Tianjin Urban Transport Improvement Project

Environmental Impact Assessment Report

Tianjin Environment Assessment Center

August 2015

Foreword

In order to implement the national positioning requirements on Tianjin and national guiding suggestions on the urban transport development, Tianjin Municipal Government formulates the Beautiful Tianjin Construction Program, Implementation Suggestions of Tianjin Municipal People's Government on Prior Development of Urban Public Transport, Measures for Developing Public Transport and Optimizing Travel Environment to "accelerate to build a modern integrated transport system", "strengthen transport order and environment management", "generally improve the municipal public facilities", "optimize the layout for urban and rule public transport line and hub", "significantly improve the share ratio of public transport", "carry out pilot service system for public bicycles", and continues to increase efforts for treating traffic jams so as to provide an efficient, convenient, safe and civilized transport environment for citizens.

The World Bank has always been committed to improving the living standards in development countries, including the construction of infrastructures such as transport, and actively provided advanced transportation concept for development countries. In 2002, Tianjin received the second chance for urban development and environment project with the World Bank loans for transport and environment, in which the transport part included the improvement project for center ring road and improvement project for inner ring road with 12 sub-items. By implementing the load project and transforming the advanced concept of the World Bank into substantial outcomes, Tianjin has made great improvement in aspects such as scientific planning, financing program standardization, project organization and management, institutional capability building, enforcement efficiency, experience and others, promoted the green transport to develop in deeper and wider fields and made the concepts of public travel and environment protection more popular.

In summary, to consolidate and sustain the results of World Bank loans in the prior period, and make demonstrations for green development of urban transport, especially in the aspects of advocating efficient transport travel, improving slow traffic ratio, promoting transit oriented development (TOD) model, reducing the impacts of extreme air in urban transport and others, Tianjin decides to implement the third World Bank loans for improving the urban transport and improving the transport

operation and management for an ecological city.

The total investment of the project is RMB 1.426 billion, wherein, RMB 0.62 billion is the loan applied with the World Bank, and the rest is from the municipal finance. The project content includes two parts: road network smoothing project and technical support project. The technical support project requires no environment impact assessment, thus this assessment is only specific to the environmental impact assessment of road network smoothing project.

The road network smoothing project includes green transport (slow traffic system) improvement project in the core zone of center city area, metro transit project, public bicycle system demonstration project and public transport station construction project:

① Green transport (slow traffic system) improvement project in the core zone of center city area: plans to reconstruction 42 roads within the about 7.2 km2 center city area of Tianjin, involving about total 49.7 km roads.

② Metro transit project. This project constructs connection facilities in peripheries of 111 stations in total of metro line No. 1, 2, 3, 5, 6 and 9 of Tianjin, which covers 486,588m2 in total.

② Public bicycle system demonstration project. This project constructs a sound public bicycle operation management system, arranges 446 public bicycle rent stations in total in peripheries of metro stations and purchases 12,370 public bicycles.

③ Public transport station construction project. A total of 5 public transport stations are constructed downtown, covering 32,000m2 and 13,200m2 in the area of land and building area respectively.

In accordance with the stipulations of the Environmental Impact Assessment Law of the People's Republic of China and Management Methods on Environment Protection of Construction Projects of Tianjin related to environmental impact assessment of construction projects, the organizational unit, that is the World Bank Loan Office of Tianjin Urban and Rural Construction & Transportation Committee entrusts Tianjin Environmental Impact Assessment Center to conduct environmental impact

assessment of "Urban Transport Improvement Project of Tianjin". And after being entrusted, Tianjin Environmental Impact Assessment Center has compiled this Environment Impact Assessment Report of Urban Transport Improvement Project of Tianjin based on a large number of detailed investigations on the site.

1 Overview

1.1 Preparation Basis

1.1.1 National laws

(1) Environmental Protection Law of the People's Republic of China (December 26, 1989);

(2) Environmental Impact Assessment Act of the People's Republic of China (September 1, 2003);

(3) Land Administration Law of the People's Republic of China (August 28, 2004);

(4) Soil and Water Conservation Law of the People's Republic of China (March 1, 2011);

(5) Atmospheric Pollution Prevention and Control Law of the People's Republic of China(September 1, 2000);

(6) Water Pollution Prevention and Control Law of the People's Republic of China (June 1, 2008);

(7) Environmental Noise Prevention and Control of Pollution Law of the People's Republic of China (March 1, 1997);

(8) Solid Wastes Pollution Environment Prevention and Control Law of the People's Republic of China (April 1, 2005);

(9) Emergency Response Law of the People's Republic of China(November 1, 2007);

(10) Cultural Property Protection Law (October 28, 2002);

(11) Highway Law (August 28, 2004);

(12) Cleaner Production Promotion Law of the People's Republic of China (March 2, 2012);

(13) Order No.4 [2008] of the President of the People's Republic of China Circular Economy Promotion Law of the People's Republic of China (August 29, 2008)

1.1.2 Environmental policies and laws & regulations

(1) Order No.253 of the State Council of the P.R.C. Management Methods on Environment Protection of Construction Projects of Tianjin

(2) GF [2005] No. 39 The Decision of the State Council on Implementation of Scientific Development Concept to Strengthen Environmental Protection

(3) Order of the Ministry of Communications of the People's Republic of China, No. 5 of 2003 Measures for the Administration of Environmental Protection of Transport Construction Projects;

(4) Ministry of Transport of the People's Republic of China JHF [2004] No. 314 Notice on Carrying Out the Environmental Supervision of Traffic Engineering

(5) (4) Order No.253 of Ministry of Environmental Protection of the P.R.C. Classified Administration Catalogue of Environmental Impact Assessments for Construction Projects

(6) HF [2003] No. 94 Notice on Relevant Issues of Environmental Noise in the Environmental Impact Assessment of Highway and Railway (including Light Rail) and Other Construction Projects;

(7) HF [2006] No. 28 Interim Measures of Public Participation for Environmental Impact Assessment

(8) State Contingency Plans for Environmental Emergencies (January 24, 2006);

(9) Order No.591 of the State Council of the P.R.C. Regulation on the Safety Management of Hazardous Chemicals;

(10) Order No.9 of 2010 of the Ministry of Transport of the People's Republic of China Provisions on the Administration of the Road Transport of Dangerous Goods;

(11) HF [2007] No. 184 Notice on Strengthening the Environmental Impact Assessment in Highway Planning and Construction;

(12) HF [2010] No. 7 Technical Policy on Ground Traffic Noise Prevention and Control;

(13) HF [2010] No. 144 Guiding Proposals on Strengthening Prevention and Control of Environmental Noise Pollution and Improving Urban and Rural Acoustic Environment Quality;

(14) Decree No. 58 of Tianjin Municipal People's Government Management Methods on Environment Protection of Construction Projects of Tianjin;

(15) No. 52 [2002] of the Standing Committee of the Tianjin Municipal People's Congress Regulations of Tianjin Municipality on Prevention and Control of Air Pollution (2004 Revision);

(16) Decree No. 6 [2003] of Tianjin Municipal People's Government Management Methods on Prevention and Control of Environment Noise Pollution of Tianjin;

(17) Regulations of Tianjin Municipality on Urban Landscaping (2004);

(18) Tianjin Urban Road Greening Construction Standard (2004);

(19) Decree No. 67 [2004] of Tianjin Municipal People's Government Administrative Measures of Tianjin Municipality on Prevention and Control of Water Pollution;

(20) Tianjin Construction Management Committee JZ [2004] No. 149 Interim Measures for the Administration of Fugitive Dust Prevention and Control on the Construction Sites of Construction Projects in Tianjin;

(21) JZF [2006] No. 86 Decision on Strengthening Environment Protection and Optimizing Economic Growth;

(22) Decree No. 100 [2006] of Tianjin Municipal People's Government Regulations of Tianjin Municipality on Civilized Construction Management in Construction Projects;

(23) Provisions on Management of Domestic Waste in Tianjin (implemented as of May 1, 2008);

(24) Twenty-one Prohibitions of Construction in Tianjin (September 2009);

(25) Tianjin Environmental Protection Bureau JHBGH [2010] No. 398 Letter

on Adjusting “Division of Areas of Tianjin Applicable to Standards for Acoustic Environmental Quality”;

(26) JRH [2005] No. 162 Document Methods for the Implementation of Administrative Licensing for Discharging Project Dregs of Tianjin;

(27) JZF [2013] No. 35 Notice of Tianjin Municipal People’s Government on Printing and Issuing Tianjin Clean Air Action Plan;

(28) “Beautiful Tianjin No. 1 Project Implementation Plan” (2013);

(29) JZF [2013] No. 88 Tianjin Heavy Air Pollution Contingency Plan;

(30) No. 1 Announcement of the Standing Committee of the Tianjin Municipal People’s Congress Decision of the Standing Committee of the Tianjin Municipal People’s Congress on Approving of Demarcating an Ecological Zone for Permanent Protection, 2013;

(31) JHBG [2012] No. 3 Notice on Implementing “Three Simultaneities” in the Environmental Protection of Construction Projects and Commitment System of Completion-based Environmental Protection Acceptance.

1.1.3 Technical guidelines and specifications for environmental impact assessment

(1) Technical Guidelines for Environmental Impact Assessment - General Principles, HJ/T2.1-2011;

(2) Technical Guidelines for Environmental Impact Assessment - Atmospheric Environment, HJ2.2-2008;

(3) Technical Guidelines for Environmental Impact Assessment - Surface Water Environment, HJ / T 2.3-93;

(4) Technical Guidelines for Environmental Impact Assessment - Acoustic Environment, HJ2.4-2009;

(5) Technical Guidelines for Environmental Impact Assessment – Ecological Impact, HJ/T191997;

(6) Technical Guidelines for Environmental Risk Assessment on Construction

Project, HJ/T169-2004;

(7) Specifications for Environmental Impact Assessment of Highways (Trial), JTG005-96;

(8) HJ/T393-2007 Technical Specifications for Urban Fugitive Dust Pollution Prevention and Control, Ministry of Environmental Protection of the P.R.C.;

(9) HJ/T394-2007 Technical Guidelines for Environmental Protection in Ecological Construction Projects for Check & Accept Completed Project;

(10) Water and soil loss prevention and control standards for development and construction projects (GB50434-2008)

(11) Technical Specifications for Water and Soil Conservation of Development Construction Projects (GB50433-2008)

1.1.4 Planning and project data

(1) Tianjin General Urban Plan (2005-2020)

(2) Tianjin Municipal Twelfth Five-year Plan on Integrated Transportation;

(3) Tianjin Intelligent Transport Plan for Center City Area;

(4) Tianjin Plan for Pedestrian Facilities in Center City Area;

(5) Municipal Bus Special Plan of Tianjin

(6) Tianjin General Plan for National Road Transport Junction;

(7) Tianjin Plan for Passenger and Freight Transport Junction;

(8) Tianjin Municipal Twelfth Five-year Plan on Development Strategies of Public Transport Group;

(9) Proposal of Urban Transport Improvement Project of Tianjin by Using the World Bank Loans, Tianjin Tianle International Engineering Consulting Co., Ltd., June 2014;

(10) Overview of Feasibility Research Report on Urban Transport Improvement Project of Tianjin by Using the World Bank Loans, Tianjin Tianle International Engineering Consulting Co., Ltd., May 2015;

(11) Technical Support of Feasibility Research Report on Urban Transport

Improvement Project of Tianjin by Using the World Bank Loans, Tianjin Tianle International Engineering Consulting Co., Ltd., May 2015;

(12) Public Transport Station Construction Project of Feasibility Research Report on Urban Transport Improvement Project of Tianjin by Using the World Bank Loans, Tianjin Tianle International Engineering Consulting Co., Ltd., May 2015;

(13) Public Bicycle System Demonstration Project of Feasibility Research Report on Urban Transport Improvement Project of Tianjin by Using the World Bank Loans, Tianjin Tianle International Engineering Consulting Co., Ltd., May 2015;

(14) Metro Transit Project of Feasibility Research Report on Urban Transport Improvement Project of Tianjin by Using the World Bank Loans, Tianjin Tianle International Engineering Consulting Co., Ltd., May 2015;

(15) Green Transport (Slow Traffic System) Improvement Project in the Core Zone of Center City Area of Feasibility Research Report on Urban Transport Improvement Project of Tianjin by Using the World Bank Loans, Tianjin Tianle International Engineering Consulting Co., Ltd., May 2015;

(16) Technical contract entered into between the project client and Tianjin Environmental Impact Assessment Center concerning the assessment of the project.

1.1.5 Policy of World Bank

(1) Environmental Assessment (OP/BP4.01,1999.1) comprehensively applied.

(2) Natural Habitats (OP4.04,2001.6): not applied as the project does not involve in the important natural habitat defined by this policy.

(3) Pest Management (OP4.09,1998.12): not applied as the project does not involve in pest issue.

(4) Indigenous People (OP4.10,1991.9): not applied as there is no the population with aboriginal characteristics as defined in OP4.10.

(5) Physical Cultural Resources (OP4.11,1999.8): to be applied as there are a number of protected buidlings along some of the project streets where precaution is needed for construction activity.

(6) Involuntary Resettlement (OP4.12,2001.12): to be applied as the project involves demolition.

(7) Forests (OP4.36,1993.9): not applied as the project does not involve in requisition of forest land.

(8) Safety of Dams (OP4.37,2001.10): not applied as the project does not involve in dams.

(9) Projects on International Waterways (OP7.50,2001.6): not applied as the project does not involve in international waterways.

(10) Projects in Disputed Areas (OP7.60,2001.6): not applied as the project does not involve in disputed areas.

(11) Disclosure of Information (BP17.50,1993.9): to be comprehensively applied.

(12) Environmental, Health, and Safety Guidelines of International Finance Corporation (IFC) and World Bank (WB): to be comprehensively applied.

1.2 Assessment Objective

According to the classified requirements on the environmental impact assessment of construction projects of Classified Administration Catalogue of Environmental Impact Assessments for Construction Projects, the project belongs to integrated urban transport project, with the construction content consisting of public transport priority smoothing project, road network smoothing transformation project, metro transit project, public bicycle system demonstration project, and public transport station construction project, and estimated total investment of about RMB 1.587 billion, including USD 0.62 billion World Bank loans. This environmental impact assessment report is compiled in accordance with relevant provisions of the classified administration of environmental impact assessment for construction projects of the state. The project is determined as class B project according to the Project Concept Note (PCN) meeting of the World Bank, and is conducted environmental assessment through “environmental impact assessment” (EIA) and “environmental management

plan" (EMP).

(1) Investigate and analyze the current quality situation of the natural environment and social environment along the roads of the project and understand the current environmental quality along lines of the World Bank's urban transport improvement project of Tianjin.

(2) Predict and assess the impacts of each construction project of the project during the construction and operation.

(3) Extensively solicit comments and suggestions of the public along lines on the project construction through public participation, strengthen the exchange and communication between the public and relevant departments and guide the public to participate in the management and supervision of environmental protection during project construction and operation.

(4) Propose feasible environmental protection measures and suggestions according to the scope and degree of impacts of the project on the environment, minimize the adverse impacts of the project on the environment, and realize coordination and unity of the environmental and social benefits of the project.

(5) Demonstrate the feasibility of the project from the perspective of environmental protection, provide scientific basis for the environmental protection project design and environment management of the project.

1.3 Assessment principle and methods

1.3.1 Assessment Principle

Based on project location and nature, this EIA is completed according to the requirements of Environmental Impact Assessment Law of the People's Republic of China and Management Methods, Regulations on the Administration of Construction Project Environmental Protection, and Technical Guidelines for Environmental Impact Assessment, and compiled according to the requirements of relevant approved environment planning and general urban planning of the state, province and city; and the pollution prevention and control and environmental protection measures for the

proposed project are proposed on the basis of EIA, to provide scientific basis for project construction and environmental management.

1.3.2 Assessment Methods

(1) The project belongs to urban transport infrastructure improvement, and public transport and intelligent transport improvement project, and is constructed by using World Bank loans. The proposed project consists of public transport priority smoothing project, road network smoothing transformation project, metro transit project, public bicycle system demonstration project, and public transport station construction project, of which the characteristic is that the project construction content involves public transport infrastructure, public transport system and its intelligent transport management system construction, and has good systematic and overall benefits. Therefore, the EIA of the project focuses on the impacts of transport infrastructure construction on the regional environment, and analyzes and discusses the pollutant emission limits of the project and mitigation measures for the negative impacts on the environment; it not only needs to analyze and assess the environmental impacts of each sub-project construction, but also evaluate the overall environmental impacts and benefits of the project package, so as to mitigate adverse impacts and maintain regional environment quality. The project EIA Report and EMP (in Chinese and English) are compiled in accordance with relevant provisions of Classified Administration Catalogue of Environmental Impact Assessments for Construction Projects and the World Bank Safeguard Policies OP4.01.

(2) The construction and operation of the transport infrastructure will have certain impacts on the regional environment of the proposed project. On the basis of the investigation of the current situation of the project regional environment, and through project pollution analysis, this assessment plans to predict the impacts of the project construction on the environment, and propose feasible measures for preventing and controlling pollution and mitigating impacts, so as to provide basis for the project decision-making, guide project environmental protection design as well as

environmental management during project construction and operation, and enable the project construction to achieve unification of economic, social and environmental benefits.

(3) Most of the project location is in the center city area, and there are enterprises and institutions, and cultural, educational and residential areas and other environment sensitive points along lines of the construction project, which have relatively high requirements on environmental quality. Therefore, the impact of the increase or decrease of pollution source strength on the regional environment during project implementation, as well as on cultural relic environment and surrounding natural ecological environment shall be noted in the EIA.

(4) To enable the project to better exert benefits, the practical environmental control measures and management organization construction requirements shall be proposed from the perspective of environmental protection, to make urban infrastructure construction increasingly improved, and urban environment develop towards a good direction. The analysis of positive effect of environmental impacts by project implementation, as well as the protection of the local style and features and cultural and historical features shall be highlighted.

(5) The assessment shall pay attention to the environmental impacts and mitigation countermeasures as well as environmental management requirements during project construction and operation, to try to reduce the adverse disturbances on population health and natural ecological environment.

(6) The possible negligence and omissions of the EIA shall be remedied in combination with public participation, to further make the planning, design and environmental management of the proposed project become more improved and reasonable, and strive for unification of environmental, social and economic benefits in the construction and operation of proposed project; and provide scientific basis for the project operation management and environmental management, basis for the economic development planning and environmental protection planning of the project

area, and scientific basis for coordinating the relationship between environment and development for decision makers.

1.4 Assessment Timeframe

This assessment is divided into the construction period and the operation period. The construction period is the project construction stage; and the operation period is the period after the completion of the construction period. i.e.:

Construction period: the duration of the project construction is 5 years starting from 2015 and ending with completion of construction of each project in 2019.

Operation period: after 2019.

1.5 Assessment grades and scope

1.5.1 Assessment Scale

Table 1.7-1 lists the assessment topic and assessment grade result of each sub-project determined in accordance with the project characteristics and local environmental features of each sub-project in the construction project, and Technical Guidelines for Environmental Impact Assessment and Specifications for Environmental Impact Assessment of Highways.

Table 1.5-1 List of Assessment Topics and Assessment Grades

Sub-item name	Assessment Topic	Assessment Scale	Basis
Green transport (slow traffic system) improvement project in the core zone of center city area	Ecology	Level Ⅲ	In accordance with HJ19-2011, the project covers an area of <2km²; with a road length of <50km, and without special and important ecological sensitive area within the scope.
	Noise	Level Ⅲ	In accordance with HJ2.4-2009, as the red line width will not change before and after the reconstruction, the noise level will not significantly increase before and after project construction and the affected population will not change much.
	Atmosphere	Level Ⅲ	In accordance with HJ2.2-2008, this project is road construction without changing the road cross-section width, therefore the assessment grade shall be grade III.
	Water Environment	Level Ⅲ	In accordance with HJ/T2.3-93, there will only be a small amount of rain sewage during the project operation, which has simple quality.
Metro transit	Ecology	Level Ⅲ	In accordance with HJ19-2011, the project covers an area of <2km²; without special and important ecological

Sub-item name	Assessment Topic	Assessment Scale	Basis
project			sensitive area within the scope.
	Noise	Level Ⅲ	In accordance with HJ2.4-2009, the increase of the noise level will be very small before and after the construction of the public transport station and parking lot in the metro transit (within 3dBA), and there will not be a large population affected.
	Atmosphere	Level Ⅲ	The metro transit project has no concentrated pollutant emission source and its assessment grade is determined as grade III.
	Water Environment	Level Ⅲ	In accordance with HJ/T2.3-93, the wastewater quantity discharged by the public transport station in the metro transit project will be <200 m³/d, with the water pollutants discharged mainly being non-persistent pollutant, and the number of the water quality parameters needed concentration prediction is <7, with the complexity of wastewater quality being "simple". Wastewater will be discharged to the municipal sewage pipe network after treatment, and finally to the municipal wastewater treatment plant.
Public transport station construction project	Ecology	Level Ⅲ	In accordance with HJ19-2011, the project covers an area of <2km²; without special and important ecological sensitive area within the scope.
	Noise	Level Ⅲ	In accordance with HJ2.4-2009, the increase of noise level will be very small before and after the construction of the public transport station (within 3dBA), and there will not be a large population affected.
	Atmosphere	Level Ⅲ	There is no concentrated pollutant emission source in the public transport station of which the assessment grade is determined as grade III.
	Water Environment	Level Ⅲ	In accordance with HJ/T2.3-93, the wastewater quantity discharged by the public transport station will be <200 m³/d, with the water pollutants discharged mainly being non-persistent pollutant, and the number of the water quality parameters needed concentration prediction is <7, with the complexity of wastewater quality being "simple". Wastewater will be discharged to the municipal sewage pipe network after treatment, and finally to the municipal wastewater treatment plant.

The project is determined as class B according to the provisions of the World Bank Safeguard Policies OP4.01 Environmental Assessment, the environmental impacts of the proposed construction content of the project during construction and operation as well as minutes of Project Concept Note (PCN) meeting of the World Bank.

1.5.2 Assessment scope;

The environmental assessment scope of the project is determined as follows in accordance with the characteristics of the EIA of the proposed project as well as the practical operation experience, in combination with the environmental features of the proposed project.

Table 1.5-2 List of Assessment Scope

Sub-item name	Assessment factors	Assessment scope;
Green transport (slow traffic system) improvement project in the core zone of center city area	Ecology	Scope of disturbance along the lines (including temporary land use, etc.)
	Noise	Acoustic environment sensitive points of scope of temporary construction site such as the construction camp during the construction
	Air	Mainly 200m outside the construction scope
	Water Environment	The assessment scope also including 200m upstream position and 500m downstream position of the construction area。
	Social environment	The nearest culture relic protection site outside the temporary construction scope
Metro transit project	Ecology	The public transport station and parking lot project scope in the metro transit as well as the area possibly involved in the project construction
	Noise	60m outside the public transport station and parking lot in the metro transit
	Air	The public transport station and parking lot project scope as well as the area possibly involved in the project construction
	Water Environment	No assessment scope delimited, only the analysis of the standard reaching conducted
	Social environment	Surrounding transport
Public transport station construction project	Ecology	The public transport station project scope as well as the area possibly involved in the project construction
	Noise	60m outside the public transport station
	Air	The public transport station project scope as well as the area possibly involved in the project construction
	Water Environment	No assessment scope delimited, only the analysis of the standard reaching conducted
	Social environment	Surrounding transport

1.6 Environmental Protection Objectives

1.6.1 The target of cultural relics protection

According to site survey, the project is involved with 54 culture relic protection sites and stylistic buildings, including 2 key cultural relics sites under the state protection, 41 municipality protected historic sites of tianjin, 7 district protected historic sites and 4 cultural relics with rating pending. Refer to Table 1.6-1 for details.

Serial Number	Name of Cultural Relics Protection	Corresponding project	Orientation and distance	Scale and Functions	Districts	Carried Standard of Noise	Protection level	Site pictures
1.	The Former Martial Arts Center	Slow Traffic System Project-An Shan Road	East side, 15m	A building with 2-floor, building area of 2,200m2 is now the Lanebrary of Tianjin Medical University General Hospital.	Heping District	Class 2	Municipality protected historic sites of Tianjin	
2.	Jingyuan	Slow Traffic System Project-An Shan Road	West side, 10m	A building with 2-floor, building area of 4020m2	Heping District	Class 2	Municipal protected historic sites of Tianjin	

Serial Number	Name of Cultural Relics Protection	Corresponding project	Orientation and distance	Scale and Functions	Districts	Carried Standard of Noise	Protection level	Site pictures
3.	Zhangyuan(Tianjin settlement remains of Sun Yat-sen's northward)	Slow Traffic System Project-An Shan Road	East side，12m	2-floor building with front porch	Heping District	Class 2	Municipal protected historic sites of Tianjin	
4.	Former residence of Duan Qirui	Slow Traffic System Project-An Shan Road	West side，28m	2-floor residence building with building area of 2,016m2.	Heping District	Class 2	Municipal protected historic sites of Tianjin	
5.	The former Zhejiang Industrial Bank Co., Ltd	Slow Travel System Project-Binjiang Road	West side，16m	Main building 2-floor with building area of 2,043m2.	Heping District	Class 2	Municipal protected historic sites of Tianjin	

Serial Number	Name of Cultural Relics Protection	Corresponding project	Orientation and distance	Scale and Functions	Districts	Carried Standard of Noise	Protection level	Site pictures
6.	Former site of Chi Tai Building	Slow Travel System Project-Binjiang Road	East side，14m	The main building has 5 floors and both ends have 4 floors, with building area of 8620m2 and occupied area of 2,100m2.	Heping District	Class 2	Municipal protected historic sites of Tianjin	
7.	Former site of North Bureau of the CPC Central Committee	Slow Travel System Project-Binjiang Road	West side，43m	2-floor half-timbered residential house	Heping District	Class 2	Municipal protected historic sites of Tianjin	
8.	Former New China Trust Co., Ltd Building	Slow Travel System Project-Binjiang Road	West side，14m	6-building, and now is the Tianjin General Merchandise Comercial & Trade Corporation	Heping District	Class 2	Municipal protected historic sites of Tianjin	

Serial Number	Name of Cultural Relics Protection	Corresponding project	Orientation and distance	Scale and Functions	Districts	Carried Standard of Noise	Protection level	Site pictures
9.	Tianjin National Hotel	Slow Travel System Project-Harbin Road	East side，50m	Steel-concrete framed structure in three floors, with building area of 5,188m2.	Heping District	Class 2	Municipal protected historic sites of Tianjin	
10.	China Theatre	Slow Travel System Project-Harbin Road	West side，15m	5-floor construction, with occupied area of 2,700m2 and building area of 7798m2.	Heping District	Class 2	Municipal protected historic sites of Tianjin	
11.	Former site of Continental Bank	Slow Travel System Project-Harbin Road	West side, 10m	Brick concrete structure in 3-floor building, with building area of 4985m2 and occupied area of 2,021m2.	Heping District	Class 2	Municipal protected historic sites of Tianjin	

Serial Number	Name of Cultural Relics Protection	Corresponding project	Orientation and distance	Scale and Functions	Districts	Carried Standard of Noise	Protection level	Site pictures
12.	The former French Municipal Council	Slow Travel System Project-Harbin Road	East side，16m	4 western style buildings, construction area of 5608 square meters	Heping District	Class 2	Municipal protected historic sites of Tianjin	
13.	Bohai Building	Slow Travel System Project Heping Road	North side, 22m	The main building has 8 floors and part building has 13 floors with 84.2m high and building area of 2,648m2.	Heping District	Class 2	Municipal protected historic sites of Tianjin	
14.	Elegance Hotel	Slow Travel System Project Heping Road	South side, 22m	A 6-floor building with building area of 11,940m2.	Heping District	Class 2	Municipal protected historic sites of Tianjin	

Serial Number	Name of Cultural Relics Protection	Corresponding project	Orientation and distance	Scale and Functions	Districts	Carried Standard of Noise	Protection level	Site pictures
15.	Tianjin Quanye Chang	Slow Travel System Project Heping Road	South side，8m	Steel-concrete framed structure, it has 5 floors in main building and 8 floors in corners with building area of 21,000m2.	Heping District	Class 2	Key Cultural Relics Sites under the State Protection	
16.	Former site of Ta Kung Pao	Slow Travel System Project-Heping Road	North side，12m	Brick-concrete structure in 2-floor common building with building area of 1,620m2.	Heping District	Class 2	Municipal protected historic sites of Tianjin	
17.	CPC Printing Plant	Slow Travel System Project-Jianshe Road	West side，36m	A 2-floor building with building area of 370m2	Heping District	Class 2	Municipal protected historic sites of Tianjin	

Serial Number	Name of Cultural Relics Protection	Corresponding project	Orientation and distance	Scale and Functions	Districts	Carried Standard of Noise	Protection level	Site pictures
18.	Former site of New Club	Slow Travel System Project-Jianshe Road	West side，46m	2-floor half-timbered building of area 63m2.	Heping District	Class 2	Heping District Protected Historic Sites	
19.	Former residence of Lu Hongtao	Slow Travel System Project-Jianshe Road	West side，15m	A 3-floor building with occupied area of 2,060.67m2 and building area of 1,958.80m2.	Heping District	Class 2	Municipality protected historic sites of Tianjin	
20.	Former site of Melchers	Slow Travel System Project – North Dagu Road	West side，18m	A 4-floor building with building area of 2,400m2.	Heping District	Class 2	Municipality protected historic sites of Tianjin	

Serial Number	Name of Cultural Relics Protection	Corresponding project	Orientation and distance	Scale and Functions	Districts	Carried Standard of Noise	Protection level	Site pictures
21.	Former site of Garden Building	Slow Travel System Project – North Dagu Road	West side，14m	A 5-floor building in brick concrete structure	Heping District	Class 2	Municipality protected historic sites of Tianjin	
22.	Former Kailuan Coal Mining Bureau Building	Slow Travel System Project – North Dagu Road	West side, 10m	A 3-floor building of 9,180m2 with basement in composite structure	Heping District	Class 2	Municipality protected historic sites of Tianjin	
23.	Former residence of Nathan (Board Chairman and Manager of Kailuan Coal Mining Bureau)	Slow Travel System Project – North Dagu Road	West side，23m	Chinese quadrangle with building area of 360m2	Heping District	Class 2	Municipality protected historic sites of Tianjin	

Serial Number	Name of Cultural Relics Protection	Corresponding project	Orientation and distance	Scale and Functions	Districts	Carried Standard of Noise	Protection level	Site pictures
24.	Former Office of the Eighteenth Group Army in Tianjin	Slow Travel System Project – North Dagu Road	East side, 20m	A 3-floor building in brick concrete structure	Heping District	Class 2	Heping District Protected Historic Sites	
25.	Former site of YWCA	Slow Travel System Project – North Dagu Road	West side, 10m	A 2-floor building with building area of 1,440m2	Heping District	Class 2	Municipality protected historic sites of Tianjin	
26.	Former site of Da Kuo Hotel	Slow Travel System Project-Qufu Road	South side， 40m	A 5-floor helmet-shaped tower building with area of 3,792m2, and now it is for commercial use.	Heping District	Class 2	Municipality protected historic sites of Tianjin	

Serial Number	Name of Cultural Relics Protection	Corresponding project	Orientation and distance	Scale and Functions	Districts	Carried Standard of Noise	Protection level	Site pictures
27.	Former residence of Ren Fengbao	Slow travel system Chifeng Road	West side，16m	2-floor villa building with building area of 1,131m2.	Heping District	Class 2	Heping District Protected Historic Sites	
28.	Former residence of Lane Houji	Slow travel system Chifeng Road	West side，14m	2-floor building with building area of 150m2.	Heping District	Class 2	Heping District Protected Historic Sites	
29.	Former residence of Zhang Xueliang	Slow travel system Chifeng Road	West side，9m	3-floor western style building with building area of 1,418m2.	Heping District	Class 2	Municipality protected historic sites of Tianjin	

Serial Number	Name of Cultural Relics Protection	Corresponding project	Orientation and distance	Scale and Functions	Districts	Carried Standard of Noise	Protection level	Site pictures
30.	Former residence of Fan Zhuzhai	Slow travel system Chifeng Road	West side，11m	2-floor in Kungkuan building with building area of 3,459m2.	Heping District	Class 2	Heping District Protected Historic Sites	
31.	Former site of Tianjin Telegraph Administration	Slow travel system Chifeng Road	East side，24m	3-floor building in brick concrete structure	Heping District	Class 2	Municipality protected historic sites of Tianjin	
32.	The Former Residence of Zhang Gonghui	Slow travel system Chifeng Road	East side，48m	2-floor European style building of 1,083m2.	Heping District	Class 2	Municipality protected historic sites of Tianjin	

Serial Number	Name of Cultural Relics Protection	Corresponding project	Orientation and distance	Scale and Functions	Districts	Carried Standard of Noise	Protection level	Site pictures
33.	The Former Residence of Qiao Tiehan	Slow travel system Chifeng Road	West side，23m	2-floor western style building with building area of 1,214m2.	Heping District	Class 2	Heping District Protected Historic Sites	
34.	Former site of 9D Salt Corporation	Slow travel system Chifeng Road	East side, 15m	3-floor western style building with occupied area of 2,500m2 .	Heping District	Class 2	Municipality protected historic sites of Tianjin	
35.	Former site of Banque de I'IndoChine	Slow travel system Chifeng Road	East side，10m	3-floor building with basement with building area of 3,651m2.	Heping District	Class 2	Municipality protected historic sites of Tianjin	

Serial Number	Name of Cultural Relics Protection	Corresponding project	Orientation and distance	Scale and Functions	Districts	Carried Standard of Noise	Protection level	Site pictures
36.	Former site of The Commercial Guarantee Bank of China	Slow travel system	West side，20m	2-floor western style building with building area of 1,319m2 and occupied area of 884m2 .	Heping District	Class 2	Municipality protected historic sites of Tianjin	
37.	Former site of Yien Yieh Commercial Bank	Slow travel system	West side，12m	3-floor building in composite structure with occupied area of 3,174m2 and building area of 6,244m2.	Heping District	Class 2	Key Cultural Relics Sites under the State Protection	
38.	Former site of Zizhulin Barrachks (French Barracks in Tianjin)	Slow travel system	East side，10m	A quadrangle and a 2-4 floors building with occupied area of 6,534m2	Heping District	Class 2	Municipality protected historic sites of Tianjin	

Serial Number	Name of Cultural Relics Protection	Corresponding project	Orientation and distance	Scale and Functions	Districts	Carried Standard of Noise	Protection level	Site pictures
39.	Former residence of Chen Zhuling	Slow Travel System Project-Baoding Road	North side, 15m	A 2-floor building with 3-floor in part building, its building area is 2,166m2.	Heping District	Class 2	Municipality protected historic sites of Tianjin	
40.	Lihua Mansion	Slow Travel System Project-Baoding Road	North side，41m	Steel-concrete framed structure, with 10 floors in main building, building area in 6,193m2.	Heping District	Class 2	Municipality protected historic sites of Tianjin	
41.	Former site of Swire Pacific	Slow Travel System Project-Baoding Road	North side, 15m	2-floor half-timbered building.	Heping District	Class 2	Municipality protected historic sites of Tianjin	

Serial Number	Name of Cultural Relics Protection	Corresponding project	Orientation and distance	Scale and Functions	Districts	Carried Standard of Noise	Protection level	Site pictures
42.	The Former Residence of Natong	Slow Travel System Project-Xinhua Road	West side，20m	2-floor European style building with building area of 1,380m2.	Heping District	Class 2	Municipality protected historic sites of Tianjin	
43.	Former residence of Ji Hongchang	Slow Travel System Project - Huayuan Huandao Road	South side，19m	A 2-floor(partly 3 floors) half-timbered western style building with building area of 1,160m2.	Heping District	Class 2	Municipality protected historic sites of Tianjin	
44.	Former residence of Zhang Ruiting	Slow Travel System Project - Huayuan Huandao Road	East side，36m	3-floor construction with basement in building area of 3,882m2.	Heping District	Class 2	Municipality protected historic sites of Tianjin	

Serial Number	Name of Cultural Relics Protection	Corresponding project	Orientation and distance	Scale and Functions	Districts	Carried Standard of Noise	Protection level	Site pictures
45.	Former residence of Zhuang Lefeng	Slow Travel System Project - Huayuan Huandao Road	East side，22m	Main building in 3-floor building and in parts 2-4floors.	Heping District	Class 2	Municipality protected historic sites of Tianjin	
46.	Former residence of Lane Mingzhong	Slow Travel System Project - Huayuan Huandao Road	North side，25m	2-floor European style building with building area of 1,221m2.	Heping District	Class 2	Cultural Relics Rating Pending	
47.	Former residence of Lane Jifu	Slow Travel System Project - Huayuan Huandao Road	North side，20m	2-floor building in composite structure with occupied area of 5,434m2 and building area of 4,891m2.	Heping District	Class 2	Municipality protected historic sites of Tianjin	

Serial Number	Name of Cultural Relics Protection	Corresponding project	Orientation and distance	Scale and Functions	Districts	Carried Standard of Noise	Protection level	Site pictures
48.	Former Tianjin Customs	Slow Travel System Project-Zhang Zizhong Road	West side，30m	3-floor western style building with building area of 4,746m2.	Heping District	Class 2	Heping District Protected Historic Sites	
49.	Former Site of Belfran	Slow Travel System Project-Zhang Zizhong Road	West side，6m	Steel-concrete framed structure 5 floors, building area in 3,973m2	Heping District	Class 2	Municipality protected historic sites of Tianjin	
50.	Former site of Yuzhong Hotel	Slow Travel System Project-Zhang Zizhong Road	South side，8m	A 3-floor building has 150 rooms with flattop and brick concrete structure, and its building area is 5,026m2.	Heping District	Class 2	Cultural Relics Rating Pending	

Serial Number	Name of Cultural Relics Protection	Corresponding project	Orientation and distance	Scale and Functions	Districts	Carried Standard of Noise	Protection level	Site pictures
51.	Former site of the Continental Bank Warehouse	Slow Travel System Project-Zhang Zizhong Road	South side，13m	6-floor in both main and part building.	Heping District	Class 2	Cultural Relics Rating Pending	
52.	Chong Deli lane and alley housing	Slow Travel System Project-Qufu Road	South side，40m	8-floor residential building with occupied area of 4,900m2 and building area of 10,820m2.	Heping District	Class 2	Historic Stylistic Buildings	
53.	The Former Residence of Yuan Longsun	Slow Travel System Project-Xinhua Road	West side, 5m	A 3-floor building	Heping District	Class 2	Municipality protected historic sites of Tianjin	

1.6.2 The target of ambient air and acoustic environment protection

Set targets of noise and atmospheric environment protection according to the engineering characteristics, site survey and findings. Assign each subproject's environmental targets according to the project characteristics.

(1) For the green traffic (slow travel system) improvement project in core zone of center city area, it mainly refers to the sensitive targets of protection around area while construction along the road, which involves in administrative regions of Heping District and Nankai District. Please refer to Table 1.6-2 for results.

