Shenzhen

■ **GESZ-1: “Preparation and Implementation of City-Level Transit-Oriented Development (TOD) Strategy and Project Management Support for Shenzhen”** - Research for Tasks 5-6 is being carried out. In terms of strategic environment and social impact assessment, a preliminary report outline has been created in accordance with the requirements.

■ **GESZ-2A: “Research for the Sustainable Development Planning and Construction Management of the Bainikeng Community Based on TOD Principles”** - Site-level urban design for Task 6 is being carried out. In terms of strategic environment and social impact assessment, the task outline of this section has been revised in accordance with the requirements.

PROJECT IMPLEMENTATION PROGRESS (As of December 15, 2021)

PMO	Activity	Draft TOR	Final TOR	Bidding Announcement	Shortlist Review	Bid Evaluation	Contract Negotiation	Contract Signing	Inception Report	Intermediate Output	Mid-term Report	Draft Final Report	Final Report
MoHURD	National TOD Platform												
Beijing	City-level TOD Strategy												
	Corridor and Station-level TOD Application												
	District-level TOD Application												
Tianjin	City-level TOD Strategy												
	Research on Private Sector Engagement in TOD Financing												
	District-level TOD Application												
Shijiazhuang	City-level TOD Strategy												
	Corridor-level TOD Application												
	District and Station-level TOD Application												
Nanchang	City-level TOD Strategy												
	Corridor-level TOD Application												
	Station-level TOD Application												
Ningbo	City-level TOD Strategy												
	District-level TOD Application												
	District-level TOD Application												
	Station-level TOD Application												
Guiyang	City-level TOD Strategy												
	Corridor-level TOD Application												
	Corridor-level TOD Application												
	Strategic Environmental Assessment for Corridor-level TOD Application												
Shenzhen	City-level TOD Strategy												
	District and Station-level TOD Application												

LEGEND

Colored cells indicate the progress of each project. Blue cells indicate progress from September 15, 2021 - December 15, 2021.

CAPACITY BUILDING AND ACADEMIC EXCHANGES

Under the joint guidance of Chengdu Municipal Transportation Bureau, Rail Transit Safety Technology Specialty Committee of the China Communications and Transportation Association, and the Rail Transit Branch of the Jiangsu Provincial Comprehensive Transportation Society, and the co-sponsorship of the Journal of Transportation Engineering and Information and Shine Consultant, the 2021 Rail Transit & Region Development Summit was held in Chengdu from September 3-4, 2021. The theme of the forum was “Optimizing the planning layout of urban clusters and metropolitan areas while driving transit and regional integration.” The summit discussed the topic of how to solve the difficulties faced by urban clusters and metropolitan areas in terms of the layout, planning, investment, and financing when building intercity and urban rail transit. Experts shared high-quality intercity and urban rail transit case studies and carried out further discussions centered around “new infrastructure” for new technology applications in rail transit informatization, networking, and smart construction. [\(Relevant Link\)](#)



(Image Source: Qianzhan.com)

Sponsored by the College of Architecture and Urban Planning of Tongji University, co-organized by the China Society of Natural Resources, China

Land Science Society, Urban Planning Forum, and Urban and Rural Planning, the Fourth United Planning (UP) Forum was successfully held through webinar and was livestreamed on September 3, 2021. Professor Geng Huizhi, Deputy Dean of the College of Architecture and Urban Planning of Tongji University, moderated the forum. The forum stated that when making spatial planning, experts should focus on safety and health of the city and optimize its ecological and production functions as well as its livelihood. [\(Relevant Link\)](#)

Co-sponsored by the China Academy of Urban Planning and Design, Guangdong Territorial Spatial Planning Association (formerly the Guangdong Urban Planning Association), Hong Kong Institute of Planners, and Macao Urban Planning Institute, the Guangdong-Hong Kong-Macao Greater Bay Area Planning Forum was held online and livestreamed on September 11, 2021. The theme was “Spatial transformation in the Bay Area from a green and low-carbon perspective.” Luo Yong, Chief Planner of the Guangdong Urban & Rural Planning and Design Institute, noted that by 2035, there will be hundreds of new regional railway stations constructed in the Greater Bay Area. Relying on these stations, combinations of TOD and urban function areas, such as commercial center + TOD, logistics center + TOD, industrial park + TOD, daily life commercial districts + TOD, and tourist resort + TOD, will be formed to facilitate a multi-center, interconnected, and homogenized transformation of the Greater Bay Area. [\(Relevant Link\)](#)

Co-organized by Peking University Territorial Planning and Design Institute and Peking University College of Urban and Environmental Sciences, a panel discussion on “Planning

Response towards Carbon Neutrality” was successfully held on September 27, 2021. At the event, Zeng Xiangkun, Senior R&D Director of Shenzhen LAY-OUT Planning Consultants Co., Ltd., expressed that feasible measures for achieving emission reductions in urban planning and construction include: (1) incorporating carbon reduction indicators into targets while performing cost-benefit analyses of different spatial structures; (2) strengthening cross-departmental coordination; and (3) developing and strengthening the concept of regional integration. Reducing carbon emission should be about the entire metropolitan area.

[\(Relevant Link\)](#)



(Image Source: m.planning.org.cn)

As one of the 2021 Annual Conference on Multinational Corporations Investment Series Activities in Guangdong - the Greater Bay Area Rail Transit Development Forum was held in Guangzhou on September 28, 2021. Over 120 people attended the forum. The forum was hosted by Guangzhou Municipal People’s Government and jointly organized by Guangzhou Municipal Development and Reform Commission, Guangzhou Metro Group, and Guangzhou Railway Transportation Industry Alliance. With the theme of “Advancing a High-quality Development of Rail Transit in the Greater Bay Area,” the forum showcased the layout, market opportunities, and industrial development direction of the Greater

Bay Area as well as the rail transit planning of Guangzhou during the 14th Five-Year Plan period.

[\(Relevant Link\)](#)



(Image Source: www.dayoo.com)

Sponsored by the China Association of Metros, the International Metro Transit Exhibition & Forum 2021 (Beijing) was held at the China International Exhibition Center (Jing’an Zhuang Center) from October 9-11, 2021. Over 300 exhibitors and nearly 20,000 visitors attended the event. In addition to the primary forum, 10 sub-forums and a series of special forums (including the Smart Urban Rail Innovation Forum, Urban Rail Investment & Financing Innovation and REIT Development Forum, and the first China Independent Research and Development of Urban Rail Transit Equipment and Achievement Exhibition) were also held. The Industry Department of the National Development and Reform Commission also attended the exhibition. [\(Relevant Link 1\)](#), [\(Relevant Link 2\)](#)



(Image Source: National Development and Reform Commission)

The Fourth TOD Innovation Forum sponsored by Metro Land Corporation was held in Beijing on October 10, 2021. Focusing on the theme of “Transforming from urban rail to rail-oriented cities,” the forum discussed hot topics, difficulties, and pain points during the development of urban rail transit and the implementation of TOD policies and projects. Gao Yixuan, President of Metro Land Corporation Ltd., said that TOD has returned to a rational condition, it is no longer regarded as a tool for rapid turnover in real estate. TOD is now truly considered a key component of urban development.

[\(Relevant Link\)](#)



(Image Source: The Beijing News)



(Image Source: Beijing Daily, Sohu)

Under the guidance of the Hangzhou International Urbanology Research Center and co-sponsored by Vanke Zhejiang, Dushikuaibao, and the RT Rail Transit, “Tracks and Trends” – the Third Urban TOD Forum 2021 was held at the Sky Experience Center on October 18, 2021. Liang Bingjian, Deputy Chief Planner of Beijing Urban Construction Exploration & Surveying Design Research Institute Co., Ltd., and Chief Planner of the Architectural Planning Institute, expressed his belief that elements of TOD must be interconnected in order to be effective. In other words, TOD should not be limited to the railway superstructures developed by railway companies. TOD should also be integrated with the development of surrounding cities. Business development, travel distance, and cultural and historical traditions of the area should also be taken into consideration to ensure that each station serves as a micro-center in that area.