Table 1.6-2 The environmental protection of green traffic(Slow Travel system) improvement project in core zone of center city area

Serial Number	The name of sensitive targets	Orientation and distance	Scale	The name of road transformation
1.	Wenxing Lane	West, 15m	6 buildings with 3 floors	Harbin Road (Shanxi Road to North Jiefang Road)
2.	Tianzeng Lane	West, 15m	A 3-floor residential building	
3.	Xinyi Lane	East, 15m	2-floor house	
4.	Quanye Chang Primary School	East，10m	2 teaching buildings with 3 floors	
5.	Residential building of Harbin road	East, 15m	A 5-floor residential building	
6.	Yudeli Residential Area	East side，36m	5 residential buildings with 5 floors	Heping Road (Chifeng Road to Rongjie Street)
7.	No.1 Jianshe Road	East side，5m	A 7-floor residential building	Jianshe Road (Yingkou Road to Qufu Road)
8.	Guangxuexin Lane	West side，36m	A 4-floor residential building	
9.	Jianshe Road House(Datong Garden)	West side，18m	2 residential buildings with 3 floors	
10.	No.75 Jianshe Road	West side，12m	A 7-floor residential building	
11.	No.34 Taian Road	East side，12m	A 6-floor residential building	
12.	No. 61 Middle School	East side，12m	2 teaching buildings with 4 floors	
13.	No.82 Jianshe Road	East side，12m	A 6-floor residential building	
14.	The New Culture Garden-Xinjing Ju	West side，30m	A 30-floor building	Rongye Street (Nanma Road to Duolun Road)
15.	Changshou Apartment	West side, in front, 18m	2 buildings with 8-16 floors	
16.	The New Culture Garden-Xindian Garden	East side, in front, 30m	2 residential buildings with 11 floors	
17.	The New Culture Garden-Xinya Ju	East side, broadside, 30m	4 residential buildings with 16 floors	

Serial Number	The name of sensitive targets	Orientation and distance	Scale	The name of road transformation
18.	Bandung New Culture Garden	East side, broadside, 30m	2 residential buildings with 16 floors	
19.	No.2 Nankai Middle School	West side, in front, 136m	A 9-floor teaching building	
20.	The New Culture Garden-Xinli Ju	West side, broadside, 20m	2 residential buildings with 13 floors (floors from 1 to 3 are for commercial use)	
21.	Fulton Square	West side，20m	A 33-floor residential building	
22.	Rongqing Yuan	West side，20m	A 33-floor residential building	
23.	Tianhuishang Yuan	East side，43m	2 residential buildings with 33-floor	
24.	Tianhuiming Garden	East side, the nearest 80m	4 residential buildings with 33 floors	
25.	The New World Garden	West side, the nearest 12m	4 residential buildings with 11 floors	
26.	Xinhui Huating	Esat side, the nearest 44m	4 residential buildings with 33 floors	
27.	Yong’an Hospital	East side, 20m in front	A 4-floor hospital outpatient	
28.	Tongfang Garden	East side，40m	A 33-floor residential building	Henan Road (Fu’an Street to Duolun Road)
29.	West Qingyou Lane	West side, 8m, in front	A 5-floor residential building	
30.	East Qingyou Lane	East side, 8m, broadside on	5 2-floor residential buildings	
31.	No.2 Building of Rongfang Lane	West side, in front, 8m	A 7-floor residential building	
32.	New Yiren Lane	West side, in front, 10m	A 6-floor residential building	
33.	Fufang Lane	West side, in front, 10m	2 residential buildings with 4 floors	
34.	Tianjin Stomatological Hospital	North side，30m	A 4-floor in-patient department and a 8-floor outpatient building	Dagu Road (Zhang Zizhong Road to Xuzhou Road)
35.	Primary School on Siping Dong Road	North side, broadside on, 60m	A 4-floor teaching building	
36.	Dawen Lane	South Side, broadside on, 25m	4 residential buildings with 6 floors	
37.	No.272 Hospital	East side，30m	A 5-floor hospital building	Nanmenwai Street (Nanma Road to Nanjing Road)
38.	No.272 Dormitory Community	East side, in front, 33m	2 residential buildings with 6 floors	
39.	Haiguang Xincun	East side，45m	2 residential buildings with 18 floors	
40.	Xinquan Mansions	West side，36m	A 28-floor residential building	
41.	Huifu Tingyuan	West side，36m	A 12-floor residential building	

Serial Number	The name of sensitive targets	Orientation and distance	Scale	The name of road transformation
42.	West Fuhou Lane Community	East side, broadside, 33m	2 residential buildings with 6 floors	
43.	Huaiyuan Lane Community	East side, broadside on, 76m	A 6-floor residential building	
44.	Huaiyuan Lane Community	East side, in front, 10m	A 6-floor residential building	
45.	Botai Mingju	West side, broadside on, 60m	5 6-floor residential buildings	
46.	Botai Apartment	West side, 25m	A 14-floor residential building	
47.	Mingzhuxuan Community	East side，45m	2 residential buildings with 24 floors	
48.	Hengxin Yuan	West side，30m	2 residential buildings with 8 floors	
49.	No.2 Nankai Middle School	East side, 70m	2 teaching buildings with 6 floors	
50.	Zhonghua vocational special secondary school of Tianjin	East side, 70m	2 teaching buildings with 15 floors	
51.	Heping Yuan	South side, in front, 30m	2 residential buildings with 12 floors (commercial on the first 2 floors are for)	Fu'an Street (Nanmenwai Street to Zhang Zizhong Road)
52.	Tongfang Garden	South side, 60m	3 residential buildings with 33 floors	
53.	Qufu Road Community	North side, the nearest 20m	2 residential buildings with 6 floors	Qufu Road (Taierzhuang Road to Nanjing Road)
54.	Tianjin Police Hospital	South side, 27m	2 outpatient buildings with 6 floors	
55.	Huiwen Middle School	East side, 20m	2 residential buildings with 4 floors	Anshan Road (Nanjing Road to Xing'an Road)
56.	Anshandao Primary School	East side，5m	A 4-floor teaching building	
57.	No.56, Ningxia Road	West side, 10m	A 4-floor residential buildings	
58.	Fuyuan Lane	East side，5m	2 residential buildings with 2 floors	
59.	Jingbao Vocational Training College	West side，8m	A 5-floor office building	
60.	South Xinglong Lane	East side，12m	A 7-floor residential building	
61.	Gengyu Lane small building with 2 floors	East side，10m	2 residential buildings 2 floors	
62.	Tongfang Garden	North side，28m	3 residential buildings 28 floors	Duolun Road (Zhang Zizhong Road to Nanmenwai Street)
63.	Tianhe Lane	South side，15m	2-floor house	
64.	Fuming Lane	South side，18m	3 residential buildings with 6 floors	
65.	New Fufang Lane	North side, in front, 12m	2 residential buildings with 6 floors	

Serial Number	The name of sensitive targets	Orientation and distance	Scale	The name of road transformation
66.	The New Culture Garden-Xinjing Ju	North side，10m	A 20-floor residential building	
67.	Tianjin Ophthalmic Hospital	South side, broadside, 28m	A 11-floor outpatient building	
68.	Jinlun Apartment	North side, in front, 16m	A 8-floor residential building(the first 2 floors are for commercial use)	
69.	North Sijian Lane	South side, in front, 16m	2 residential buildings with 6 floors	
70.	West Fuhou Lane Community	North side，35m	A 2-floor residential building	
71.	Taifeng Lane	West side，6m	3-floor row residential building	Chifeng Road (Nanjing Road to Zhang Zizhong Road)
72.	Aijian Apartment	South side, in front, 16m	A 6-floor residential building	Shaanxi Road (Rongye Street to Chifeng Road)
73.	Yide Lane	North side，10m	3-floor row residential building	
74.	Zhishan Lane	South side, in front, 15m	A 6-floor residential building	
75.	South Xinglong Lane	North side, in front, 10m	2 residential buildings with 7 floors	
76.	Kangda Apartment	North side, in front, 10m	2 residential buildings with 11 floors	
77.	Longhua Lane	North side, in front, 10m	2 residential buildings with 7 floors	
78.	Qingtai Lane	North side, in front, 10m	A 6-floor residential building	
79.	Yaohua Middle School	West side, in front, 25m	2 teaching buildings with 8 floors	Shanxi Road (Nanjing Road to Chifeng Road)
80.	Yaohua Primary School	East side, in front, 17m	2 teaching buildings with 4 floors	
81.	Songshou Lane	East side，16m	6 residential buildings with 7 floors	
82.	Yaohua Primary School	South side，8m	2 teaching buildings with 4 floors	Baoding Road (Shanxi Road to Zhang Zizhong Road)
83.	Hongda Apartment	South side，10m	A 7-floor residential building	
84.	North Shude Lane, South Shude Lane	Both sides, 10m	2 residential buildings with 5 floors	
85.	Chongren Lane	North side, in front, 8m	A 6-floor residential building	
86.	Tongda Yuan	South side, in front, the nearest 60m	A 11-floor residential building	
87.	Tongfang Garden	West side, in front, 20m	2 residential buildings with 24 floors	Lu'an Street (Duolun Road to Rongji Street)
88.	Pauli King Champagne	West side，20m	3 residential buildings with 35 floors	
89.	Xinhau Road	Both sides, 5m	5 2-floor residential buildings	Xinhua Road (Nanjing Road to

Serial Number	The name of sensitive targets	Orientation and distance	Scale	The name of road transformation
90.	Xinjin Lane	South side，8m	3 residential buildings with 5 floors	Duolun Road)
91.	Ziyang Lane	South side, 30m	3 residential buildings with 18 floors	
92.	Tailong Lane	North side，10m	A 2-floor residential building	
93.	Lianbi Lane	West side, 5m	A 4-floor residential building	
94.	Baohua Lane	West side, 5m	3 residential buildings with 2 to 3 floors	
95.	No.19 Kindergarten	West side，8m	2-floor Kindergarten building	
96.	Inpatient department of Police Hospital	West side，15m	A 6-floor inpatient department	
97.	Municipal Political Consultative Conference Committee	East side，30m	A 12-floor office buildings	
98.	No.217 to 235, Xinhua Road	East side，5m	4 residential buildings with 5 to 6 floors	
99.	Hamidao Primary School	South side, in front, 20m	A 4-floor teaching building	
100.	Xinhua Road small building with 2 floors	Both sides, in front, 10m	2-floor row residential building	
101.	Kaifeng Lane	North side, broadside, 5m	A 22-floor residential building	Xuzhou Road (Nanjing Road to Taierzhuang Road)
102.	No.2 to 5, Taierzhuang Road	West side, in front, 25m	4 residential buildings with 17 floors	Taierzhuang Road (Yingkou Road to Bengbu Road)
103.	Mingyuan Lane Community	West side, in front, 22m	A 22-floor residential building	
104.	Nantong Lane Community	West side, in front, 15m	A 5-floor residential building	
105.		West side, broadside on, 40m	3 residential buildings with 5 floors	
106.	Tiankang Yuan	South side, in front, 38m	3 residential buildings with 33 floors	Beima Road (Dongma Road to Xima Road)
107.	Shangjia Xinyuan	South side, in front, 36m	5 residential buildings with 33 floors	
108.	Longting Pavilions	South side, in front, 30m	5 30-floor residential buildings	
109.	Northeast Art Mansion	South side, 107m	3 residential buildings with 33 floors	
110.	Jingde Garden	West side, broadside, 20m	A 30-floor residential building	Dongma Road (Beima Road to Nanma Road)
111.	Xin’an Garden	West side, broadside on, 66m	2 residential buildings with 22 floors	
112.	Yanlord Haihe Square	East side, broadside on, 55m	2 residential buildings with 30 floors	

Serial Number	The name of sensitive targets	Orientation and distance	Scale	The name of road transformation
113. South	The First Intermediate People's Court of Tianjin	North side, in front, 36m	A 20-floor office building	Nanma Road (Dongma Road to Xima Road)
114.	Anti-Corruption Bureau of the First Department of Tianjin People's Procuratorate	North side，in front，32m	A 20-floor office building	
115.	Pingxiang Mansion	North side, in front, 24m	2 residential buildings with 30 floors	
116.	Jinfeng Mansion	North side, in front, 24m	2 residential buildings with 30 floors	
117.	Youdian Apartment	South side, in front, 48m	4 residential buildings with 35 floors	
118.	Chengnan Jiayuan	South side, in front, 50m	A 33-floor residential building	
119.	South Weian Lane Community	West side, in front, 25m	2 residential buildings with 7 floors (commercial on the fist floor)	Xima Road (Beima Road to Nanma Road)
120.	Middle Weian Lane Area	West side, in front, 25m	3 residential buildings with 7 floors	
121.	Tianlin Yuan	East side, broadside, the nearest 42m	3 residential buildings with 24 floors	
122.	Weianbei Lane Area	West side, in front, 20m	2 residential buildings with 7 floors	
123.	Tianyue Yuan	East side, broadside, 35m	6 30-floor residential buildings	
124.	Zuyi Lane	West side, in front, 20m	4 residential buildings with 6 floors	
125.	Nation Building Community	West side, in front, 15m	2 residential buildings with 6 floors	
126.	Huanqing Building	West side, in front, 15m	3 residential buildings with 6 floors	
127.	Tiankang Yuan	North side, in front, 22m	4 residential buildings with 33 floors	North City Street (Dongma Road to Xima Road)
128.	Tianyue Yuan	South side, in front, 35m	2 residential buildings with 30 floors	
129.	Zhongying Primary School	South side，正对，25m	A 2-floor teaching building	
130.	Tianjin Shuige Hospital	North side, in front, 24m	A 8-floor hospital (out-patient and in hospital)	
131.	Chonghua Middle School	South side，正对，55m	A 4-floor teaching building	
132.	Shangjia Xinyuan	North side, in front, the nearest 25m	5 residential buildings with 33 floors	
133.	Longting Pavilions	North side, in front, 22m	6 30-floor residential buildings	
134.	Jingde Garden	South side, in front, 50m	5 30-floor residential buildings	

Serial Number	The name of sensitive targets	Orientation and distance	Scale	The name of road transformation
135.	Xiyuan New Garden	South side，in front，114m	2 residential buildings with 24 floors	North Gulou Street (East Chengxiang Road to Dongma Road)
136.	Ruyuan Apartment	North side，in front，20m	A 11-floor residential building	
137.	Yangguang Jingdian	South side, in front, 30m	4 residential buildings with 33 floors	Nancheng Street (Dongma Road to Xima Road)
138.	Tongluowan Garden	South side，in front，24m	5 30-floor residential buildings	
139.	Tan Fu	West side，33m	Villa Area	Middle Chengxiang Road (Beima Road to Nanma Road)
140.	Yanlord Haihe Square	West side, broadside, 20m	4 residential buildings with 30 floors	Zhang Zizhong Road (Tongbei Road to Tongnan Road)

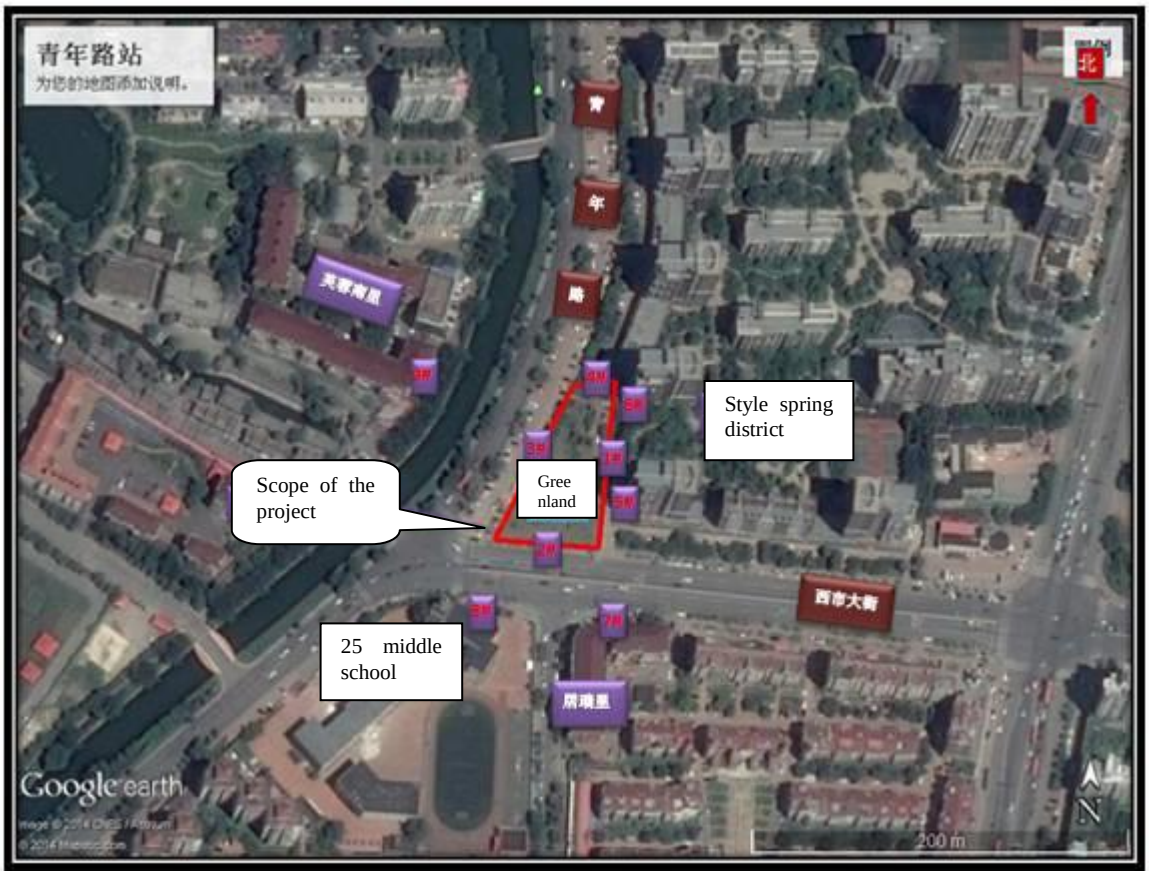
(2) For public transport station project, the main target is the noise environmental targets during construction and operation periods.

Please refer to Table 1.6-3 for results. Please see attached figures 1.6-1-1.6-3 for surrounding environment.

Table 1.6-3 The summary of sensitive targets of noise and atmosphere environment in public transport station project.

Serial Number	Name of Sensitive Points	Projects Belongs	Distance (m)	Direction	Function	Executive standard	
						Acoustic function division	Orient the side of this project
1.	No.4 building of Gediao Spring	Nankai Qingnian Road Station	24	East	Residential building	Class 1	Class 1
2.	No.7 building of Gediao Spring		24	East	Residential building	Class 1	Class 1
3.	Jurui Lane		45	South	Residential building	Class 1	Class 4a
4.	Teaching building of No.25 Middle School		40	South	Teaching building	Class 1	Class 2
5.	South Furong Lane		70	West	Residential building	Class 1	Class 1

Serial Number	Name of Sensitive Points	Projects Belongs	Distance (m)	Direction	Function	Executive standard	
						Acoustic function division	Orient the side of this project
6.	Nankai Foreign Languages School	People's Hospital Station	30	West	Teaching building	Class 2	Class 2
7.	Shuijun Garden		80	North	Residential building	Class 2	Class 4a
8.	Honey Baby Kindergarten	Beichen Liuyuan Station	10	North	Kindergarten	Class 1	Class 1
9.	Xijing Yuan Community		20	East	Residential building	Class 1	Class 1
10.	New Children's Hospital		120	West	Hospital under construction	Class 1	Class 4a



Attached Map 1.6-1 Schematic Diagram of Nankai Qingnian Road Station Surroundings

Attached Map 1.6-2 Schematic Diagram Of Hongqiao Hospital Surroundings

Attached Map 1.6-3 Schematic Diagram Of Liu Yuan Surroundings

The statistical results of the aforesaid environment sensitive targets are shown in Table 1.6-6.

Table 1.6-6 Statistical results of environment sensitive targets

Serial Number	Type of sensitive targets	Quantity (piece)	Scale estimation
1	Residence	134	4820 families, 20800 persons
2	Hospitals	7	800 beds in total
3	Schools	8	About 14,350 students
4	Kindergarten	1	100 children
5	Cultural relic	54	-
Total	—	204	31990

According to Table 1.6-6, the project covers 204 various environment sensitive targets in total in each district of Tianjin, wherein there are 134 sensitive points in residential district, 7 in hospital, 8 in various schools and 1 in kindergarten, covering nearly 14,350 people in all sensitive targets.

1.6.3 Ecological protection targets

The ecological environmental protection targets in this project mainly include temporary land occupation of project and vegetation within land area.

1.7 Assessment Standard

1.7.1 Water Environment

It is forbidden to drain wastewater (sewage) into surrounding water body. The sanitary sewage produced during public transport station project construction of this project shall be discharged into municipal pipeline network and construction sewage shall be recycled after oil insulative deposition treatment, which shall not be charged externally; all wastewater produced during operation shall be discharged into municipal sewage pipeline network and finally into municipal sewage treatment plants. The wastewater discharge should meet the Level III standard of Integrated Wastewater Discharge Standard (GB8978-1996), refer to Table 1.7-1 for specific standard values.

Table 1.7-1 Integrated Wastewater Discharge Standard (GB8978-1996)

Standard No.	Standard name	Standard values and levels	Pollutant	Standard value (mg / L)
GB8978-1996	Integrated Wastewater Discharge Standard	Level Ⅲ	pH	6～9
			SS	400
			BOD_5	300
			The COD	500
			Petroleum	20
			Animal and vegetable oil	100
			Ammonia nitrogen	/
			LAS	20

1.7.2 Atmospheric Environment

(1) GB3095-2012 Ambient Air Quality Standard, see Table 1.7-2.

Table 1.7-2 Ambient Air Quality Standards Unit: mg/Nm3

Pollutant / Value Selecting Time	NO_2	PM_{10}	SO_2
Average per hour	0.20	0.15	0.50
Daily Average	0.08	0.07	0.15
Annual average	0.04	—	0.06

1.7.3 Acoustic environment

Residential area of this project's assessment district shall abide by Class 1 and 2 of Standards for Acoustic Environmental Quality (GB3096-2008). Refer to Table 1.7-3 for specific standard values of Standards for Acoustic Environmental Quality (GB3096-2008).

The factory boundary noise in public transport station shall abide by Class 2 standard of Emission Standard for Industrial Enterprises Noise at Boundary (GB12348-2008); the construction site during construction period shall abide by relevant standard of Emission Standard of Environment Noise for Boundary of Construction Site (GB12523-2011). Refer to Table 1.7-4, 1.7-5 and 1.7-6 for each standard value.

Table 1.7-3 Standards for Acoustic Environmental Quality (GB3096-2008)

Classes	Daytime dB(A)	Nighttime dB(A)
1	55	45
2	60	50
4a	70	55

Table 1.7-4 Emission Standards for Industrial Enterprises Noise at Boundary (GB12348-2008)

Classes	In the day	At night	Applicable scope
Class 2 Area	60dB（A）	50dB（A）	1m beyond factory boundary of public transport station

Table 1.7-5 Emission Standards for Building Construction Environment Noise at Boundary (GB12523-2011)

In the day	At night
70 dB	55 dB

1.8 Function zoning of acoustic environment

In accordance with the Letter of Adjusting the Applicable Zoning of <Standards for Acoustic Environmental Quality> in Tianjin City ([2010] No.398) prepared by Tianjin Environmental Protection Bureau and the results confirmed by competent administrative department of environmental protection in the project location, all engineering areas are divided into Class 1 and 2 and the noise categories below shall be followed along the project:

The adjacent area shall be Class 1 standard adaptive area, the area within 50m away from boundary line of primary and secondary trunk roads belongs to Class 4a and the area beyond 50m shall belongs to Class 1.

The adjacent area is Class 2 standard adaptive area, the area within 35m away from boundary line of primary and secondary trunk roads belongs to Class 4a and the area beyond 35m shall belong to Class 2.

2. Project Overview

2.1 The Geological Location of the project

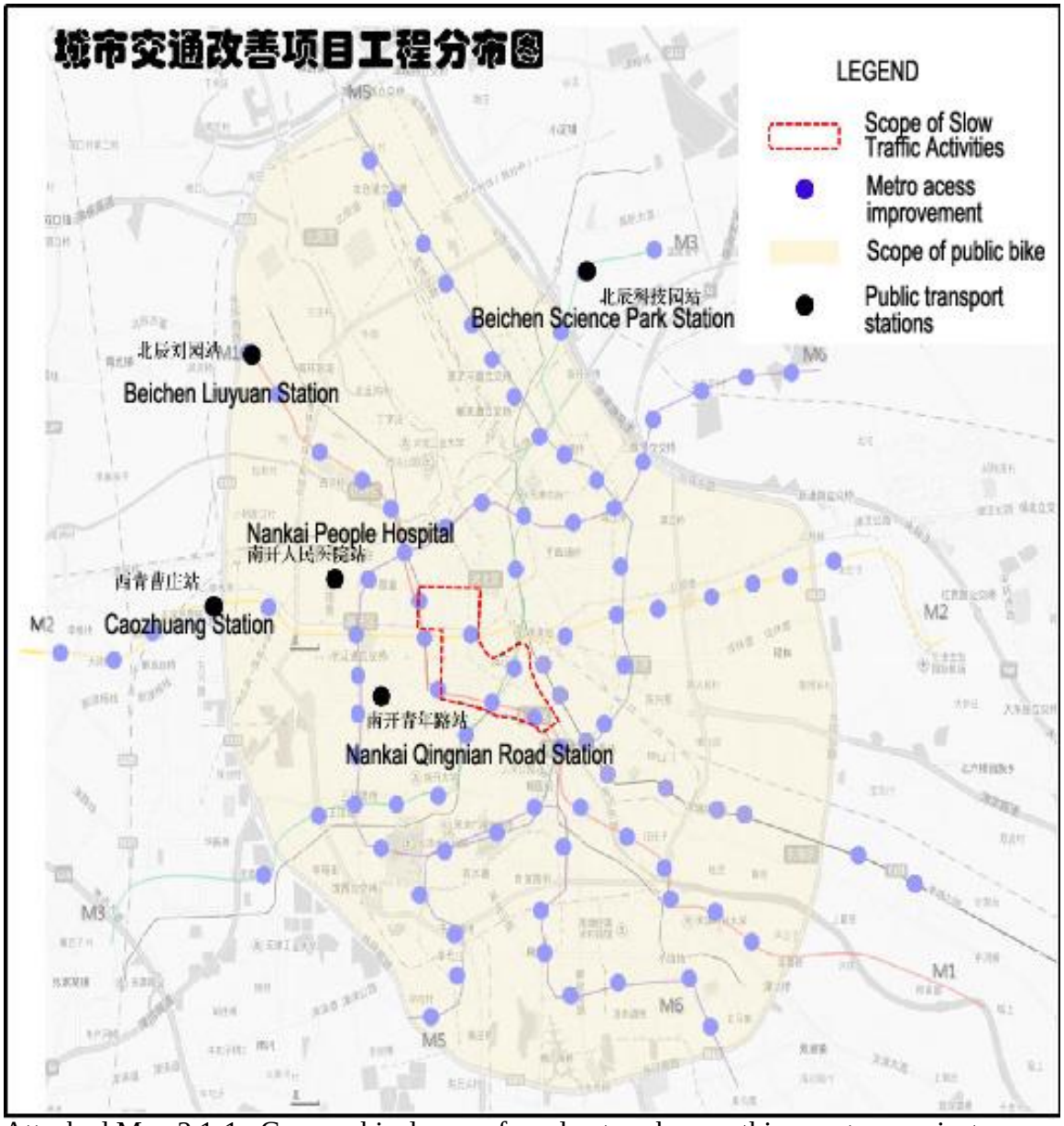
This project includes: road network smoothing project and technical support project. Therein, assessment of such 4 sub-projects as green transport (slow traffic system) improvement project, metro transit project, public bicycle system demonstration project and public transport station construction project shall be primarily carried out in road network smoothing project in the core zone of center city areas. The geographical map of road network smoothing project is as follows.

Sub-project I: green transport (slow traffic system) improvement project in core zone of center city areas. The project is located at the core zone of center city area of Tianjin, and expands to Beima Road to north, Haihe River to east, Nanjing Road and Bengbu Road to south and Nanmenwai Street and Xima Road to the west. It covers a total area of 7.2 km^2.

Sub-project II: metro transit project The project selects the stations of metro line No. 1, 2, 3, 5, 6 and 9 relatively near to the city area, including 111 stations on 6 metro lines. It targets at construction of transit facilities around the metro stations.

Sub-project III: public bicycle system demonstration project The project is located in the area within 500-2000m along metro lines in the center city area. There are 446 rent stations mainly around the metro stations.

Sub-project IV: the project targets at setting up 5 public transport stations, namely Xiqing Caozhuang Station, Nankai Qingnian Road Station, Nankai People's Hospital Station, Beichen Science Park Station and Beichen Liuyuan Station. The main administrative regions are Xiqing, Nankai and Beichen. Since the 5 public transport stations are all located in urban area of Tianjin, which never suffer from flood submergence before, there is no risk of public transport station being flooded.



Attached Map 2.1-1 Geographical map of road network smoothing system project

2.2 Project content

Urban Transport Improvement Project of Tianjin by Using the World Bank Loans includes: road network smoothing system project and technical support project. Threrein, road network smoothing project contains such 4 sub-projects as green transport (slow traffic system) improvement project, metro transit project, public bicycle system demonstration project and public transport station construction project; and technical support project is composed of 8 sub-projects. Refer to Table 2.2-1 for specific summary of project construction contents. The following engineering analysis is carried out mainly

for the 4 sub-projects of road network smoothing system project.

Table 2.2-1 Construction contents of the project

Contents	Sub-item name	Construction contents
Road network smoothing project	Green transport (slow traffic system) improvement project in the core zone of center city area	It is planned to reconstruct 42 roads within the scope of 7.2km^2 in center city area of Tianjin, including 26 roads in Heping District covering an area about 5.2m2 and 16 roads in Nankai District covering an area about 2.0m2 with total length of roads nearly 49.7km.
	Metro transit project	The project targets at constructing transit facilities for 111 stations in total for metro line No. 1, 2, 3, 5, 6 and 9 in Tianjin, and occupies a total area of 486,588m2, including 169747m2 of public transport transit stations, 109783m2 of small motorcycle parking area and 207058m2 of bicycle parking lot. At the construction site, it also involves projects for roads, stations, parking lots and others as well as transport project, lighting project, drainage project and green projects.
	Public bicycle system demonstration project	The project targets at establishing perfect public bicycle operation management system, laying out 446 public bicycle rent stations around the metro station and purchasing 12370 public bicycles, 17270 parking piles for public bicycles, 446 management cabinets, private bicycles parking frames, back-stage management and monitoring system.
	Public transport station construction project	The public transport station construction project targets at building five public transport stations within the scope of center city area and four districts around the city, namely Xiqing Caozhuang Station, Nankai Qingnian Road Station, Nankai People's Hospital Station, Beichen Science Park Station and Beichen Liuyuan Station.
Technical support project	Research on green transport development strategy in center city area in Tianjin	
	Research on motor development policies and greenhouse gas emission in Tianjin	
	Policy support system for optimizing public transit network in center city area	
	Research on public bicycle management and operation model	
	Multi-channel financing mechanism for sustainable development of urban road smoothing project	
	Implementation standards for urban disaster prevention and recovery system project	
	Demonstration platform for disaster prevention and recovery system	
	Advertising and promotion for comprehensive improvement of urban transport	

2.3 Green transport (slow traffic system) improvement project in the core zone of center city area

2.3.1 Road project

Slow traffic system project targets at restructuring 42 roads within scope of about 7.2km2 in center city area of Tianjin, including 26 roads covering an area of about 5.2 km2 and 16 roads covering an area of about km2 with total length of road nearly 49.7 km2.

2.3.1.1 Route selection

Table 2-3-1-1 List of Road Transformation

Serial Number	Road Name	Initial point	Termination point	Length of the Transformation section (m)	Width of red line (m)	Road grade	Notes
1	Binjing Road	Heping Road	North Jiefang Road	510	16	By-pass	Heping District
2	Harbin Road	Shaanxi Road	North Dagu Road	1417	10-12	By-pass	Heping District
		North Dagu Road	North Jiefang Road		16		
3	Heping Road	Chifeng Road	Yingkou Road	290	16	By-pass	Heping District
		Nanma Road	Rongji Street	300	36		
4	Jianshe Road	Yingkou Road	Yantai Road	1065	30	Secondary arterial road	Heping District
		Yantai Road	Qufu Road		24		
5	Rongye Street	Nanma Road	Duolun Road	1330	30	Main arterial road	Heping District
6	Nanhe Road	Fu'an Street	Duolun Road	1450	10-12	By-pass	Heping District
7	Xing'an Road	Heping Road	Rongji Street	1650	25	Secondary arterial road	Heping District
		Rongji Street	North Dagu Road		25		
8	North Dagu Road	Zhang Zizhong Road	Yantai Road	2286	40	Main arterial road	Heping District
		Yantai Road	Qufu Road		12	Secondary arterial road	
		Qufu Road	Xuzhou Road		36	Main arterial road	
9	Nanmenwai Street	Nanma Road	Nanjing Road	1750	50	Main arterial road	Heping District

10	Fu'an Street	Nanmenwai Street	Zhang Zizhong Road	1305	36	Main arterial road	Heping District
11	Qufu Road	Taierzhuang Road	Nanjing Road	735	40-50	Main arterial road	Heping District
12	Anshan Road	Nanjing Road	Xing'an Road	1345	14-16	Secondary arterial road	Heping District
13	Duolun Road	Zhang Zizhong Road	Xing'an Road	1626	24	Secondary arterial road	Heping District
		Xing'an Road	Xinhau Road		20		
		Xinhau Road	Nanmenwai Street		14		
14	Chifeng Road	Nanjing Road	Zhang Zizhong Road	1875	14-16	Main arterial road	Heping District
15	Shaanxi Road	Rongye Street	Chifeng Road	1500	10-12	By-pass	Heping District
16	Shanxi Road	Nanjing Road	Chifeng Road	480	17-18	Secondary arterial road	Heping District
17	Baoding Road	Shanxi Road	Hebei Road	1250	15(21)	Secondary arterial road	Heping District
		Hebei Road	Xinhau Road		20		
		Xinhau Road	Jianshe Road		23-25		
		Jianshe Road	North Dagu Road		24		
		North Dagu Road	Zhang Zizhong Road		30		
18	Lu'an Street	Duolun Road	Rongji Street	635	25	Main arterial road	Heping District
19	Xinhau Road	Nanjing Road	Yingkou Road	2061	22	Main arterial road	Heping District
		Yingkou Road	Jinzhou Road		16		
		Jinzhou Road	Duolun Road		10-12		
20	Xuzhou Road	Nanjing Road	North Dagu Road	560	20	By-pass	Hexi District
		North Dagu Road	North Jiefang Road		20		
		North Jiefang Road	Taierzhuang Road		14		
21	Huayuan Huandao Road			472	12	Pedestrian street	Heping District
22	Chengde Road	Heping Road	Xinhau Road	125	16	Pedestrian street	Heping District
23	Dandong Road	Heping Road	Xinhau Road	145	16	Pedestrian street	Heping District
24	Liaoning Road	Chifeng Road	Yingkou Road	110	12	Pedestrian street	Heping District

25	Zhang Zizhong Road	Tongnan Road	Yingkou Road	2646	–	Secondary arterial road	Heping District
26	Taierzhuang Road	Yingkou Road	Bengbu Road	1690	–	Secondary arterial road	Heping District
27	Beima Road	Dongma Road	Xima Road	1600	45	Main arterial road	Nankai District
28	Dongma Road	Beima Road	Nanma Road	1000	36	Main arterial road	Nankai District
29	Nanma Road	Dongma Road	Xima Road	1600	36(40)	Main arterial road	Nankai District
30	Xima Road	Beima Road	Nanma Road	1000	45	Main arterial road	Nankai District
31	Beicheng Street	Dongma Road	Xima Road	1300	30	Secondary arterial road	Nankai District
32	West Gulou Street	Xima Road	West Chengxiang Road	290	40	Secondary arterial road	Nankai District
33	East Gulou Street	East Chengxiang Road	Dongma Road	320	30	Secondary arterial road	Nankai District
34	Nancheng Street	Dongma Road	Xima Road	1600	30	Secondary arterial road	Nankai District
35	West Chengxiang Road	Beima Road	Nanma Road	1000	30	Main arterial road	Nankai District
36	Middle Chengxiang Road	Beima Road	Beicheng Street	1058	60	Main arterial road	Nankai District
		Beicheng Street	Nanma Road		50		Nankai District
37	East Chengxiang Road	Beima Road	Nanma Road	1000	36	Main arterial road	Nankai District
38	Tongbei Road	Dongma Road	Zhang Zizhong Road	300	45	Main arterial road	Nankai District
39	Tongnan Road	Dongma Road	Zhang Zizhong Road	230	36	Main arterial road	Nankai District
40	Shuige Street	Dongma Road	Zhang Zizhong Road	280	28	Secondary arterial road	Nankai District
41	Zhang Zizhong Road	Tongbei Road	Tongnan Road	1073	—	By-pass	Nankai District

42	East Haihe Road	Shizilin Street	Shisanjing Road	5445	—	Secondary arterial road	Nankai District
	Total			49704			

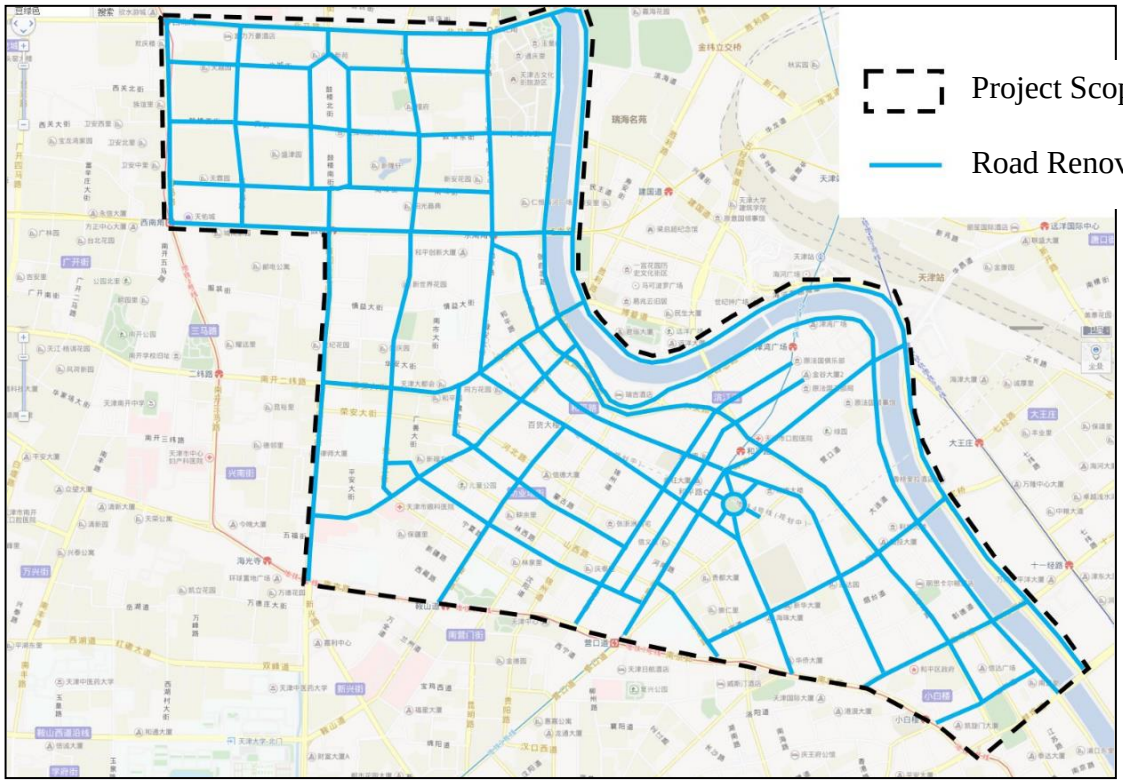


Figure 2.3-1 Unblocked Transformation Engineering Roadmap for Road Network

2.3.1.2 Engineering Transformation Scheme

(1) Binjiang Road

Before Transformation: width of the red line on Binjiang Road is 16 m; 2 bi-directional lanes; the cross section is 3 m (sidewalk) – 10 m (mixed roadway for motor vehicles and non-motor vehicles) – 3 m (sidewalk).

After Transformation: without changing width of the red line, 5.5 m (common roadway for pedestrians and non-motor vehicles) + 5 m (motor vehicle lane) + 5.5 m (common roadway for pedestrians and non-motor vehicles)

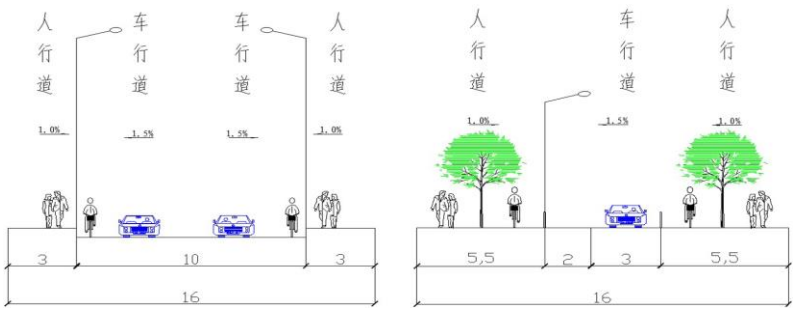


Figure 2-3-1-1 Comparison Chart of Cross Section of Binjiang Road before and after Transformation

(2) Harbin Road

A. Harbin Road (Section between Shaanxi Road and North Dagu Road)

Before Transformation: width of the red line is 10 – 12 m; 2 one-way lanes; the cross section is 1.5 - 2 m (sidewalk) – 7 - 10 m (mixed roadway for motor vehicles and non-motor vehicles) –1.5 - 2 m (sidewalk).

After Transformation: 1 one-way lane; the cross section is 2 - 3 m (common roadway for pedestrians and non-motor vehicles) – 5 m (roadway) 3 – 4 m (common roadway for pedestrians and non-motor vehicles).

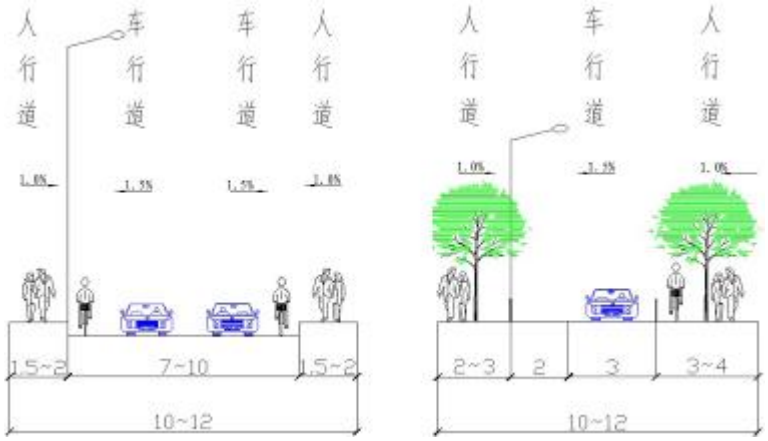


Figure 2-3-1-2 Comparison Chart of Cross Section of Harbin Road (Section between North Dagu Road and North Jiefang Road) before and after Transformation

B. Harbin Road (Section between North Dagu Road and North Jiefang Road)

Before Transformation: width of the red line is 16 m; 2 one-way lanes; the cross section

is 3 m (sidewalk) – 10 m (roadway) – 3 m (sidewalk).

After Transformation: 1 one-way lane; the cross section is 5.5 m (common roadway for pedestrians and non-motor vehicles) + 5 m (motor roadway) + 5.5 m (common roadway for pedestrians and non-motor vehicles).

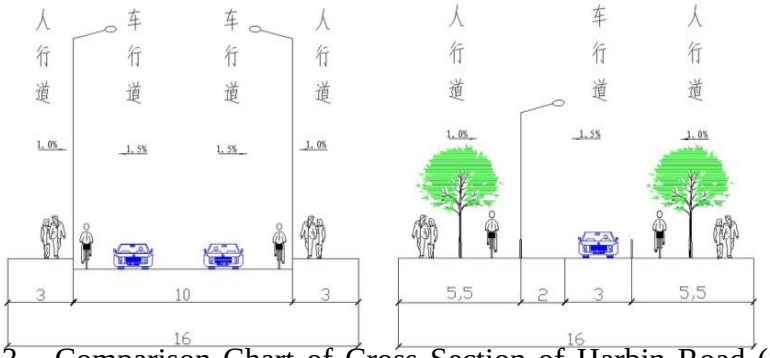


Figure 2-3-1-3 Comparison Chart of Cross Section of Harbin Road (Section between North Dagu Road and North Jiefang Road) before and after Transformation

(3) Heping Road

A. Heping Road (Section between Chifeng Road and Yingkou Road)

Before Transformation: width of the red line is 16 m; 2 bi-directional lanes; the cross section is set to be 3 m (sidewalk) – 10 m (roadway) – 3 m (sidewalk).

After Transformation: 1 one-way lane; the cross section is 5.5 m (common roadway for pedestrians and non-motor vehicles) + 5 m (motor roadway) + 5.5 m (common roadway for pedestrians and non-motor vehicles).

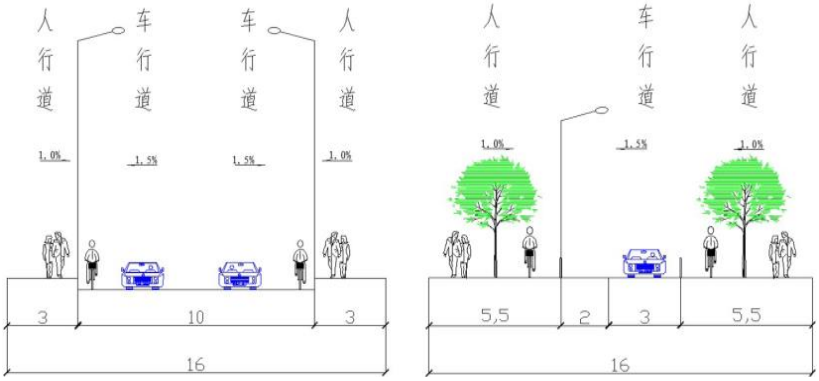


Figure 2-3-1-4 Comparison Chart of Cross Section of Heping Road (Section between Chifeng Road and Yingkou Road) before and after Transformation

B. Heping Road (Section between Nanma Road and Rongji Street)

Before Transformation: width of the current road is 36 m; 6 bi-directional lanes; the cross section is 4 m (sidewalk) – 28 m (roadway) – 4 m (sidewalk).

After Transformation: 4 m (sidewalk) – 4 m (non-motor roadway) – 20 m (motor roadway) – 4m (non-motor roadway) – 4 m (sidewalk); Set separation guard bars between the motor roadway and the non-motor roadway.

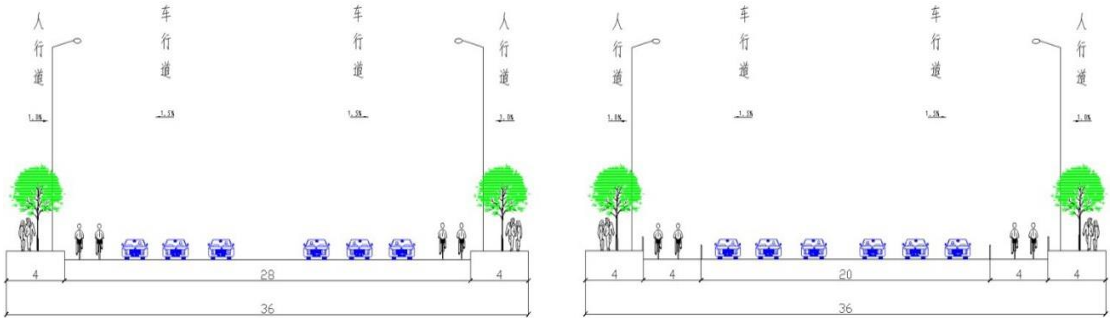


Figure 2-3-1-5 Comparison Chart of Cross Section of Heping Road (Section between Nanma Road and Rongji Street) before and after Transformation

(4) Jianshe Road

A. Jianshe Road (Section between Yingkou Road and Yantai Road)

Before Transformation: width of the red line is 30 m; 4 one-way lanes; the cross section is 3 m (sidewalk) –24 m (4 one-way lanes + non-motor roadway) – 3 m (sidewalk).

After Transformation: adjust the road from the single lane to the two-way traffic; 4 bi-directional lanes; set a central green belt with the width of about 12.5 m in the middle of road; the cross section is set to be: 1.5 (sidewalk) – 2 (non-motor roadway) – 6 (motor roadway) – 12.5 (central green belt) – 6 (motor roadway) – 2 (non-motor roadway) – 3 (sidewalk)

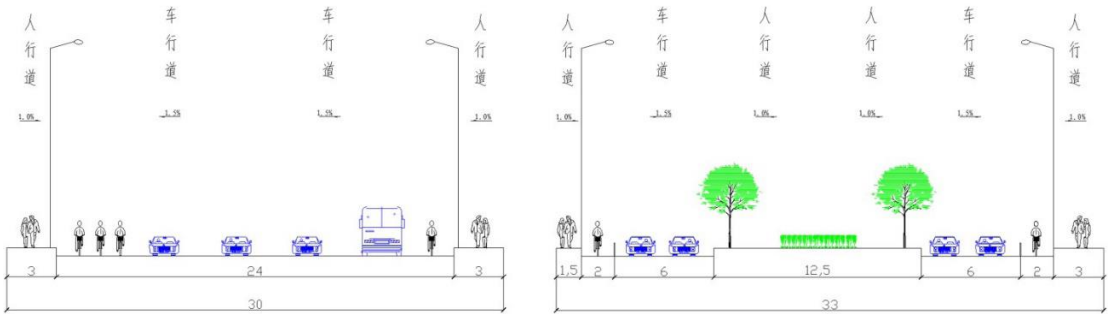


Figure 2-3-1-6 Comparison Chart of Cross Section of Jianshe Road (Section between Yingkou Road and Yantai Road) before and after Transformation

B. Jianshe Road (Section between Yantai Road and Qufu Road)

Before Transformation: width of the red line is 24 m; 3 one-way lanes; the cross section is set to be 3 m (sidewalk) – 18 m (3 one-way lanes + non-motor roadway) – 3 m (sidewalk).

After Transformation: adjust the one-way lane to bi-directional roads; 3 bi-directional lanes (one up lane, two down lanes); set a central green belt with the width of about 8 m in the middle of road; the cross section is set to be: 1.5 (sidewalk) – 2 (non-motor roadway) – 6 (motor roadway) – 8 (central green belt) – 3 (motor roadway) – 2 (non-motor roadway) – 1.5 (sidewalk)

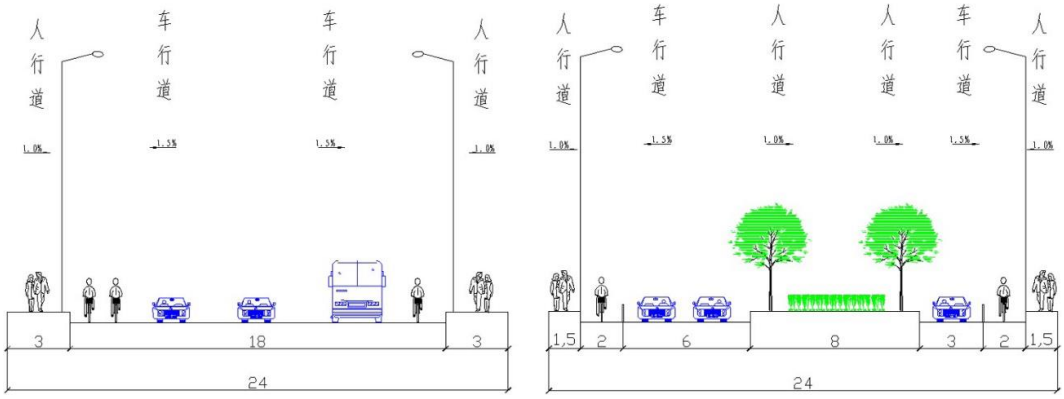


Figure 2-3-1-7 Comparison Chart of Cross Section of Jianshe Road (Section Yantai Road and Qufu Road) before and after Transformation

(5) Rongye Street (Section between Nanma Road and Duolun Road)

Before Transformation: width of the red line is 30 m; 4 bi-directional lanes; the cross section is set to be 6 m (sidewalk) – 18 m (4 bi-directional lanes + mixed lane for motor vehicles and non-motor vehicles) – 6 m (sidewalk).

After Transformation: 6 m (sidewalk) + 2.25 (non-motor roadway) + 13.5 m (motor roadway) + 2.25 (non-motor roadway) + 6 m (sidewalk)

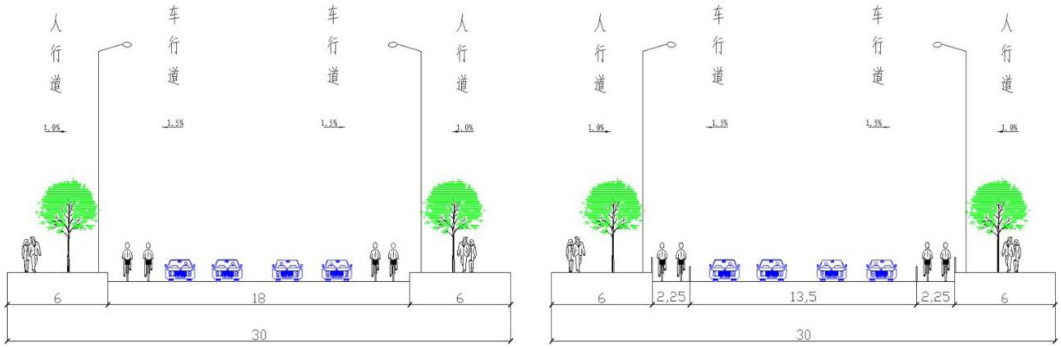


Figure 2-3-1-8 Comparison Chart of Cross Section of Rongye Street (Section between Nanma Road and Duolun Road) before and after Transformation

(6) Henan Road (Section between Fu'an Street and Duolun Road)

Before Transformation: width of the red line is 10 - 12 m; 2 one-way lanes; the cross section is set to be 1.5 – 2.5 m (sidewalk) – 7 m (2 one-way lanes) - 1.5 – 2.5 m (sidewalk).

After Transformation, the pavement layout has been transformed as 1 one-way lane; the cross section is set to be: 2.5 – 3.5 m (sidewalk) + 5 m (motor roadway) + 2.5 – 3.5 m (sidewalk).

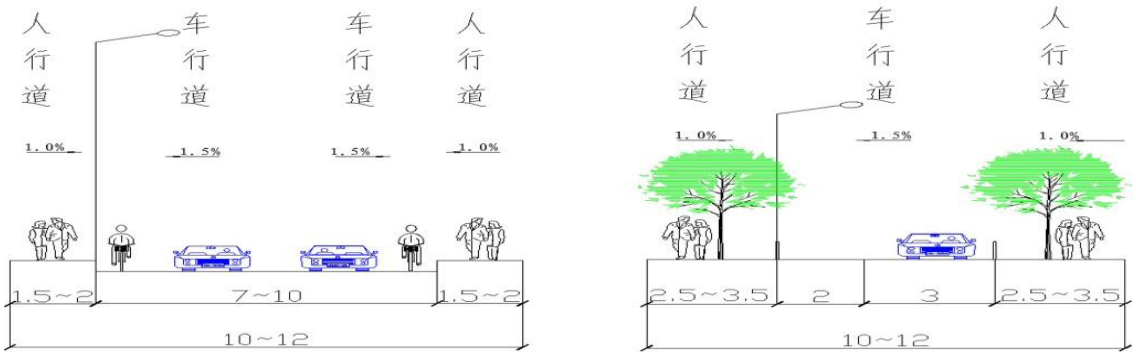


Figure 2-3-1-9 Comparison Chart of Cross Section of Henan Road (Section between Fu'an Street and Duolun Road) before and after Transformation

(7) Xing'an Road

A. Xing'an Road (Section between Heping Road and Rongji Street) Before Transformation: width of the red line is 25 m; 4 bi-directional lanes; the cross section is set to be 2 m (sidewalk) - 21 m (4 bi-directional lanes + non-motor roadway) – 2 m (sidewalk).

We will not change the width of roads, plan to separate motor vehicles and non-motor vehicles and add guard columns for motor vehicles and non-motor vehicles to prevent motor vehicles from occupying the non-motor roadway.

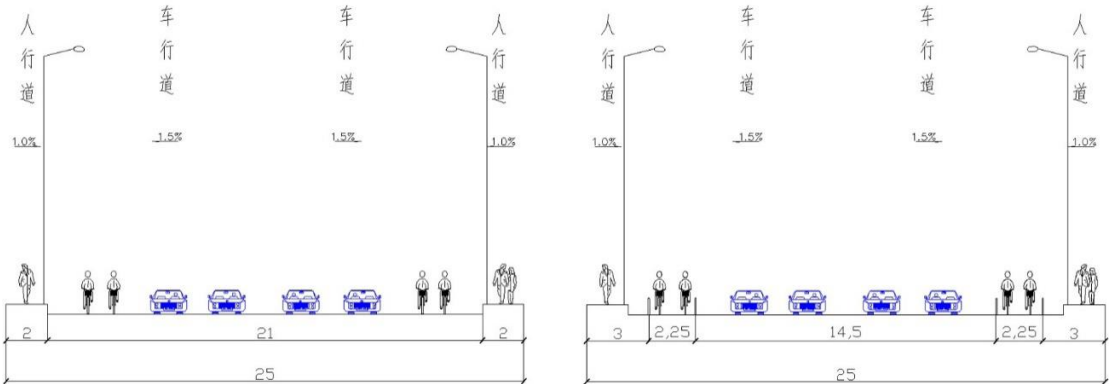


Figure 2-3-1-10 Comparison Chart of Cross Section of Xing'an Road (Section between Heping Road and Rongji Street) before and after Transformation

B. Xing'an Road (Section between Rongji Street and North Dagu Road)

Before Transformation: width of the red line is 25 m; 4 bi-directional lanes; the cross section is set to be 1 m (sidewalk) - 21 m (4bi-directional lanes + non-motor roadway) – 3 m (sidewalk).

After Transformation: the cross section is set to be: 3 m (sidewalk) – 2.25 m (non-motor roadway) – 14.5 m (4bi-directional lanes) – 2.25 (non-motor roadway) – 3 m (sidewalk).

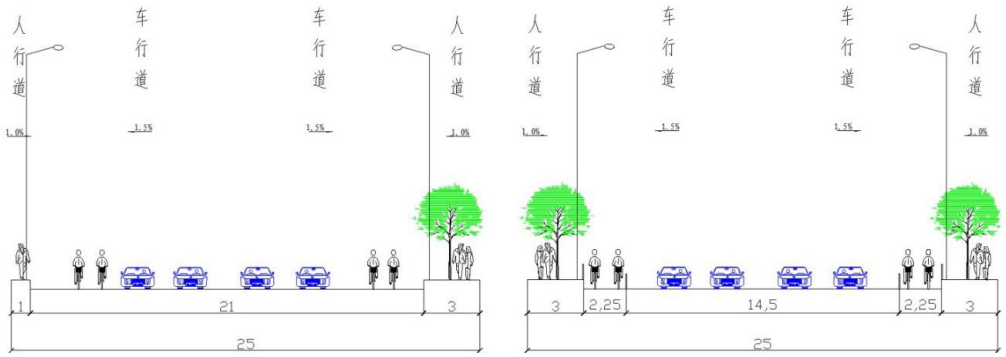


Figure 2-3-1-11 Comparison Chart of Cross Section of Xing'an Road (Section between Rongji Street and North Dagu Road) before and after Transformation

In order to extend the popularity of business circle of Heping Road to coastal area of Haihe River and connect the slow travel passages between Heping District and coastal area of Haihe River, we plan to build an overpass at the intersection of Xing'an Road and Hami Road.

(8) North Dagu Road

A. North Dagu Road (Section between Zhang Zizhong Road and Yantai Road)

Before Transformation: width of the red line is 40 m; 6 bi-directional lanes; the cross section is set to be 4 m (sidewalk) - 32 m (6 bi-directional lanes + non-motor roadway) – 4 m (sidewalk).

After Transformation: 4 m (sidewalk) – 3 m (non-motor roadway) – 26 m (motor roadway + bilateral parking belts) – 3 (non-motor roadway) – 4 m (sidewalk).

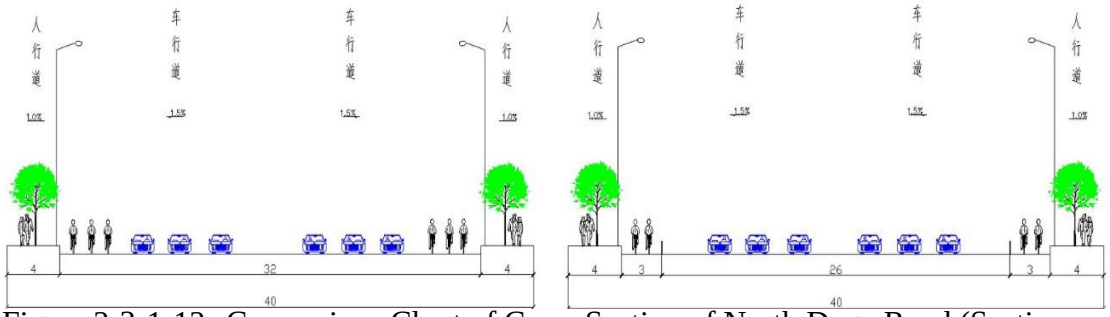


Figure 2-3-1-12 Comparison Chart of Cross Section of North Dagu Road (Section between Xing'an Road and Yantai Road) before and after Transformation

B. North Dagu Road (Section between Yantai Road and Qufu Road)

Before Transformation: width of the red line is 12 m; 2 one-way lanes; the cross section is set to be 2 m (sidewalk) - 8 m (2 one-way lanes + non-motor roadway) – 2 m (sidewalk).

After Transformation: 2 m (sidewalk) – 6 m (motor roadway) – 2 (non-motor roadway) - 2 m (sidewalk). Set the guard bars to separate the non-motor roadway and motor roadway.

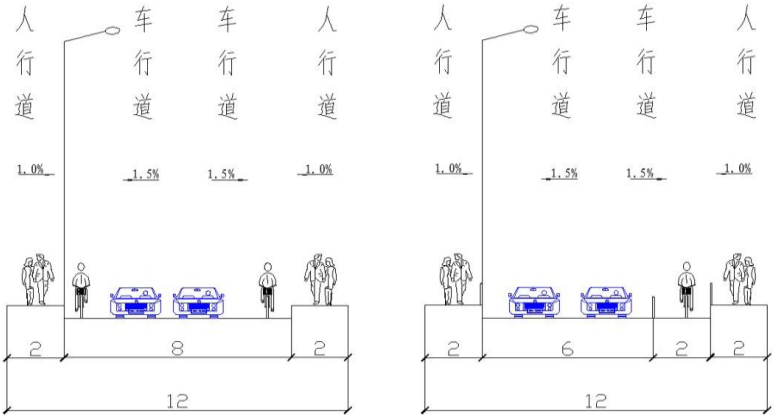


Figure 2-3-1-13 Comparison Chart of Cross Section of North Dagu Road (Section between Yantai Road and Qufu Road) before and after Transformation

C. North Dagu Road (Section between Qufu Road and Xuzhou Road)

Before Transformation: width of the red line is 36 m; 6 bi-directional lanes; the cross section is set to be 3.5 m (sidewalk) - 29 m (6 bi-directional lanes + non-motor roadway)

– 3.5 m (sidewalk).

After Transformation: 3.5 m (sidewalk) – 3 m (non-motor roadway) – 23 m (motor roadway + single-side parking belt) – 3 (non-motor roadway) – 3.5 m (sidewalk).

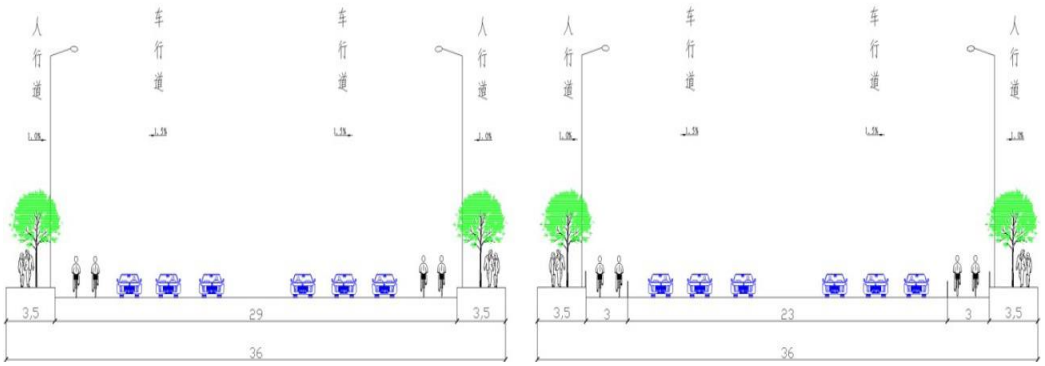


Figure 2-3-2-14 Comparison Chart of Cross Section of North Dagu Road (Section between Qufu Road and Xuzhou Road) before and after Transformation

(9) Nanmenwai Street (Section between Nanma Road and Nanjing Road)

Before Transformation: width of the red line is 50 m; 6 bi-directional lanes; the cross section is set to be 1.5 - 3 m (sidewalk) – 21 - 22 m (roadway) – 1 – 2 m (central isolation belt or isolation guard bars) - 21 - 22 m (roadway) - 1.5 - 3 m (sidewalk).

After Transformation: 3 m (sidewalk) – 3.5 m (non-motor roadway) – 3.5 m (side separation belt) – 14 m (roadway) 2 m (central separation belt) - 14 m (roadway)– 3.5 m (side separation belt) – 3 m (sidewalk).

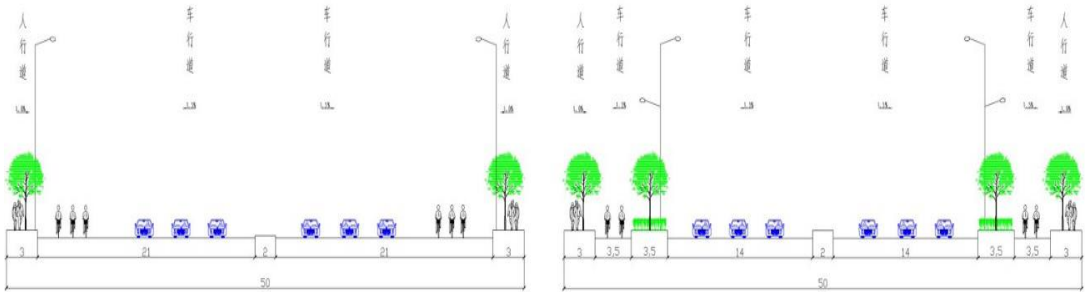


Figure 2-3-1-15 Comparison Chart of Cross Section of Nanmenwai Street (Section between Nanma Road and Nanjing Road) before and after Transformation

(10) Fu'an Street (Section between Nanmenwai Street and Zhang Zizhong Road)

Before Transformation: width of the red line is 36 m; 6 bi-directional lanes; the cross section is set to be 4 m (sidewalk) – 28 m (roadway) – 4 m (sidewalk).

After Transformation: 4 m (sidewalk) – 3.5 m (non-motor roadway) – 21 m (roadway) - 3.5 m (non-motor roadway) – 4 m (sidewalk).

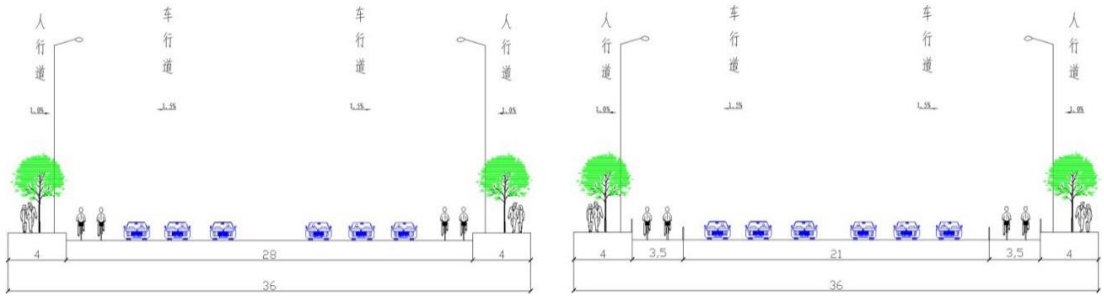


Figure 2-3-1-16 Comparison Chart of Cross Section of Fu'an Street (Section between Nanmenwai Street and Zhang Zizhong Road) before and after Transformation

(11) Qufu Road (Section between Nanjing Road and Taierzhuang Road)

Before Transformation: width of the red line is 40 – 50 m; 6 – 8 –bi-directional lanes; the cross section is set to be 4 m (sidewalk) – 4.5 – 6 m (non-motor roadway) – 10.5 – 14 m (motor roadway) – 2 m (central isolation belt) - 10.5 – 14 m (motor roadway) - 4.5 – 6 m (non-motor roadway) - 4 m (sidewalk).

After Transformation: without adjusting the road width, it is planned to separate the motor vehicles and non-motor vehicles. Set the separation guard bars between the motor roadway and the non-motor roadway, and set the sidewalk guard post at the intersections and other places to prevent the motor vehicles from occupying the sidewalk and the non-motor roadway. Take full advantage of the road space; transfer the position of the bus stops to the separation belt for the motor vehicles and non-motor vehicles to decrease interference of stopping the bus on the non-motor vehicles.

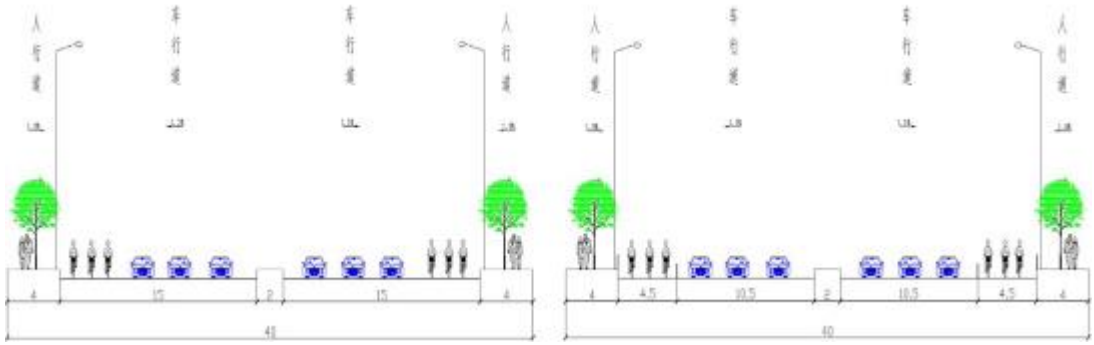


Figure 2-3-1-17 Comparison Chart of Cross Section of Qufu Road (Section between Nanjing Road and Taierzhuang Road) before and after Transformation

(12) Anshan Road (Section between Xing'an Road and Nanjing Road)

Before Transformation: width of the red line is 14 - 16 m; 2 one-way lanes; the cross section is set to be 2 - 4 m (sidewalk) – 9 m (roadway) – 2 - 5 m (sidewalk).

After Transformation: 3 m (sidewalk) – 1.5 m (non-motor roadway) – 6 m (motor roadway) - 1.5 m (non-motor roadway) – 3 m (sidewalk).

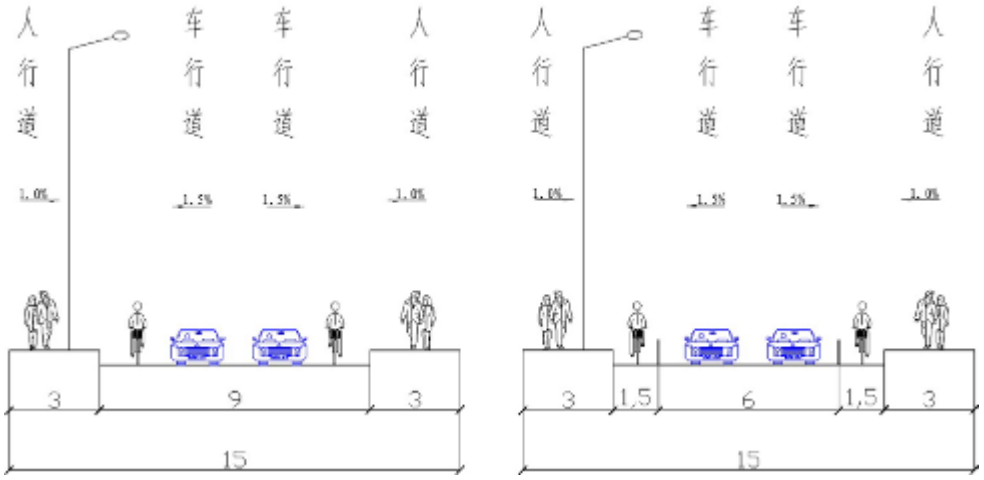


Figure 2-3-1-18 Comparison Chart of Cross Section of Anshan Road (Section between Xing'an Road and Nanjing Road) before and after Transformation

(13) Duolun Road

A. Duolun Road (Section between Zhang Zizhong Road and Xing'an Road)

Before Transformation: width of the red line is 24 m; 4bi-directional lanes; the cross

section is set to be 2 m (sidewalk) – 20 m (roadway) – 2 m (sidewalk).

After Transformation: 2 m (sidewalk) – 3 m (non-motor roadway) – 14 m (motor roadway) - 3 m (non-motor roadway) – 2 m (sidewalk).

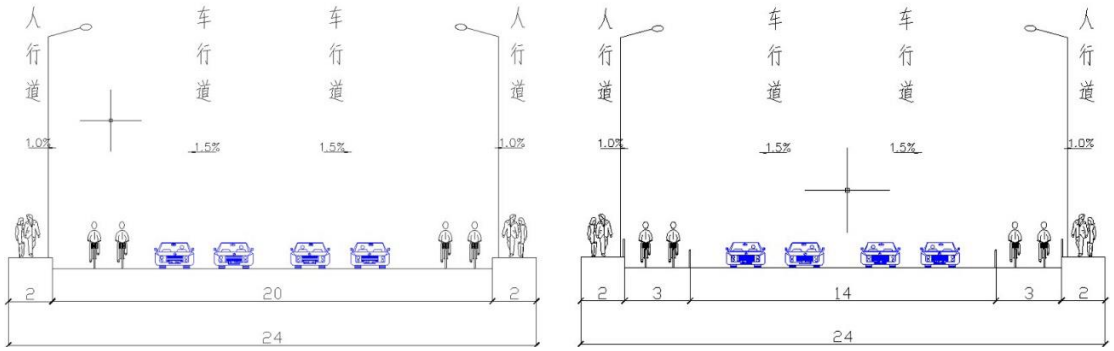


Figure 2-3-1-19 Comparison Chart of Cross Section of Duolun Road (Section between Zhang Zizhong Road and Xing'an Road) before and after Transformation

B. Duolun Road (Section between Xing'an Road and Xinhua Road)

Before Transformation: width of the red line is 20 m; 2 one-way lanes; the cross section is set to be 3 m (sidewalk) – 14 m (roadway) – 3 m (sidewalk).

After Transformation: 3 m (sidewalk) – 2.5 m (non-motor roadway) – 9 m (motor roadway + single-side parking belt) – 2.5 m (non-motor roadway) – 3 m (sidewalk).

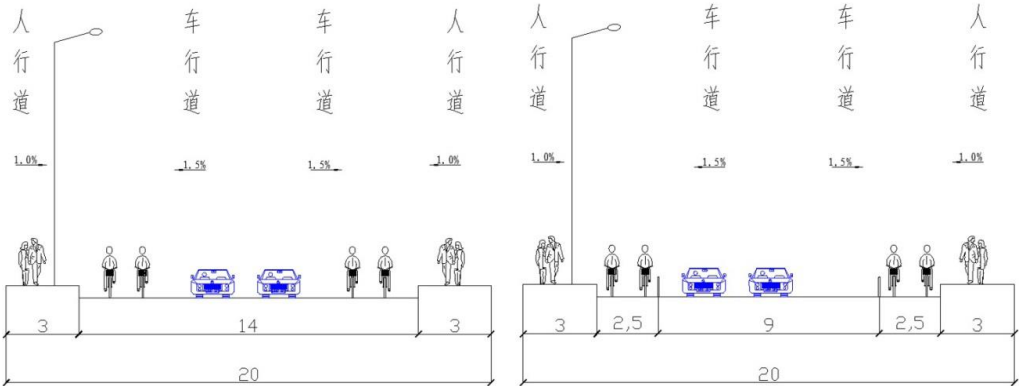


Figure 2-3-1-20 Comparison Chart of Cross Section of Duolun Road (Section between Xing'an Road and Xinhua Road) before and after Transformation

C. Duolun Road (Section between Xinhua Road and Nanmenwai Street)

Before Transformation: width of the red line is 14 m; 2 one-way lanes; the cross section is 2 m (sidewalk) – 10 m (roadway) – 2 m (sidewalk).

After Transformation: 2 m (sidewalk) – 1.5 m (non-motor roadway) – 7 m (motor roadway) – 1.5 m (non-motor roadway) – 2 m (sidewalk).

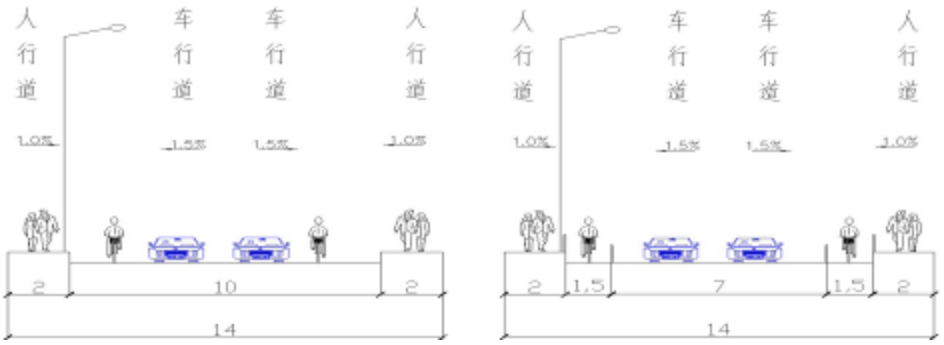


Figure 2-3-1-21 Comparison Chart of Cross Section of Duolun Road (Section between Xinhua Road and Nanmenwai Street) before and after Transformation

(14) Chifeng Road (Section between Nanjing Road and Zhang Zizhong Road)

Before Transformation: width of the red line is 14 - 16 m; 2 one-way lanes; the cross section is set to be 2 - 3 m (sidewalk) – 10 m (roadway) – 2 - 3 m (sidewalk).

After Transformation: 3.5 m (sidewalk) – 2 m (non-motor roadway) – 3.5 m (motor roadway) – 2 m (non-motor roadway) – 3 m (sidewalk).

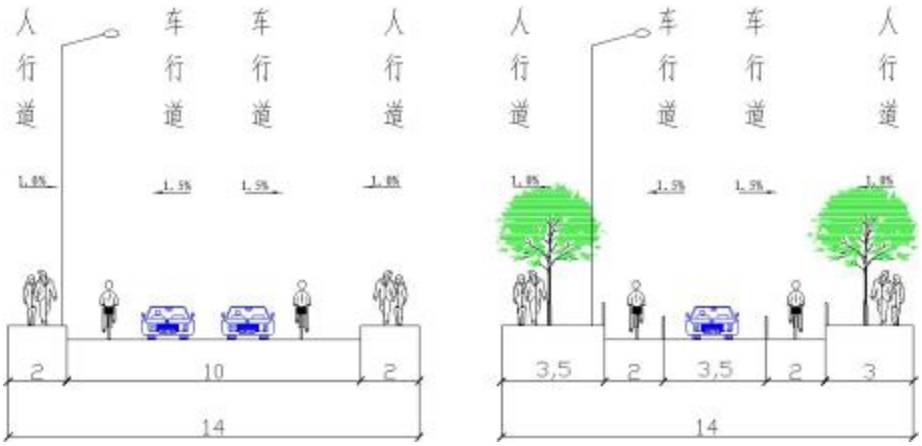


Figure 2-3-1-22 Comparison Chart of Cross Section of Chifeng Road (Section between Nanjing Road and Zhang Zizhong Road) before and after Transformation

(15) Shaanxi Road (Section between Rongye Street and Chifeng Road)

Before Transformation: width of the red line is 10 -12 m; 2 one-way lanes; the cross section is set to be 2 – 2.5 m (sidewalk) – 6 - 7 m (roadway) – 2 – 2.5 m (sidewalk).

After Transformation: the pavement is set to be one-way lane; the cross section is set to: 3 m (sidewalk) – 2 m (non-motor roadway) – 5 m (motor roadway + roadside parking belt) – 2 m (sidewalk).

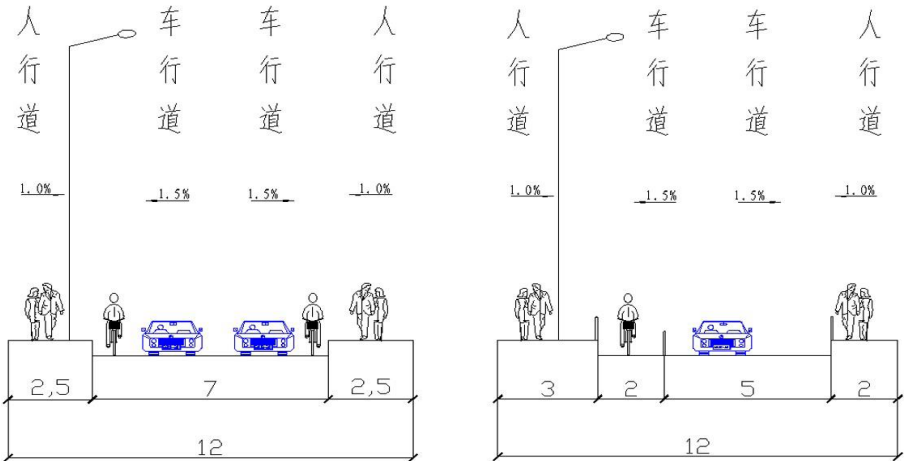


Figure 2-3-1-23 Comparison Chart of Cross Section of Shaanxi Road (Section between Rongye Street and Chifeng Road) before and after Transformation

(16) Shanxi Road (Section between Nanjing Road and Chifeng Road)

Before Transformation: width of the red line is 17 -18 m; 2 one-way lanes; the cross section is set to be 3 - 4 m (sidewalk) – 11 m (roadway) – 3 - 4 m (sidewalk).

After Transformation: 4 m (sidewalk) – 2.5 m (non-motor roadway) – 6 m (motor roadway) – 2.5 m (non-motor roadway) - 4 m (sidewalk). Without adjusting the road width, increase the sidewalk width and separate the motor vehicles and non-motor vehicles.

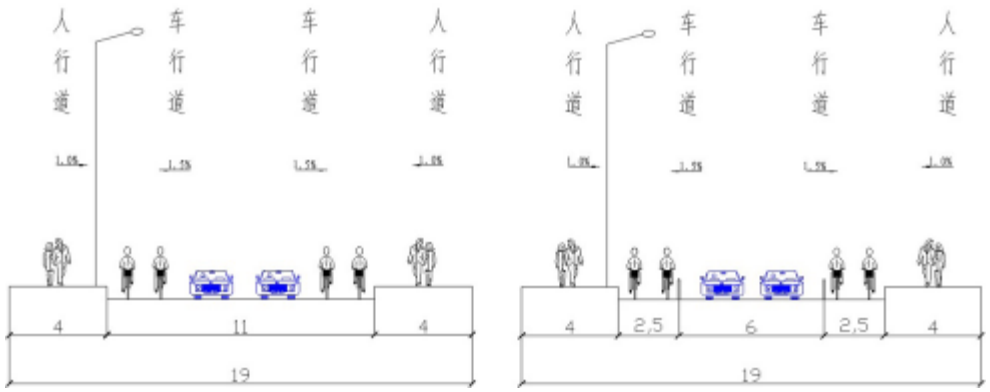


Figure 2-3-1-24 Comparison Chart of Cross Section of Shanxi Road (Section between Nanjing Road and Chifeng Road) before and after Transformation

(17) Baoding Road

A. Baoding Road (Shanxi Road Hebei Road Section)

Before Transformation: width of the red line is 15m; 2 one-way lanes; the cross section is set to be 2 m (sidewalk) – 11 m (roadway) – 2 m (sidewalk).

After Transformation: 3 m (sidewalk) – 2.5 m (non-motor roadway) – 10 m (motor roadway + bilateral parking belts) - 2.5 m (non-motor roadway) - 3 m (sidewalk).

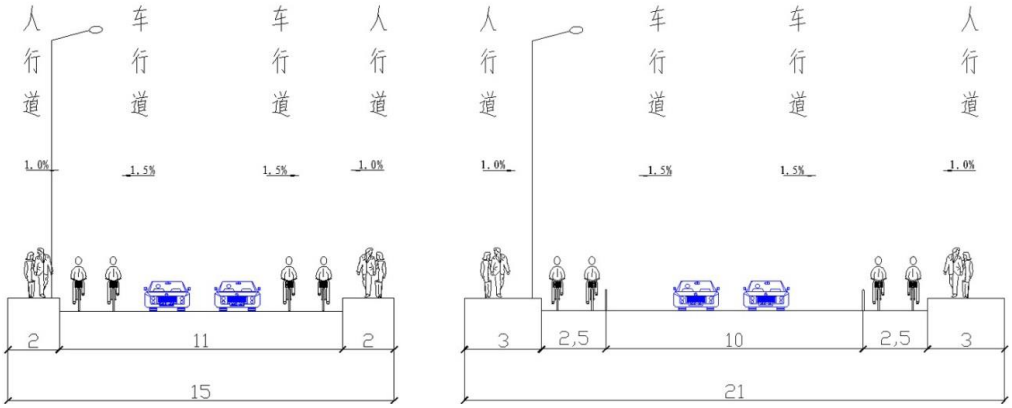


Figure 2-3-1-25 Comparison Chart of Cross Section of Baoding Road (Section between Shanxi Road Hebei Road) before and after Transformation

B. Baoding Road (Section between Hebei Road and Xinhua Road)

Before Transformation: width of the red line is 20 m; 2 one-way lanes; the cross section is set to be 3 m (sidewalk) – 14 m (roadway) – 3 m (sidewalk).

After Transformation: 3 m (sidewalk) – 2 m (non-motor roadway) – 10 m (motor roadway + bilateral parking belts) – 2 m (non-motor roadway) - 3 m (sidewalk).