[\(Relevant Link\)](#)



(Image Source: www.zj.chinanews.com.cn)

Co-sponsored by the Urban and Small Town Reform and Development Center of the National Development and Reform Commission, UN-Habitat, and Chengdu Municipal People’s Government, the Fifth International High-Level Forum of Sustainable Urban Development and Belt and Road Sustainable Cities Alliance Roundtable were held in Chengdu on October 26, 2021. The forum issued the Consensus on Green Urbanization.

This Consensus emphasized the promotion of green urban construction, the optimization of urban spatial morphology and infrastructure supply, the promotion of demarcation of urban development boundaries, and the facilitation of infill and intensive development. It also promotes the transit-oriented development (TOD) model, as well as small community blocks, dense road networks, and mixed-use development. Cities should strongly push the development of green buildings forward, advance the utilization of renewable energy, and construct a complete and efficient infrastructure to collect and recycle rainwater and waste.

[\(Relevant Link 1\)](#), [\(Relevant Link 2\)](#)



(Image Source: The Paper)

Co-hosted by the Ministry of Housing and Urban-Rural Development (MOHURD), Shanghai Municipal People's Government, and UN-Habitat, 2021 World Cities Day China Observance was held in Shanghai from October 30 - November 1, 2021. It was also the First SDG Cities Global Conference. The theme was "Adapting Cities for Climate Resilience". On November 1, Shanghai Municipal People's Government issued the Shanghai Self-Evaluation Report on the Implementation of the United Nations 2030 Agenda for Sustainable Development, (hereafter as the Shanghai Report). The Shanghai Report introduced the concepts and strategic layout of sustainable development in China and included guidance on how to promote

sustainable development concepts. The report outlined the alignment between Shanghai's urban development and the Sustainable Development Goals (SDGs), which included the definition of "Better City, Better Life" and introduced the practical concepts and strategies in terms of "Cities by the People and for the People," "Four Key Functions," and refined urban management.

[\(Relevant Link\)](#)



(Image Source: Xinhua News Agency)

Under the guidance of Sichuan Provincial Communist Youth League and co-hosted by Chengdu Municipal Communist Youth League, Chengdu Rail Transit, and the Organizing Committee of the "Future Designer" National College Digital Art and Design Competition, the Award-winning Works Exhibition of the Chengdu TOD Youth Design Competition was held in the TOD City Smart Hall on November 12, 2021. The exhibition included works that expressed the positive thinking and vivid imagination of nearly 20 university students regarding the transit-oriented development of Chengdu. Organized under the theme of "TOD Vision Guided by Youthful Wisdom," the competition was the first in the country to focus on transit-oriented development at a university level. [\(Relevant Link\)](#)



(Image Source: www.jiemian.com)

The 26th UN Climate Change Conference (COP26) was concluded in Glasgow, UK, on November 14, 2021. Nearly 200 countries jointly agreed to the Glasgow Climate Pact. At COP26, signatory countries also approved provisions related to the implementation of the international carbon market outlined in the Paris Agreement. The provisions dealt with how signatory countries could use the international carbon trading market to reduce their carbon emissions. The latest agreement introduced new rules for carbon trading at a national level, in which governments could achieve emission targets by funding emission reduction projects in

other countries. Officials expect these rules to lay the foundation for the international carbon trading market. As the world’s largest developing country, China has strengthened its Intended Nationally Determined Contributions (INDCs), accelerating the development of the “1+N” policy system, actively explored new models of low-carbon development, and made contributions to furthering global climate governance and addressing climate change. [\(Relevant Link\)](#)



(Image Source: The Paper)

INDUSTRY NEWS

Metropolitan Areas Along Rail

Shenzhen Metro Group Company Limited (SZMC), a municipal state-owned enterprise, held a TOD brand launch conference on October 13, 2021. The SZMC TOD industry-city integration model relies on the advantages of the integration of national, intercity, and urban rails to link the Greater Bay Area with core areas of Shenzhen and promote industrial development. This project will efficiently integrate all core elements of Shenzhen's industry chain and facilitate the development of cities and metropolitan areas along the rail. ([Relevant Link](#))

TOD Integration Project Development

Hangzhou Public Resources Trading Platform issued a bidding announcement for the "Hangzhou Rail Transit Phase IV TOD Integration Utilization Special Planning Service Project" on October 22, 2021. The announcement noted that the planned route/site crosses around 50 plots with an estimated land area of 160 ha (2,400 mu) across a total of 139 sites. The announcement also proposed 30-40 sites for the centralized development and utilization of TOD with an estimated land area of 1200 ha (18,000 mu), along with 9 depots with an estimated land area of 700 ha (10,500 mu). Phase IV of the Hangzhou Rail Transit construction plan is made up of 12 projects, including 5 new projects and 7 extension projects, with an estimate total scale of 244.8 km. The announcement clearly outlines the key development areas and spatial layout of all sites at all levels. ([Relevant Link](#))

As of November 15, 2021, the construction of Foshan Urban Rail Transit Line 2 Project – Phase I has mostly been completed. Handover procedures for stations, rail transit areas, railyards, and depots

have been completed. Trial operations started on August 18, 2021. Phase I of Foshan Urban Rail Transit Line 2 has a total length of 32.4 km passing four districts of Guangzhou and Foshan. Line 2 starts from Foshan Nanzhuang Station to Guangzhou South Railway Station. There are 17 stations on Line 2, 14 of which are underground, 3 of which are elevated, and 10 of which are transfer stations. ([Relevant Link](#))

On September 27, 2021, Chengdu Rail Transit announced that it would launch the construction of 10,000 affordable housing units in its TOD project in 2021 and would continue to implement more affordable rental housing projects in the future. At present, as part of the first batch of demonstration projects, the Shuangfengqiao TOD project has been included in the affordable rental housing construction plan. ([Relevant Link](#))

On September 30, 2021, the groundbreaking ceremony for the Xingfu Depot and Platform Construction (TOD) Project of Nantong Urban Rail Transit Line 2 – Phase I was held in Nantong, Jiangsu. The Project is located in Xingfu Town, Chongchuan District with a total land area of 319,300m². It consists of a depot with a gross floor area of 92,400m² and a 2-story railway superstructure with a gross floor area of 310,900m². The Xingfu Depot 01 contract undertaken by a consortium made up of CREC No. 4 and Nantong Construction Group Co., Ltd. is primarily made up of a 2-story railway superstructure and 10 buildings ([Relevant Link](#))

On October 28, 2021, a press conference for Shanghai's first TOD commercial complex, the Sky City, was held in Shanghai. Developed by Vanke (Shanghai) and Shentong Assets, the project is a

subway superstructure of Xuying Road Station on Line 17 with a gross floor area of around 800,000m², including a 100,000m² commercial land, the headquarters of China Hongqiao Group, a residential area, apartments for rental purpose, a kindergarten, and a riverside park. The project will be the first TOD commercial complex in China.

[\(Relevant Link\)](#)

Transport Hub Development

On October 8, 2021, Sichuan's 2021 Q4 projects started constructions. The Bazhong East Railway Station TOD project marked the start of this new phase. The project represents a total investment of CNY 10 billion. Its construction duration is from 2021-2031. The Bazhong East Railway Station TOD project will be constructed as “the new hub for Sichuan and Shaanxi and the guest meeting room for the Qinba region” following the concept of industry-station-city integration. It is the first high-speed rail TOD project in the province. Centered in Bazhong East Railway Station, the project will develop comprehensively a total of 100 ha of land surrounding the station. After the project is completed, it will serve over 100,000 residents and create over 20,000 new jobs in the area.

[\(Relevant Link\)](#)

As of November 11, 2021, the civil construction component of the Gangxia North Integrated Transit Hub in Futian District will be completed by the end of the year and will start its operation next year. The Gangxia North Integrated Transit Hub is a transfer hub for Metro Lines 2, 10, 14, and 11. It is the largest single rail transit project in China. The Gangxia North Hub is also a super underground project. The underground development of the project has been carried out along with the hub construction. A bus terminal and a taxi transit

station will also be built as the transit hub's supporting facilities. The underground spaces of the transit hub, Shennan Road, and Caitian Road are interconnected, which form a convenient and comprehensive transit system.

[\(Relevant Link 1, Relevant Link 2\)](#)

As of November 15, 2021, the Dayun Comprehensive Core Transit Hub, the largest integrated transit hub in eastern Shenzhen, has entered the main building construction stage and is expected to be completed and put into operation in 2022. In the future, the hub will connect Metro Lines 3, 14, and 16, along with Line 4 of the Shenzhen–Dayawan intercity railway. Located to the south of Hefeng Road in Longgang District, west of Longgang Avenue, east of Guiping Road (planned), and north of Hexin Road (planned), Shenzhen Dayun Hub is a large-scale transit hub that integrates subway, intercity, bus, and other connection facilities. The hub covers a total area of 60,000m² and features a planned gross floor area of 173,200m². [\(Relevant Link\)](#)

TOD Town Integration Development

On October 9, 2021, Shentong Metro Group and Changxing Island Development Office of Chongming District (Shanghai) held a discussion on the Chongming Line and Metro Town. Two parties signed a framework agreement for TOD project cooperation of Changxing Island Station on Chongming Line. The Changxing Island TOD project is located in the core area of Changxing Island and next to the rail transit station.

[\(Relevant Link\)](#)

On November 10, 2021, the first session of the 17th National Congress of Shunde District, Foshan began. Acting District Chief Ou Zhuming delivered a government work report. The report outlined that Shunde will build an interconnected three-dimensional transportation system which will help Shunde fully integrate into the Greater Bay Area's 1-hour traffic circle. Specific measures include accelerating the construction of Foshan Metro Line 11 and actively pushing key projects forward, such as Zhaoqin-Shunde-Nansha intercity and Nansha Port Railway. Shunde should also conduct in-depth research on how to better connect more Guangzhou subway lines to Shunde and strengthen the connection with the Shenzhen–Zhongshan Bridge and Shiziyang Channel. The report also mentioned that Shunde will advance the upgrade and renovation of roads in towns and villages in order to realize all towns and streets are connected.

[\(Relevant Link\)](#)

Carbon Neutrality and Green Financing

On November 19, 2021, the “State Power Investment Corporation Limited 2021 New Energy No.4 Phase 1 Green Targeted Asset Commercial Paper (Carbon Neutral Bond)” was issued in the interbank market, with Bank of China and China Merchants Bank as the lead underwriters. The product is backed by CNY 8.434 billion at an AAA rating with an expected maturation date of February 17, 2022 and issued interest rate of 2.65%. The carbon neutrality project requires that underlying basic assets should belong to the following categories: (1) clean energy projects (including solar, wind, and hydro power); (2) clean transportation projects (including urban rail transit, electrified freight rail, and electric bus replacement); (3) sustainable construction projects (including green construction, ultra-low-energy buildings, and energy-saving renovation of existing buildings; and other projects with benefits to carbon emission reduction. [\(Relevant Link\)](#)

POLICY CHANGES

Industry Standards

On September 30, 2021, 23 departments (including the NDRC) jointly issued the *Guiding Opinions on Facilitating the Construction of Child-Friendly Cities* (No. 1380 [2021] of the NDRC). This Guiding Opinions indicates that all regions should aim to build child-friendly cities. To achieve this goal, regions should formulate standards for planning and construction of urban child-friendly spaces and facilities, enhance the layout of urban functions, optimize the design of public spaces, drive urban construction to adapt the physical and mental development of children, and meet the demands of child-oriented services and activities. In transit development, all regions should improve their slow traffic systems¹, optimize the planning of pedestrian routes and facilities around campuses, and ensure road safety for children. Regions should also enhance the accessibility for urban public transit stations and streets, strengthen traffic safety education, and improve the travel safety of children. ([Relevant Link](#))

“14th Five-Year Plan” – Transit Plans

On September 20, 2021, the General Office of Jiangsu Provincial People’s Government issued a notice on the *Jiangsu’s 14th Five-Year Plan for Railway Development and the Mid-and Long-Term Layout Planning for the Railway Roadmap*. The overall goal of the Plan is to complete the construction of Jiangsu on the rail by 2035. To achieve this goal, a modern direct railway network that covers all counties and cities in Jiangsu will be initially built during the 14th Five-Year Plan period.

The railway network shall reach key urban clusters across the country from Nanjing in 4 hours and its surrounding urban clusters in 3 hours. Within this network, traveling between districts and cities in Jiangsu should take 2 hours and commuting among the metropolitan area will be 1 hour.

([Relevant Link](#))

On October 11, 2021, the Guangzhou Municipal Transportation Bureau officially issued *The 14th Five-Year Transportation Plan of Guangzhou*. According to the Transportation Plan, during the 14th Five-Year Plan period, Guangzhou’s transportation industry will reach carbon peak. Moreover, Guangzhou facilitates the next-generation construction of national central city and integrated gateway city, promote the integration of Guangzhou and Foshan, Guangzhou and Qingyuan, and Guangzhou and Dongguan. Guangzhou will also support the development of the Guangdong-Hong Kong-Macao Greater Bay Area.

([Relevant Link](#))

On October 13, 2021, the General Office of Fujian Provincial People’s Government issued the *Special Plan for Urban-Rural Infrastructure Construction of Fujian Province during the 14th Five-Year Plan Period* (No. 52 [2021] of the General Office). This special plan outlined that by the end of the 14th Five Year Plan period, Fujian will establish a high-quality urban-rural infrastructure system that is convenient, livable, green, safe, and smart. It requires Fujian Province to focus on the construction of a fast rail system connecting the Fuzhou metropolitan and Xiamen-Zhangzhou-Quanzhou metropolitan, and accelerate

¹ The slow traffic system refers a type of urban traffic system that put walking, biking, and public transportations as the main urban transportation methods.

the construction of the Fuzhou – Changle Airport Intercity Railway (Line F1) as well as the transfer system for the Fuzhou Changle International Airport and Fuzhou–Xiamen HSR transport hubs. Fujian will continue working on the Phase II of the Fuzhou Rail Transit Construction Project and its revision project and will start the construction of Phase III. During the 14th Five-Year Plan period, Fujian will complete the restoration of South Jiangbin East Boulevard along with the construction of 5 large Park and Ride in Fuzhou. The Plan includes 16 major (inter)city rail transit projects representing a total investment of CNY 273.1 billion, and 131 major transit facility projects representing a total investment of CNY 154.8 billion. ([Relevant Link](#))

On October 18, 2021, the Chongqing Municipal People’s Government issued the [14th Five-Year Comprehensive Transit Plan for Chongqing \(2021-2025\)](#). This transit plan outlines that by 2035, Chongqing will complete the construction of Chongqing on the Rail, which includes a 1-hour commuting circle in the primary metropolitan area. The Plan aims to establish the interconnection of districts within the metropolitan area and between metropolitan area and its surrounding cities as well as to actively drive the equal sharing of transit services. ([Relevant Link](#))