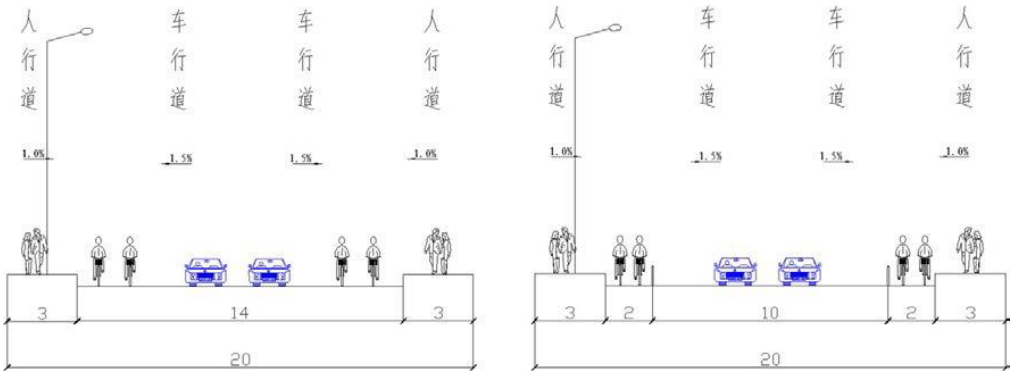


Figure 2-3-1-26 Comparison Chart of Cross Section of Baoding Road (Section between Hebei Road and Xinhua Road) before and after Transformation

C. Baoding Road (Section between Xinhua Road and Jianshe Road)

Before Transformation: width of the red line is 23 - 25 m; 2 one-way lanes; the cross section is set to be 2.5 – 3.5 m (sidewalk) – 18 m (roadway) – 2.5 – 3.5 m (sidewalk).

After Transformation: 4 m (sidewalk) – 2.5 m (non-motor roadway) –10 m (motor roadway + bilateral parking belts) – 2.5 m (non-motor roadway) - 4 m (sidewalk).

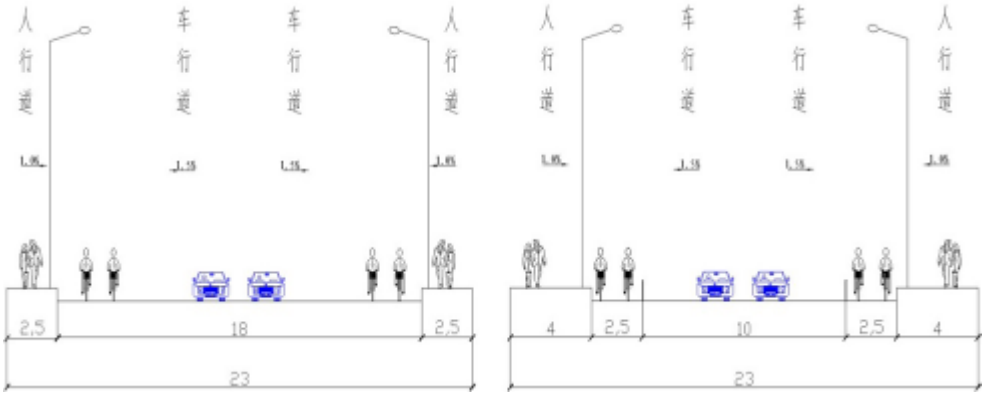


Figure 2-3-1-27 Comparison Chart of Cross Section of Baoding Road (Section between Xinhua Road and Jianshe Road) before and after Transformation

D. Baoding Road (Section between Jianshe Road and North Dagu Road)

Before Transformation: width of the red line is 24 m; 4 bi-directional lanes; the cross

section is set to be 3 m (sidewalk) – 18 m (roadway) – 3 m (sidewalk).

After Transformation: 4 m (sidewalk) – 2.5 m (non-motor roadway) –11 m (motor roadway + bilateral parking belts) – 2.5 m (non-motor roadway) - 4 m (sidewalk); the pavement is 2 bi-directional lanes after Transformation.

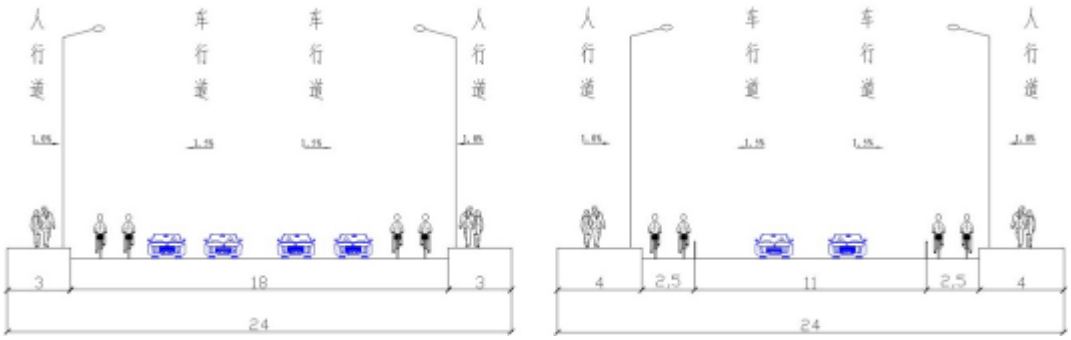


Figure 2-3-1-28 Comparison Chart of Cross Section of Baoding Road (Section between Jianshe Road and North Dagu Road) before and after Transformation

E. Baoding Road (Section between North Dagu Road and Zhang Zizhong Road)

Before Transformation: width of the red line is 30 m; 4 bi-directional lanes; the cross section is set to be 2 m (sidewalk) – 26 m (roadway) – 2 m (sidewalk).

After Transformation: the pavement is 6 bi-directional lanes after Transformation; the cross section is set to be 3.5 m (sidewalk) – 2.5 m (non-motor roadway) – 18 m (motor roadway) –2.5 m (non-motor roadway) – 3.5 m (sidewalk).

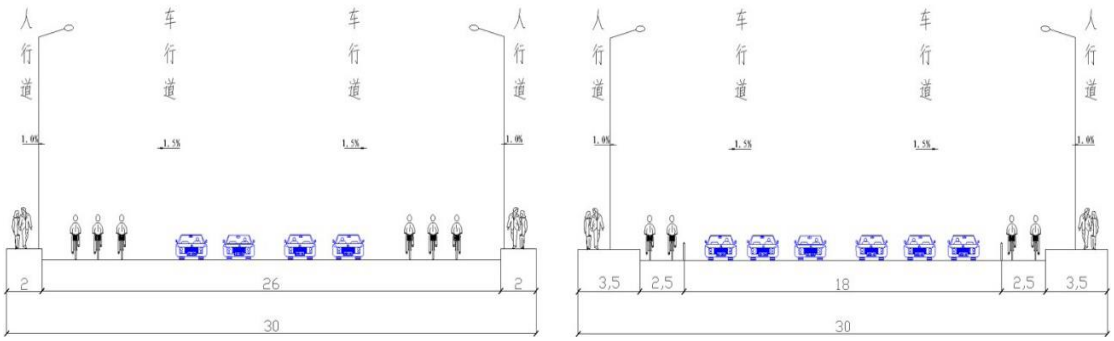


Figure 2-3-1-29 Comparison Chart of Cross Section of Baoding Road (Section between North Dagu Road and Zhang Zizhong Road) before and after Transformation

(18) Lu'an Street (Section between Duolun Road and Rongji Street)

Before Transformation: width of the red line is 25 m; 4 bi-directional lanes; the cross section is set to be 2.5 m (sidewalk) – 20 m (roadway) – 2.5 m (sidewalk).

After Transformation: 3.5 m (sidewalk) – 3 m (non-motor roadway) - 12 m (motor roadway + bilateral parking belts) – 3 m (non-motor roadway) – 3.5 m (sidewalk); the pavement is 2 bi-directional lanes after Transformation.

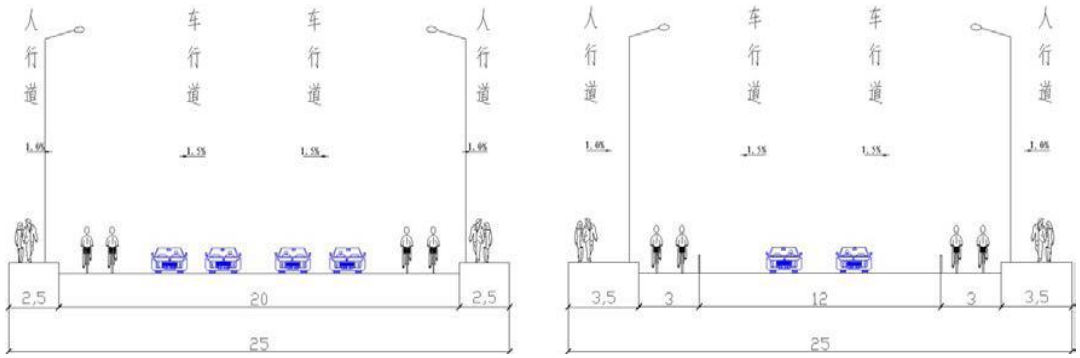


Figure 2-3-1-30 Comparison Chart of Cross Section of Lu'an Street (Section between Duolun Road and Rongji Street) before and after Transformation

(19) Xinhau Road

A. Xinhua Road (Section between Nanjing Road and Yingkou Road)

Before Transformation: width of the red line is 22 m; 2 one-way lanes; the cross section is set to be 3 m (sidewalk) – 10 m (roadway) – 9 m (sidewalk).

After Transformation: 3 m (sidewalk) – 3 m (non-motor roadway) – 6 m (motor roadway) – 4.5 m (parking belt) – 2.5 m (non-motor roadway) – 3 m (sidewalk). Under the premise of no adjustment of road width, increase the width of roadway eastwards, and decrease the width of sidewalk on the east side and separate motor vehicles and non-motor vehicles.

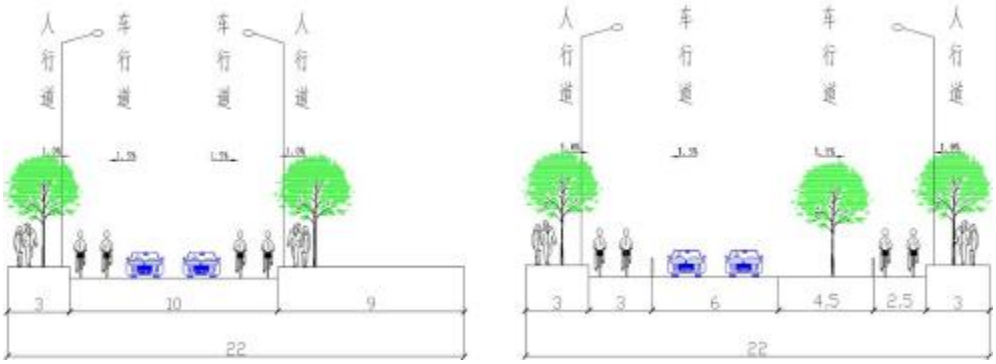


Figure 2-3-1-31 Comparison Chart of Cross Section of Xinhua Road (Section between Nanjing Road and Yingkou Road) before and after Transformation

B. Xinhua Road (Section between Yingkou Road and Jinzhou Road)

Before Transformation: width of the red line is 16 m; 2 one-way lanes; the cross section is set to be 3 m (sidewalk) – 10 m (roadway) – 3 m (sidewalk).

After Transformation: 3 m (sidewalk) – 2 m (non-motor roadway) – 6 m (motor roadway) - 2 m (non-motor roadway) – 3 m (sidewalk).

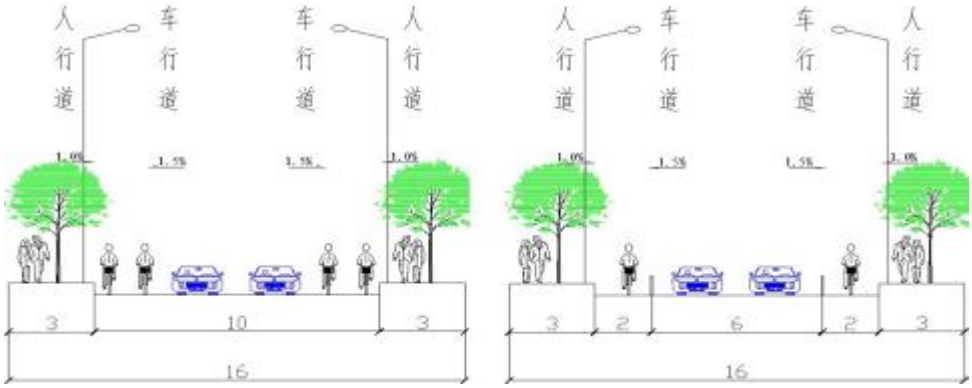


Figure 2-3-1-32 Comparison Chart of Cross Section of Xinhua Road (Section between Yingkou Road and Jinzhou Road) before and after Transformation

C. Xinhua Road (Section between Jinzhou Road and Duolun Road)

Before Transformation: width of the red line is 10 - 12 m; 1 one-way lane; the cross section is set to be 2.5 m (sidewalk) – 7 m (roadway) – 2.5 m (sidewalk).

After Transformation: 2.5 m (sidewalk) – 2 m (non-motor roadway) –3 m (motor roadway) - 2 m (non-motor roadway) – 2.5 m (sidewalk).

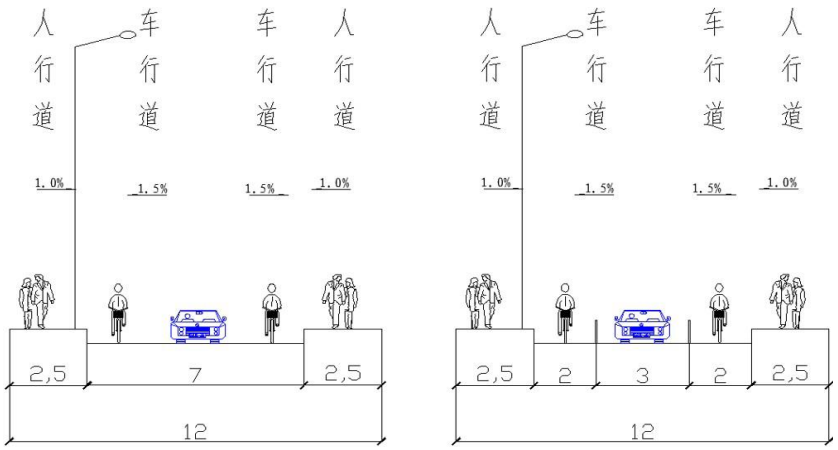


Figure 2-3-1-3 3 Comparison Chart of Cross Section of Xinhua Road (Section between Jinzhou Road and Duolun Road) before and after Transformation

(20) Xuzhou Road

A. Xuzhou Road (Section between Nanjing Road and North Dagu Road)

Before Transformation: width of the red line is 20 m; 2 one-way lanes; the cross section is set to be 2.5 m (sidewalk) – 15 m (roadway) – 2.5 m (sidewalk).

After Transformation: 2.5 m (sidewalk) – 3 m (non-motor roadway) – 9 m (motor roadway + roadside parking belt) - 3 m (non-motor roadway) – 2.5 m (sidewalk).

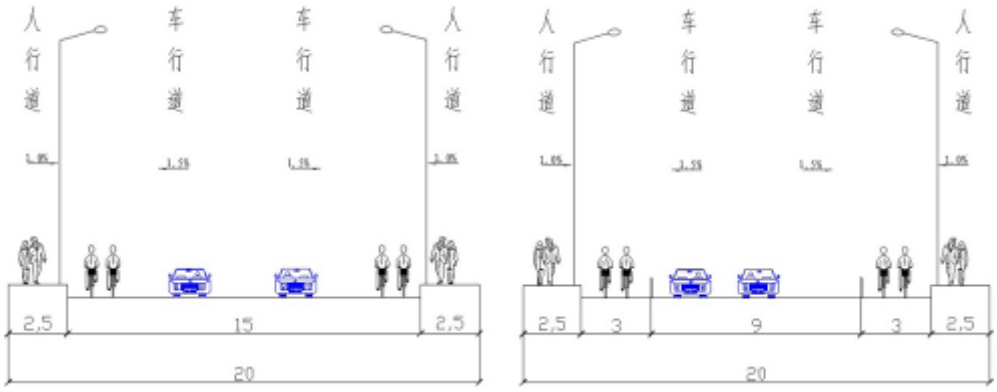


Figure 2-3-1-34 Comparison Chart of Cross Section of Xuzhou Road (Section between Nanjing Road and North Dagu Road) before and after Transformation

B. Xuzhou Road (Section between North Dagu Road and North Jiefang Road)

Before Transformation: width of the red line is 12 m; 2 one-way lanes; the cross section

is set to be 2 m (sidewalk) – 8 m (roadway) – 2 m (sidewalk); width of the red line on the road is 20 m; it is temporarily occupied by the construction site in the north.

After Transformation: 3 m (sidewalk) – 2.5 m (non-motor roadway) – 7 m (motor roadway) – 2.5 m (non-motor roadway) – 5 m (sidewalk). The road transformation plans to recover the road occupied by the site.

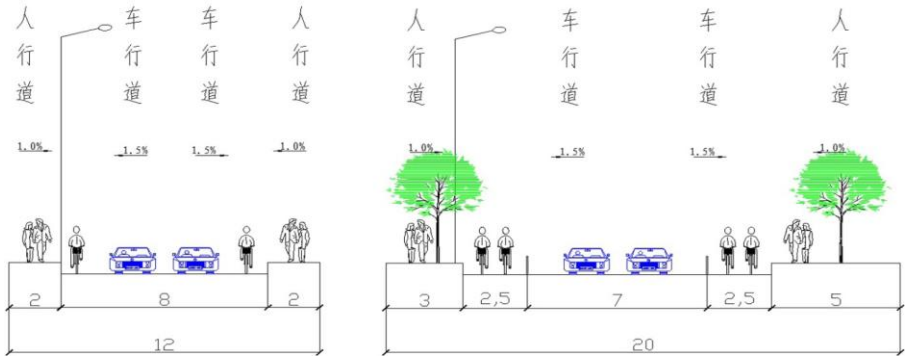


Figure 2-3-1-35 Comparison Chart of Cross Section of Xuzhou Road (Section between North Dagu Road and North Jiefang Road) before and after Transformation

C. Xuzhou Road (Section between North Jiefang Road and Taierzhuang Road)

Before Transformation: current width of the road is 14 m; 2 one-way lanes; the cross section is set to be 3 m (sidewalk) – 8 m (roadway) – 3 m (sidewalk).

After Transformation: 3 m (sidewalk) – 2 m (non-motor roadway) - 4 m (motor roadway) - 2 m (non-motor roadway) – 3 m (sidewalk); the pavement is 1 one-way lane after Transformation.

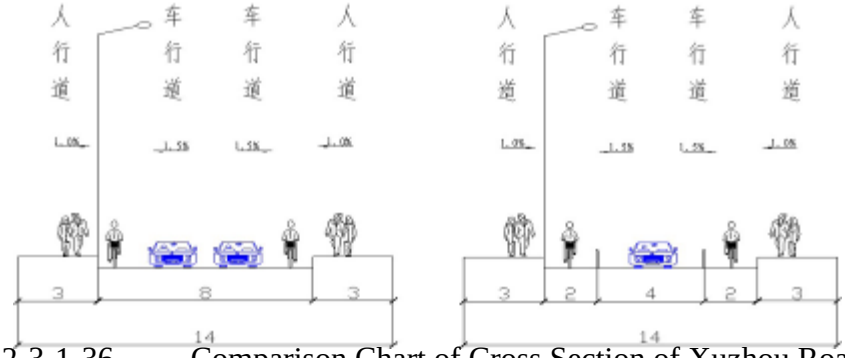


Figure 2-3-1-36 Comparison Chart of Cross Section of Xuzhou Road (Section between North Jiefang Road and Taierzhuang Road) before and after Transformation

(21) Huayuan Huandao Road

Before Transformation: current width of the road is 12 m; 2 one-way lanes; the cross section is set to be 2 m (sidewalk) – 10 m (roadway) – 2 m (sidewalk).

After Transformation: Under the premise of no adjustment of road width, transform this section of road into pedestrian street. Remove the current road surface layer and pave the roads with imitation granite materials uniformly and transform the roadway into pedestrian street.

(22) Chengde Road

Before Transformation: current width is 16 m; 2 one-way lanes; the cross section is set to be 3 m (sidewalk) – 10 m (roadway) – 3 m (sidewalk).

After Transformation: Under the premise of no adjustment of road width, transform this section of road into pedestrian street. Remove the current road surface layer and pave the roads with imitation granite materials uniformly and transform the roadway into pedestrian street. Set guard posts at intersections to prevent vehicles from entering the central park through this road.

(23) Dandong Road

Before Transformation: current width is 16 m; 2 one-way lanes; the cross section is set to be 3 m (sidewalk) – 10 m (roadway) – 3 m (sidewalk).

After Transformation: Under the premise of no adjustment of road width, transform this section of road into pedestrian street. Remove the current road surface layer and pave the roads with imitation granite materials uniformly and transform the roadway into pedestrian street. Set guard posts at intersections to prevent vehicles from entering the central park through this road.

(24) Liaoning Road

Before Transformation: current width of the road is 12 m; 2 one-way lanes; the cross section is set to be 2 m (sidewalk) – 10 m (roadway) – 2 m (sidewalk).

After Transformation: Under the premise of no adjustment of road width, transform this section of road into pedestrian street. Remove the current road surface layer and pave the roads with imitation granite materials uniformly and transform the roadway into pedestrian street. Set guard posts at intersections to prevent vehicles from entering the central park through this road.

(25) Zhang Zizhong Road (Heping District Section)

Set the dedicated bikeway in the existing sidewalk area on this section close to the bank of Haihe River; width of the bikeway is 4 m; the colorful concrete bituminous pavement is adopted and the warning marks such as the road marking and signs.

(26) Taierzhuang Road

Set the dedicated bikeway in the existing sidewalk area on this section close to the bank of Haihe River; width of the bikeway is 4 m; the colorful concrete bituminous pavement is adopted and the warning marks such as the road marking and signs.

(27) Beima Road (Section between Dongma Road and Xima Road)

Before Transformation: current width is 45 m; 8 bi-directional lanes; the cross section is set to be 3 m (sidewalk) – 3 m (non-motor roadway) – 1.5 m (separation belt between motor vehicle lane and non-motor vehicle lane) - 30 m (roadway) –1.5 m (separation belt between motor vehicle lane and non-motor vehicle lane) - 3 m (non-motor roadway) - 3 m (sidewalk).

After Transformation: Under the premise of no adjustment of road width, it is planned to afforest the existing side separation belt. Set separation guard bars between motor vehicle lane and non-motor vehicle lane at the north side of the road section between YingYuan Road and Jinzhongqiao Road and set guard posts in sideways to prevent the motor vehicles from occupying sidewalks and non-motor vehicles.

(28) Dongma Road (Section between Beima Road and Nanma Road)

Before Transformation: width of the current road is 36 m; 6 bi-directional lanes; the cross

section is 4 m (sidewalk) – 28 m (roadway) – 4 m (sidewalk).

After Transformation: 4 m (sidewalk) – 4 m (non-motor roadway) - 20 m (motor roadway) - 4 m (non-motor roadway) – 4 m (sidewalk).

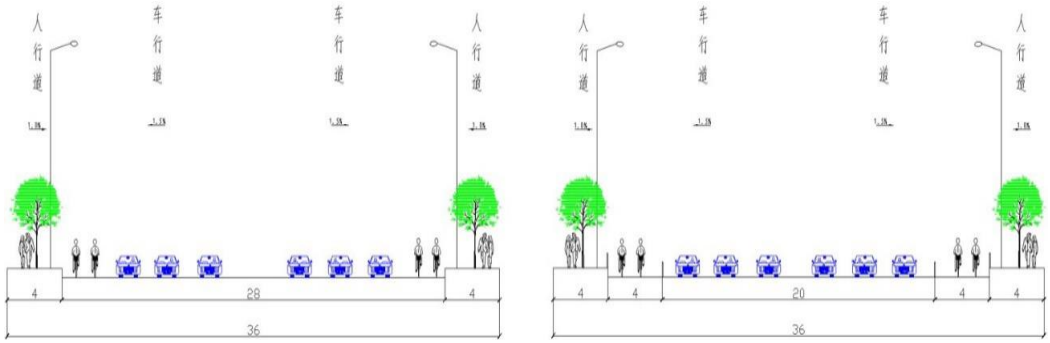


Figure 2-3-1-37 Comparison Chart of Cross Section of Dongma Road (Section between Beima Road and Nanma Road) before and after Transformation

(29) Nanma Road (Section between Dongma Road and Xima Road)

Before Transformation: current width is 36 m; 6 bi-directional lanes; the cross section is set to be 3.5 m (sidewalk) – 29 m (roadway) – 3.5 m (sidewalk).

After Transformation: the cross section layout: 5.5 m (sidewalk) – 4.5 m (non-motor roadway) – 2.5 m (separation belt between motor vehicles and non-motor vehicles) - 15 m (motor roadway) – 4.5 m (non-motor roadway) – 5.5 m (sidewalk); the pavement is 4 bi-directional lanes after Transformation.

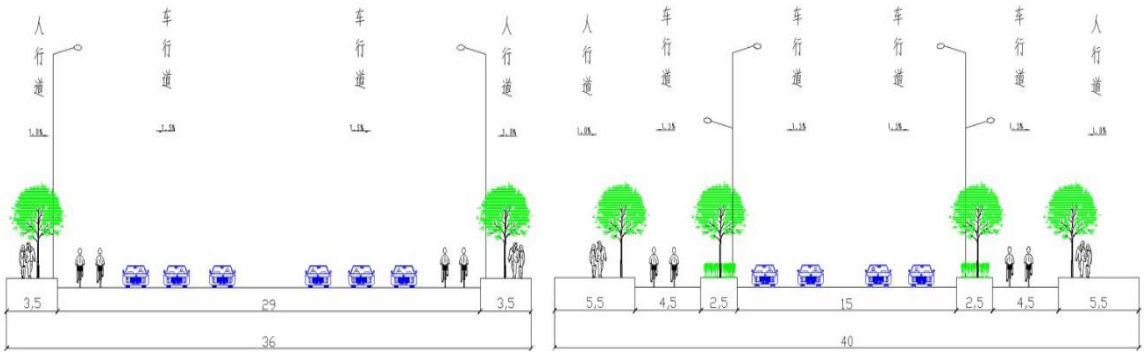


Figure 2-3-1-38 Comparison Chart of Cross Section of Nanma Road (Section between Dongma Road and Xima Road) before and after Transformation

(30) Xima Road (Beima Road to Nanma Road)

Before Transformation: current width is 45 m; 8 bi-directional lanes; the cross section is set to be 1.5 m (sidewalk) – 3 m (non-motor roadway) – 1.5 (separation belt between motor vehicle lane and non-motor vehicle lane) - 29 m (roadway) –1.5 (separation belt between motor vehicle lane and non-motor vehicle lane) – 3.3 m (non-motor roadway) - 5 m (sidewalk).

After Transformation: 6 m (sidewalk) – 3.5 m (non-motor roadway) – 3 m (separation belt between motor vehicles and non-motor vehicles) – 22.5 m (motor roadway+ parking belt) – 1.7 m (separation belt between motor vehicles and non-motor vehicles) – 1.7 m (non-motor roadway) – 3.3 m (non-motor roadway) – 5 m (sidewalk); the pavement is 6 bi-directional lanes + parking belt after Transformation.

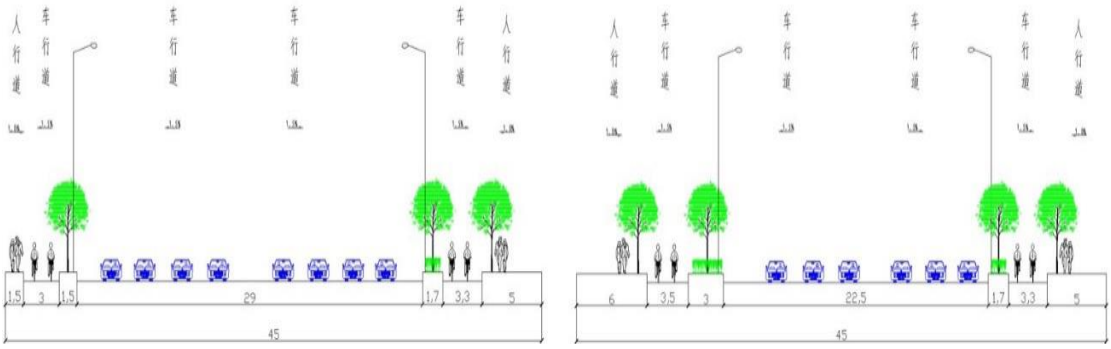


Figure 2-3-1-39 Comparison Chart of Cross Section of Xima Road (Section between Beima Road and Nanma Road) before and after Transformation

(31) Beicheng Street (Section between Dongma Road and Xima Road)

Before Transformation: current width is 30 m; 4 bi-directional lanes; the cross section is set to be 3 m (sidewalk) - 24 m (roadway) - 3 m (sidewalk).

After Transformation: 3 m (sidewalk) – 2.5 m (non-motor roadway) – 2.5 m (separation belt between motor vehicles and non-motor vehicles) – 14 m (motor roadway) – 2.5 m (non-motor roadway) – 3 m (sidewalk); in addition, improve the 3 m green belts on both sides of the road. The pavement is 4 bi-directional lanes after Transformation.

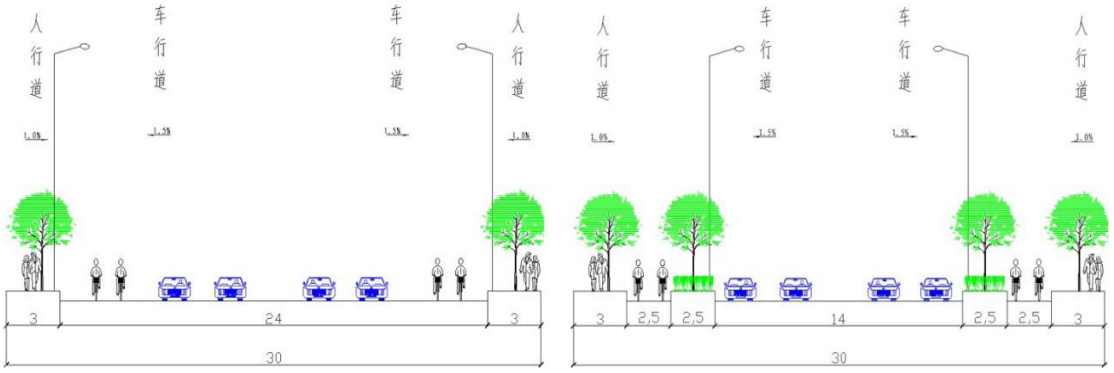


Figure 2-3-1-40 Comparison Chart of Cross Section of Beicheng Street (Section between Dongma Road and Xima Road) before and after Transformation

(32) West Gulou Street (Section between Xima Road and West Chengxiang Road)

Before Transformation: current width is 40 m; 6 bi-directional lanes; the cross section is set to be 4 m (sidewalk) - 32 m (roadway) - 4 m (sidewalk).

After Transformation: 4 m (sidewalk) – 3.5 m (non-motor roadway) – 3 m (separation belt between motor vehicles and non-motor vehicles) – 19 m (motor roadway + bilateral parking belts) - 3 m (separation belt between motor vehicles and non-motor vehicles) –3.5 m (non-motor roadway) – 4 m (sidewalk); the pavement is 4 bi-directional lanes.

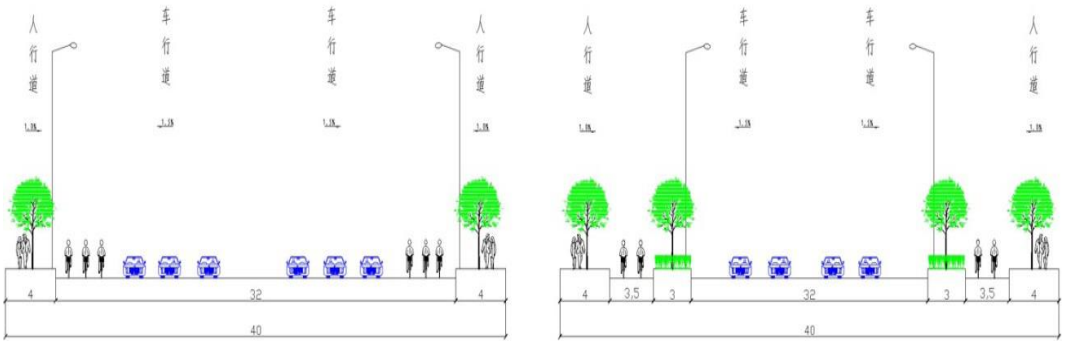


Figure 2-3-1-41 Comparison Chart of Cross Section of West Gulou Street (Section between Xima Road and West Chengxiang Road) before and after Transformation

(33) East Gulou Street (Section between Dongma Road and East Chengxiang Road)

Before Transformation: current width is 30 m; 2 bi-directional lanes; the cross section is set to be 10 m (sidewalk and facility belt) - 4 m (green belt) - 12 m (roadway) – 4 m

(sidewalk and facility belt).

After Transformation: 6.5 m (sidewalk) – 3.5 m (non-motor roadway) – 4 m (green belt) – 9.5 m (motor roadway + parking belt) –2.5 m (non-motor roadway) - 4 m (sidewalk).

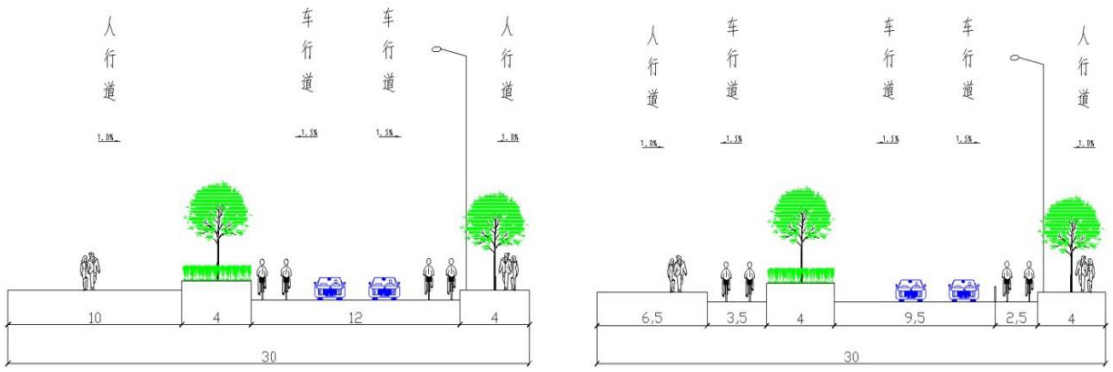


Figure 2-3-1-42 Comparison Chart of Cross Section of East Gulou Street (Section between Dongma Road and East Chengxiang Road) before and after Transformation

(34) Nancheng Street (Section between East Chengxiang Road and West Chengxiang Road)

Before Transformation: current width is 30 m; 4 bi-directional lanes; the cross section is set to be 3 m (sidewalk) - 24 m (roadway) – 3 m (sidewalk).

After Transformation: 3 m (sidewalk) – 2.5 m (non-motor roadway) – 2.5 m (lane separation belt between motor vehicle lane and non-motor vehicle lane) – 14 m (motor roadway) –2.5 m (lane separation belt between motor vehicle lane and non-motor vehicle lane) – 2.5 m (mom-motor roadway) - 3 m (sidewalk); in addition, improve the 3 m green belts on both sides of the road.

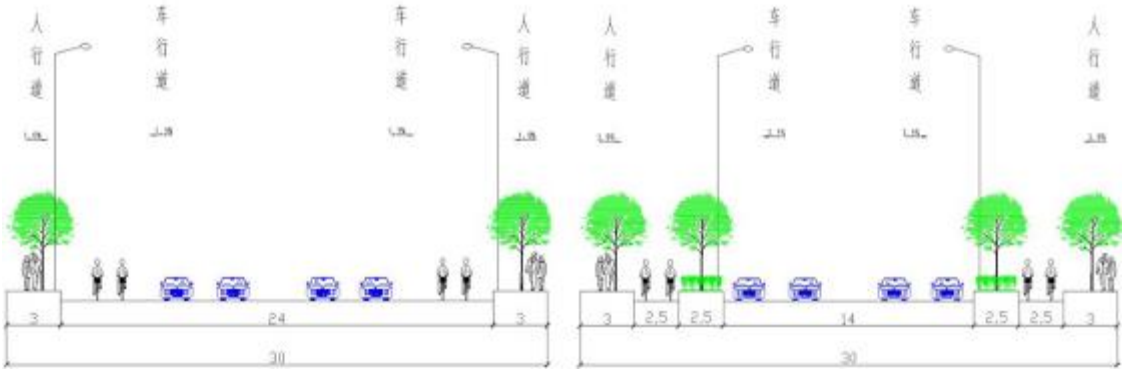


Figure 2-3-1-43 Comparison Chart of Cross Section of Nancheng Street (Section between East Chengxiang Road and West Chengxiang Road) before and after Transformation

(35) West Chengxiang Street (Section between Beima Road and Nanman Road)

Before Transformation: current width is 30 m; 4 bi-directional lanes; the cross section is set to be 4 m (sidewalk) - 22 m (roadway) – 4 m (sidewalk).

After Transformation: 4 m (sidewalk) – 2.5 m (non-motor roadway) – 2 m (separation belt between motor vehicle lane and non-motor vehicle lane) – 13 m (motor roadway) –2 m (separation belt between motor vehicle lane and non-motor vehicle lane) - 2.5 m (mom-motor roadway) - 4 m (sidewalk).

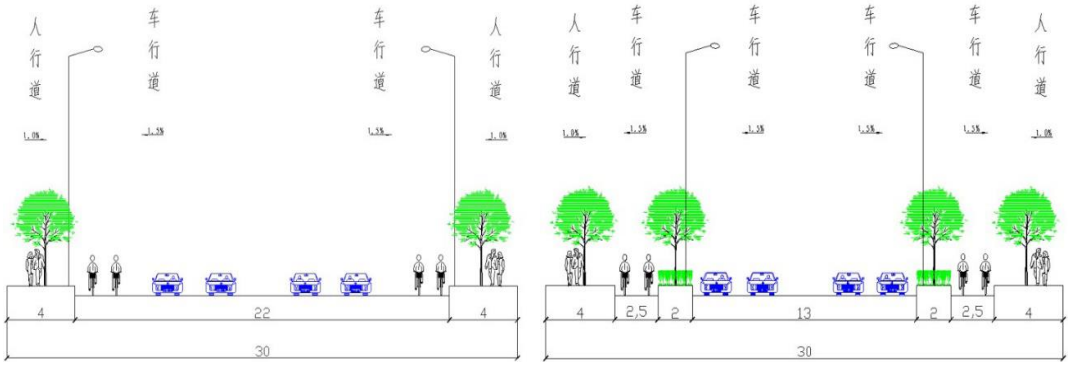


Figure 2-3-1-44 Comparison Chart of Cross Section of West Chengxiang Street (Section between Beima Road and Nanman Road) before and after Transformation

(36) Middle Chengxiang Road

A. Middle Chengxiang Road (Section between Beima Road and Beicheng Street)

Before Transformation: current width is 60 m; 8bi-directional lanes; the cross section is set to be 3.5 m (sidewalk) – 9 m (auxiliary road) – 1.5 m (lane separator) – 15 m (motor roadway) – 2 m (lane separator) – 15 m (motor roadway) – 1.5 m (lane separator) – 9 m (auxiliary road) – 3.5 m (sidewalk).

After Transformation: 3 m (sidewalk) – 7 m (auxiliary road) – 3.5 m (lane separator) – 14 m (motor roadway) – 4 m (lane separator) – 14 m (motor roadway) – 3.5 m (lane separator) – 7 m (auxiliary road) – 3.5 m (lane separator); widen the non-separator and afforest it.

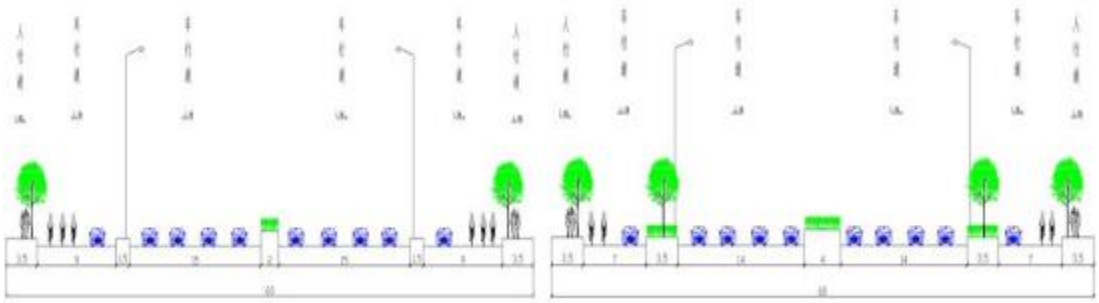


Figure 2-3-1-45 Comparison Chart of Cross Section of Middle Chengxiang Road (Section between Beima Road and Beicheng Street) before and after Transformation

B. Middle Chengxiang Road (Beicheng Street and Nanma Road)

Before Transformation: each half range of the current width is 25 m; 4 one-way lanes respectively; the cross section is set to be 3.5 m (sidewalk) – 18 (roadway) – 3.5 m (sidewalk).

After Transformation: 3.5 m (sidewalk) – 3.5 m (non-motor roadway) – 2.5 m (lane separator for motor vehicles and non-motor vehicles) – 12 m (motor roadway + parking belt) – 3.5 m (sidewalk); after the transformation, each half range of the road surface is set to be 3 one-way lanes; build separation belt between motor vehicle lane and non-motor vehicle lane and afforest it to separate motor vehicle lane and non-motor vehicle lane. In addition, improve the virescence of belt park on both sides.

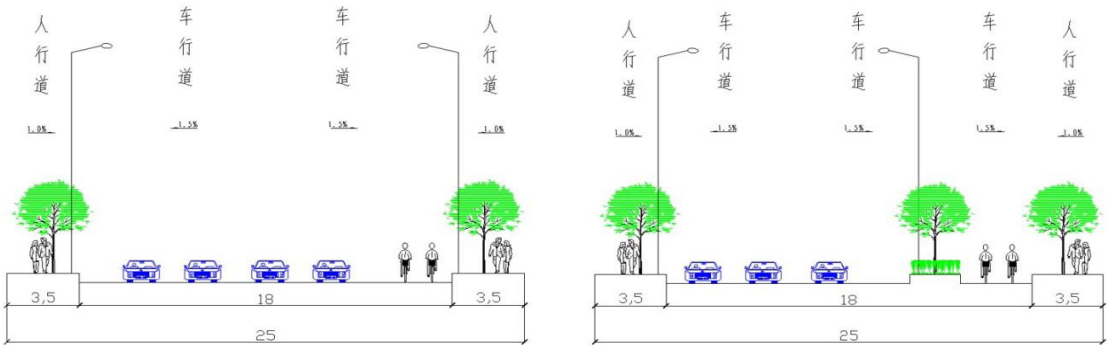


Figure 2-3-1-46 Comparison Chart of Cross Section of Middle Chengxiang Road (Beicheng Street and Nanma Road) before and after Transformation

(37) East Chengxiang Road (Section between Beima Road and Nanma Road)

Before Transformation: width of the current road is 36 m; 6 bi-directional lanes; the cross section is 4 m (sidewalk) – 28 m (roadway) – 4 m (sidewalk).