On October 25, 2021, the Huangpu District People’s Government of Guangzhou issued the [Transit System Construction Plan in Huangpu District and Guangzhou Development District during the 14th Five-Year Plan Period \(2021-2025\)](#). This document outlines that Huangpu

will continuously work on 40 (expanding to 79 in the near future) transit projects. Huangpu District will promote the comprehensive and high-quality development of its cities and the cities in Guangzhou Development District. The Special Plan aims to integrate Huangpu and Guangzhou Development District into the Greater Bay Area’s 1-hour economic zone. One of the objectives of the Special Plan is to achieve “60-30-30” at the regional level. In order to achieve this objective, Huangpu will optimize the structure of resident transportation methods, and construct an advanced public transit system with rail transit as the backbone, buses as a primary component, and taxis and bicycles as supporting components. ([Relevant Link](#))

On November 25, 2021, Nanjing Municipal Party Committee and People’s Government issued the [Urban-Rural Construction Plan of Nanjing during the 14th Five-Year Plan Period](#), which outlined that the 1-hour transit circle will have at least 80% completion by 2025 and the urban rail coverage will reach over 550 km. Nanjing will accelerate the construction of friendly community spaces for all ages. Nanjing will also push forward the comprehensive development of underground spaces in major districts, such as Jinagbei Core District and Zidong Core Area. From 2020 to 2025, Nanjing will build a total underground space of no less than 4,000,000m² and underground pipeline corridors of around 60 km in length per year. ([Relevant Link](#))

² 60 minutes to the main cities in the Greater Bay Area, 30 minutes to Baiyun Airport, Guangzhou South Railway Station, Guangzhou East Railway Station, and other key transit hubs, and 30 minutes to the Guangzhou’s city center.

Rail Transit Development

On September 28, 2021, Zhejiang Provincial Development and Reform Commission issued a notice on the *Opinions on Facilitating a Healthy and Sustainable Development of Rail Transit in Zhejiang*. This document has five primary segments: (1) optimizing the overall planning of railway networks; (2) orderly developing intercity and suburban-urban railways in the metropolitan area as well as rationally developing urban rail transit, and utilizing existing railways to operate commuter rail; (3) strengthening credit risk management and control, ensuring project financing sources, expanding financing channels, and strengthening comprehensive land development efforts; (4) standardizing project implementation, clarification of adjustment processes, and adjustments of construction planning; and (5) optimizing efficiency of transit organization, refining service operations, and encouraging diversified operations. [\(Relevant Link\)](#)

On September 28, 2021, the *Special Plan for Comprehensive Transit in Hangzhou (2021-2035)* was approved by the municipal government. The Plan is made up of 14 segments, including general principles, transit development strategies, and safeguards. The scope of this document covers the entire city of Hangzhou. The Plan outlines key aspects of Hangzhou's external transportation, urban transit, hub system, public transit, pedestrian and non-motorized vehicle transit, road network, parking system, tourist transit, and smart transit. [\(Relevant Link\)](#)

On September 30, 2021, Beijing Municipal Commission of Planning and Natural Resources issued the *Fire Protection Design Guidelines for Beijing Sub-Center's Comprehensive Transit Hubs*. The guidelines can be applied to the fire protection design and its safety assessment of the underground space its connected ground space. This guidelines not only provides efficient solutions for technical problems caused by spatial integration and station functions, but also reference for projects' design, assessments, and constructions. [\(Relevant Link\)](#)

On October 22, 2021, the Hangzhou Municipal People's Government issued the Special Plan for the Comprehensive Utilization of Rail Transit in Hangzhou (Draft). The scope of this *Special Plan (Draft)* covers the entire area of Hangzhou. According to the Special Plan, Hangzhou will be divided in to 6 districts and 21 special districts based on the metro plan by 2035. The city will complete 30 – 40 TOD projects by the same year. [\(Relevant Link\)](#)

On December 9, 2021, the Beijing Municipal Commission of Planning and Natural Resources issued a solicitation of public opinions for the *Beijing Rail Transit Network Plan (2020-2035)*. The publicity period is 30 days. The Plan outlines that Beijing should construct a people-oriented, integrated network and facilitates high-quality urban development. The total scale of the planned network is approximately 2673 km, including 1095 km of regional express lines and 1578 km of urban rail transit. The Plan also seeks to increase the green transit to over 80%. More specifically, rail transit in central urban area and city sub-center will account for over 27%, and corridor rail transit will account for over 40%. [\(Relevant Link\)](#)

Urban-Rural Planning and Construction

On October 21, 2021, the General Office of the CPC Central Committee and the General Office of the State Council issued the *Opinions on Promoting Green Development in Urban-Rural Construction*, which outlined that through facilitating urban-rural integrated development, transforming urban-rural construction and development methods, and proposing innovative methods, by 2025, institutional green development mechanisms and policy systems for urban-rural construction shall be basically established. Significant results in the green transformation of construction methods shall be achieved. Carbon emission shall be further reduced. Problems of urban diseases shall be alleviated. There will be improvements to the overall quality of the urban-rural ecosystem, significant improvements to the quality of urban-rural development and the capacity of resources and the environment. By 2035, green development in urban-rural construction and rapid reductions of carbon emissions will be realized. ([Relevant Link](#))

On November 26, 2021, the State Council issued the *Opinions on Facilitating High-Quality Development of Beijing Sub-Center*. This document mentioned that Beijing will strengthen its environmental governance. The Opinions also included the construction of a convenient, efficient, and modern transit system in the city's sub-center. More specifically, relevant departments should build a smart and integrated public transit system with rail transit as the backbone. ([Relevant Link](#))

On November 29, the People's Government of Sichuan Province issued the *Chengdu Metropolitan Area Development Plan*. This document outlines the transformation of Chengdu on the rail through constructing a multi-level rail transit network with Chengdu as the central hub and utilizing

arterial railways, intercity railways, suburban-urban railways, and urban rail transit. Chengdu also aims to construct a 1-hour commuting circle and accelerate the transformation of the Chengdu Railway Hub loop line. The Transportation Department should make full use of the surplus capacity of existing railways for suburban-urban rail transit and orderly develop suburban-urban railways. The Plan also mentioned that Chengdu should consider connecting adjacent towns and cities in Deyang, Meishan, and Zhiyang through railways and construct a commuter rail system in the Chengdu Metropolitan Area with Chengdu Station, Chengdu East Station, Tianfu Station, Jianzhou Station, Deyang North Station, Meishan North Station, and Ziyang North Station as main transfer stops. ([Relevant Link](#))

Carbon Neutrality and Carbon Peak

On October 26, 2021, the State Council issued the *Action Plan for Carbon Dioxide Peaking before 2030*. The document outlines 10 key tasks and required carbon peaking throughout the entire process and all aspects of economic and social development. All sectors should focus on green and low-carbon energy transformation. The Action Plan requires that by 2025, the proportion of non-fossil fuel energy consumption will be around 20%. Energy consumption per unit of GDP and carbon dioxide emissions per unit of GDP will reduce by 13.5% and 18% respectively comparing to 2020. It also requires that by 2030, the proportion of non-fossil fuel energy consumption will be around 25%. Carbon dioxide emissions per unit of GDP drop by over 65% comparing to 2005. ([Relevant Link](#))

Comprehensive Land Development

On November 19, 2021, the Municipal Planning and Natural Resources Bureau of Shenzhen announced the publicity for the *Underground Space Utilization Plan of Shenzhen (2020-2035) (draft)*. This draft will have a publicity period of 15 days. The objective of the Plan is to optimize Shenzhen's urban structure as well as fully utilize its urban spaces and functions. To achieve this objective, relevant authorities should make an efficient, quality, and sustainable use of the underground spaces in Shenzhen. ([Relevant Link](#))