After Transformation: 4 m (sidewalk) – 4.5 m (non-motor roadway) – 2.5 m (lane separator for motor vehicles and non-motor vehicles) – 14 m (motor roadway) – 2.5 m (lane separator for motor vehicles and non-motor vehicles) – 4.5 m (non-motor roadway) – 4 m (sidewalk); the pavement after Transformation is 4 bi-directional lanes; build establish separation belt between motor vehicle lane and non-motor vehicle lane and afforest it to separate motor vehicle lane and non-motor vehicle lane

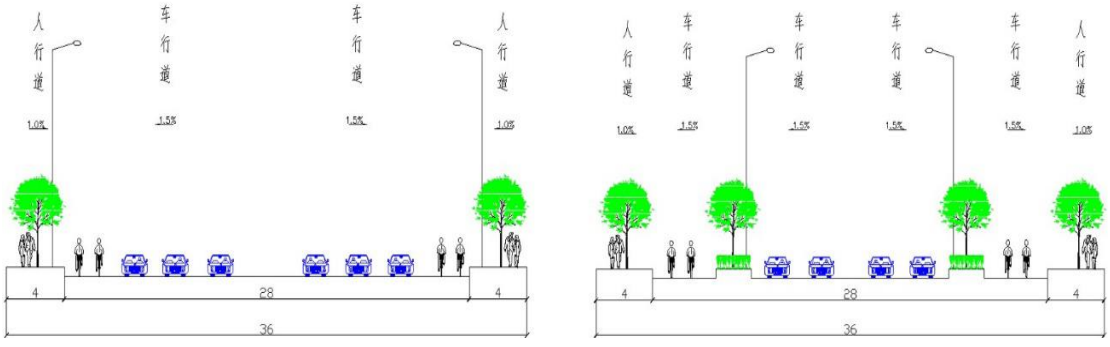


Figure 2-3-1-47 Comparison Chart of Cross Section of East Chengxiang Road (Section between Beima Road and Nanma Road) before and after Transformation

(38) Tongbei Road (Section between Dongma Road and Zhang Zizhong Road)

Before Transformation: the current width of the road is 45 m; 8bi-directional lanes; the cross section is set to be 3 m (sidewalk) – 3 m (non-motor roadway) – 1.5 m (lane separation belt between motor vehicle lane and non-motor vehicle lane) – 30 m (roadway) – 1.5 m (lane separation belt between motor vehicle lane and non-motor vehicle lane) – 3 m (non-motor roadway) – 3 m (sidewalk).

After Transformation: Under the premise of no adjustment of road width, it is planned to afforest the existing side separation belt. Set guard posts in sidewalks to prevent motor vehicles from encroaching sidewalks and non-motor vehicle lanes.

(39) Tongnan Road (Section between Dongma Road and Zhang Zizhong Road)

Before Transformation: current width is 36 m; 6 bi-directional lanes; the cross section is set to be 3.5 m (sidewalk) – 29 m (roadway) – 3.5 m (sidewalk).

After Transformation: the cross section is set to be: 3 m (sidewalk) – 4.5 m (non-motor roadway) – 2.5 m (lane separation belt between motor vehicle lane and non-motor vehicle lane) – 15 (motor roadway) - 4.5 m (non-motor roadway) – 3 m (sidewalk); the pavement after Transformation is 4bi-directional lanes).

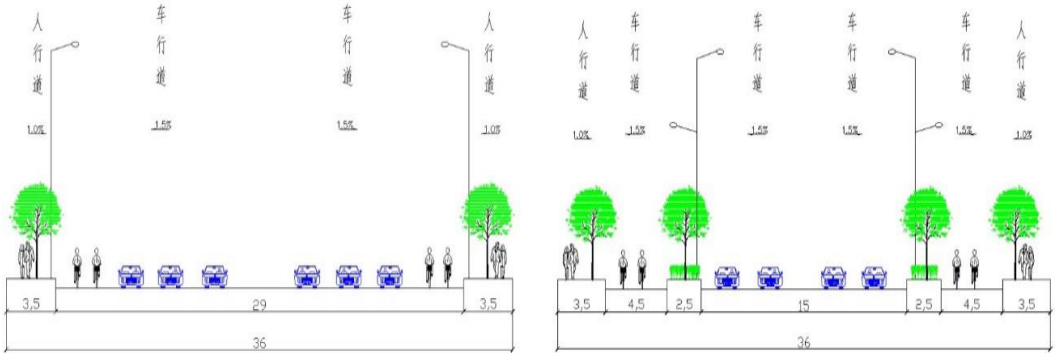


Figure 2-3-1-48 Comparison Chart of Cross Section of Tongnan Road (Section between Dongma Road and Zhang Zizhong Road) before and after Transformation

(40) Shuige Street

Before Transformation: the current width of the road is 28 m; 4 bi-directional lanes); the cross section is set to be 3 m (sidewalk) – 22 m (roadway) – 3 m (sidewalk).

After Transformation: the cross section is set to be 3 m (sidewalk) – 4 m (non-motor roadway) – 14 (motor roadway) – 4 m (non-motor roadway) – 3 m (sidewalk); the pavement after Transformation is 4 bi-directional lanes.

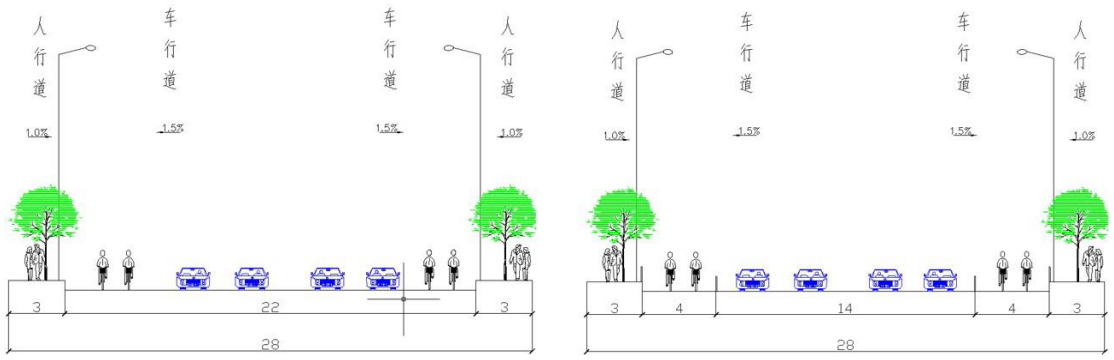


Figure 2-3-1-49 Comparison Chart of Cross Section of Shuige Street (Section between Dongma and Zhangzhong Road) before and after Transformation

(41) Zhang Zizhong Road (Nankai District Section)

Set the dedicated bikeway in the existing sidewalk area on this section close to the bank of Haihe River; width of the bikeway is 4 m; the colorful concrete bituminous pavement is adopted and the warning marks such as the road marking and signs.

(42) East Haihe Road

Set the dedicated bikeway in the existing sidewalk area on this section close to the bank of Haihe River; width of the bikeway is 4 m; the colorful concrete bituminous pavement is adopted and the warning marks such as the road marking and signs.

2.3.1.3 Technical Standards of Road

Table 2-3-1-1 Major Technical Index of the roads

Road grade	Main arterial road	Secondary arterial road	By-pass
Runing speed calculating	40 km/h	30 km/h	20 km/h
Cross slope	Roadway: 1.5% (bi-directional); sidewalk: 1% (inward)		
Standard axle load of road surface design	BZZ-100KN		
Do not set the ultrahigh minimum radius (m)	300	150	70
Set the ultrahigh minimum radius (the limit value) (m)	70	40	20
Set the ultrahigh minimum radius (the general value) (m)	150	85	40
Do not set the easement curve minimum radius (m)	500		
Minimum length of vertical curve (m)	35	25	20

Minimum length of easement curve (m)	35	25	20
Maximum longitudinal grade limit (%)	7	8	8
Minimum longitudinal grade length (m)	110	85	60
Limited minimum radius of convex vertical curve (m)	400	250	100
General minimum radius of convex vertical curve (m)	600	400	150
Limited minimum radius of concave vertical curve (m)	450	250	100
General minimum radius of concave vertical curve (m)	700	400	150
Limited minimum length of vertical curve (m)	35	25	20
General minimum radius of vertical curve	90	30	
Seismic standard	Seismic basic intensity is 7 degrees and seismic peak acceleration is 0.15 g.		
Design life	20 Years	15 Years	10 Years

2.3.1.4 Roadbed Design

The road project is implemented on the existing roads. The main transformation object is the surface layer of roads. Therefore, the current roadbeds are reserved in principle. If it needs to construct virescence side separation belt in partial road sections, the roadbeds need to be removed to the plain soil layer. And then, carry out backfill with planting soil.

2.3.1.5 Road surface design

The main transformation object of road engineering of this project is the road surface layer. According to the adjustments of road cross section layout in the design scheme, for the pavements which fail to meet the use requirement, remove the existing pavements and pave new pavement structure. The main pavement structures newly constructed in this project include: pavement of roadway, pavement of sidewalk, pavement of pedestrian street and non-motor vehicle lane of colored bituminous concrete.

(1) Removal of pavements

Firstly, this project will remove pavements of partial road sections in central urban areas according to the cross section transformation design scheme.

1) Removal of sidewalks

In partial road section, to transform sidewalks or side separation belts into other forms of pavements (motor vehicle lane, pedestrian street, virescence side separation belt), it needs to remove the surface layer of pavements of the sidewalks. The depth of removal is 40 cm.

2) Removal of roadway

In this project, it needs to change the purpose of roadway of partial roads and removes the currently existing bituminous concrete roadway (typical pavement form of roadways in central urban area).

① If sidewalks or colored bikeways will be constructed after removal of the currently existing roadways, only the bituminous concrete surface layer of current roadways needs to be removed. The removal depth is 20 cm. The new pavements will be paved with the base course of pavement exposed after the removal as the roadbeds.

② If stone or bituminous concrete pavements of roadways will be constructed after removal of the currently existing roadways, the current pavements need to be removed completely. The removal depth is 50 cm. And then new road surface layer will be paved.

③ If the roads will be transformed into green belt and side separation belt and border trees will be planted after removal of the currently existing roadways, the whole pavement and roadbeds need to be removed together, in order to guarantee growth of the arbors. The removal depth is 150 cm and the plain soil layer will be exposed. And then, carry out backfill with planting soil.

(2) New road surface

1) Pavements of pedestrian street

Such pavements are mainly applied to roads along the cross dynamic shaft and important landscape roads, such as Beijing Road, Jianshe Road, Henan Road, Rongye Street and etc. The pavements mainly adopt Imitation granite material. Imitation granite pavement is a kind of high class pavements. Motor vehicles can run on the pavements. Pave the pavement structure as the following: 14 cm of Imitation granite material + 3 cm of sand bed + 15 cm of concrete C20. The total thickness of pavement is 31 cm.

2) Pavements of general roadways

Adopts the pavement form of bituminous concrete. The bituminous concrete roadways will be paved on the roadbeds after removal and clearance. The construction is as the following: 4cm AC-10c fine grain bituminous concrete + 6cm AC-20c medium grain bituminous concrete + 1 cm under seal layer + 18 cm 5% cement stabilized macadam + 18 cm lime powder, coal ash and macadam (6:14:80) + 15 cm lime powder, coal ash and

dust (12:35:53). The total thickness is 61 cm.

3) Pavements of general sidewalks

The sidewalks newly constructed in this project are paved on the roadbeds of original sidewalks or roadways. The pavement structure is as the following: 6 cm sidewalk bricks + 3 cm sand bed + 15 cm concrete C20 + 15 cm lime soil (12%).

4) Pavements of colored bikeways

Mill the surface layer of bituminous concrete pavements of the original roadways first, and then, pave pavements of colored bituminous concrete. The detailed scheme is as the following: 4 cm AC – 10c fine grain colored bituminous concrete + 6 cm AC-20c medium grain bituminous concrete + 1 cm under seal layer.

2.3.1.6 Summary of cross section classification

Classification of road section layouts is as shown in the following table:

Table 2-3-1-2 List of Road Cross Section Layouts

Width of red line:	Corresponding road	Cross section layout
60	Middle Chengxiang Road (Beima Road-Beicheng Street) (main)	3.5m (sidewalk)-7m (auxiliary lane)-3.5m (separation belt)-14m (motor roadway)-4m (separation belt)-14m (motor roadway)-3.5m (separation belt)-7m (auxiliary lane)-3.5m (sidewalk)
50	Qufu Road (Nanjing Road-Taierzhuang Road) (main), Nanmenwai Street (main)	4m (sidewalk)-4.5-6m (non-motor roadway)-10.5-14m (motor roadway)-2m (central isolation belt)-10.5-14m (motor roadway)-4.5-6m (non-motor roadway)-4m (sidewalk)
45	Tongbei Road (main), Beima Road (main)	3m (sidewalk)-3m (non-motor roadway)-1.5m (separation belt for motor vehicle lanes and non-motor vehicle lanes)-30m (roadway)-1.5m (separation belt for motor vehicle lanes and non-motor vehicle lanes)-3m (non-motor roadway)-3m (sidewalk)
	Xima Road (main)	6m (sidewalk)-3.5m (non-motor roadway)-3m (separation belt for motor vehicle lanes and non-motor vehicle lanes)-22.5m (motor vehicle lane + lay-by)-1.7m (separation belt for motor vehicle lanes and non-motor vehicle lanes)-1.7m (non-motor roadway)-3.3m (non-motor roadway)-5m (sidewalk)
40	North Dagu Road (Zhangzizhong Road-Yantai Road) (main)	4m (sidewalk)-3.5m (non-motor roadway)-3m (separation belt for motor vehicle lanes and non-motor vehicle leans)-19m (motor roadway+bilateral parking belts)-3m (separation belt for motor vehicle lanes and non-motor vehicle leans)-3.5m (non-motor roadway)-4m (sidewalk)
	West Gulou Street (secondary)	4m (sidewalk)-3 (non-motor roadway)-26m (motor roadway+bilateral parking belts)-3 (non-motor roadway)-4m (sidewalk)
36	Heping Road (Nanma Road-Rongji Street) (secondary), Dongma Road (main)	4m (sidewalk)-4m (non-motor roadway)-20m (motor roadway)-4m (non-motor roadway)-4m (sidewalk)
	North Dagu Road (Qufu Road-Xuzhou Road) (main)	3.5m (sidewalk)-3 (non-motor roadway)-23m (motor roadway+single-side parking belt)-3 (non-motor roadway)-3.5m (sidewalk)
	Fu’an Street (main)	4m (sidewalk)-3.5m (non-motor roadway)-21m (roadway)-3.5m (non-motor roadway)-4m (sidewalk)
	Nanma Road (main), Tongnan Road (main)	5.5m (sidewalk)-4.5m (non-motor roadway)-2.5m (separation belt for motor vehicle lanes and non-motor vehicle leans)-15m (motor roadway)-4.5m (non-motor roadway)-5.5m (sidewalk)
	East Chengxiang Road (main)	4m (sidewalk)-4.5m (non-motor roadway)-2.5m (separation belt for motor vehicle lanes and non-motor vehicle leans)-14m (motor roadway)-2.5m (separation belt for motor vehicle lanes and non-motor vehicle leans)-4.5m (non-motor roadway)-4m (sidewalk)
30	Jianshe Road (Yingkou Road-Yantai Road) (secondary)	1.5 (sidewalk)-2 (non-motor roadway)-6 (motor roadway)-12.5 (central green belt)-6 (motor roadway)-2 (non-motor roadway)-3 (sidewalk)
	Rongye Street (main)	6m (sidewalk)+2.25 (non-motor roadway)+13.5m (motor roadway)+2.25 (non-motor roadway)+6m (sidewalk)

	Baoding Road (North Dagu Road-Zhangzizhong Road) (secondary)	3.5m (sidewalk)-2.5m (non-motor roadway)-18m (motor roadway)-2.5m (non-motor roadway)-3.5m (sidewalk)
	Beicheng Street (secondary), Nancheng Street (secondary), Shuige Street (secondary)	3m (sidewalk)-2.5m (non-motor roadway)-2.5m (separation belt for motor vehicle lanes and non-motor vehicle leans)-14m (motor roadway)-2.5m (non-motor roadway)-3m (sidewalk)
	East Gulou Street (secondary)	6.5m (sidewalk)-3.5m (non-motor roadway)-4m (green belt)-9.5m (motor vehicle lane + lay-by)-2.5m (non-motor roadway)-4m (sidewalk)
	West Chengxiang Road (main)	4m (sidewalk)-2.5m (non-motor roadway)-2m (separation belt for motor vehicle lanes and non-motor vehicle leans)-13m (motor roadway)-2m (separation belt for motor vehicle lanes and non-motor vehicle leans)-2.5m (non-motor roadway)-4m (sidewalk)
25	Middle Chengxiang Road (Beicheng Street-Nancheng Street) (main)	3.5m (sidewalk)-3.5m (non-motor roadway)-2.5m (separation belt for motor vehicle lanes and non-motor vehicle leans)-12m (motor vehicle lane + lay-by)-3.5m (sidewalk)
	Baoding Road (Xinhua Road-North Dagu Road) (secondary)	4m (sidewalk)-2.5m (non-motor roadway)-10m (motor roadway+bilateral parking belts)-2.5m (non-motor roadway)-4 (sidewalk)
	Lu'an Street (main)	.5m (sidewalk)-3m (non-motor roadway)-12m (motor roadway+bilateral parking belts)-3m (non-motor roadway)-3.5m (sidewalk)
	Xing'an Road (time)	3m (sidewalk)-2.25m (non-motor roadway)-14.5m (two ways and four lanes)-2.25m (non-motor roadway)-3m (sidewalk)
24	Jianshe Road (Yantai Road-Qufu Road) (secondary)	1.5 (sidewalk)-2 (non-motor roadway)-6 (motor roadway)-8 (central green belt)-3 (motor roadway)-2 (non-motor roadway)-1.5 (sidewalk)
	Duolun Road (Zhangzizhong Road-Xing'an Road) (secondary)	2m (sidewalk)-3m (non-motor roadway)-14m (motor roadway)-3m (non-motor roadway)-2m (sidewalk)
	Baoding Road (Jianshe Road-North Dagu Road) (secondary)	4m (sidewalk)-2.5m (non-motor roadway)-11m (motor roadway+bilateral parking belts)-2.5m (non-motor roadway)-4 (sidewalk)
22	Xinhua Road (Nanjing Road-Yingkou Road) (main)	3m (sidewalk)-3m (non-motor roadway)-6m (motor roadway)-4.5m (lay-by)-2.5m (non-motor roadway)-3m (sidewalk)
20	Duolun Road (Xing'an Road-Xinhua Road) (secondary)	3m (sidewalk)-2.5m (non-motor roadway)-9m (motor roadway+single-side parking belt)-2.5m (non-motor roadway)-3m (sidewalk)
	Baoding Road (Shanxi Road-Xinhua Road) (secondary)	3m (sidewalk)-2m (non-motor roadway)-10m (motor roadway+bilateral parking belts)-2m (non-motor roadway)-3m (sidewalk)
	Xuzhou Road (Nanjing Road-North Dagu Road) (branch)	2.5m (sidewalk)-3m (non-motor roadway)-9m (motor vehicle lane + roadside lay-by)-3m (non-motor roadway)-2.5m (sidewalk)
	Xuzhou Road (Nanjing Road-North Dagu	3m (sidewalk)-2.5m (non-motor roadway)-7m (motor roadway)-2.5m (non-motor roadway)-5m (sidewalk)

	Road) (branch)	
18	Shanxi Road (secondary)	4m (sidewalk)-2.5m (non-motor roadway)-6m (motor roadway)-2.5m (non-motor roadway)-4 (sidewalk)
16	Xinhua Road (Yingkou Road-Jinzhou Road) (main), Anshan Road (secondary)	3m (sidewalk)-2m (non-motor roadway)-6m (motor roadway)-2m (non-motor roadway)-3m (sidewalk)
	Heping Road (Chifeng Road-Yingkou Road) (branch)	5.5m (common roadway for pedestrians and non-motor vehicles)+5m (motor roadway)+5.5m (common roadway for pedestrians and non-motor vehicles)
14	Duolun Road (Xinhua Road-Nanmenwai Street) (secondary)	2m (sidewalk)-1.5m (non-motor roadway)-7m (motor roadway)-1.5m (non-motor roadway)-2m (sidewalk)
	Xuzhou Road (North Jiefang Road-Taierzhuang Road) (branch)	3m (sidewalk)-2m (non-motor roadway)-4m (motor roadway)-2m (non-motor roadway)-3m (sidewalk)
12	Harbin Road (Shaanxi Road-North Dagu Road) (branch), Henan Road (branch), Shaanxi Road (branch)	The section is 2-3m (common roadway for pedestrians and non-motor vehicles)-5m (roadway)-3-4m (common roadway for pedestrians and non-motor vehicles)
	North Dagu Road (Yantai Road-Qufu Road) (secondary)	2m (sidewalk)-6m (motor roadway)-2 (non-motor roadway)-2m (sidewalk)
	Xinhua Road (Jinzhou Road-Duolun Road) (secondary)	2.5m (sidewalk)-2m (non-motor roadway)-3m (motor roadway)-2m (non-motor roadway)-2.5m (sidewalk)

2.3.2 Drainage project

Because the cross section layouts of many roads in this project have been adjusted and locations and widths of roadways have changed, the water collecting pipes and water collecting wells need to be arranged anew. Among others, the roads in old Chengxiang regions are constructed in recent years uniformly so that the water collecting pipeline network is complete and with complete functions. It is not necessary to repave them renew. Therefore, the major task is to construct necessary new pavement water-collecting wells on the basis of currently existing water-collecting pipeline network. In old roads in core area of Heping District, after many years of operation, the drainage capacity of water-collecting pipe network can't meet the current specification requirements anymore and the facilities have been worn out. Therefore, this rebuilt project will pave the water-collecting pipe and water-collecting wells along the roads.

Generally speaking, the newly constructed water collecting pipelines in this project extend to the outer edge of roadways. The water collecting branch pipelines adopt d300mm reinforced concrete pipe and backward trenching construction. The well bores of water-collecting wells adopt concrete material and the water-collecting filter adopts nodular cast iron material.

Table 2-3-2-1 List of Road Drainage Projects

Serial Number	Road name	Newly Constructed Water-collecting Branch Pipes (m)	Newly Constructed Water-collecting Well (well)
1.	Binjing Road	500	62
2.	Harbin Road	566.8	113
3.	Heping Road	58	40
4.	Jianshe Road	1251	168
5.	Nanhe Road	580	116
6.	Xing'an Road	180	132
7.	North Dagu Road	192	32
8.	Nanmenwai Street	2200	240
9.	Anshan Road	484.2	106
10.	Chifeng Road	750	151
11.	Shaanxi Road	932	114
12.	Shanxi Road	211.2	38
13.	Baoding Road	988	129
14.	Lu'an Street	456.8	51
15.	Xinhau Road	638.4	108
16.	Xuzhou Road	147.2	27
17.	Nanma Road		128
18.	Xima Road		80
19.	Beicheng Street		104
20.	West Gulou Street		24
21.	East Gulou Street	176	26

22.	Nancheng Street		66
23.	West Chengxiang Road		80
24.	Middle Chengxiang Road		48
25.	East Chengxiang Road		80
26.	Tongnan Road		8
	Total	10311.6	2271

2.3.3 Greening project

According to different road transformation schemes, partial roads within the area give more priority to sidewalks than roadways. The ratio of roadway has been deceased by a large margin to increase the width of sidewalks. For such roads, add street furniture such as flower beds and facilities on the basis of the original virescence to improve the travel quality for walk; For partial widened road sections, it needs to remove the green belts at sides of the roads and migrate the currently existing border trees in this area together; for the partial road sections transformed into three-board structure from the original one-board structure, carry out virescence in the newly constructed side separation belts correspondingly. Plant shrubs to form green separation belt for motor vehicle lanes and non-motor vehicle lanes. And plant border trees in the separation belts to shelter the non-motor vehicle lanes together with the border trees at sides of sidewalks and improve comfort level for travel by non-motor vehicles.

787.5m2 of green belts and 281 border trees are removed and 5 border trees are migrated in this project.

3300 m2 of virescence in newly constructed flower beds and 50985.25 m2 of green belts are newly constructed and 2885 border trees are planted.

2.3.4 Lighting project

Transformation of multiple roads is involved in the area of slow traffic system project in center city area. The property of some roads changed. They mainly support pedestrians for relaxations instead of vehicles, so that there are higher requirements for landscape of the roads. And the original street lamps need to be replaced with the street lamps which have a certain landscape effect; widening of some roads needs to migrate the original street lamps at sides outwards; some roads change from one-board structure to three-board structure, which needs to move the original street lamps at the sides inwards to the newly constructed separation belt between motor vehicle lanes and non-motor vehicle lanes; And illuminating facilities along parts of some roads need to be constructed newly.

The landscape street lamps are arranged in the sidewalks on two sides of the roads. The distance to the side is 0.5 m. The interval is about 18 m. They are arranged on both sides; other relocated and newly constructed street lamps are arranged within the separation belt for motor vehicle lanes and non-motor vehicle lanes and within the sidewalks of the roads after extension. The interval is about 40 m. They are arranged on both sides.

144 road lamps are removed, 446 road lamps are migrated and 937 landscape street lamps are newly constructed in this project.

25289.4m of power supply circuit are rerouted and 4896.5m of power supply circuit are newly constructed.

2.3.5 Traffic project

(1) Traffic marking

The slow traffic system project in center city area redistributes the cross sections of many roads. The original traffic markings of some roads are removed because of pavement transformation. Because the widths of non-motor vehicle lane and motor vehicle lane are redistributed for some roads, the roads need to be relined. 221074.5 linear meters of signs and markings are to be set in this project.

(2) Traffic sign

Aiming at road transformation of slow traffic system in center city area, regulate the traffic signs within the areas. Because of widening or changes in cross sections of some roads, the traffic signs need to be removed and traffic sign boards need to be added to some roads. 339 traffic signs are set.

(3) Traffic signal lamp and safety islands

In the road project, widening of the roads involves with removal project of traffic signal lamps in partial road sections. Migrant the traffic signal lamps at the sides of the original roads to the sides of the transformed roads. Because of changes of road property, traffic signal lamps need to be added to partial road sections. 22 traffic signal lamps and 84 safety islands are newly constructed.

(4) Guard posts and guard bars

At the relatively wider sections of non-motor vehicle lanes, guard bars can be adopted for separation. 54433 guard posts and 33273 linear meters of guard bars are newly

constructed.

(5) Bus Station

Awnings of two public transport stations will be constructed on Fu'an Street and Qufu Road within the construction area of this project. The awnings adopt the form combining steel structure and glass showcase. 140m2 of awnings of public transport stations are newly constructed.

2.4 Metro transit project

2.4.1 Station selection

The project selects the stations of metro line No. 1, 2, 3, 5, 6 and 9 relatively near to the city area, including 111 stations on 6 metro lines. It targets at construction of transit facilities around the metro stations. Classify transit stations to four classes:

Class I: station of traffic vitality promotion (10). Set public transport transit stations, parking lot for cars and other traffic facilities surrounding them with space of vitality promotion between access and hub station so as to improve the level of transfer service.

Class II: station of park vitality promotion (6). The access is close adjoining parks, effectively serving park gathering & distribution and stream of people in traffic transfer through environmental design.

Class III: station of green belt vitality promotion (24). The access is closely adjoining small green belts or wider road green belts, improving the attraction of metro to surrounding areas through the environment.

Class IV: general station (other non-reconstructed station). Given limited land surrounding the access, improve the environment of metro transfer through canalization surrounding stations.

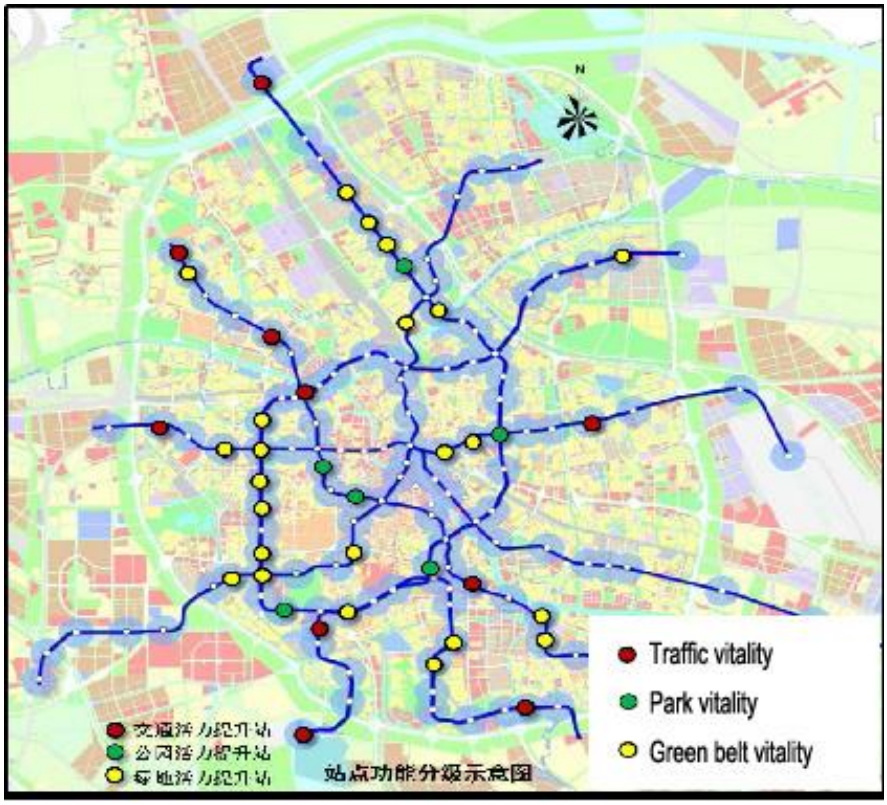


Figure 2-4-1 Schematic Drawing for Distribution of Metro Transit Project Stations

2.4.2 Overall size of project

The project targets at constructing transit facilities for 111 stations in total for metro line No. 1, 2, 3, 5, 6 and 9 in Tianjin, and occupies a total area of 486,588m2, including 169747m2 of public transport transit stations, 109783m2 of small motorcycle parking area and 207058m2 of bicycle parking lot. At the construction site, it also involves projects for roads, stations, parking lots and others as well as transport project, lighting project, drainage project and green projects. Major technical indexes for metro transit project are as follows:

Table 2-4-2 Major Technical Indexes for Metro Transit Project

Serial Number	Item	Unit	Index	Notes
I	Public transport transit project			
1	Road	Square meter	93361	-
2	Platform	Square meter	45832	-
3	Greening	Square meter	30544	-
II	Car parking lot.			
1	Road	Square meter	54892	-
2	Parking space	Square meter	32935	-

3	Greening	Square meter	21956	-
III	Parking lot for bikes			
1	Parking space	Square meter	207058	-
IV	Berthing space			
1	Parking berths for cars	Piece	3137	-
2	Parking berths for bikes	Piece	138000	-

2.4.3 Specific Plan on Demonstration Stations

According to project data, select 8 stations as demonstration stations for specific illustration:

Table 2-4-3 List of Demonstration Stations

Serial Number	Station name	Line	Station Classify	Notes
1	Liqizhuang Station	Line No. 5	Class I	Traffic vitality promotion
2	Weidi Road Station	Line No. 5	Class II:	Park vitality promotion
3	Wujiayao Station	Line No. 3	Class III:	Green belt vitality station
4	Xiaobailou Station	Line No. 1	Class IV	General station
5	Chentangzhuang Station	Line No. 1	Class IV	General station
6	Zhongshan Road Station	Line No. 3	Class IV	General station
7	Xihengdi Station	Line No. 1	Class IV	General station
8	Benxi Road Station	Line No. 1	Class IV	General station

(1) Liqizhuang Station

Liqizhuang Station is the origin and terminal station on metro line No.5. Transit facilities cover 5 sectors with parking lot for bikes, public transport transit station, and parking lot for cars and temporary stopping area for taxis. Herein, located in the northwestern side of the metro station, Section 1 is the parking lot for bikes, covering an area of 500m2 with 300 parking berths for bikes; located in the northwestern side of the metro station, Section 3 is the parking lot for cars with access set in the planning road, covering an area of 8600 m2 with 250 parking berths for cars; located in the northeastern side of the metro station, Section 4 is the public transport transit station, covering an area of 4800 m2 for parking 43 buses at night; located in the due north of the metro station, Section 5 is temporary area for stopping and carrying passengers with lanes and virescence inside and 20 temporary parking berths for taxis; while located in the due north of the metro station, Section 6 is the station square,

covering an area of 4000 m2 with virescence, booths etc. Refer to Figure 2-4 for specific layout

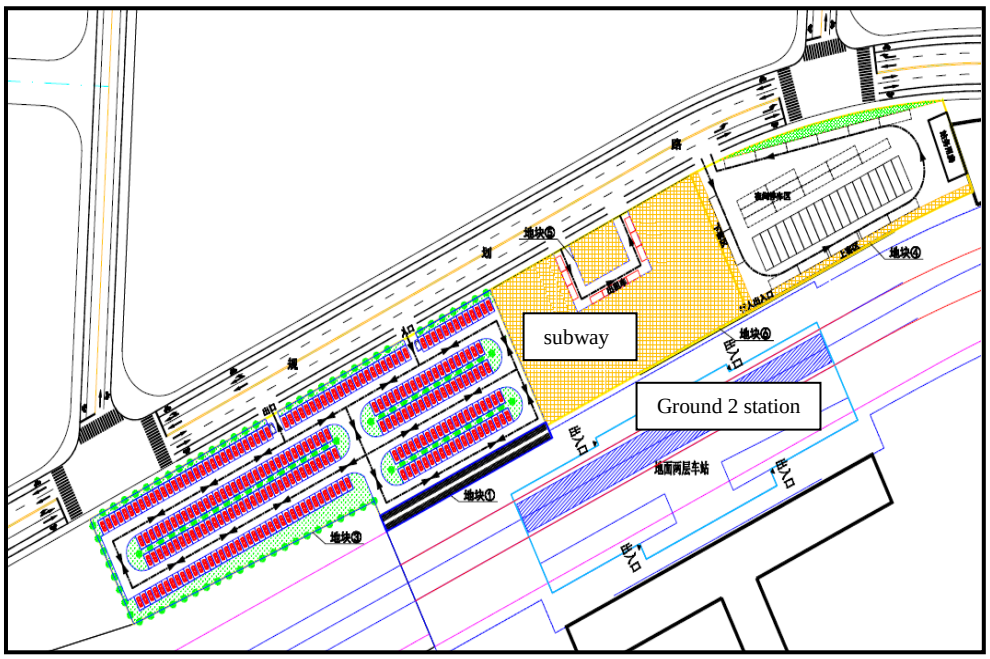


Figure 2-4-3-1 Plan of Liqizhuang Station Transit Facilities

Table 2-4-3-1 List of Liqizhuang Station Transit Facilities

Transit facilities	Area (m^2)	Berth (pieces)	Site Conditions	Property of planned land	Notes
Parking lot for bikes	500	300	Metro land	—	Recent settings
Parking lot for cars	8600	250	Vacant land	—	Recent settings
Public transport transit station	4800	43	Vacant land	—	Recent settings
Stopping space for taxis	800	20	Vacant land	—	Recent settings
Square in front of station	4000	-	Vacant land	—	Recent settings

Table 2-4-3-2 Major Technical Indexes for Liqizhuang Station

Serial Number	**Item**	**Unit**	**Index**	**Notes**
1	Total land area	Square meter	17850	
1.1	Public transport transit station	Square meter	4800	
1.1.1	Platform	Square meter	460	
1.1.2	Road	Square meter	4100	

1.1.3	Greening area	Square meter	240	
1.2	Car parking lot.	Square meter	8600	
1.2.1	Stall	Square meter	3500	
1.2.2	Road	Square meter	3900	
1.2.3	Greening area	Square meter	1200	
1.3	Parking lot for bikes	Square meter	450	
1.3.1	Stall	Square meter	450	
1.3.2	Greening area	Square meter	–	
1.4	Area for carrying passengers by taxis	Square meter	800	
1.4.1	Lanes and stopping berths	Square meter	450	
1.4.2	Waiting area foot passengers	Square meter	–	
1.4.3	Greening	Square meter	350	
1.5	Square	Square meter	4000	
1.5.1	Auxiliary facility area	Square meter	2500	
1.5.2	Green area	Square meter	1500	
1.6	Channelize			
1.6.1	Safety island	Square meter	–	
1.6.2	Isolation guardrails	m	800	
1.6.3	Stop piles	Piece	500	
1.6.4	Marking	Square meter	200	
2	Berthing space			
2.1	Public transport vehicle parking lot	Piece	43	

2.2	Car parking lot.	Piece	250	
2.3	Parking lot for bikes	Piece	300	
2.4	Temporary stopping berths for taxis	Piece	20	20 stopping berths in get-off area

(2) Weidi Road Station

Weidi Road Station is a station along metro line No.5 with 2 parking lots for bikes, 2 bus stopping space, 4 temporary stopping spaces for taxis and 1 street park square. Herein, one of the two parking lots for bikes is located nearby Entrance A, occupying an area of 300 m2 with 180 parking berths for bikes; the other is located in the street park with 20 parking berths for bikes; there are a total of 200 parking berths for bikes in the two parking areas for bikes. Located on the exit lane of Weidi Road, the 2 public transport stations are 90m away from the crossing set on the separation belt for motor vehicle lanes and non-motor vehicle leans. Temporary stopping spaces for taxis are located on the Weidi Road nearby Access B and D with 4 stopping berths. Refer to Figure 2-4-3-2 for specific layout

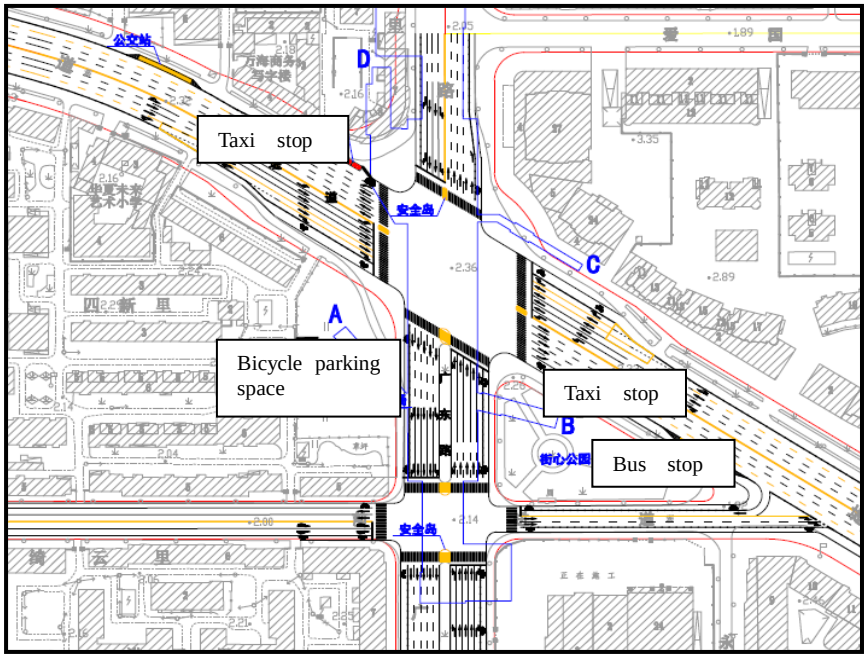


Figure 2-4-3-1 Plan of Weidi Road Station Transit Facilities

Table 2-4-3-3 List of Weidi Road Station Transit Facilities

Transit facilities	Area (m²)	Berth (pieces)	Site Conditions	Property of planned land	Notes
Parking lot for bikes	300	200	Greenbelt	—	Recent settings

Public transport transit station	-	2	Land for roads	—	Recent settings
Stopping space for taxis	--	4	-	—	Recent settings
Garden in the city center	4000	-	Greenbelt	—	Recent settings

Table 2-4-3-4 Major Technical Indexes for Weidi Road Station

Serial Number	Item	Unit	Index	Notes
1	Total land area	Square meter	–	
1.1	Public transport transit station	Square meter	–	
1.1.1	Platform	Square meter	150	
1.1.2	Road	Square meter	–	
1.1.3	Greening area	Square meter	–	
1.2	Car parking lot.	Square meter	–	
1.2.1	Stall	Square meter	–	
1.2.2	Road	Square meter	–	
1.2.3	Greening area	Square meter	–	
1.3	Parking lot for bikes	Square meter	300	
1.3.1	Stall	Square meter	300	
1.3.2	Greening area	Square meter	–	
1.4	Area for carrying passengers by taxis	Square meter	–	
1.4.1	Lanes and stopping berths	Square meter	–	
1.4.2	Waiting area foot passengers	Square meter	–	
1.4.3	Greening	Square meter	–	

1.5	Square	Square meter	4000	
1.5.1	Auxiliary facility area	Square meter	1000	
1.5.2	Green area	Square meter	2000	
1.6	Channelize			
1.6.1	Safety island	Square meter	100	
1.6.2	Isolation guardrails	m	1300	
1.6.3	Stop piles	Piece	1100	
1.6.4	Marking	Square meter	390	
2	Berthing space			
2.1	Public transport vehicle parking lot	Piece	-	
2.2	Car parking lot.	Piece	-	
2.3	Parking lot for bikes	Piece	200	
2.4	Temporary stopping berths for taxis	Piece	4	

(3) Wujiayao Station

Wujiayao Station is a station along metro line No.3 with 1 parking lot for bikes, 2 bus stopping spaces, temporary stopping space for taxis and green belt park. Herein, the parking lot for bikes is located nearby Access A2 and D, covering an area of 300 m2 with 200 parking berths for bikes. Bus stopping spaces are located on Wujiayao Street, east of the crossing between Wujiayao Street and Qixiangtai Road, about 80m away from the crossing set on the separation belt for motor vehicle lanes and non-motor vehicle leans. The temporary stopping space for taxis is located on Qixiangtai Road nearby Access B with 4 stopping berths. Refer to Figure 2-4-3-3 for specific arrangement

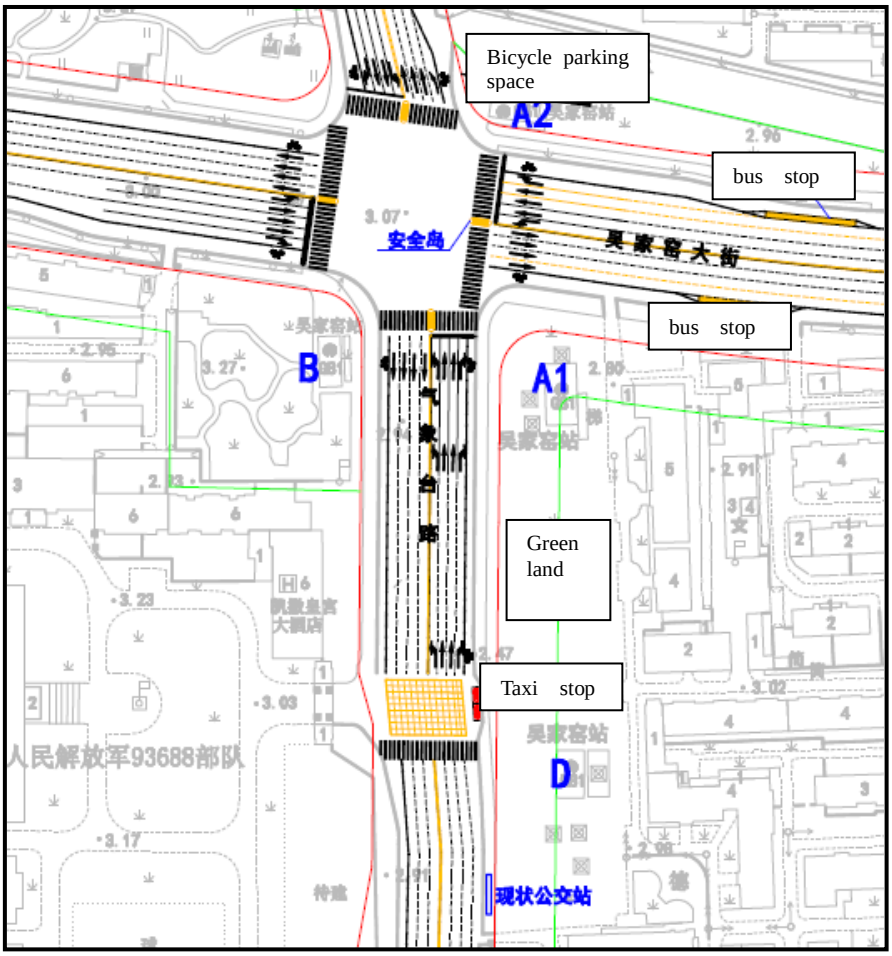


Figure 2-4-3-3 Plan of Wujiayao Station Transit Facilities

Table 2-4-3-5 List of Wujiayao Station Transit Facilities

Transit facilities	Area (m^2)	Berth (pieces)	Site Conditions	Property of planned land	Notes
Parking lot for bikes	300	200	Green space/ open space	—	Recent settings
Public transport transit station	-	2	Land for roads	—	Recent settings
Stopping space for taxis	--	4	-	—	Recent settings

Table 2-4-3-6 Major Technical Indexes for Wujiayao Station

Serial Number	Item	Unit	Index	Notes
1	Total land area	Square meter	–	
1.1	Public transport transit station	Square meter	–	
1.1.1	Platform	Square meter	150	

1.1.2	Road	Square meter	–	
1.1.3	Greening area	Square meter	–	
1.2	Car parking lot.	Square meter	–	
1.2.1	Stall	Square meter	–	
1.2.2	Road	Square meter	–	
1.2.3	Greening area	Square meter	–	
1.3	Parking lot for bikes	Square meter	300	
1.3.1	Stall	Square meter	300	
1.3.2	Greening area	Square meter	–	
1.4	Area for carrying passengers by taxis	Square meter	–	
1.4.1	Lanes and stopping berths	Square meter	85	
1.4.2	Waiting area foot passengers	Square meter	–	
1.4.3	Greening	Square meter	–	
1.5	Square	Square meter	4000	
1.5.1	Auxiliary facility area	Square meter	2000	
1.5.2	Green area	Square meter	2000	
1.6	Channelize			
1.6.1	Safety island	Square meter	40	
1.6.2	Isolation guardrails	m	1200	
1.6.3	Stop piles	Piece	900	
1.6.4	Marking	Square meter	300	
2	Berthing space			
2.1	Public transport vehicle parking lot	Piece	–	
2.2	Car parking lot.	Piece	–	
2.3	Parking lot for bikes	Piece	200	
2.4	Temporary stopping berths for taxis	Piece	4	

(4) Xiaobailou Station

Xiaobailou is a station along metro line No.1 with 2 parking lots for bikes and

temporary stopping space. The parking lots for bikes are set nearby Access B and D respectively, covering an area of 422 m2 with 223 parking berths for bikes. Temporary stopping space for taxis: 1 temporary stopping space for taxis is set on both sides of Nanjing Road, south of Xuzhou Road, north of Machang Road and north of Jianshe Road nearby metro access respectively with 10 stopping berths. Refer to Figure 2-4-3-4 for specific plan.

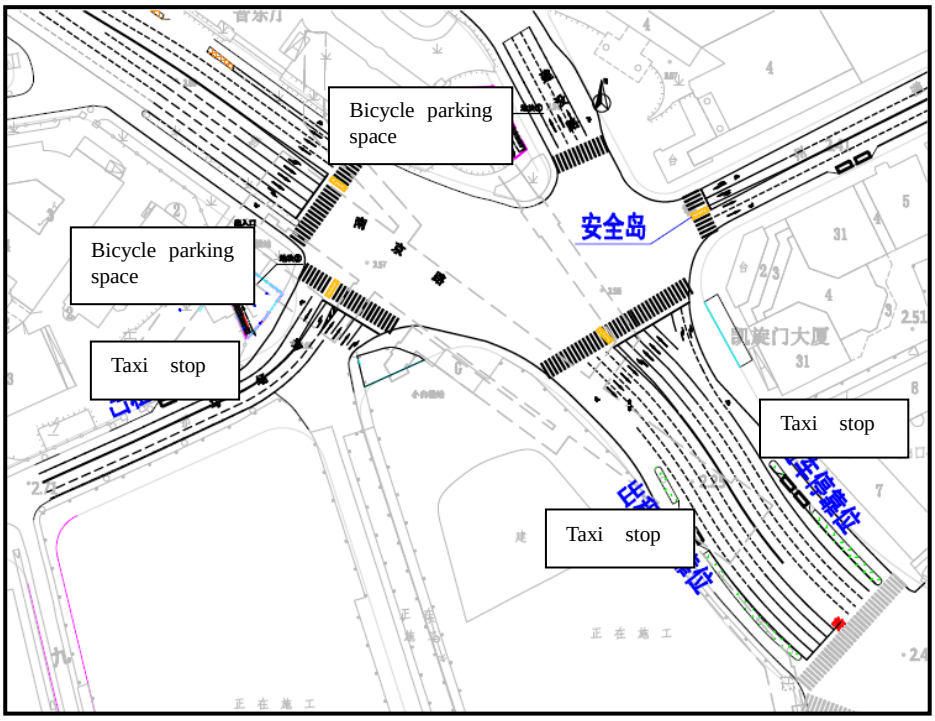


Figure 2-4-3-4 Reconstruction Plan of Xiaobailou Station Metro Transit

Table 2-4-3-7List of Xiaobailou Station Metro Transit Facilities

Transit facilities	Area (m^2)	Berth (pieces)	Site Conditions	Property of planned land	Notes
Parking lot for bikes	422	223	Green space/square	Land for roads and facilities	Recent settings
Stopping space for taxis	--	10	-	-	Recent settings

Table 2-4-3-8 Major Technical Indexes for Xiaobailou Station

Serial Number	Item	Unit	Index	Notes
1	Total land area	Square meter	468	
1.1	Public transport transit station	Square meter	–	
1.1.1	Platform	Square meter	–	

1.1.2	Road	Square meter	–	
1.1.3	Greening area	Square meter	–	
1.2	Car parking lot.	Square meter	–	
1.2.1	Stall	Square meter	–	
1.2.2	Road	Square meter	–	
1.2.3	Greening area	Square meter	–	
1.3	Parking lot for bikes	Square meter	468	
1.3.1	Stall	Square meter	234	
1.3.2	Greening area	Square meter	234	
2	Berthing space			
2.1	Public transport vehicle parking lot	Piece	–	
2.2	Car parking lot.	Piece	–	
2.3	Parking lot for bikes	Piece	107	
2.4	Temporary stopping berths for taxis	Piece	10	

(5) Chentangzhuang Station

Chengtangzhuang Station is a station along metro line No.1 with Section 1, 2, 3 and 4. Section 1 and 2 are located below the platform bridge connecting with Station A, Section 4 is located below the platform bridge connecting with Station B and Section 3 is located below the side of exit of Station B, all of which are parking lots for bikes. The accesses of parking lots for bikes are set on South Dagu Road, covering an area of 174 m2 with 58 parking berths for bikes. Two temporary stopping spaces for taxis are set on mixed roadways for motor and non-motor vehicles on both sides of South Dagu Road. Refer to Figure 2-4-3-5 for specific plan.

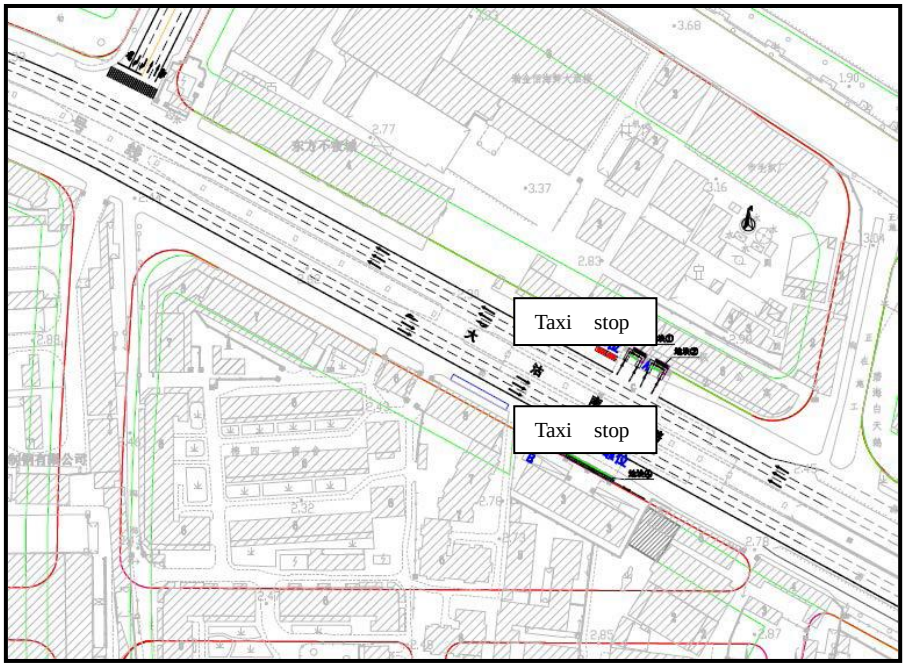


Figure 2-4-3-5 Plan of Chentangzhuang Station Metro Transit

Table 2-4-3-9 List of Chentangzhuang Station Transit Facilities

Transit facilities	Area (m^2)	Berth (pieces)	Site Conditions	Property of planned land	Notes
Parking lot for bikes	174	58	Metro land	Land for roads and facilities/land for traffic stations	Recent settings
Temporary stopping area	--	4	-	-	Recent settings

Table 2-4-3-10 Major Technical Indexes for Chentangzhuang Station

Serial Number	Item	Unit	Index	Notes
1	Total land area	Square meter	174	
1.1	Public transport transit station	Square meter	–	
1.1.1	Platform	Square meter	–	
1.1.2	Road	Square meter	–	
1.1.3	Greening area	Square meter	–	
1.2	Car parking lot.	Square meter	–	
1.2.1	Stall	Square meter	–	
1.2.2	Road	Square meter	–	

1.2.3	Greening area	Square meter	–	
1.3	Parking lot for bikes	Square meter	174	
1.3.1	Stall	Square meter	174	
1.3.2	Greening area	Square meter	–	
2	Berthing space			
2.1	Public transport vehicle parking lot	Piece	–	
2.2	Car parking lot.	Piece	–	
2.3	Parking lot for bikes	Piece	58	
2.4	Temporary stopping berths for taxis	Piece	4	

(6) Zhongshan Road Station

Zhongshan Road Station is a station along metro line No.3 with parking lot for bikes located on the north of Access A, covering an area of 301 m2 with 124 parking berths for bikes; temporary stopping space for taxis: 2 temporary stopping berths are set on the non-motor roadway on the west of Kunwei Road, located 10m away from the south of Access C. The residual width of non-motor roadway is 2.5m, thus ensuring normal transport of non-motor vehicles. Refer to Figure 2-4-3-6 for specific plan.

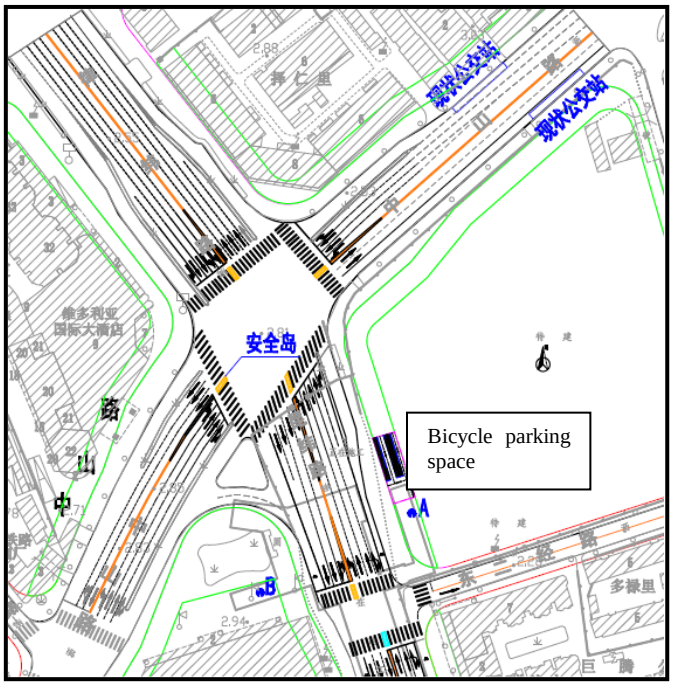


Figure 2-4-3-6 Plan of Zhongshan Road Station Metro Transit

Table 2-4-3-11 List of Zhongshan Road Station Transit Facilities

Transit facilities	Area (m²)	Berth (pieces)	Site Conditions	Property of planned land	Notes
Parking lot for bikes	301	124	Greenbelt	—	Recent settings
Temporary stopping area	--	2	-	—	Recent settings

Table 2-4-3-12 Main technical index of Zhongshan Road

Serial Number	Item	Unit	Index	Notes
1	Total land area	Square meter	301	
1.1	Public transport transit station	Square meter	–	
1.1.1	Platform	Square meter	–	
1.1.2	Road	Square meter	–	
1.1.3	Greening area	Square meter	–	
1.2	Car parking lot.	Square meter	–	
1.2.1	Stall	Square meter	–	
1.2.2	Road	Square meter	–	
1.2.3	Greening area	Square meter	–	
1.3	Parking lot for bikes	Square meter	301	
1.3.1	Stall	Square meter	301	
1.3.2	Greening area	Square meter	–	
2	Berthing space			
2.1	Public transport vehicle parking lot	Piece	–	
2.2	Car parking lot.	Piece	–	
2.3	Parking lot for bikes	Piece	124	
2.4	Temporary stopping berths for taxis	Piece	2	

(7) Xihengdi Station

Xihengdi Station is a station along metro line No.1 with parking lot for bikes on the north of Access A, covering an area of 623 m2 with 372 parking berths for bikes; temporary stopping area for taxis: 2 temporary stopping berths are set on non-motor roadways on both sides of Chenchang Road, located nearby Access A and B. The

residual width of non-motor roadways is 3.5m, ensuring normal transport of non-motor vehicles. Refer to Figure 2-4-3-7 for specific plan.

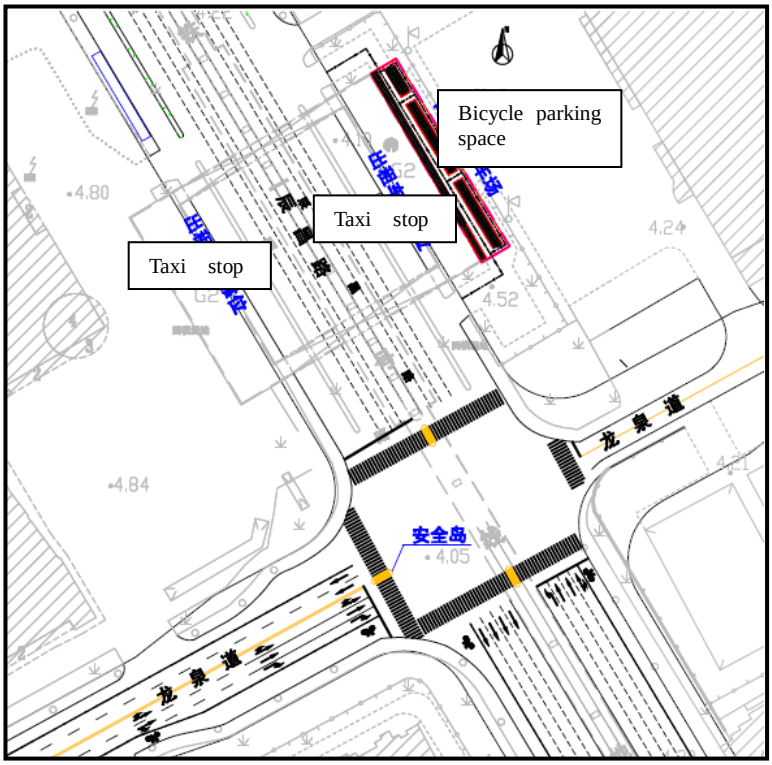


Figure 2-4-3-7 Plan of Xihengdi Station Metro Transit

Table 2-4-3-13 List of Xihengdi Station Transit Facilities

Transit facilities	Area (m^2)	Berth (pieces)	Site Conditions	Property of planned land	Notes
Parking lot for bikes	623	372	Vacant land	—	Recent settings
Temporary stopping area	--	4	-	—	Recent settings

Table 2-4-3-14 Major Technical Indexes for Xihengdi Station

Serial Number	Item	Unit	Index	Notes
1	Total land area	Square meter	623	
1.1	Public transport transit station	Square meter	–	
1.1.1	Platform	Square meter	–	
1.1.2	Road	Square meter	–	
1.1.3	Greening area	Square meter	–	
1.2	Car parking lot.	Square meter	–	

1.2.1	Stall	Square meter	–	
1.2.2	Road	Square meter	–	
1.2.3	Greening area	Square meter	–	
1.3	Parking lot for bikes	Square meter	623	
1.3.1	Stall	Square meter	623	
1.3.2	Greening area	Square meter	–	
2	Berthing space			
2.1	Public transport vehicle parking lot	Piece	–	
2.2	Car parking lot.	Piece	–	
2.3	Parking lot for bikes	Piece	372	
2.4	Temporary stopping berths for taxis	Piece	4	

(8) Benxi Road Station

Benxi Road Station is a station along metro line No.1 with parking lots for bikes surrounding 4 accesses, covering an area of 200 m2 with 135 parking berths for bikes; temporary stopping area for taxis: 2 temporary stopping berths are set on non-motor roadways on both sides of Dingzigu Third Road, located nearby Metro Access B and D. The residual width of non-motor roadways is 3m, ensuring normal transport of non-motor vehicles. Refer to Figure 2-4-3-8 for specific plan.

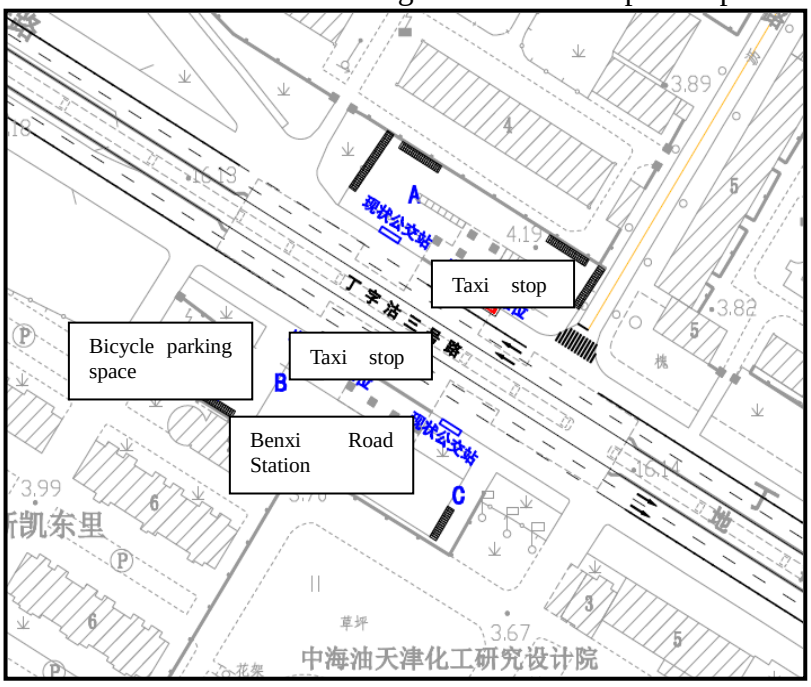


Figure 2-4-3-8 Plan of Benxi Road Station Metro Transit

Table 2-4-3-15 List of Benxi Road Station Transit Facilities

Transit facilities	Area (m2)	Berthing space (number)	Site Conditions	Property of planned land	Notes
Parking lot for bikes	200	135	Vacant land	—	Recent settings
Temporary stopping area	--	4	-	—	Recent settings

Table 2-4-3-16 Main technical index of Benxi Road

Serial Number	Item	Unit	Index	Notes
1	Total land area	Square meter	200	
1.1	Public transport transit station	Square meter	–	
1.1.1	Platform	Square meter	–	
1.1.2	Road	Square meter	–	
1.1.3	Greening area	Square meter	–	
1.2	Car parking lot.	Square meter	–	
1.2.1	Stall	Square meter	–	
1.2.2	Road	Square meter	–	
1.2.3	Greening area	Square meter	–	
1.3	Parking lot for bikes	Square meter	200	
1.3.1	Stall	Square meter	200	
1.3.2	Greening area	Square meter	–	
2	Berthing space			
2.1	Public transport vehicle parking lot	Piece	–	
2.2	Car parking lot.	Piece	–	
2.3	Parking lot for bikes	Piece	135	
2.4	Temporary stopping berths for taxis	Piece	4	

2.4.4 Project plan

2.4.4.1 Plan of Public Transport Station Transit Project

1. Road project

(1) Roadbed

The site of public transport transit station is to-be-constructed land. After leveling

original ground, store up 30cm 8% lime soil and make corresponding structure above it.

(2) Road surface

The pavement structure of public transport transit station is as follows: 24cm thick fτ=5.0MPa cement concrete +0.6mm plastic film buffer sealing coating +18cm cement stabilized macadam (cement 5%) + 18cm lime powder, coal ash and macadam (8: 12: 80) +15cm lime soil (12%). The total thickness is 75cm.

2. Platform project

Platforms of public transport transit station and transit station road are in the same roadbed and platform layout is generally in a stripping way on both sides of roadway for passengers to gather, distribute and wait. Public transport station is in the structure of cement concrete made on the roadbed. Specific structure is: 6cm color cement concrete tile +3cm sand bed +17cm cement concrete (C30) +18cm lime powder, coal ash and macadam (8: 12: 80)+ 18cm lime powder, coal ash and macadam (8: 12: 80) +15cm lime soil (12%), 77cm thick in total.

(3) Greening project

Plant hedgerows at the edges of site, corners etc. to isolate the space of public transport transit station. Plant arbors of higher branches without excreta among hedgerows so as to set locations of auxiliary facilities such as overshadow, noise reduction and illumination and plant arbors in station areas on both sides of roadway.

(4) Lighting project

Set landscape lamps in sidewalks on both sides of site roads, 0.5m away from roadways on both sides.

(5) Drainage project

Set d200mm reinforced concrete rainwater collection branch pipelines in the site of public transport transit station in backward trenching construction. The well bores of water-collecting wells adopt concrete material and the water-collecting filter adopts nodular cast iron material. Rainwater at the site is discharged from drainage pipes to municipal rainwater pipeline network on the road outside the site through water collecting inlet.

6. Project of other supporting facilities

(1) Bus awnings

Set bus awnings in the area of public transport transit station in the form combining

steel structure and glass showcase.

(2) Public transport station house

Depending on the land of public transport transit station, set 2-3 movable metal station houses in public transport transit station placed in the area of entrance of transit station and area of exit.

(3) Movable Toilets

Since the area of transfer is populated, consider setting 2-3 movable sanitary toilets in the public transport transit station.

2.4.4.2 Plan of Project of Parking Space for Cars

1. Plan of roadways

(1) Roadbed

The site of parking lot for cars is to-be-constructed land. After leveling original ground, store up 30cm 8% lime soil and make corresponding structure above it.

(2) Road surface

Pavement structure of roadway: 4cm fine grain bituminous concrete (AC-13C) +6cm medium grain bituminous concrete (AC-20C) +0.6cm emulsified asphalt sealing coating +18cm lime powder, coal ash and macadam (8: 12: 80) +15cm lime soil (12%). The total thickness of asphalt pavement is 43cm.

2. Project of parking berths

Pavement structure of parking berths in this project is advised to be: 8cm grass-planting brick + 3cm sand bed +15cm cement macadam (open gradation and cement 5%) +15cm lime soil (10%). The total thickness is 41cm. Double splayed lattice bricks are advised for paving in design. The compressive strength of grass-planting bricks and blind pass bricks is required to be higher than 35MPa and their rupture strength is required to be at least 4MPa.

(3) Greening project

Hedgerows are planted at the edges of site, corners and other areas inaccessible to parking berths to isolate parking lot. Arbors, etc. of higher branches without excreta among hedgerows are planted.

(4) Lighting project

Sodium lamps are adopted as the source of light. The semi-cut-off integrated lamps are adopted as the landscape lamps set on the edges of roadways. And street lamp posts are mainly cylinder one shape metal lamp posts. The height is about 3.5 m.

(5) Drainage project

Set d200mm reinforced concrete rainwater collection branch pipelines in the site of parking lot for cars in backward trenching construction. The well bores of water-collecting wells adopt concrete material and the water-collecting filter adopts nodular cast iron material. Rainwater at the site is discharged from drainage pipes to municipal rainwater pipeline network on the road outside the site through water collecting inlet.

2.4.4.3 Plan of Project of Parking Space for Bikes

1. Road project

(1) Roadbed

The site of parking lot for bikes is to-be-constructed land. After leveling original ground, store up 30cm 8% lime soil and make corresponding structure above it.

(2) Road surface

Pavement structure of waterproof and skid resistance is advised for parking lot for bikes: 6cm color tile +3cm sand bed +15cm lime soil (12%) +15cm lime soil (10%). The total thickness is 39cm. The compressive strength of color bricks and blind pass bricks is required to be higher than 35MPa and their rupture strength is required to be at least 4MPa.

2. Project of other supporting facilities

Ceiling of membrane structure is adopted with bike frames below.

2.5 Public bicycle system demonstration project

2.5.1 Overall layout

A well-equipped public bike operation management system is built in which 446 public bike rental stations are set surrounding the metro station and 12370 public bikes are purchased, with 17270 public bike parking piles, 446 management cabinets, private parking frames, back-stage management, monitoring system, etc. Refer to Figure 2-5-1 for plan sketch of public bike sites

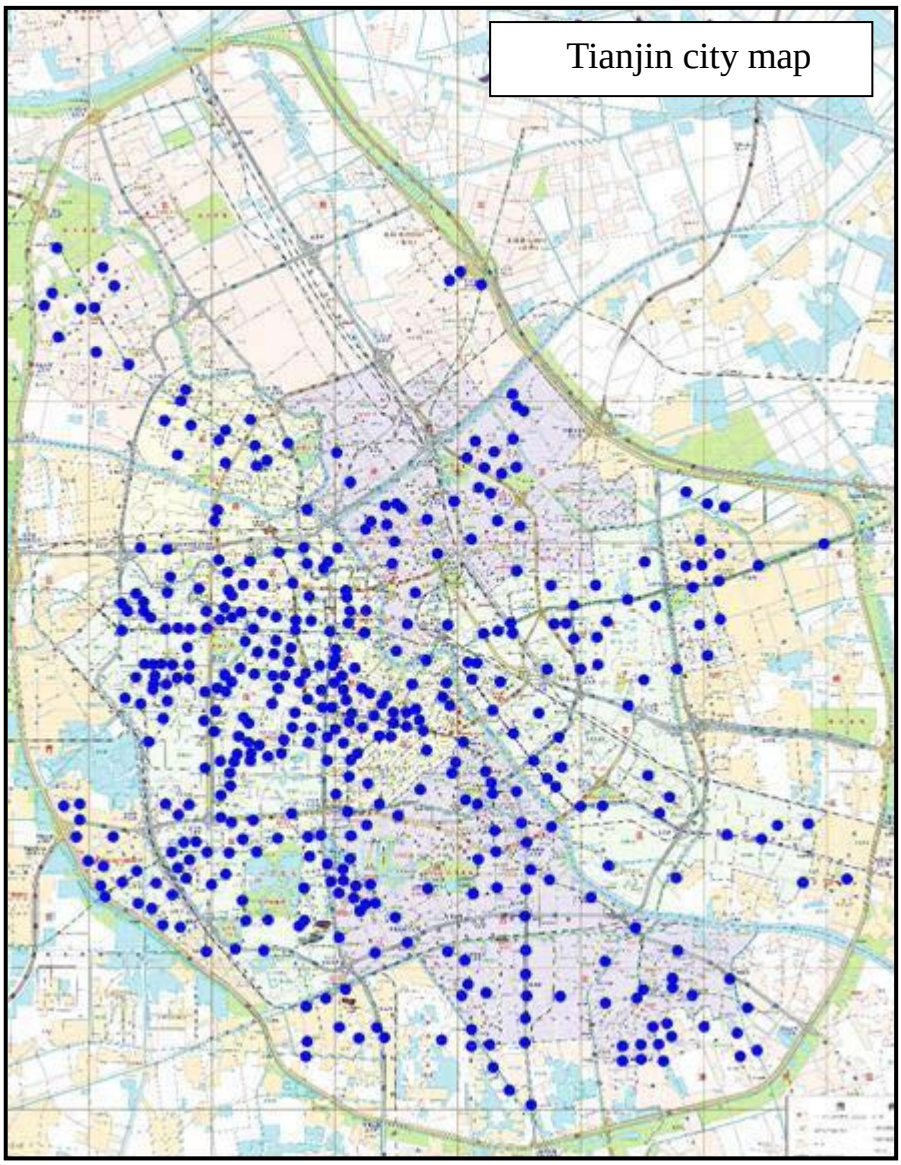


Figure 2-5-1 Plan Sketch of Public Bike Sites

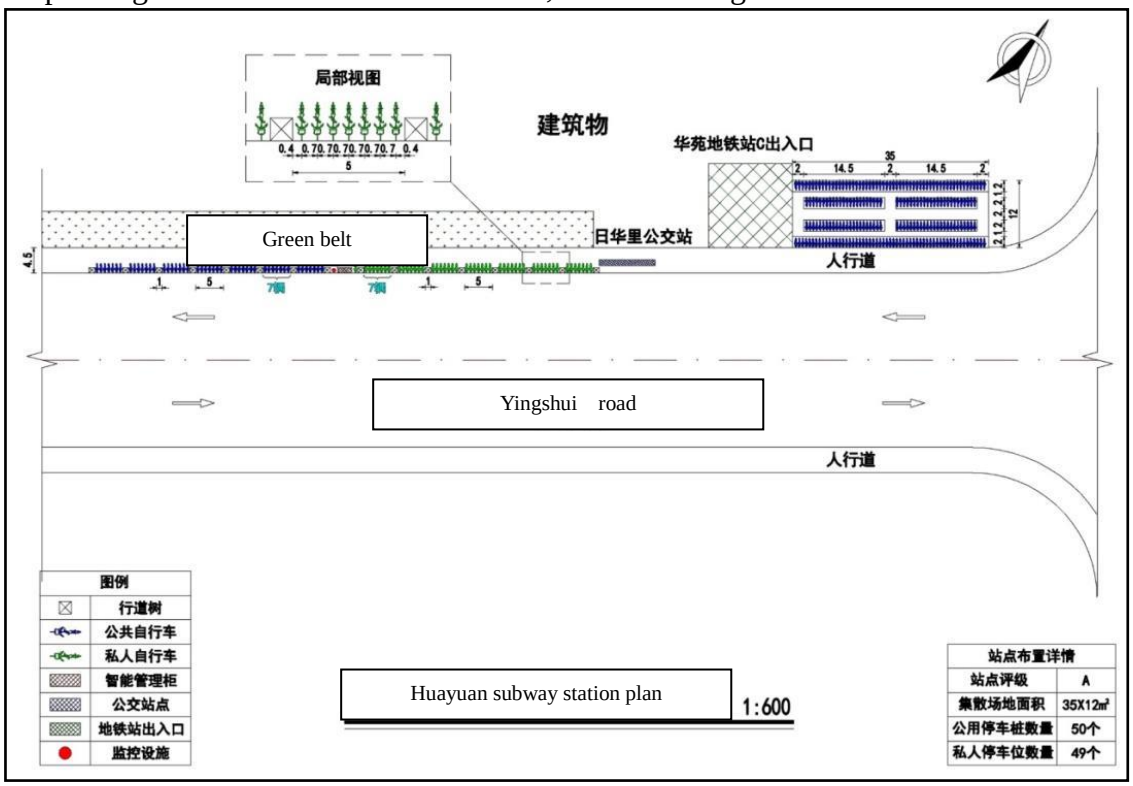
2.5.2 Construction Scale

Table 2.3-5 Size of construction of public bike system demonstration project

Service site	Building standard for parking piles	Building standard for bikes	Service points	Total parking piles	Total bikes	Parking berths for private bikes	Notes
Level I	100	75 vehicles	17	1700	1275	360	Set at the metro station, to undertake the function of "zero-distance transfer" between public bikes sand metro.
Grade II	50	35 vehicles	37	1850	1295	670	
Level Ⅲ	35	25 vehicles	392	13370	9550	1645	They are set in public transport sites, large residential areas, sites of public buildings, travel sites etc.
Total			446	17270	12370	2675	

2.5.3 Legend description

Take the rental site at the Huayuan Station along metro line No.3 as an example. Exit C for Huayuan Station along metro line No.3 is located in the north of Yingshui Road. Border trees planted on the northern sidewalk of Yingshui Road are 5m away from each other with 7 parking berths for public or private bikes in each interval. A total of 50 parking berths are set for private and public bikes. A 35m×12m open space is set on the east of Exit C as the area of gathering and distributing public bikes. In the future, the quantity of public and private bikes parked will be adjusted in time depending on actual demands. For details, refer to the figure below:



2.6 Public transport station construction project

A total of 5 public transport stations are constructed downtown, covering 32,000m2 and 13,200m2 in the area of land and building area respectively. Xiqing Caozhuang Station, Nankai Qingnian Road Station, Nankai People's Hospital Station, Beichen Science Park Station and Beichen Liuyuan Station are covered. Newly constructed public transport stations are distributed as follows:

Table 2-6-1 Locations of public transport stations to be constructed in plan

Serial Number	Name	Position	Site area (m2)
1	Xiqing Caozhuang Station	North of Fusheng Road Caozhuang Metro Station	13500
2	Nankai Qingnian Station	Intersection between Xishi Street and Qingnian Road	1500
3	Nankai People's Hospital Station	Intersection of Jieyuan Xi Road and Lin Tong Road	1400
4	Beichen Science Park Station	Intersection of Gaoxin Road and Jinwei Route	9500
5	Beichen Liuyuan Station	Eastern Side of Liuyuan Metro Station of Chenchang Road	6500

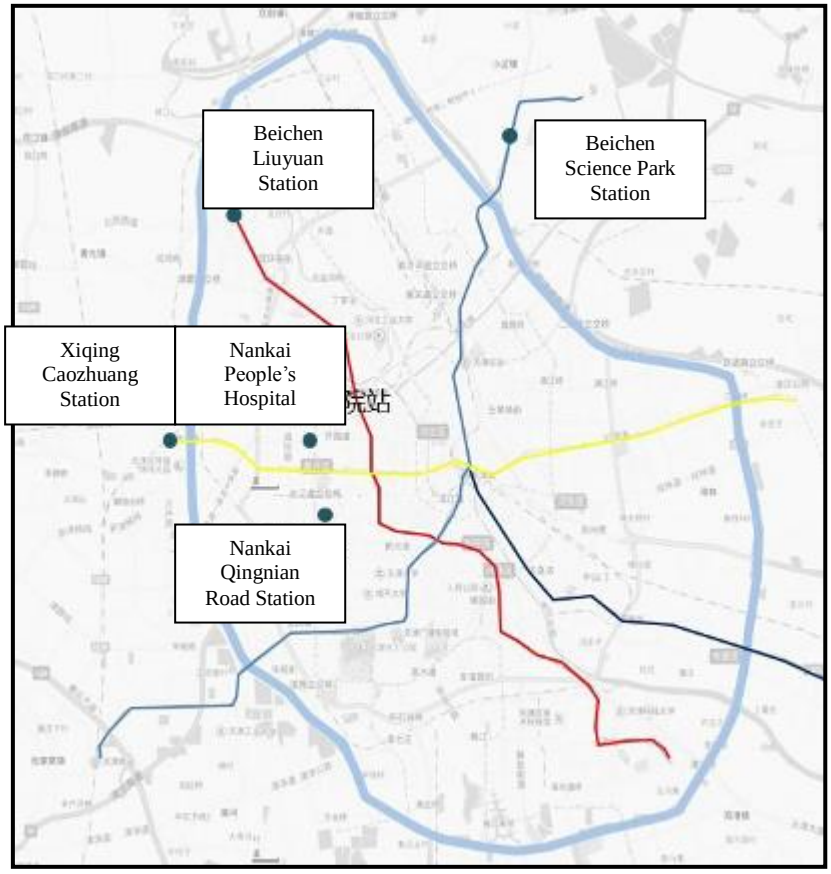


Figure 2-6-1 Distribution Map of Public Transport Stations

2.6.1 Xiqing Caozhuang Station

It is located in Fusheng Road, Xiqing District, Tianjin, north of Caozhuang Metro Station. It expands to the land of virescence to the east, Fusheng Road to the south, land of virescence to the west and land of metro to the north. The land is triangle, covering an area of 13500m2. It is now a parking lot.

Figure 2-6-1 Site of Xiqing Station

(1) Project content

This project is planned to cover an area of 13500m2 and construct one service building for bus origin and terminal station and one bus awning. The service building is a single-floor building which is 800m2 in building area. Waiting hall, office, dispatching room, resting room, staff canteen, kitchen, warehouse and other premises for supporting service facilities are set in the service building whose fire-resistance rating in building design is Level II.

No gas station is set in the public transport station. Instead, the area of bus repair is set including workshop of bus inspection, repair and maintenance, warehouse of spare parts, components and tires, warehouse of waste safety, etc. Repair staff in the station only make emergency repair on buses such as replacement of belts, bulbs etc. Major economic and technical indexes for Caozhuang Station are shown in the following table.

Table 2.6-1 Main economic and technical indicators at Caozhuang Station

Serial Number	Item	Unit	Number
1	Total land occupation area of station site	m ²	13500
2	Total building area	m ²	800
2.1	Service building	m ²	800
3	Plot ratio		0.06
4	Building density	%	5.9
5	Greening ratio	%	25
6	Greening area	m ²	3375
7	Coverage of roads and squares	m ²	9325
8	Parking space	Piece	125

9	Parking berths for bikes	Piece	25

(2) Scale

5 bus lines are set in the station with about 84 buses in operation. Herein, 25 buses are parked, cleaned and daily maintained in the station as the base while other buses are parked and managed in other parking lots for buses.

The station runs 365 days a year, 12 hours a day including 4 peak hours. The departure interval for each line in peak hours is 10min and 35 buses go in and out of the station per hour; the departure interval in other periods is about 15min and 25 buses go in and out of the station per hour. About 280 buses go in and out of the station every day in average.

(3) Passenger volume, fixed number of staff and shift system

About 8 employees are fixed in the station in two-shift system; time of operation is 6:30-18:30. The operation is made for 12 hours per day throughout the year. It is expected that the average passenger volume of this station per day is about 5000 person times.

(4) Public project

① Water supply: water is supplied by municipal tap water pipeline, primarily applicable to staff kitchen, washing, toilet flushing and bus cleaning. The volume of water consumption in this project is shown in the following table.

Table 2.6-2 Statistics of Water Consumption in Caozhuang Station Unit: m^3/d

Serial Number	Usage	Index for water consumption	Number	Water consumption	Waste water quantity	Notes
1	Kitchen	25 L/person for a meal	80 Person	2.00	1.80	Kitchen is set in the station.
2	Water for staff activities Water consumption	40L/ person day	80 Person	3.20	2.88	Toilet is open to the public
3	Vehicle Water for cleaning	150L/week ·bus	84 vehicles	1.80	1.62	Scrubbing by hairbrush
4	Passenger	15L/person time	500 Person Times	7.50	6.75	Calculated by 10%of volume ofpublic transport
5	Total	—	—	14.5	13.05	—

② Drainage: rainwater-sewage distribution system is adopted in this project in

which rainwater enters municipal rainwater and drainage system after being collected in the rainwater well. The sewage generated in the station is generally domestic sewage for staff. Besides, there is a small amount of water for bus cleaning. The gross sewage generated during operation is about 13.05m3/d, 4171m3/a. Domestic sewage is gathered, processed in manure pit and drained to municipal sewage pipeline network before ultimately entering Xianyang Road Sewage Treatment Plant for treatment.