Territorial Spatial Planning

On November 17, 2021, the Beijing Municipal Commission of Planning and Natural Resources issued a solicitation of public opinions on the short-term territorial spatial plan of Beijing. The primary function of the *Beijing Territorial Spatial Plan (2021-2025) (Draft)* is to further implement the city's overall planning and provide guidance. The objectives include but not limited to strengthening Beijing's strategic position as the country's capital, further adjusting Beijing's structure, and promoting green development. ([Relevant Link](#))

On November 26, 2021, Nanning Municipal Commission of Planning and Natural Resources issued a solicitation of public opinions on the draft of the *Nanning Territorial Spatial Master Plan (2021-2035)*. The period of publicity is November 26 - December 25. The Plan outlines that Nanning will construct a 1-hour economic circle in the central city area to service a total of 8-9 million residents. The circle should cover basic education, home care, and basic medical facilities in urban communities. Centered around major towns and small/med-size cities, 22 30-minute transit circles will be constructed. Most towns will be equipped with primary schools, childcare, cultural and sports facilities, and clinics. Small/med-size cities and major towns will have middle schools, culture and sports facilities, and eldercare center. ([Relevant Link](#))

SPECIAL DISCUSSION

TOD Principles and Urban Resilience



1. INTRODUCTION

In July 2021, floods caused by extreme rainstorms struck both Henan, China and Western Europe. The record-breaking and continuous heavy rainfall caused huge loss of life and damage to property. The Blue Book on Climate Change in China 2021 issued by the China Meteorological Administration pointed out that the heavy rain in Zhengzhou and severe flooding in Europe were not isolated cases. The risk of extreme weather and climates has been further exacerbated by global warming, and urban infrastructure is facing greater pressure from extreme events.

As such, how urban development can enhance resilience and guarantee normal operations under the impact of climate change and natural disasters has become a key topic that requires urgent study. As a method of large-scale development and construction incorporating underground transit hubs, underground connecting spaces, and other facilities that are easily affected by flooding, there is a greater need for TOD to incorporate urban resilience in compact, accessible, and high-density built environments in response to the disaster risks. In this issue, we will introduce and analyze the concept of urban resilience along with natural disaster risk assessment and prevention measures in vulnerable urban spaces with the goal of providing inspiration to TOD principles in meeting the challenges of climate change.

2. URBAN RESILIENCE

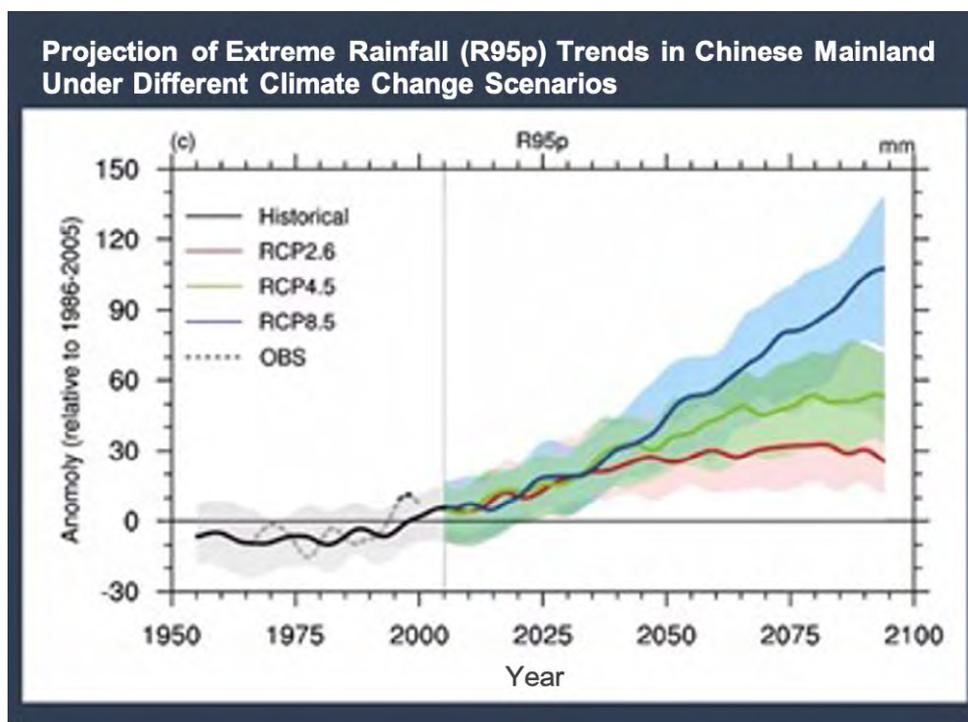
The United Nations Conference on Housing and Sustainable Urban Development (Habitat III) held in 2016 advocated for “urban ecology and resilience” as one of the core elements of the new urban agenda. The core characteristics of urban resilience include (1) diversity: the ability of urban systems to resist multiple threats through functionally distinct components; (2) redundancy: enhancing the reliability of urban systems through multiple fail-safes; (3) robustness: improving the ability of cities to confront and respond to external impacts; and (4) resilience: the reversibility and reducibility of urban built environments, along with capacity for self-recovery.

The concept of urban resilience has also seen increased interest from the field of urban planning. The concepts and strategies of resilient urban planning are widely used in areas such as climate change response and disaster risk management which emphasizes on enhancing adaptability and innovation to improve the resilience of urban systems in the medium and long term. Resilient urban planning focuses more on software/hardware integration, coordination of various departments, and establishment of a multi-level management platform and engagement with community partnerships to make up for the shortcomings of any individual system.

Given that resilient urban planning needs to consider floods, droughts, high temperatures, earthquakes, and a variety of other disaster risks that are bound to increase in frequency, understanding the sensitivities and vulnerabilities of urban systems to such changes is of particular importance.

3. DISASTER RISK MANAGEMENT OF URBAN RAIL IN RESPONSE TO FLOODING

Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX, 2012) by the Intergovernmental Panel on Climate Change (IPCC) pointed out that given the increasing impact of human activity on the rising global temperature, extreme climate events such as droughts and heavy rainfall will become more frequent. A joint study by the National Climate Center and the Chinese Academy of Meteorological Sciences in 2015 concluded that by the end of the century, the frequency and intensity of extreme rainfall (R95p) in Chinese Mainland would increase significantly compared to the past (1986-2005).

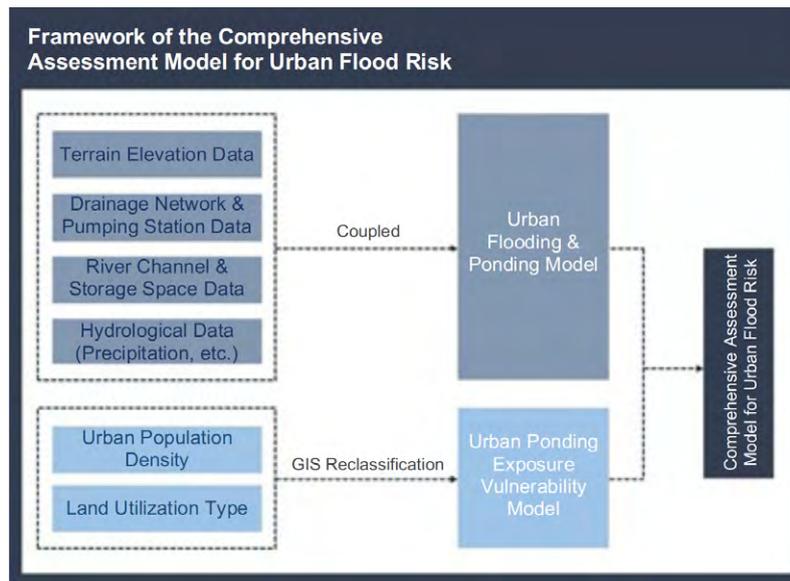


Projection of medium and long-term changes to extreme rainfall in Chinese Mainland
Image Source: [Ying et al. \(2015\). Change in Extreme Climate Events Over China Based on CMIP5. Atmospheric and Oceanic Science Letters ,8\(4\), 185-192](#)