③ Power supply: power is supplied by municipal 10kV power grid. One box transformer is set in the station, introduced by buried cable.

④ Heating and cooling: household air-conditioners of electric energy are adopted for heating and cooling in this project.

⑤ Staff canteen is designed in the station in this project with a small kitchen. Natural gas for fuel is supplied by municipal gas pipeline network.

2.6.2 Nankai Qingnian Road Station

Qingnian Road Station in Nankai District is located in the intersection of Qingnian Road and Xishi Street in Nankai District (northeastern side). The land is trapezoid in an area of 1500 ㎡. The station stretches to Gediao Chuntian Residential Area to the east, Xishi Street to the south, Qingnian Road to the west and parking lot to the north. The land of station is currently used as parking lot and green space.

Figure 2-6-2 Site of Nankai Qingnian Road Station

(1) Project content

Nankai Qingnian Road Station covers an area of 1500 m2, building management room, dispatching room, monitoring room, resting room, toilet, dining room, utility room for cleaning appliances and other premises for management and service in the station. Its total building area is 360 m2 with supporting construction of 319.33 m2 in virescence and 1000.67 m2 of road square. The building area of the station is 360 ㎡ and its functions include waiting hall, dispatching room, toilet, and repair room in the first floor and office and driver's resting room etc. on the second floor. Toilet is on the first floor, open to the public.

No gas station is set in the public transport station. Instead, the area of bus repair is set including workshop of bus inspection, repair and maintenance, warehouse of spare parts, components and tires, warehouse of waste safety, etc. Repair staff in the station only make emergency repair on buses such as replacement of belts, bulbs etc. Table of Major Technical-Economic Index

Table 2.6-3 Major Economic and Technical Indexes for Qingnian Road Station

Serial Number	Item	Unit	Number
1	Total land occupation area of station site	㎡	1500
2	Total building area	㎡	360
3	Plot ratio	-	0.24
4	Building density	%	12
5	Greening ratio	%	21.3
6	Greening area	m ²	319.33
7	Coverage of roads and squares	m ²	1000.67
8	Parking space	Piece	10
9	Parking berths for bikes	Piece	40

(2) Scale

Two bus lines are set in the station with about 30 buses in operation. Herein, 18 buses are parked, cleaned and daily maintained in the station as the base while other buses are parked and managed in other parking lots for buses.

The station runs 365 days a year, 12 hours a day including 4 peak hours. Departure interval for each line in peak hours is 10min and 12 buses go in and out of the station

per hour; the departure interval in other periods is about 15min and 8 buses go in and out of the station per hour. About 112 buses go in and out of the station every day in average.

(3) Passenger volume, fixed number of staff and shift system

About 30 employees are fixed in the station in two-shift system; time of operation is 6:30-18:30. The operation is made for 12 hours per day throughout the year. It is expected that the average passenger volume of this station per day is about 2500 person times.

(4) Public project

① Water supply: water is supplied by municipal tap water pipeline, primarily applicable to staff kitchen, washing, toilet flushing and bus cleaning. The volume of water consumption in this project is shown in the following table.

Table 2.6-4 Statistics of Water Consumption in Qingnian Road Station

Serial Number	Usage	Index for water consumption	Number	Water consumption	Waste water quantity	Notes
1	Kitchen	25 L/ person for a meal	60	1.50	1.35	
2	Staff	40 L/ person day	60 Person	2.40	2.16	
3	Vehicle cleaning water	150L/week ·bus	60 vehicles	1.29	1.16	Scrubbing by hairbrush
4	Passenger	15L/person time	600 Person Times	9.00	8.10	Calculated by 10% of volume of public transport
5	Total			14.19	12.77	

② Drainage: rainwater-sewage distribution system is adopted in this project in which rainwater enters municipal rainwater and drainage system after being collected in the rainwater well. The sewage generated in the station is generally domestic sewage for staff. Besides, there is a small amount of water for bus cleaning. Gross sewage generated during operation is about 13.05m3/d, 1872m3/a. Domestic sewage is gathered, processed in manure pit and drained to municipal sewage pipeline network before ultimately entering Xianyang Road Sewage Treatment Plant for treatment.

③ Power supply: power is supplied by municipal 10kV power grid. One box transformer is set in the station, introduced by buried cable.

④ Heating and cooling: household air-conditioners of electric energy are adopted for heating and cooling in this project.

⑤ Virescence: area of virescence in this project is 400m2.

⑥ Canteen: staff canteen is designed in the station in this project with a small kitchen. Natural gas for fuel is supplied by municipal gas pipeline network.

2.6.3 Nankai People's Hospital Station

The People's Hospital Station is located at the intersection of Jieyuan Xi Road and Lin Tong Road, Nankai District. The traffic is convenient, and there is People's Hospital, residential area, commercial area and schools around the station. The land is triangular-shaped and the land area is 1400m2. It is currently commercial land and open space.

Figure 2-6-3 Site selection of Nankai People's Hospital Station

(1) Project content

Nankai Renmin Hospital Station covers an area of 1400m2. The total building area of management and service rooms in the constructed station such as management room, control room, monitoring room, retiring room, toilet, dining room, utility room for cleaning appliances is 720m2. And 240m2 of virescence and 800m2 of road and plazas are constructed for support.

No gas station is set in the public transport station. Instead, the area of bus repair is set

including workshop of bus inspection, repair and maintenance, warehouse of spare parts, components and tires, warehouse of waste safety, etc. Repair staff in the station only make emergency repair on buses such as replacement of belts, bulbs etc. Major economic and technical indexes for People's Hospita Station are shown in the following table.

Table 2.6-5 Major economic and technical indexes of People's Hospital Station

Serial Number	Item	Unit	Number
1	Total land occupation area of station site	m^2	1400
2	Total building area	m^2	720
3	Plot ratio	-	0.51
4	Building density	%	26
5	Greening ratio	%	17.1
6	Greening area	m^2	240
7	Coverage of roads and squares	m^2	800
8	Parking space	Piece	10
9	Parking berths for bikes	Piece	30

(2) Construction Scale

1 bus line is set in the station with about 17 buses in operation. Herein, 15 buses are parked, cleaned and daily maintained in the station as the base while other buses are parked and managed in other parking lots for buses.

The station runs 365 days a year, 12 hours a day including 4 peak hours. The departure interval for each line in peak hours is 10min and 12 buses go in and out of the station per hour; the departure interval in other periods is about 15min and 8 buses go in and out of the station per hour. About 56 buses go in and out of the station every day in average.

(3) Passenger volume, fixed number of staff and shift system

About 15 employees are fixed in the station in two-shift system; time of operation is 6:30-18:30. The operation is made for 12 hours per day throughout the year. It is expected that the average passenger volume of this station per day is about 1300 person times.

(4) Public project

① Water supply: water is supplied by municipal tap water pipeline, primarily applicable to staff kitchen, washing, toilet flushing and bus cleaning. The volume of

water consumption in this project is shown in the following table.

Table 2.6-6 Statistics of water consumption for the project

Serial Number	Usage	Index for water consumption	Number	Water consumption	Waste water quantity	Notes
1	Kitchen	25 L/person for a meal	15 Person	0.38	0.34	Kitchen is set in the station.
2	Domestic water for staff	40L/ person ·day	15 Person	0.60	0.54	Toilet is open to the public
3	Vehicle cleaning water	150L/week ·bus	17 vehicles	0.36	0.33	Scrubbing by hairbrush
4	Passenger	15L/person time	130 Person Times	1.95	1.76	Calculated by 10% of volume of public transport
5	Total	-	-	3.29	2.97	

② Drainage: rainwater-sewage distribution system is adopted in this project in which rainwater enters municipal rainwater and drainage system after being collected in the rainwater well. The sewage generated in the station is generally domestic sewage for staff. Besides, there is a small amount of water for bus cleaning. The gross sewage generated during operation is about 2.97m3/d, 960m3/a. Domestic sewage is gathered, processed in manure pit and drained to municipal sewage pipeline network before ultimately entering Xianyang Road Sewage Treatment Plant for treatment.

③ Power supply: power is supplied by municipal 10kV power grid. One box transformer is set in the station, introduced by buried cable.

④ Heating and cooling: household air-conditioners of electric energy are adopted for heating and cooling in this project.

⑤ Canteen: staff canteen is designed in the station in this project with a small kitchen. Natural gas for fuel is supplied by municipal gas pipeline network.

2.6.4 Beichen Science Park Comprehensive Hub Station

Beichen District North China Group public transport station covers an area of 9500m2 and is located at Beichen Science Park, in the northeast direction of West Outer Ring Road, and it is closely adjacent to Gaoxin Road in the south, North China Group Station along Metro No. 3 Line in the north, and Jinwei Route in the west. There is Shijie Industrial Park and Huachen Industrial Park around it. Most facilities in the park are plants, with some supporting commercial and residential area. The land is mainly used as the the public parking lot at North China Group Station along the

Metro Line No. 3. Site selection for the project is as shown in the following figure:

Figure 2-6-4 Site of Nankai Qingnian Road Station

(1) Project content

Beichen Science Park Comprehensive Hub Station covers an area of 9,500m2. The total building area of management and service rooms in the constructed station such as management room, control room, monitoring room, retiring room, toilet, dining room, utility room for cleaning appliances is 920m2.And 2,375m2 of virescence and 6,665m2 of road and plazas are constructed for support.

No gas station is set in the public transport station. Instead, the area of bus repair is set including workshop of bus inspection, repair and maintenance, warehouse of spare parts, components and tires, warehouse of waste safety, etc. Repair staff in the station only make emergency repair on buses such as replacement of belts, bulbs etc. Major economic and technical indexes of Beichen Science Park Comprehensive Hub Station are shown in the following table.

Table 2.6-7 Major economic and technical indexes of Beichen Science Park Comprehensive Hub Station

Serial Number	Item	Unit	Number
1	Total land occupation area of station site	m^2	9500
2	Total building area	m^2	920
3	Plot ratio	-	0.1
4	Building density	%	5

5	Greening ratio	%	25
6	Greening area	m^2	2375
7	Coverage of roads and squares	m^2	6665
8	Parking space	Piece	32
9	Parking berths for bikes	Piece	500

(2) Construction Scale

6 bus lines are set in the station with about 101 buses in operation. Herein, 32 buses are parked, cleaned and daily maintained in the station as the base while other buses are parked and managed in other parking lots for buses.

The station runs 365 days a year, 12 hours a day including 4 peak hours. The departure interval for each line in peak hours is 10min and 12 buses go in and out of the station per hour; the departure interval in other periods is about 15min and 8 buses go in and out of the station per hour. About 336 buses go in and out of the station every day in average.

(3) Passenger volume, fixed number of staff and shift system

About 90 employees are fixed in the station in two-shift system; time of operation is 6:30-18:30. The operation is made for 12 hours per day throughout the year. It is expected that the average passenger volume of this station per day is about 5400 person times.

(4) Public project

① Water supply: water is supplied by municipal tap water pipeline, primarily applicable to staff kitchen, washing, toilet flushing and bus cleaning. The volume of water consumption in this project is shown in the following table.

Table 2.6-8 Statistics of water consumption for the project

Serial Number	Usage	Index for water consumption	Number	Water consumption	Waste water quantity	Notes
1	Kitchen	25 L/person for a meal	90 Person	2.25	2.03	Kitchen is set in the station.
2	Water for staff activities Water consumption	40L/ person day	90 Person	3.60	3.24	Toilet is open to the public
3	Vehicle Water for cleaning	150L/week ·bus	101 vehicles	2.16	1.95	Scrubbing by hairbrush

4	Passenger	15L/person time	750 Person Times	11.25	10.13	Calculated by 10% of volume of public transport
5	Greening	2/m2 time		2.40	0	-
6	Total			21.66	17.35	

② Drainage: rainwater-sewage distribution system is adopted in this project in which rainwater enters municipal rainwater and drainage system after being collected in the rainwater well. The sewage generated in the station is generally domestic sewage for staff. Besides, there is a small amount of water for bus cleaning. The gross sewage generated during operation is about 17.35m3/d, 5617m3/a. Domestic sewage is gathered, processed in manure pit and drained to municipal sewage pipeline network before ultimately entering Beichen Science Park Sewage Treatment Plant for treatment.

③ Power supply: power is supplied by municipal 10kV power grid. One box transformer is set in the station, introduced by buried cable.

④ Heating and cooling: household air-conditioners of electric energy are adopted for heating and cooling in this project.

⑤ Canteen: staff canteen is designed in the station in this project with a small kitchen. Natural gas for fuel is supplied by municipal gas pipeline network.

2.6.5 Beichen Liuyuan Comprehensive Hub Station

The site selected is located at the eastern side of Chenchang Road, Beichen District, southern side of Beichen Road, northern side of Longyan Road, adjacent to Liuyuan Station along metro line No. 1, with convenient traffic, and it is to be created into a comprehensive transport hub. The land is rectangle-shape, and covers an area of 6,500m2. The land is now used as a temporary public transport station. Site selection for the project is as shown in the following figure:

Figure 2-6-5 Site selection of Beichen Liuyuan Comprehensive Hub Station

(1) Project content

Beichen Liuyuan Comprehensive Hub Station covers an area of 6,500 square meters. The total building area of management and service rooms in the constructed station such as management room, control room, monitoring room, retiring room, toilet, dining room, utility room for cleaning appliances is 620 square meters. The indoor public transport parking lot covers 2,065 square meters and the underground parking lot covers 7,800 square meters. And 1,625 square meters of virescence and 2,500 square meters of road and plazas are constructed for support.

No gas station is set in the public transport station. Instead, the area of bus repair is set including workshop of bus inspection, repair and maintenance, warehouse of spare parts, components and tires, warehouse of waste safety, etc. Repair staff in the station only make emergency repair on buses such as replacement of belts, bulbs etc.

Table 2.6-9 Major economic and technical indexes of Beichen Liuyuan Comprehensive Hub Station

Serial Number	Item	Unit	Number
1	Total land occupation area of station site	m^2	6500
2	Total building area	m^2	10485
2.1	Public transport station service building	m^2	620
2.2	Public transport indoor parking lot	m^2	2065
2.3	Underground parking lot	m^2	7800
3	Plot ratio	-	1.54
4	Building density	%	34
5	Greening ratio	%	25
6	Greening area	m^2	1625
7	Coverage of roads and squares	m^2	2500
8	Parking space	Piece	25

(2) Construction Scale

4 bus lines are set in the station with about 67 buses in operation. Herein, about a half of buses are parked, cleaned and daily maintained in the station as the base while other buses are parked and managed in other parking lots for buses.

The station runs 365 days a year, 12 hours a day including 4 peak hours. The departure interval for each line in peak hours is 10min and 12 buses go in and out of the station per hour; the departure interval in other periods is about 15min and 8 buses go in and out of the station per hour. About 336 buses go in and out of the station every day in average.

(3) Passenger flow, fixed number of staff and shift system of Beichen Liuyuan Station

About 90 employees are fixed in the station in two-shift system; time of operation is 6:30-18:30. The operation is made for 12 hours per day throughout the year. It is expected that the average passenger volume of this station per day is about 5400 person times.

(4) Public project

① Water supply: water is supplied by municipal tap water pipeline, primarily applicable to staff kitchen, washing, toilet flushing and bus cleaning. The volume of water consumption in this project is shown in the following table.

Table 2.6-10 Statistics of water consumption for Liuyuan public transport station

Serial Number	Usage	Index for water consumption	Number	Water consumption	Waste water quantity	Notes
1	Kitchen	25 L/person for a meal	60 Person	1.50	1.35	Kitchen is set in the station.
2	Water for staff activities Water consumption	40L/ person day	60 Person	2.40	2.16	Toilet is open to the public
3	Vehicle Water for cleaning	150L/week ·bus	67 vehicles	1.44	1.29	Scrubbing by hairbrush
4	Passenger	15L/person time	540 Person Times	12.75	11.48	Calculated by 10% of volume of public transport
5	Total			18.09	16.28	

② Drainage: rainwater-sewage distribution system is adopted in this project in which rainwater enters municipal rainwater and drainage system after being collected in the rainwater well. The sewage generated in the station is generally domestic sewage for staff. Besides, there is a small amount of water for bus cleaning. The gross sewage generated during operation is about 16.28m3/d, 5469m3/a. Domestic sewage is gathered, processed in manure pit and drained to municipal sewage pipeline network before ultimately entering Beicang Sewage Treatment Plant for treatment.

③ Power supply: power is supplied by municipal 10kV power grid. One box transformer is set in the station, introduced by buried cable.

④ Heating and cooling: household air-conditioners of electric energy are adopted for heating and cooling in this project.

⑤ Canteen: staff canteen is designed in the station in this project with a small kitchen. Natural gas for fuel is supplied by municipal gas pipeline network.

2.7 Other project overview

2.7.1 Soil borrowing and spoiling project

According to the data provided by the building unit, the project is to construct 4 sub-projects including soil borrowing and spoiling project in the road network smoothing system project, involving an excavation area of 128791m3 and an filling area of 147810m3. In principle, the project excavation shall be fully used in filling or other projects. However, as it is the center city area reconstruction project, the excavation caused is mainly used for worn-out road surface, and the available part is

small. All earthworks required for the project are commercial soil and are provided by professional soil borrowing company. Earthwork balance table is as follows:

Table 2.7-1 Road Project Earthwork Balance Table

Serial Number	Item	Quantity (m3)
1	Excavation works	128791
2	filling using cutting material	25783
3	Discarded quantity	103008
4	Project filling	147810
5	Purchased earthwork	122027

As the area of project design is large, the building unit will entrust different building units for construction. Since the construction sub-projects are of different contents, the situations of soil borrowing and utilizing differ greatly. Spoil of the project mainly comes from project excavation that can not be used. According to Provisions on Management of Domestic Waste in Tianjin (implemented as of May 1, 2008) and other relevant requirements, the building units and the construction unit shall not stack the spoil randomly and the spoil must be transported to the location designated by local land management department after relevant procedures are handled. The spoil of the project shall be transported to and used for other projects under construction at the same time by the government recognized transport unit selected by the building unit under the deployment of the waste soil management department.

2.7.2 Project demolition

In the road network smoothing system project, road reconstruction sub-projects do not involve in the change of cross section, land requisition and demolition. The construction of public transport station and metro transit project is conducted on the reserved open space, and thus does not involve in demolition; therefore, the project does not involve in land requisition and demolition.

2.7.3 Greening scheme

A certain amount of urban green land and vegetation must be removed and is to be compensated by means of transplanting tall trees and relocated greening. It is proposed to strengthen the greening around public transport station and metro transit project and on both sides of the roads, mainly by planting border trees, and three-dimensional planting mode with a combination of arbor, shrub and lawn if possible, to increase the public green area.

According to project design data, arbor trees for greening are mainly such trees as

Chinese scholar trees and Chinese ash trees with a DBH of more than 10cm, with the interval of about 6m. According to relevant laws and regulations as well as the construction standards on road greening in Tianjin, the greening rate of the road with the red line width of 40-50m shall not be smaller than 25%, and that with the red line width of less than 40m shall not be smaller than 20%. Refer to specific greening programs for each project in each section.

2.7.4 Construction organization

For road reconstruction project, the current traffic shall not be interrupted during the project construction period as much as possible. Generally, semi-range construction shall be carried out first, and the construction on the other side shall be carried out after the completion of the reconstruction of one side; or temporary accesses shall be built before construction to ensure smooth traveling of vehicles.

During construction, the construction unit and traffic management department shall coordinate with each other, and the traffic management department shall effectively organize traffic flow on reconstructed roads and surrounding and adjacent road sections to avoid traffic jam or blockage.

2.7.5 Engineering Occupied Land

(1) Permanent Land Occupation

In addition to using the roadbed of current roads and roadside open space, the project construction also needs the requisition of some state-owned lands. Refer to Table 2-4-2 for specific conditions.

Table 2-4-2 Land requisition statistics

Serial Number	Project name;	Land use	Area (m2)	Land ownership
1	Metro transit project	Open space, land for road, road for metro, green land and land for traffic station	486588	State-owned
2	Public transport station construction project	Open space and land for road	32000	State-owned
3	Total	—	518588	—

(2) Temporary land occupation

Temporary land occupation generally includes production and living area, construction road, soil borrowing (spoil) area, temporary soil stock area, etc. According to design data, no stock yard will be established along the project, and the materials shall be uniformly transported to the site by providers of construction

materials. Construction staffs mainly live in idle enterprise plants or residential houses. Generally, no construction camp is established on roadside. Temporary land occupation is mainly for temporary soil stock area, established around the public transport station.

Open space is mainly used, with the area of about 10,000m².

2.8 Project overall schedule

The project passed the identification by World Bank in January 2014, was pre-assessed in January 2015, and assessed in March 2015. Project negotiation is expected to be carried out in April-May 2015, and the project will be submitted to the executive director of the World Bank for approval in June-July 2015.

Overall construction period of the project is 5 years, planned to start from 2015 and completed in 2019. The preliminary implementation plan is as follows:

In 2015-2018, complete the construction of green transport (slow traffic system) improvement project, metro transit project, public bicycle system demonstration project at the core area of center city area in the road network smoothing system project.

In 2016-2017, complete the construction of public transport stations.

In 2015-2019, complete the tasks of the technical support project.

2.9 Capital raising and investment estimation

The total investment of the project is RMB 1.426 billion, wherein, RMB 0.62 billion is the loan applied with the World Bank, and the rest is from the municipal finance.

Refer to Table 2.9-1 for sub-project investment and capital raising.

Table 2.9-1 Table of Project Investment Estimation and Capital Raising Situations

Sub-item	Investment condition (RMB ten thousand)		Capital raising situations
Road network smoothing project	Green transport (slow traffic system) improvement project in the core zone of center city area	57695.47	RMB 205.7351 million loaned with World Bank and RMB 371.2195 million raised by the building unit independently
	Metro transit project	57993.06	RMB 282.0882 million loaned with World Bank and RMB 297.8424 million raised by the building unit independently
	Public bicycle system demonstration project	13046.24	RMB 62.1246 million loaned with World Bank and RMB 68.3378 million raised by the building unit independently
	Public transport station construction project	10301	RMB 35.4798 million loaned with World Bank and RMB 67.5302 million raised by the building unit independently
Technical support project	3598.51		RMB 34.6622 million loaned with World Bank and RMB 1.3229 million raised by the building unit independently

3. Environmental Quality of Monitoring and Assessment

3.1 Overview of natural environment

3.1.1 Geographic location

Tianjin is located in the east of North China Plain, downstream of Haihe River Basin, borders Bohai Sea in the east and Yanshan Mountain in the north, with the geographical coordinates as northern latitude 38°33′57″ - 40°14′57″ and east longitude 116°42′5″ - 118°3′31″. It is about 186km long from south to north and about 101km from east to west and the total land area of the city is 11,919.7km2. Except the northern mountain area in Jixian County, most of the rest regions are plain, which covers 94% of the total land area. The built-up area is 374.3 km2, accounting for 3.14% of the total area of the city.

3.1.2 2). Climatic Characteristics

Tianjin is of warm temperate semi-humid continental monsoon climate and the four seasons here are distinctive, dry and windy in spring, hot and rainy in summer, sunny and cool in autumn, cold and dry in winter, which is the longest season in Tianjin. The annual average temperature is 13.1℃ specifically, the annual coldest month is January, with the monthly average temperature as -3.9℃ - 5.7℃ and the lowest temperature being -12.8℃; while the hottest month in summer in July, with the average temperature as 25.6℃ - 26.4℃ and the hottest temperature up to 39.6℃. The annual average precipitation is 500-700mm. Precipitation is not evenly distributed in the four seasons. Summer has the largest precipitation, mainly in July and August, with the average precipitation of 390mm, accounting for 65% of the annual precipitation. The dominant wind direction throughout the year is the southwester, monthly average wind speed throughout the year is 3.3m/s, and the largest wind speed is 33m/s. The largest freezing depth of soil is 0.7m; and the seismic basic intensity is 7 degrees.

3.1.3 Terrain feature

Tianjin is of complicated geological structure, mostly covered by cenozoic sediments. The dominant topography is plain and depression. There are low mountains and hills in the north, and the altitude decreases from north to south. The north is the highest with the altitude of 1,052m, and the southeast is the lowest with the altitude of 3.5m. The highest peak of the city is Jiushanding Mountain (with an altitude of 1,078.5m). Overall profile of the landform is high in the northwest and low in the southeast.

Tianjin mainly consists of mountain, hill and plain, wherein plain takes up about 93%. Except for the junction of the northern part and the south side of Yanshan Mountain, where is dominated by mountains, all the remaining is alluvial plain. The mountainous area in the north of Jixian County is low hills, with the altitude lower than 1km. Close to the mountainous area is inclined plain formed by pluvial alluvial fan, distributed in a fan shape. To the south of the inclined plain is alluvial plain, and to the southeast coastal plain.

3.2 Review of current social environment

Tianjin has been originally formed since the opening of the Sui-Dynasty Grand Canal; in the second year of Yongle period (i.e. 1404 A.D.), "Tianjin garrison area" was established. In December of the same year, the left Tianjin garrison area was set up, when Tianjin began to take shape. In the middle of the 19th century, it was constructed into a trading port, and then gradually developed into the largest financial and commercial center in northern China at that time, taking up an important position in modern history of China. Now, Tianjin is one of the four municipalities directly under the central government, the economic center around Bohai Sea and the largest coastal open city in northern China. Tianjin is one of the places in China that has the best public security environment, with solid social order and people living and working in peace and contentment. Tianjin people are plain, frank, helpful, creditable and practical, and have strong professional ethics.

Tianjin governs 16 administrative districts and counties, including 13 municipal districts. The center city area includes Heping District, Hedong District, Hexi District, Nankai District, Hebei District and Hongqiao District; the districts around the city include Xiqing District, Dongli District, Jinnan District, Beichen District, Wuqing District and Baochi District and coastal new districts (original Tanggu, Hangu and Dagang administrative districts); the 3 municipal counties are respectively Jinghai County, Ninghe County and Jixian County. The projects involved in the environment assessment are mainly located in these six center city areas, and a small amount of projects are distributed in those four districts around the city, including Beichen District, Dongli District, Xiqing District and Jinnan District.

3.2.1 Population

By the end of 2011, the permanent population in Tianjin was 13.5458 million, wherein 9.9644 million are of Tianjin citizenship, with the density of population of 847/km2.

Refer to in Table 3.2-1 for the population of the districts involved in the project.

Table 3.2-1 Statistics of the Population of Districts Involved in the Project

Area	Total registered population (ten thousand people)	Density of population (people/km2)
Nankai District	86.66	22480
Hebei District	63.18	21331
Hongqiao District	53.84	25325
Dongli District	35.73	747
Xiqing District	36.60	646
Beichen District	37.37	790
Jinnan District	42.06	1084
Hedong District	71.80	18117
Hexi District	80.30	21127

3.2.2 Current economic development situation

Tianjin has a long industrial history, and in the national industrial cities, ranks top with respect to industrial scale, total industrial output, economic benefits and so on. Tianjin has formed four pillar industries including the mechanical industry focused on automobile and mechanical equipment, the electronic industry focused on microelectronics and communication equipment, the chemical industry focused on petrochemical industry, marine chemical industry and fine chemical industry and the metallurgical industry focused on high quality steel pipe, steel and high-end metal products.

In the last decade, the economy in Tianjin national has kept continuous and sound development, and the economic strength has been significantly strengthened. In 2011, Tianjin's municipal GDP reached RMB 1.130728 trillion, 16.4% higher than that in 2010 and local general budget revenue reached RMB 145.513 billion, 26.5% higher than that in 2010; the total fixed asset investment reached RMB 751.067 billion. Tianjin has achieved significant results in foreign economy. Now, 110 countries and regions from Europe, Asia, America and Australia have made investment in this place. In 2011, the foreign investment in actual use reached USD 13.056 billion; the gross foreign export reached USD 44.498 billion, and the total import value reached USD

58.893 billion.

3.2.3 Life quality

In 2011, residents' living standard in Tianjin was further improved; the per capita disposable income of urban residents was up to RMB 26,921, and the per capita consumption expenditure was as high as RMB 18,424. At the end of the year, every hundred households of urban residents owned 95.6 computers and 115.8 mobile phones.

3.2.4 Education and culture cause

Tianjin is developed in education and cultural business, and is one of regions densely populated with talents in northern China. Nankai University and Tianjin University are renowned both at home and abroad. At the end of 2011, there were 1554 schools of different types and levels, including 55 regular institutions of higher education, 625 secondary schools and 874 primary schools and the total number of students were 1.5432 million.

3.2.5 Infrastructure

Tianjin has superior geographical condition, developed sea, land and air transport, and is an important transport hub in northern China. Tianjin Port is the largest port in northern China and one of the ports with the most complete terminal functions in coastal ports in China, and has ranked among the world's top 20 ports. Tianjin has basically formed a stereo-transport network with sea, land and air transport combined and centered on the port. The railway and highway could radiate into regions in northern, northwest and northeast China. Internally, the city has vast hinderland of 2 million km2 and externally, it has navigation relationship with more than 300 ports in more than 170 countries and regions. Tianjin Binhai International Airport is now the largest air cargo transport center, providing services for more than 40 domestic and international airlines. The post and telecommunication here has come into being the information transmission system for local calls, long-distance calls, microwave communication, satellite communication, etc.

3.2.6 Protective buildings along the line

According to site survey, the project is involved with 54 culture relic protection sites and stylistic buildings, including 2 key cultural relics sites under the state protection, 41 municipality protected historic sites of tianjin, 7 district protected historic sites and 4 cultural relics with rating pending. Tianjin Quanyechang and the former site of Yien

Yieh Commercial Bank are national cultural relics protection units.

Through site preliminary investigation of the environmental assessment group, the cultural protection buildings along the roads of the project are well kept, and are currently mainly functioned as residential house, store, bank, organization, scenic spot, etc. According to field survey, the distance between the cultural protection buildings and the project is 8-50m, and all cultural protection buildings are located beyond the red line range of the project

3.3 Environmental quality investigation and assessment

3.3.1 Investigation and assessment of acoustic environmental status;

3.3.1.1 Selection of monitoring points

The noise monitoring points arranged for assessment includes 3 sub-projects in the road network smoothing project. For specific noise monitoring points, refer to Attached Map 3.3-1-3.3-5, and for the monitoring scope, refer to Table 3.3-1.

Table 3.3-1 Table of Noise Monitoring Scope

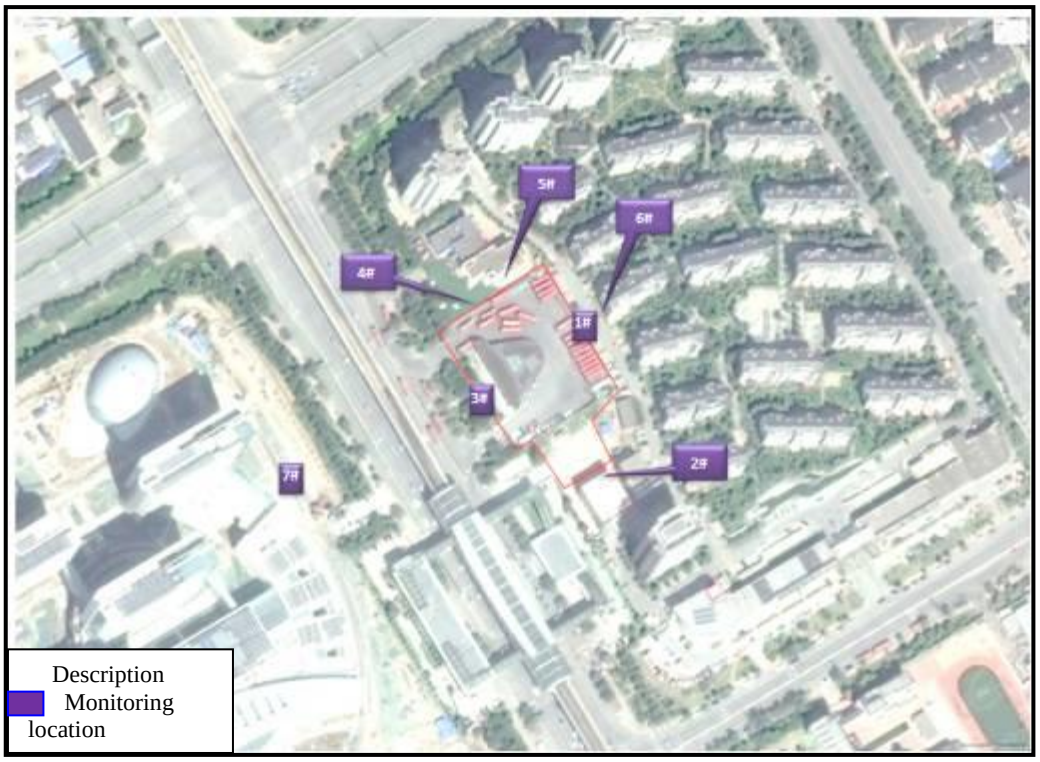
Project name;	Monitoring location	Number
Public transport station construction project	Monitoring points are arranged around 5 public transport stations and at environmental protection targets	32
Green transport (slow traffic system) improvement project in the core zone of center city area	Arrange monitoring points at the start points of 42 roads and representative environmental targets, and make statistics synchronously of the traffic flow on 42 roads.	—
Metro transit project	Arrange monitoring points at the representative environmental protection targets around the metro transit public transport stations	—

Attached Map 3.3-1 Layout of Monitoring Points at Xiqing Caozhuang Sub-station

Attached Map 3.3-2 Layout of Monitoring Points at Qingnian Road Station, Nankai District

Attached Map 3.3-3 Layout of Monitoring Points at People's Hospital Station, Hongqiao District

Attached Map 3.3-4 Layout of Monitoring Points at Beichen Science Park Station



Attached Map 3.3-5 Layout of Monitoring Points at Beichen Liuyuan Station

3.3.1.2 Supervision time and frequency

Pony Testing conducted acoustic environment quality monitoring for the public transport station construction project.

The monitoring methods were in accordance with the GB/3096-2008 Standards for Acoustic Environmental Quality. According to Management Methods on Prevention and Control of Environment Noise Pollution of Tianjin, the measurement was carried out from 6:00am - 22:00pm, and 22:00pm - 6:00am. All sub-projects were monitored for 2 times in the morning, afternoon and evening respectively for two consecutive days, to summarize main noise sources.

3.3.1.3 Monitoring results

(1) Monitoring results of public transport station

Table 3.3-2 Monitoring of current conditions of noises Unit: dB(A)

Serial Number	No.	Monitoring Locations	Project involved	In the day			At night		
				Monitoring value		Standard value	Monitoring value		Standard value
1.	N_1	East boundary	Xiqing Caozhuang Station	59. 1	58. 8	60	49. 2	49. 5	50
2.	N_2	South boundary		67. 7	69. 3	70	54. 0	53. 5	55
3.	N_3	North boundary		58. 6	59. 3	60	47. 1	48. 1	50

Serial Number	No.	Monitoring Locations	Project involved	In the day			At night		
				Monitoring value		Standard value	Monitoring value		Standard value
4.	N_1	East boundary	Qingnian Road Station	58.5	57.7	55	45.4	46.1	45
5.	N_2	South boundary		66.9	68.1	70	51.2	52.8	55
6.	N_3	West boundary		65.1	64.1	70	50.6	48.9	55
7.	N_4	North boundary		63.4	63.7	55	47.2	48.9	45
8.	N_5	No.4 building of Gediao Spring		55.1	56.2	55	44.2	45.3	45
9.	N_6	No.7 building of Gediao Spring		56.7	57.2	55	43.2	42.8	45
10.	N_7	Jurui Lane		67.6	68.5	70	52.2	51.8	55
11.	N_8	No. 25 Middle School		69.5	67.2	60	51.3	50.9	50
12.	N_9	South Furong Lane		55.5	56.5	55	43.2	44.7	45
13.	N_1	East boundary	People's Hospital Station	56.2	57.6	60	47.2	48.9	50
14.	N_2	West boundary		54.5	53.0	60	41.9	42.8	50
15.	N_3	North boundary		66.9	68.8	70	52.2	52.0	55
16.	N_4	Yameili		58.0	58.4	60	47.6	46.6	50
17.	N_5	Nankai Foreign Languages School		56.3	57.6	60	43.4	43.8	50
18.	N_6	Shuijun Garden		64.4	64.2	70	49.5	49.6	55
19.	N_1	East boundary	East zone of Beichen Science Park	55.3	55.9	65	49.4	49.5	55
20.	N_2	South boundary		68.2	68.6	65	54.1	54.5	55
21.	N_3	West boundary		58.2	57.2	70	49.4	49.5	55
22.	N_4	East boundary	West area	56.7	57.5	65	47.1	49.2	55
23.	N_5	South boundary		58.2	58.5	65	47.6	47.1	55
24.	N_6	West boundary		56.3	56.6	65	43. 8	42.2	55
25.	N_7	North boundary		57.3	56.7	65	45.7	45.9	55
26.	N_1	East boundary	Beichen Liuyuan	57.7	57.5	55	48.9	50.6	45

Serial Number	No.	Monitoring Locations	Project involved	In the day			At night		
				Monitoring value		Standard value	Monitoring value		Standard value
27.	N_2	South boundary	Station	66.5	67.7	55	48.5	48.8	45
28.	N_3	West boundary		72.9	72.6	70	66.9	64.2	55
29.	N_4	North boundary		62.8	63.1	55	49.4	48.6	45
30.	N_5	Honey Baby Kindergarten		59.6	59.0	55	48.1	48.4	45
31.	N_6	Xijing Yuan Community		58.5	58.1	55	49.4	49.5	45
32.	N_7	New Children's Hospital		68.9	68.6	70	63.1	62.2	55

3.3.1.4 Present environment quantity condition assessment

(1) Current noise quality assessment at the public transport station

① Xiqing Caozhuang Station

Status quo values of noise at the east and north boundaries of Xiqing Caozhuang Station conform to the standards in GB3096-2008 Standards for Acoustic Environmental Quality (class 2). Status quo values of noise at the south boundary in the day and at night conform to class 4a standards.

② Qingnian Road Station

Status quo values of noise at the east and north boundaries exceed GB3096-2008 Standards for Acoustic Environmental Quality (class 1). Status quo values of noise at the south and west boundaries conform to class 4a standards. Status quo values of noise of Building 4 and 7 in Gediaochuantian Community at the east of the site boundary in the day and at night exceed GB3096-2008 Standards for Acoustic Environmental Quality (class 1). Status quo values of noise of Juruili Residential Building at the south of the site boundary conform to class 4a standards. Status quo values of noise of the teaching buildings of the No. 25 Middle School in the day and at night exceed class 2 standards. Status quo values of noise of South Furong Lane Residential Building at the west of the site boundary conform to class 1 standards in the day and exceed the standard at night. The above sensitive points exceed the standards all due to the influence of the traffic noises of surrounding Xishi Street and

Qingnian Road.

③ People's Hospital Station

Status quo values of noise at the east and west boundaries conform to class 2 standards. Status quo values of noise at the north boundary can conform to class 4a standards at night. Status quo values of noise at Yameili and Nankai Foreign Language Middle School conform to class 2 standards. Shuijun Garden Residential Building can conform to class 4a standards.

④ Beichen Science Park Station

Status quo values of noise at the east and south boundaries of the east district conform to class 3 standards in the day and at night. Status quo values of noise at the west boundary conform to class 4a standards in the day and at night. Status quo values of noise at the east, south, west and north boundaries of the west district conform to class 3 standards in the day and at night.

⑤ Beichen Liuyuan Station

Status quo values of noise at the east, south and north boundaries exceed class 1 standards in the day and at night. Status quo values of noise at the west boundary exceed class 4a standards in the day and at night. The standards exceed the standards due to the influence caused by the traffic noise at Chenchang Road. Status quo values of noise at HoneyBaby Kindergarten and Xijingyuan Community exceed class 1 standards in the day and at night. Status quo values of noise of the children's hospital under construction conform to class 4a standards in the day, and exceed class 4a standards at night. The standards exceed the standards due to the influence caused by the traffic noise at Chenchang Road.

3.3.2 Investigation and analysis of environmental air quality

3.3.2.1 Ambient air quality of the whole city

According to the 2013 annual report, in Tianjin, the average concentration of sulfur dioxide (SO2) was 59mg/m3, lower than the annual average concentration standard (60mg/m3); the average concentration of nitrogen dioxide (NO2) was 54mg/m3, 0.4 times greater than the annual average concentration standard (40mg/m3); the average concentration of inhalable particle (PM10) was 150mg/m3, 1.1 times greater than the annual average concentration standard (70mg/m3); the average concentration of fine particle (PM25) was 96mg/m3, 1.7 times greater than the annual average concentration standard (35mg/m3)

Over the years, the concentration of sulfur dioxide and nitrogen dioxide had decreased significantly and in the recent two years, the concentration risen a little; the concentration of inhalable particle had decreased significantly, but raised significantly in 2013.

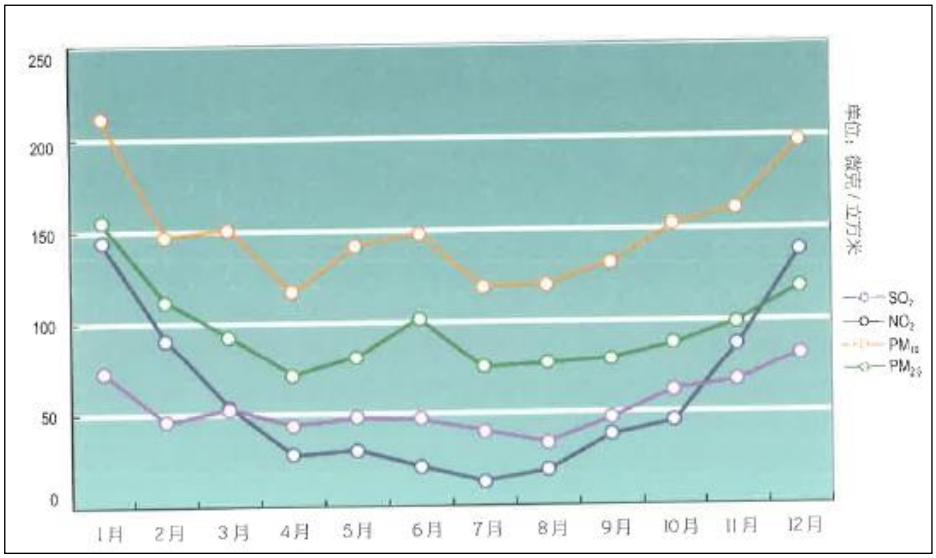


Figure 3.3-1Diagram of Annual Change of Normal Pollutants Unit: mg /m^2

3.3.2.2 Environmental air quality of each district and county

In environmental air in each district and county in 2013, the annual average concentration of PM25 was 87-107mg/m3, lower than the national standard; the annual average concentration of sulfur dioxide was 40-70mg/m3, of which only Hebei District but not Nankai District, Dongli District, Heping District and Hedong District succeeded in reaching the national standard; the annual average concentration of nitrogen dioxide was 35-61mg/m3, of which Hebei District, Heping District, Nankai District, Hedong District and Dongli District did not reach the national standard; the annual average concentration of inhalable particle was 138-171mg/m3, of which Hebei District, Heping District, Nankai District, Hedong District and Dongli District did not reach the national standard.