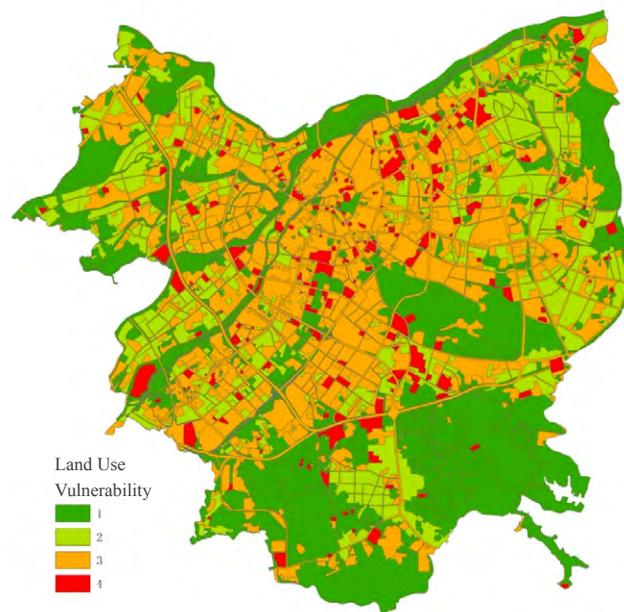
From a technical and economic perspective, it is infeasible for urban management to safeguard against natural disasters with a low probability of occurrence through massive investments and large-scale engineering projects. This approach is inconsistent with the concept of urban resilience. Practices advocated by the international community include risk assessments for natural disasters that exceed design standards, issuing disaster warnings in advance, assisting decision-making for disaster prevention, and guiding citizens to effectively avoid disasters.

Comprehensive Assessment Model for Urban Flood Risk

The first step in urban flooding disaster prevention and mitigation is to simulate and evaluate the flood risk in urban built environments based on a comprehensive assessment model for urban flood risk and geographic information systems. This model consists of two parts. First, simulate urban vulnerability to ponding using population density and construction land types. Second, calculate hazard factors such as the range, depth, and time of urban flooding using the hydrological model. Model results are derived from coupling and overlaying flood vulnerability to accurately identify the spatial distribution of flood risks, evaluate danger to infrastructure and users, and effectively guide the disaster prevention and mitigation efforts of rail stations and lines.



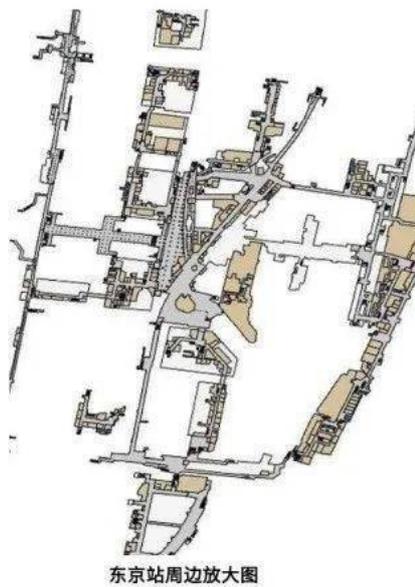
Framework of the Comprehensive Assessment Model for Urban Flood Risk
Image Source: [Infrastructure Research Center, CAUPD Shenzhen](#)



Vulnerability classifications of land types in the central urban area of Dongguan
Note: The higher the vulnerability, the greater the impact of flooding on the region.
Image Source: [Infrastructure Research Center, CAUPD Shenzhen](#)

Digital Mapping of Underground Spaces

In addition to surface environments, flood warning and assessment in urban areas must also consider the vulnerable underground spaces. As TOD involves the large-scale construction and development of underground transit hubs, it is critical to understand the structure and connectivity of underground spaces with regard to disaster prevention and mitigation. The Japanese government is currently engaged in the development of indoor geospatial information technologies to realize indoor and underground spatial navigation. The digital underground map covers an area of 1km from east to west and 2km from north to south, with Tokyo Station at the center and 7 other rail stations. The map includes data such as the number of underground floors, slopes, and other general pedestrian traffic information to provide accessible routes for users with limited mobility in the event of a disaster, and the location, usage status, and route to temporary shelters for local evacuation (along with alternative routes accounting for traffic congestion).

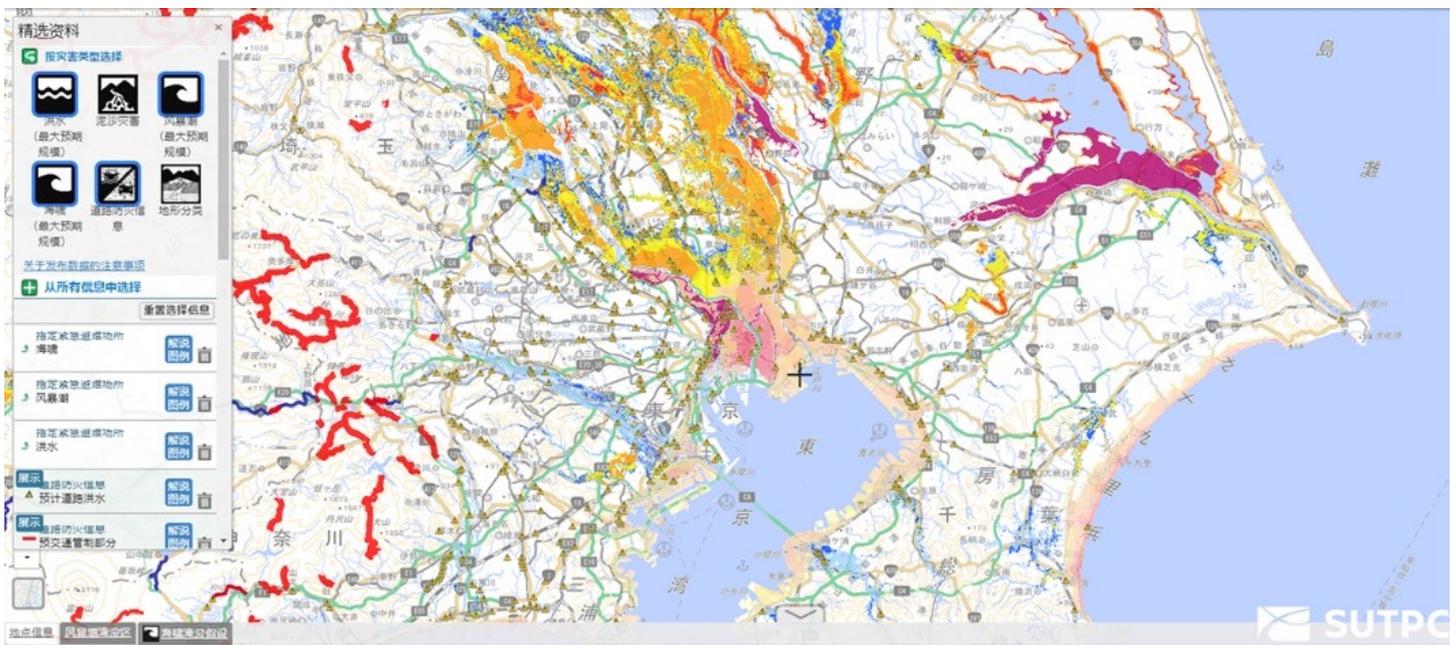


- 地图中包含的信息
- 男厕所
 - 女厕所
 - 多功能厕所
 - 楼梯
 - 直梯
 - 扶梯
 - 坡道
 - 室内功能空间

※公益財団法人交通生态学・移动性财団の象形图引用

Digital map of Tokyo underground
Image Source: [Ministry of Land, Infrastructure, Transport and Tourism \(Japan\)](#)

In addition to understanding the underground spatial structure, Tokyo Metro emphasizes the joint prevention and control of flood control work. By integrating climate, surface, and underground data, Tokyo Metro has also developed a flooding simulation and retrieval system through joint agreements with subways, underground streets, and connecting buildings. Based on the simulated flood arrival time of the embankment breach, maximum flood depth, and a three-dimensional layout of the station, the system jointly formulates a targeted flood protection plan and emergency measures. At the national level, Japan attaches importance to the timeliness and comprehensiveness of data. The country has integrated storm surges, floods, and other events into an overlay danger map, along with rainfall, river water level, and surveillance cameras into a river disaster prevention platform to provide society with flood forecast maps and real-time monitoring information in various regions while facilitating disaster information communication.



Overlay danger map of the Tokyo area

Image Source: [Infrastructure Research Center, CAUPD Shenzhen](#)

Regulations and Measures for the Prevention of Rail Transit Flooding

In addition to the forecasting and early warning of urban flooding disasters, the increasing frequency and intensity of disasters in recent years makes it necessary to ensure the safety of facilities and personnel in urban rail transit through policies, regulations, and flood control measures. According to incomplete statistics, in the past 10 years, there have been a total of 19 incidents of flooding in subway stations or lines across 11 cities in Chinese Mainland. In specific, 2016, 2020, and 2021 had witnessed the most subway flooding incidents, with June and July being the peak periods (79%). The average 6-hour rainfall of the 19 incidents was 90.6mm, the average 24-hour rainfall was 133.4mm, and the average rainfall level was above “heavy rainstorm”. Heavy

rainfall caused rainwater to pour through the station entrances, burst through the retaining wall of rail yards, block the station entrance and the retaining wall of the foundation, and pour into the mainlines or stations. The impact was slightly lighter for 10 of the incidents, of which most were handled through the emergency closure of station entrances with continued normal operations (or simply bypass the relevant stations). The line area was flooded in 4 incidents, resulting in the suspension of that section or a redirection of the route. There was a serious impact in 3 incidents, resulting in the shutdown of multiple lines or even the entire network.

City	Time	Line/Station	Event Impact	Precipitation in 6 hours (mm)	Precipitation in 24 hours (mm)
Beijing	June 23, 2011	Taoranting Station	Entrance D closed, normal operations	70.1	80.3
	July 21, 2012	9 lines, 12 station entrances	9 lines flooded, 12 entrances temporarily closed, and certain sections of the airport line suspended	80	160.3
	July 18, 2021	Jin'anqiao Station	Station closed with terminal changes on Line 6 and Line S1.	64.3	75.6
Guangzhou	April 22, 2010	Yangji Station	Several entrances closed, normal operations	73.9	73.9
	May 10, 2016	Changban Station	Entrance C closed, normal operations	49	90.3
	May 22, 2020	Guanhu Station, Xinsha Station, and others	Entire line shut down	204.1	219.5
	July 30, 2021	Shenzhoulu Station	Sections of Line 21 closed	25	25.2
Shenzhen	June 13, 2017	Chegongmiao Station	Station closed and bypassed	99	131.3
Chengdu	July 03, 2011	Tianfu Square Station	Could not pass through fence	30	61.7
	June 28, 2018	Guangfu Station	Station temporarily closed and bypassed	65	65.1
Wuhan	July 06, 2016	Zhongnan Road, Wuchang Railway Station, Meiyuanxiaoqu Station	Station temporarily closed and bypassed	118	188.7
Nanjing	June 27, 2015	Mozhoudonglu Station	Entrance 3 and 4 closed, normal operations	75	144.7
	July 07, 2016	Mingfaguangchang Station	Line 1 loses power, passengers are evacuated, and certain sections continue operations; station bypassed by Line 3	60	68.1
Xi'an	July 24, 2016	Xiaozhai Station	Station closed and bypassed	46	50.3
	June 07, 2016	Banpo Station	Station closed and bypassed	15	23.9
Zhengzhou	July 20, 2021	Entire Network	Entire network closed, 14 killed on Line 5	374.3	624.1
Changsha	May 15, 2020	Martyrs Park East Station (Pilot)	Flooding of station and rail area	20.4	73
Qingdao	July 23, 2020	Jinggangshan Rd Station	Flooding of station and rail area, certain sections closed	147.2	173.8
Nanning	June 03, 2016	Baihualing Station East (Under Construction)	Flooding of station	105	205.2

Subway flooding incidents in China and corresponding rainfall

Note: Incidents consolidated from online news websites. Corresponding rainfall quoted from NOAA global climate historical data.

Image Source: [Shenzhen Urban Transport Planning Center](#)

In view of the increasingly tense flood prevention situation and the management requirements of multi-department coordination for urban flood control, various national ministries and commissions have promulgated a number of regulations over recent years.

In April 2021, the **General Office of the State Council** issued the *Implementation Opinions on Strengthening the Control of Urban Flooding*, which outlined that by 2025, each city shall have basically constructed a drainage and flooding prevention system that is capable of draining ponding in a timely manner after the rain stops and completely eliminating areas prone to severe ponding.

In 2020, the **Work Safety Commission under the State Council** issued the *Guidance Manual for National Safe and Secure Model City Construction and Development*, which required source management, formation of multi-level spatial plans and emergency response system, formulation of special plans such as comprehensive disaster prevention and mitigation along with drainage and flooding prevention, and implementation of “one-vote veto” system for major safety risks in urban-rural planning, layout, design, construction, and operation.

In July 2021, the **National Development and Reform Commission** issued the *Urgent Notice on Improving the Safety of Key Urban Infrastructure*, which required the immediate and comprehensive study of potential disaster hazards, establishment of a risk ledger and flood risk map, and improvement of emergency plans based on the most severe and extreme weather conditions. In the event of extreme weather or exceptional conditions, the highest response level should be executed immediately.

In April and June 2021, the **Ministry of Transport** issued a series of flood safety notices across the transportation industry, requiring investigations into hidden dangers. The Ministry required the prioritization of prevention and risk avoidance, along with the timely shutdown of operations in the case of heavy rainfall. Rail operators were urged to prepare adequate flood prevention reserves, ensure targeted investigations and management of key areas such as low-lying rail sections, and strictly prevent the occurrence of flooding incidents.

The Ministry of Housing and Urban-Rural Development has required the strengthened construction of urban source control systems, drainage systems, and flood prevention systems. The newly revised *Standards for Sponge City Construction, Design Standards for Outdoor Drainage, and Technical Specifications for Urban Flood Prevention and Control* require that the return period of flood prevention and control in ultra-large, super-large, and large cities be designed at 100 years, 50-100 years, and 30-50 years respectively.

Local Adaptation of Policy Ensures Comprehensive Management

In addition to policies and regulations at the national level, provinces and cities have also implemented measures in accordance with local conditions. In terms of urban safety and hidden danger rectification, flood control and prevention, drainage improvement, and emergency response plans, a number of other regulatory requirements were implemented. In terms of subway operation, safety was further addressed through hidden risk investigation, implementation of flood control plans, preparation of emergency resources, and the establishment of early warning and monitoring systems.

BEIJING

Comprehensive management of risk sources and practical thinking for emergencies.

In terms of urban safety, the realization of source management, enhanced foundations, and refined supervision are part of the efforts to establish a risk classification management system and a risk investigation and prevention system. In terms of flood control and prevention, key problem areas shall be managed, and the layout of urban emergency rescue bases shall be improved. The target is that by 2025, hourly rainfall should be able to reach 65mm without ponding on primary roads, and 54mm on other roads without ponding. The *General Emergency Plan* was revised in 2021 with a greater focus on prevention and risk management. On July 27, the Beijing Municipal People's Government proposed to grant authority to frontline subway units and suspend work, classes, and subway operations during emergency situations.

SHANGHAI

Safety risk assessment and process control by classification.

The city demanded the implementation of a third-party safety assessment system for rail transit, along with public participation in risk management. In April 2021, the *Opinions on the Prevention and Control of Urban Safety Risks* was issued, which outlined that an urban safety risk prevention and control structure should have basically formed by 2025. Safety risk assessments should be conducted once every three years, with general risk information updated on a yearly basis to facilitate the risk assessment of rail transit and large-scale hubs. Relevant plans were released in August, requiring the accelerated development of a drainage supervision platform and sponge city construction, strengthened management and control of the entire classification process, and refinement of emergency plans for different scenarios in accordance with the major risks posed to rail.

GREATER BAY AREA

Strengthened planning and technical support for targeted early warning.

In 2020, the Guangdong Provincial People's Government outlined an inter-city subway line emergency connection mechanism, which required that safety facilities should be included in detailed territorial spatial planning. The Shenzhen Municipal People's Government has focused its efforts on optimizing

facility layout, dynamic risk assessment, technical support, public participation, and integration of the Greater Bay Area. The goal is to achieve world-class core safety indicators by 2025. The Guangzhou Municipal People's Government has begun to monitor the operational data of urban sewage and rainwater nodes to realize targeted early warning for clearance and maintenance points. On August 4, 2021, the Guangdong Provincial People's Government issued requirements for subway operators to formulate different shutdown procedures for stations, sections, lines, and entire networks.

TIANJIN

Increased drainage standards and construction of a full-coverage monitoring network.

In May 2021, the *Special Drainage Plan and Emergency Management during the 14th Five-Year Plan Period* were issued, which required that by 2025, core areas shall completely eliminate drainage systems with a return period of less than 1 year, while those of 3-5 years shall be increased by 58%. The establishment of a full-coverage monitoring network for emergency early warnings, meteorological monitoring, and flood prevention and management was also required, along with the implementation of comprehensive investigation and assessment of natural disaster risks and the compilation of risk prevention and control zone maps.

CHENGDU

Comprehensive safety rectification and enhanced emergency response capacity.

In April 2021, the *Transit Industry Safety Rectification Plan* was issued, which required the establishment of a day-to-day safety management and hidden danger screening system, along with the use of GPS to strengthen dynamic vehicle monitoring. On August 24, the *Notice on Strengthening the Flood Control of Underground Integrated Pipelines and Corridors* was issued, which required the investigation and rectification of hidden dangers and the special treatment of water leakage points to improve disaster prevention and emergency response capacity during flood seasons.

WUHAN

Enhanced flood prevention and standardization of weather disaster response.

In July 2021, the *Implementation Plan for Improving City Capabilities* was issued, which required optimization of water system dispatch, enhanced flood control standards, and sponge city construction. By 2025, the flood control rate of rivers above Grade 3 should reach 95% and overall drainage capacity should reach a return period of 100 years to essentially eliminate problems of flooding in the central urban area. On August 23, the *Regulations for Severe Weather Response* was issued, which clearly regulated early disaster warning, emergency response, post-incident recovery, and supports and guarantees while clearly outlining that at-risk subways may stop operations before reporting.

CHONGQING

Comprehensive supervision of facilities and paramilitary management of emergencies.

In 2019, the *Implementation Opinions on the Safe Operation of Urban Rail* was issued, which required the establishment of a smart management system, comprehensive supervision of key operational facilities, and regular third-party assessments of operational safety. In 2021, the *Key Points for Natural Disaster Prevention* was issued, which required further management of flood-prone areas, increased resolution of the forecast system to 3km, and exploration of paramilitary management of the emergency system.

NANJING

Establishment of an assessment system and the construction of a safety prevention and control mechanism.

In 2018, the Nanjing Municipal People's Government issued the *Opinions on Ensuring the Safe Operation of Urban Rail*, which required the establishment of a third-party assessment system for operational safety. Lines within 10 years of operation should be examined once every 5 years, while lines that have operated for over 10 years should be examined once every 3 years. In 2019, the *Implementation Opinions on Urban Safety Development* was issued, which required subway operators construct technical support, smart management and control, and professional safety prevention and control mechanisms.

HANGZHOU

Elimination of flooding and focus on the joint protection of hubs during emergencies.

In 2020, the *Emergency Plan for Urban Rail Operational Incidents and Measures for the Safety Management of Integrated Transit Hubs* were revised, focusing on emergency coordination amongst various urban rail and integrated hub units. In May 2021, the *Urban Flood Control in Zhejiang during the 14th Five-Year Plan Period* was issued, which required that serious urban flooding be basically eliminated by 2025, along with the effective handling of once-in-50-year heavy rain by the central urban area of Hangzhou.

4. CONCLUSION

Global warming will further increase risks of extreme weather and climates. For the foreseeable future, China will face the continuing threat of extreme rainfall, the frequency and intensity of severe urban flooding will increase significantly, and urban infrastructure will face greater pressure from extreme events. The large-scale construction and development of underground transit hubs and spaces inherent to TOD objectively increases the risk of infrastructure damage from urban flooding. Given this context, integrating the concept of urban resilience, assessing the risk of urban flooding, improving disaster early warning systems, and enhancing disaster prevention and mitigation capacity are key issues that must be tackled.

This issue introduced research on urban flooding risk assessment models and Tokyo Metro's comprehensive projection and early warning system that integrates data on underground spaces, surface environments, and meteorological conditions. The issue also summarized flooding incidents in Chinese subways over recent years, along with a series of policies and regulations promulgated by various ministries and commissions, provinces, and cities. The issue intends to provide reference and guidance for natural disaster risk management in the application of TOD to build more efficient and convenient cities under the impact of climate change and extreme events.

5. CITATIONS

[1] Blue Book on Climate Change in China 2021 ([Relevant Link](#))

[2] Resilient Urban Planning: International Case Studies and Exploration in Beijing ([Relevant Link](#))

[3] Wang Chengkun, Huang Jiping, Zeng Sheng, et al. Risk Assessment of Urban Flooding Based on Ponding Characteristics and Vulnerability. *China Water & Wastewater* 201935(5):125-130 ([Relevant Link](#))

[4] Ying et al. (2015). Change in Extreme Climate Events Over China Based on CMIP5. *Atmospheric and Oceanic Science*, 8 (4), 185-192. ([Relevant Link](#))

[5] A Comprehensive Assessment Model for Urban Flood Risk for Resilient Disaster Prevention and Management ([Relevant Link](#))

[6] Summary of Subway Flood Control Measures under the circumstance of Increased Heavy Rainfall Across the Country ([Relevant Link](#))

UPCOMING TOD EVENTS

15th Annual City-Rail International Conference
(Theme: integration, safety, intelligence, and eco-friendliness in high-quality development)

December 9-10, 2021, Shanghai, China

(Relevant Link)

China International Railway Conference for Urban & Intercity Transit (CIRC 2021)

December 20-22, Shanghai, China

(Relevant Link)

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