3.3.3 Investigation and assessment of ecologic environmental status;

3.3.3.1 Current conditions of animals and plants along the line of the project

The sub-projects of the project are mainly located in cities and suburbs, and the location of the project is highly developed due to the influence of human activities, and artificial ecosystem is within the location. The site selected is mainly urban road, open space and concentrated living area. There is no native vegetation in the assessment scope, and the current vegetation are mainly border trees, greenbelts and

other cultivated plants, and the species are simple. Major arbors along the line mainly include locust tree and elm; main shrubs and herbaceous plants are stipa bungeana trin, rumex patientia, plantain herb and armoise. Through the investigation and check of relevant materials on site, no rare and endangered wild plants or ancient and rare trees are found in the project location.

Due to the long-term influence of human activities in the assessment scope, current visible terrestrial animals are mainly domestic livestock and a small amount of wild animals. Domestic livestock mainly includes dogs, chickens, etc. For wild animals, no other wild animals are distributed except some insects and a small amount of sparrows, magpies and rats rehabilitated in the shrubs, and no terrestrial wild animals under the key conservation of the state and province are discovered in the project assessment area.

3.3.3.2 Soil borrowing and spoiling of the project

The roadbed of existing road can be used as the roadbed for the reconstructed road of the project. The quantity of earthwork is limited. All the soil borrowed for the project is commercial soil; the main spoil is the old road surface and a small amount of construction waste. The spoil of the project shall be transported to and used for other projects under construction at the same time by government recognized transport unit selected by the building unit under the deployment of the waste soil management department. Therefore, there is no soil borrowing and spoil areas.

4. Project Analysis

4.1 Analysis for Conformity of Plans

4.1.1 Tianjin General Urban Plan

Tianjin General Urban Plan (2005-2020) approved by the State Council points out that the urban property of Tianjin is "an economic center around Bohai Sea Area, which shall be gradually built into an international port city, northern economic center and ecological city"; the urban functions include "modern manufacturing and R&D transformation base, northern international shipping center, international logistic center, regional comprehensive transport hub, modem services center, national famous historical and cultural city and tourist city featured with modern history records and livable city with good ecological environment." Corresponding development strategies proposed in the general plan include "speeding up infrastructure construction; strengthening the connection of infrastructure construction between the functional areas in Tianjin and surrounding cities, striving to create a comprehensive transport hub closely related with surrounding areas, speeding up the construction of modern logistics base, etc." Besides, the general plan also proposes that the urban transport development goal is to "build compound transport corridor along the urban main development axis and development belt, optimize urban road network, prioritize public transport, create good bicycle and pedestrian traffic environment and establish a "quick, efficient, safe and green" modern urban comprehensive transport system with rapid conversion of various means of transport." With respect to road system, it proposes to: "improve the road system of expressway, primary trunk road, secondary truck road and branch road and form a road network with reasonable structure, clearly defined level and high efficiency." Meanwhile, it proposes that the municipal infrastructure construction goal is to "build a safe and highly efficient modern urban infrastructure system, emphasize water resource supply, energy supply, information and communication safety and provide support and assurance for the sustainable development of Tianjin urban and rural economic society in 2020".

Urban infrastructure projects involved in the project mainly include green transport (slow travel system) improvement project, metro transit project, public bicycle system demonstration project and public transport station construction project in the core zone of center city area. Project construction can improve the internal urban transport network, public transport system and other infrastructure conditions in Tianjin,

conform to the requirements of Tianjin General Urban Plan (2005-2020), promote the rapid economic development in Tianjin and improve significantly the image of Tianjin as an international city.

The project roads are renovated from existing roads, and the stations are the lands for public transport determined by the plan; therefore, comparison and selection are not conducted on line direction and site selection programs.

4.1.2 Tianjin Municipal "twelfth five-year" development plan

Focus on strengthening external radiation, promoting two-city connection and smoothing urban transport, and accelerate the construction of transport infrastructures such as "two ports and three roads". By the end of "Twelfth Five-Year Plan" period, basically form the efficient, convenient, safe, green and integrated modern traffic system and transport system that center on "the two cities" and reach the hinterland, and basically build the positions as the northern international shipping center and the international logistic center hub.

Public transport. Carry out the strategy to prioritize public transport, establish and improve urban and rural integrated public transport network system. Further optimize the public line layout, add special lines for public transport and open rapid transit lines. Increase the financial investment and subsidy on public transport, add operation vehicles, improve the public transport service level, and guide the citizens to prefer to select public transport. The public transport share ratio shall be improved to 30%. The implementation of the project shall strive to optimize road network conditions, reasonably dredge and allocate the traffic, mitigate the increasing of road traffic pressure, improve urban transport, increase travel efficiency of residents, and conform to the "twelfth five-year" development plan in Tianjin.

4.1.3 Tianjin Municipal "Twelfth Five-Year" Plan on Comprehensive Transport

By the end of "Twelfth Five-Year Plan" period, basically form the efficient, convenient, safe, green and integrated transport system that centers on "the two cities" (center city area and core zone of Binhai New Area) and take "two high" (high speed railway and expressway) and "two rapid" (rapid rail and rapid road) as the framework, and basically build the pivot position of the northern international shipping center and international logistic center that center on "two ports" (seaport and airport).

Regard to ground public transport: focus on enhancing the connection between the

buses and rail, improving the service level and providing adequate bus stations. Firstly, to optimize the road network. Adjust the public lines along the No.1, No.2, No.3 and No.9 rails, and enhance the rail connection; adjust the traffic on the public line entering the core zone near the rail ring line; cover the public line service to the whole city and realize the new integrated development pattern for urban and rural public transport. Secondly, to improve the speed of public transportation. Build 100 km of special bus road to improve the bus service. Build 65 km of rapid bus transit in Binhai New Area to form the core public net. Improve the public operation speed in the main corridor to about 18 km/h by 50% compared to the current status. Thirdly, to improve the site facilities. Build 7 bus parking sites and 70 initial and terminal stations to realize over 80% of bus parking rate at night. Increase public transport capacity, add 4,000 buses and keep air-conditioned at the percentage of over 60% to enhance the travel comfort and improve the service quality. Fourthly, take public transport as the priority. Formulate the bus priority development policies, increase public financial investment and off preferential ticket price for transit between buses and rail as well as between buses to reduce the travel expenses.

The project will give priority to the reconstruction and smoothing of public transport and conduct road network smoothing improvement, construct public bicycle demonstration project and establish additional functional public transport stations on the sections with the most traditional bus lines in Tianjin,. The implementation of the project will help establish the public transport-oriented urban transport system, and conform to the “twelfth five year” comprehensive transport planning in Tianjin.

4.1.4 Tianjin Municipal “Twelfth Five-Year” Plan on Drainage

Improve the drainage design standards for the center city area and four districts around the city, plan to design recurrence interval for new rainwater facilities in key areas reach 3-5 years; and design the water conservancy recurrence interval to the standard of 20-50 years. Urban sewage treatment rate shall reach 98%, and the sewage pipe network penetration rate shall reach 98%. Construction standard for sewage treatment plants: Grade 1-A standard. Water quality in all main river channels shall reach the above IV standard for surface water.

This project will aim at water logging problems of built up areas of central urban areas of Tianjin in rainy season and establish demonstration project of flood disaster defense and recovery system. After the construction is completed, the control and

management level of city drainage system will be improved and the drainage capacity of drainage pipes of the city will be improved greatly. Therefore, construction of the project is important basic condition for improving the disaster prevention and mitigation capabilities of our city and guaranteeing the security of life and property of people. The project is devoted to improving the construction standards and drainage capacity of urban drainage pipelines, improving flood control level, while improving the smoothness of urban transport under extreme conditions so as to facilitate the normal reconstruction of urban transport system after the disaster, thus improving the overall defense capacity, loading capacity and adaptation capacity of the city. Therefore, the project construction conforms to Tianjin "twelfth five-year" on drainage plan.

4.1.5 Beautiful Tianjin Construction Program

Encourage green travel, give the priority to develop public transport, improve the bus share rate and build the rapid bus system. By 2016, add 4,000 buses and optimize 164 bus lines to realize full coverage of urban and rural areas. Build the rent service network system for urban bicycles. Accelerate to build the integrated intelligent transport information platform. Focus on managing the advertisements along the two sides of high-speed roads.

The construction of projects involved can greatly improve current public transport conditions from the urban center to the suburb in Tianjin and improve rapid public transport system, which is of great significance on the "construction of modern transport system" proposed in Tianjin General Plan, and can thus improve the living standard of the citizens and promote urban overall facility level to meet the positioning requirements of a modern and international city. Besides, make demonstrations for green development of urban transport in Tianjin, especially in the aspects of advocating efficient transport travel, improving slow traffic ratio, promoting transit oriented development (TOD) model and reducing the impacts of extreme air in urban transport and others, Conform to the beautiful Tianjin construction program.

4.1.6 Analysis for Conformity of industrial policies

According to the requirements of "strengthening the construction of energy, transportation, water conservancy, information and other infrastructure, and enhancing the safeguard capacity of economic society development" in Article 5 of

Interim Provisions for Promotion of Industry Structure Adjustment (GF [2005] No. 40) issued by the State Council, and the "vehicle passenger and freight station, urban public transport station; intelligent highway transport, rapid passenger and freight transport, highway drop and pull transport system development and construction; highway management service, emergency security system development and construction; super-large span bridge construction and maintenance technology application; urban public transport" in "Article 24. Highway and road transport (including urban passenger transport)" of the encouraged projects set forth in No. 9 Decree on Guiding Catalog of Industrial Structure Regulation (2011 version) issued by the National Development and Reform Commission, the project construction conforms to relevant national industrial policies.

4.2 Identification and screening of project environment impacts

4.2.1 Overview of environment influence

The project is the urban comprehensive transport improvement project, the construction of which will significantly increase transport management level, fully explore the potential of existing urban road network and effectively improve current transport in Tianjin, so as to mitigate the transport and purify the environment. The project will cause certain adverse impacts on local ecological and social environment during the construction process and certain sub-projects will cause noise, wastewater, waste gas and solid waste upon construction during operation; however, by taking certain environmental protection measures, it is able to control the emission of pollutants, reduce adverse impacts, thus meeting the emission standards specified by the state. Therefore, the influence factors of project construction on natural and social environment are to be analyzed from positive and negative aspects.

The influence extent and scope of various sub-projects are different, so the emphasis and depth of the environment influence assessment of various sub-projects are different. To minimize the negative environment impacts brought by project construction, strengthen the positive environment impacts, the environment influence assessment will conduct in-depth quantitative forecast analysis and assessment and provide effective and feasible environment mitigation measures; conduct quantitative or qualitative forecast analysis and assessment, to demonstrate the effects of project construction on the improvement of Tianjin environment quality. Refer to Table 4.2-1 for environment influence identification and screening results of each sub-project.

Table 4.2-1 Environment Impacts Identification and Screening Results for Tianjin Urban Transport Improvement Project

Sub-item		Identification of Environmental Impacts	
		Positive impacts	Negative impacts
Road network smoothing project	Green transport (slow traffic system) improvement project in the core zone of center city area	Solve urban congestion phenomenon	The construction site is located at city center, with various sensitive goals, large project quantity and great influence scope and extent. The project will cause great influence on the vegetation, water environment, environmental air (construction dust) and acoustic environment during construction. The project will cause great influence on the residents around the public transport stations during operation.
	Metro transit project	Improve rail transport service level	
	Public bicycle system demonstration project	Improve the travel conditions of public facilities	
	Public transport station construction project	Provide maintenance site for buses to realize the public transport prioritization policy.	
Technical support project	The contents of the project are consultation service. There is no civil project quantity and it will not cause impacts on the environment.		

According to project contents, the project can be divided into two categories: civil project and non-civil project. Civil project includes four sub-projects in the road network smoothing system project; while non-civil project includes intelligent dispatching equipment and scientific research project content. Civil project ha great positive and negative impacts on the environment, while non-civil project has obvious positive impacts. With respect to civil project, public transport station construction project and green transport (slow traffic system) improvement project at the core area of center city area have much greater impacts than other four improvement sub-projects. Therefore, the assessment is to conduct detailed environment influence assessment on the public transport station construction project and green transport (slow traffic system) improvement project at the core area of center city area in civil projects. For the metro transit project and public bicycle system demonstration project in civil projects, only environment influence analysis will be conducted during the construction period. For non-civil projects, no in-depth analysis and assessment will be conducted and only necessary statements will be provided in relevant sections.

4.2.2 Environmental impact analysis

4.2.2.1 Construction preparation and construction period

(1) The road foundation excavation, filling and other project activities during

project construction will cause damages to surface vegetation, surface disturbance, soil bareness and local landscape change.

(2) Land acquisition and occupation, foundation construction, materials and equipment and earthwork transport and other construction activities will occupy and destroy urban roads and increase traffic load.

(3) The noises caused by excavator, pile driver, heavy-duty loader, transport vehicles and other mechanical equipment during the construction will influence surrounding sensitive spots such as residential areas, schools and hospitals.

(4) The production wastewater during construction and the domestic wastewater discharged by the construction staff on site will influence surrounding area.

(5) The influence of construction operation on the environment is mainly raise dust pollution, mainly resulting from earthwork project, surface excavation and transport processes.

(6) The water drainage pipeline constructed in the project mainly takes use of the groove-buried pipelines. The groove soil will easily cause water and soil loss when accumulated on the two sides of the groove mouth. Meanwhile, rainwater may easily deposit in the unfinished groove, thus causing sewage sludge.

(7) The public transport station reconstruction and road reconstruction construction may cause short-term adverse impacts on local traffic, travel and safety of residents nearby, operation of organizations, management of stores, etc.

4.2.2.2 Analysis of environment impact in operation period

Environment impacts during the operation period of the project mainly come from the pollution of road reconstruction, bus transfer noise and exhaust gas on the surrounding environment.

4.3 Favorable Impacts factors

The project includes 2 sub-projects, both of which are urban transport infrastructure construction projects. After the project is finished, its positive impacts are greater than its negative ones on the environment. The positive impacts lie in that it can solve urban traffic jam, optimize residents' travel modes and promote the development of human civilization. Refer to Table 4.3-1 for the positive impacts of the project.

Table 4.3-1 Positive Impacts of Urban Transport Improvement Project of Tianjin by Using the World Bank Loans

Contents	Sub-item name	Construction contents	Favorable influence factors
Road network smoothing project	Green transport (slow traffic system) improvement project in the core zone of center city area	Upgrade 42 roads within the scope of about 7.2 km2 in the center city area of Tianjin, including 26 roads in Heping District with about 5.6 km2, and 16 roads in Nankai District with about 2.0 km2. The total length of roads involved is about 49.7 km.	Solve urban congestion phenomenon
	Metro transit project	This project constructs connection facilities in peripheries of 111 stations in total of metro line No. 1, 2, 3, 5, 6 and 9 of Tianjin, which covers 486,588m2 in total.	Improve auxiliary facilities for urban rail transport
	Public bicycle system demonstration project	Build perfect public bicycle operation and management system and establish a total of 446 public bicycle lease stations.	Improve the travel rate of public facilities
	Public transport station construction project	Build a total of 5 public transport stations in center city area.	Provide maintenance site for buses to realize the public transport prioritization policy.
Technical support project	-	Conduct relevant researches based on the construction goals of urban transport improvement project	Provide the basis for urban construction

4.4 Negative influence factors

4.4.1 Negative influence factors during construction period

The project construction will inevitably occupy the existing land and vegetation, and local ecological environment will be damaged; furthermore, the construction noise, ground dust and waste dirt & spoil slag produced by such construction activities as demolition, excavation, dumping and transport in the construction process will impact the surrounding environment, which is planned to evaluate by means of analogy survey to propose precautionary measures.

① Noise

The noise during construction period of the project mainly comes from construction machineries, such as road roller, loader, excavator, agitator, etc. The noise could reach 90~98dB(A) in 5 meters from the sound source when these machineries are running, and the sudden unsteady sound source will generate negative influence to the construction staff and surrounding residents.

② Exhaust gas

The raise dust generated in the construction, the dust pollution generated in the transport, load & unload and agitation processes of the road materials, and the raise dust generated by wind blow with road materials during the stacking period, will influence the local air quality.

Exhaust emission by oil-fueled construction machinery and transport vehicles will increase the total amount of atmospheric pollutant emission in local area environment. During asphalt paving operation, the asphalt fume will influence roadside residents and units in surrounding areas, however, because the asphalt pavement is short period disposable operation, and the temperature of heated asphalt concrete drops quickly, therefore the influence is ephemeral, the smoke emission will almost be over once the operation activities complete.

③ Waste water

The wastewater mainly includes waste oil by mechanical escape, emission, drip, leakage and oily wastewater pollution from uncovered machinery under rain swashing; other than that, it also includes the construction muddy water, domestic wastewater from construction staff, and surface runoff generated by raining. Construction waste, waste soil and soil generated in the construction period, carry with large quantities of pollutants and suspended particulate matters along the surface runoff in heavy rains, and flow into nearby waters.

④ Solid waste

Solid waste in the construction period mainly includes waste earth-rock, construction waste generated with operation waste dirt and domestic waste generated by construction staff.

⑤ Ecological Environment

The roadbed filling and digging damage the wayside vegetation, which will somehow change the local ecological structure in the roadside districts. Exposed surface under rain wash will generate localized water and soil loss, undermine soil fertility, and impact the stability of local terrestrial ecosystem.

⑥ Social Impact

There are numerous sensitive spots along the existing roads and public transport station lines, including enterprises and public institutions, residential districts, schools, hospitals, etc. Public transport station and road transformation construction will

generate certain social impacts, mainly showing as that transformation construction of public transport and road occupies road surface and intensifies traffic pressure along the line, which generates temporary interference on the traffic; meanwhile, engineering construction will bring along short period negative impacts on the business of enterprises and public institutions, resident travel and store operation; especially the transformation construction of transport stations and roads near schools, hospitals and other sensitive spots will bring along short period negative influence on the safe travel of the hospital patients and school students.

4.4.2 Negative influence factors in operation period

The environmental impacts of the project after completion and operation are mainly attributed to wastewater, solid waste, public transport noise and road transformation noise, atmosphere, etc.

① Traffic noise source

Transport noise comes from passing vehicles. Vehicle noise is a comprehensive sound source that consists of various noises, including engine noise, exhaust noise, vehicle vibration noise, transmission device noise, braking noise, etc. Amongst above noises, the engine noise is a primary pollution source. The engine noise is significantly related to the speeds of engine and vehicle respectively. The strength of transport station noise, not only relates to vehicle speed, but also to such various factors as public transport type, road structure, road surface covering, etc.

② Source air pollution

After project completion, vehicle exhaust will be a primary source of environment air pollutant. The scale of pollutant discharge amount is related to vehicle travel distance and vehicle numbers in a period of time. Vehicle exhaust pollutant mainly comes from crankcase leak, fuel system volatilization and exhaust funnel emission, which mainly consist of CO and NOx.

③ source of water pollution

The pollutant drainage water in project operation period includes domestic wastewater from the staff and mobile staff of 5 public transit hubs and oily wastewater generated by vehicle maintenance and repair.

④ Solid waste source

Domestic garbage from operating staff of public transport stations and overhaul waste oil, etc.

Table 4.4-1 Negative influence factors of Urban Transport Improvement Project of Tianjin by Using the World Bank Loans

Serial Number	Sub-item Name	Contents of main project	Negative influence factors
1	Green transport (slow traffic system) improvement project in the core zone of center city area	It is planned to reconstruct 42 roads within the scope of 7.2km^2 in center city area of Tianjin, including 26 roads in Heping District covering an area about 5.2m2 and 16 roads in Nankai District covering an area about 2.0m2 with total length of roads nearly 49.7km.	Construction noise, water and atmosphere pollution, social impact; operation period noise, atmosphere impact
2	Metro transit project	This project constructs connection facilities in peripheries of 111 stations in total of metro line No. 1, 2, 3, 5, 6 and 9 of Tianjin, which covers 486,588m2 in total.	Construction noise, water and atmosphere pollution, social impact
3	Public bicycle system demonstration project	Build perfect public bicycle operation and management system and establish a total of 446 public bicycle lease stations.	Construction noise
4	Public transport station construction project	Build a total of 5 public transport stations in center city area.	Construction noise, water and atmosphere pollution, social impact; operation period noise pollution, atmosphere pollution, drainage, solid waste pollution

4.5 Environment influential factors identification and assessment factors selection

4.5.1 Identification of construction project influence factor

According to the construction project characteristics, its improvement to transport environment and exhaust features of pollutants, identify the extent and characteristics of project environmental influence factors by the Table of project environmental influence factors, the result of identification is shown in Table 4.5-1, Table 4.5-2.

Table 4.5-1 Extent identification of project environmental influence factors

Environmental resource		Natural environment						Ecological energy						Social environment							Life quality			
		Underground hydrology	Underground water	Surface hydrology	Surface water	Air quality	Surface environment	Urban ecology	Forest cover	Wild animals	Aquatic animal	Endangered animals	Fishery breeding	Land utilization	Land development	Industrial development	Water supply	Energy traffic	Fuel component	Energy saving	Health and safety	Socio-economic	Cultural relics and	Life standard
Construction period	Land clearing	/	/	/	/	-1	-1	/	/	/	/	/	/	/	/	/	/	-1	/	/	/	/	/	/
	Underground excavations.	/	/	/	/	-2	-2	/	/	/	/	/	/	/	/	/	/	-1	/	/	/	/	/	/
	Transporting	/	/	/	/	-1	-1	/	/	/	/	/	/	/	/	/	/	-1	/	/	/	/	/	/
	Construction and installation	/	/	/	/	/	-1	/	/	/	/	/	/	/	/	/	/	-1	/	/	/	/	/	/
	Matial Stacking	/	/	/	/	-1	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Brief summary			/	/	/	/	-5	-5	/	/	/	/	/	/	/	/	/	/	-4	/	/	/	/	/
Operation period	Sewage Discharge	/	/	/	-1	/	/	/	/	/	/	/	/	/	/	/	/	+2	/	/	/	/	/	/
	Air Emissions	/	/	/	/	-1	/	/	/	/	/	/	/	/	/	/	/	+2	/	+2	+2	+2	/	+2
	Noise	/	/	/	/	/	-1	/	/	/	/	/	/	/	/	/	/	+2	/	/	+2	+2	/	+2
	Solid waste discharge	/	/	/	/	/	/	-1	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Product	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	+3	/	/	/	/	/
	Employment	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	+1
	Housing	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Brief summary			/	/	/	-1	-1	-1	-2	/	/	/	/	/	/	/	/	/	/	/	+2	+4	+4	/

Note: ①3 - Major influence; 2- medium influence; 1- marginal effect; "+" showing positive influence; "-" showing negative influence.

② The extent of environmental influence factors in project operation period includes the positive aspects and the negative aspects. In view of the advantages far outweigh the disadvantages, so the illustration in the Table refers to main influence.

Table 4.5-2 Characteristic analysis of project environmental influence

Influence nature / Environmental resource		Negative impacts										Positive impacts									
		Construction period					Operating period					Construction period					Operating period				
		Short—term	Long term	Reversible	Irreversible	Local	Extensive	Short—term	Long term	Reversible	Irreversible	Local	Extensive	Short—term	Long term	Local	Extensive	Short—term	Long term	Local	Extensive
Natural Resources	Underground hydrology																				
	Underground water quality																				
	Surface hydrology																				
	Surface water quality	√		√		√															
	Air quality								√		√		√								
	Noise environment								√		√		√								
Biology Resources	Urban ecology	√		√		√													√		√
	Forest animal																				
	Wild animals																				
	Aquatic animal																				
	Endangered animals																				
	Fishery breeding																				
Social environment	Land utilization	√		√		√															
	Industrial development area																				
	Agriculture development																				
	Water supply	√		√		√															
	traffic	√		√		√													√		√
	Fuel component																				
Life quality	Energy saving																				
	Health and safety																				
	Socio-economic	√		√		√													√		√
	Cultural relics and historic sites																				
	Life standard	√		√		√													√		√

4.5.2 Assessment factors selection of environmental influence

According to the project analysis, combined with the status qua of the environment, illustrate the selection result of assessment factors of the environmental influence in the following Table 4.5-3.

Table 4.5-3 Selection of environmental influence assessment factors

Item	Environment assessment factors	Analyze or predict assessment factors
Ambient air	CO、NO_2、PM_{10}、$PM_{2.5}$	CO、NO_2、$PM_{2.5}$
Acoustic environment	Equivalent A-weighted sound pressure level	Equivalent A-weighted sound pressure level
Water Environment	pH, SS, CODCr, BOD5, petroleum, ammonia nitrogen, total phosphorus, animal and vegetable oil	pH, SS, CODCr, BOD5, petroleum, ammonia nitrogen, total phosphorus, animal and vegetable oil
Ecological Environment	Soil, vegetation, water and soil loss	Soil, vegetation, water and soil loss
Social environment	Traffic, urban landscape, life quality	

4.6 Source strength estimate

4.6.1 Source strength in construction period

4.6.1.1 Source strength of sound environment pollution in the construction period

The noise during construction period of the project mainly comes from construction machineries, such as road roller, loader, excavator, agitator, etc. The noise in a 5m distance from sound source when these machinery are running could reach 84~100 dB(A), these sudden unsteady sound source will make negative impacts on the construction staff and surrounding residents.

Table 4.6-1 Main construction machinery noise level within various distances (unit: dB(A))

Phase	Machinery name	5m	10m	20m	40m	60m	80m	100m	150m	200m
Foundation construction phase	Loaders	90	84	78	72	68.5	66	64	60.5	58
	Bulldozer	86	80	74	68	64.5	62	60	56.5	54
	Excavator	84	78	72	66	62.5	60	58	54.5	52
	Pile engine	100	94	88	82	78	76	74	70	68
Road surface construction period	Vibrating roller	86	80	74	68	64.5	62	60	56.5	54
	Motor grader	90	84	78	72	68.5	66	64	60.5	58
	Paver	87	81	75	69	65.5	63	61	57.5	55
	Amalgamator	87	81	75	69	65.5	63	61	57.5	55

4.6.1.2 Source strength of environment air pollution in the construction period

Pollution source in the project construction process is mainly raise dust pollution. In

which, raise dust pollution is mainly attributed to road materials that are in the process of transport, load & unload, stacking, and the process of mixing at the mixing unit. Source strength of raise dust: earth materials, sand-gravel materials and cements all are required to transport from outside in the construction period, and transport quantity is massive, so the transport raise dust and vehicle emission will impact the air quantity in the local area. According to relative analogy monitoring data, the raise dust influence range is 50 - 150m under on-site downwind direction, and the average TSP concentration in the influenced area is 491g/m3 .

4.6.1.3 Source strength of water pollution in the construction period

Wastewater in the construction period mainly comes from production and domestic activities, including concrete mixing and vehicle washing wastewater, oily wastewater generated by washing construction machinery and gross sewage by construction staff. Construction wastewater: waste oil by mechanical escape, emission, drip, leakage and oily wastewater pollution from uncovered machinery under rain swashing; gross sewage and domestic waste of construction community will generate pollution in surrounding waters; the pH of concrete mixing and vehicle washing wastewater generally shows alkalinity. Wastewater volume generated by swashing sand-gravel materials is quite small, and the wastewater ingredient is relatively simple which generally is SS and a small quantity of petroleum.

Gross sewage: calculate with unit pollutant discharge coefficient, population of on-site construction staff in peak time is about 200 persons, domestic water demand as per 100L/(person day), pollutant discharge coefficient as per 90%, and the production of gross sewage will be about 18m3/day. Main pollutants of gross sewage by construction staff are COD, animal and vegetable oil, SS and so on, and the sewage quality is, COD: 200 ~300mg/L, animal and vegetable oil: 50mg/L, SS: 80 ~100mg/L.

4.6.1.4 Solid waste in the construction period

Construction period solid waste is mainly the construction waste generated by project earth-rock excavation and construction residue dirt, and domestic garbage from construction staff.

(1) Earthwork excavation and construction waste: according to initial estimate about project design documentation, project excavation earthwork is 128700m3; fill earthwork is 147800m3; discarded earthwork is 103000m3; and earthwork volume of

excavation using for fill is 25800m3.

(2) Construction staff domestic garbage: the population of on-site construction staff at the peak time is about 200 persons; daily production of domestic garbage is 0.20t.

4.6.2 Source strength in operation period

4.6.2.1 Source strength of sound environment pollution in operation period

The engine, cooling system and transmission system of public transport vehicles make noises when starting up and running slowly at the stations, and the sound source strength is 75dB(A).

Road traffic noise influence, select 9 representative roads and assess the sound environment quality, select the daily vehicle flow of the 9 roads as source strength.

4.6.2.2 Source strength of environment air pollution in operation period

Main pollutant in project operation period is mainly attributed to exhaust emitted by vehicles when entering and exiting stations, running slowly on road, idling, and startup, and the pollution factors are CO and NOx.

4.6.2.3 Source strength of water environmental pollution in operation period

Water environmental pollution in operation period is mainly attributed to the gross sewage generated by operating staff and floating population and oily wastewater produced by vehicle overhaul in Caozhuang transport transit station. After the project is put into operation, the wastewater of public transport transit hub will be collected by sewage pipes and discharged to local sewage treatment plant.

Main pollutants of oily wastewater produced by vehicle overhaul are COD, BOD5, and petroleum, etc.; Main pollutants of gross sewage are COD, BOD5, animal and vegetable oil, ammonia nitrogen and so on, as per analogy with similar project, see the drainage water quality prediction in Table 4.6-1.

Table 4.6-1 Prediction of sewage water quality in the operation period

Factor	Ph	SS	COD_{Cr}	BOD_5	Petroleum	Ammonia nitrogen	Total phosphorus	Animal and vegetable oil
Emission concentration	7.2	250	350	200	15	30	2.7	40

Project wastewater volume in operation period is as follows:

Table 4.6-2 Prediction of water pollutant drainage volume Unit kg/a.

Serial Number	Project	Sewage	COD_{Cr}	Ammonia nitrogen	Petroleum
1	Xiqing Caozhuang Station	4172	1.46	0.13	0.06
2	Nankai Qingnian Road Station	1872	0.66	0.06	0.03
3	Nankai People's Hospital Station	961	0.34	0.03	0.01
4	Beichen Science Park Station	5617	1.97	0.17	0.08
5	Beichen Liuyuan Station	5470	1.91	0.16	0.08
6	Total	18092	6.34	0.55	0.26

4.6.2.4 Solid waste in operation period

The project solid waste in operation period is mainly comprised of domestic garbage. Domestic garbage mainly comes from the operating staff and transfer passengers in 9 public transport transit hubs; according to the project design documentation, the domestic waste volume of the 9 public transport hubs in operation period is 334t/a, which will be collected at station pick-up points and delivered to urban domestic garbage disposal plants.

5. Acoustic Environmental Impact Prediction and Assessment

5.1 Assessment on acoustic environment impacts in construction period

5.1.1 Noise prediction methods and prediction modes in operation period

In view of the complexity of construction noise and the locality and phased features of construction noise impacts, according to Environment Noise Emission Standard in Building Construction Fields (GB12523-2011), this report calculates the noise pollution range of different construction equipment to enable the construction unit to adopt appropriate noise pollution prevention measures combined with practical situation of the construction during different construction periods.

The noise of construction machinery can be managed merely as point sound source, and estimate the noise strength of sound source with different distances according to noise decay mode of the sound source, and the prediction mode is as follows

$$L_p = L_{p0} - 20\lg(r / r_0)$$

In the mode: Lp: predicted value of construction noise in the distance of r meters from the sound source, dB(A);

Lp0: noise reference value in the distance of r0 meters from the sound source, dB(A);

5.1.2 Analysis of noise influence range calculation and influence in operation period

The noise during construction period of the project mainly comes from construction machineries, such as road roller, loader, excavator, agitator, etc. The noise in a 5m distance from sound source when these machinery are running could reach 84~100 dB(A), these sudden unsteady sound source will make negative impacts on the construction staff and surrounding residents.

Table 5.1-1 Main construction machinery noise level within various distances (unit: dB(A))

Serial Number	Enginery type	Distance from the plant (m)										
		5	10	20	30	40	60	80	100	150	200	300
1	Wheel loader	90	84.0	78.0	74.4	71.9	68.4	65.9	64.0	60.5	58.0	54.4
2	Motor grader	90	84.0	78.0	74.4	71.9	68.4	65.9	64.0	60.5	58.0	54.4
3	Vibrating roller	86	80.0	74.0	70.4	67.9	64.4	61.9	60.0	56.5	54.0	50.4
4	Dual-drum roller	81	75.0	69.0	65.4	62.9	59.4	56.9	55.0	51.5	49.0	45.4
5	Three-wheel road roller	81	75.0	69.0	65.4	62.9	59.4	56.9	55.0	51.5	49.0	45.4
6	Tyre roller	76	70.0	64.0	60.4	57.9	54.4	51.9	50.0	46.5	44.0	40.4

7	Bulldozer	86	80.0	74.0	70.4	67.9	64.4	61.9	60.0	56.5	54.0	50.4
8	Crawler-type hydraulic excavator	84	78.0	72.0	68.4	65.9	62.4	59.9	58.0	54.5	52.0	48.4
9	Paver	87	81.0	75.0	71.4	68.9	65.4	62.9	61.0	57.5	55.0	51.4
10	Concrete mixer	65	59.0	53.0	49.5	46.9	43.4	40.9	39.0	35.5	33.0	29.5

As per the calculation result of a single machinery in Table 5.1-1: during earthwork period, the noise value of construction at the distance of 60m from construction machinery could meet the standard 70dB(A) of the Environment Noise Emission Standard in Building Construction Fields (GB12523-2011) in the day; the noise value of night construction at the distance of 300m from construction machinery could meet the standard 55dB(A) at night; in the structure period, the noise value of construction at the distance of 40m from the construction machinery could meet the standard 70dB(A) of the Environment Noise Emission Standard in Building Construction Fields (GB12523-2011) in the day; the noise value of night construction at the distance of 200m from construction machinery can meet the standard 55dB(A) at night.

The mainly influenced objects include residence communities, schools, hospitals, kindergartens and other sensitive areas, and all the above sensitive spots are located around the construction area in a range of 5-200m, as a result, the construction noise in construction period will impose different levels of influence, in which, the construction will exceed standard by 3.0-14.0dB(A) in the day, and the construction will exceed standard by 2.0-24.0dB(A) at night.

As per above analysis, conclude the project noise environmental impacts in construction period as the followings:

① Construction machinery noise will make negative impacts on the environment protection objects surrounding the construction area, particularly, the night influence is obvious.

② As the public work and have leisure outside, and entertain themselves in the living room in the day, their tolerance to sound pollution is stronger and are able to understand the construction noise of municipal project; residents always need quite sleeping environment at night, and have minor tolerance to noise, therefore the project construction usually disturb the residents at night.

③ This assessment suggests that, on basis of regulations such as Management Methods on Prevention and Control of Environment Noise Pollution of Tianjin, the

construction site and materials stock yard of the project construction should be allocated remotely from sensitive spots, and second, night construction (22:00-6:00) in the road sections of the sensitive spots surrounding area should be forbidden; except for night emergency construction. Under urgent process requirement of night construction, the construction unit should summit application to relevant authorities 3 days prior, and negotiate with the public which are likely to be influenced to reach consensus before construction.

④ With project completion, the construction period noise influence will no longer exist anymore. The negative environmental influence of construction noise is temporary and short period.

5.2 Assessment on acoustic environment impacts in Operation Period

5.2.1 Assessment of sound environmental influence on green traffic (slow traffic system) improvement project in the core zone of center city area during the operation period

5.2.1.1 Noise prediction mode introduction

This environmental assessment uses Cadna /A Software to predict road traffic noise. Cadna/A system refer to a noise simulation and control software based on IS09613 standard method and adopting WINDOWS system as operating interface. The system is applicable to the influence prediction, assessment, engineering design, and control countermeasures of various noise sources of industrial facilities, roadways, railways and local regions.

Calculation principle of the Cadna/A software originates from ISO9613-2:1996 Calculation Method of Attenuation of Sound during Propagation Outdoors issued by International Organization for Standardization The description of noise physical principles, demarcation of sound source condition, considerable influence factors in the noise propagation process and noise calculation mode in the software are completely identical to relative regulations of the International Organization for Standardization. The domestic issuing of GB/T17247.2—1998 Acoustics--Attenuation of sound during propagation outdoors--Part 2: General method of calculation is consistent with the ISO9613—2:1996 standard of the International Organization for Standardization. The calculation method of Cadna/A Software is consistent with the domestic calculation method of sound propagation attenuation. The software is certified by Assessment Center for Environment Engineering, Ministry of

Environmental Protection of the People's Republic of China (See China Environmental Assessment Center Documentation [2001] No. 7) The introduction to main calculation mode of traffic noise of the software is as follows.

a. Road traffic radiant sound level Lm, E: the radiant sound level with a 25m horizontal distance from road center line and 2.25m vertical distance from the ground.

$$L_{m,E} = L_m + D_V + D_{stro} + D_{stg} \quad (1)$$

In the mode

Lm— determine the average sound level as per formula (2);

Dv— correction of various top speed limit;

Dstro— correction to various road surface; as the project roads are all smooth asphalt road surface, correction is not needed;

Dstg— correction to gradient; as the gradient of project roads is less than 5%, correction is not needed.

B. Average sound level Lm

It is the sound level of sound wave under free propagation given that the horizontal distance from road center line of 25m, smooth asphalt road surface, 100km/h speed limit, gradient<5%, and average height to road surface of 2.25m.

$$L_m = 37.3 + 10\lg[M \times (1 + 0.081 \times p)] \quad (2)$$

In the mode

M— average vehicle flow per hour of one-way lane For multilane calculation, the vehicle flow of two outer lanes is M/2.

P— percentage of trucks (load capacity>2.8 tons); if there is no specific vehicle flow data, the value of M and P can be further calculated as per daily vehicle flow DTV (i.e. average vehicle flow in 24 hours).

C. Speed correction DV

Make correction on speed limit different from 100km/h as per following formula:

$$D_v = L_{car} - 37.3 + 10\lg[100 + 10^{0.1 \times D} - 1) \times p / (100 + 8.23 \times p)] \quad (3)$$

$$L_{car} = 27.7 + 10 \times \lg[1 + 0.02 \times V_{car})^3]$$

$$L_{truck} = 23.1 + 12.5 \times \lg(V_{truck})$$

$$D = L_{car} - L_{truck}$$

In the mode

Vcar— Speed limit of cars(km/h)

V_{track} — Speed limit of trucks(km/h)

Lcar, Ltruck — hourly average radiant sound pressure level Lm of cars and trucks

It can be concluded as per principles of above mode that, the Cadna/A Software is applicable to the traffic noise prediction of the environmental assessment.

5.2.1.2 Selection of typical sections

The environmental assessment will select the roads with typical cross section width to conduct prediction. The environmental assessment involves 38 roads (exclude 4 pedestrian streets) with different level, different speed, different red line width and different vehicle flow, which are classified and aggregated into 9 categories, see details in Table 5-2-1-1. In each category, select the longer traffic line of road with a number of environment protection objects, calculate and analyze the attenuation rules of its plane section and vertical section.

Table 5-2-1-1 Classification of roads involved in the environmental assessment

Serial Number	Grade	Speed (km/h)	Width of red line: (m)	The same kind of roads	Selected typical road sections	Minor cross section hourly vehicle flow (pcu/h)	
						In the day	At night
1	Main arterial road	40	45、50、60	Middle Chengxiang Road (Beima Road-Beicheng Street), Qufu Road (section between Nanjing Road and Taierzhuang Road), Nanmenwai Street, Tongbei Road, Beima Road, Xima Road	Nanmenwai Street	6200	1550
2	Main arterial road	40	36、40	North Dagu Road (section between Zhangzizhong Road and Yantai Street), Dongma Road, North Dagu Road (Qufu Street ~Xuzhou Street), Fu'an Street, Nanma Road, Tongnan Road, East Chengxiang Road	Fu'an Street	5500	1375
3	Main arterial road	40	16、22、25、30	Rongye Street, Xinhua Road (Nanjing Road-Jinzhou Street), West Chengxiang Road, Middle Chengxiang Road (Beicheng Street-Nancheng Street), Luan Street	Rongye Street	2900	725
4	Secondary arterial road	30	36	Heping Road (Nanma Road ~Rongji Street section)	Heping Road (Nanma Road ~Rongji Street section)	4900	1225

5	Secondary arterial road	30	30	Jianshe Road (Yingkou Road ~Yantai Road section), Baoding Road(North Dagu Road ~Zhangzizhong Road section), Beicheng Street, Nancheng Street, Shuige Street, East Gulou Street	Beicheng Street	3300	825
6	Secondary arterial road	30	20、24、25	Baoding Road (Xinhua Road-North Dagu Road), Xingan Road, Jianshe Road (Yantai Road ~Qufu Road section), Duolun Road (Zhangzizhong Road ~Xingan Road section), Baoding Road (Zhangzizhong Road ~Xingan Road section), Baoding Road (Jianshe Road ~North Dagu Road section), Duolun Road (Xingan Road-Xinhua Road section), Baoding Road(Shanxi Road-Xinhua Road section)	Baoding Road (Xinhua Road-North Dagu Road)	1500	375
7	Secondary arterial road	30	16、18	Shanxi Road, Anshan Street	Anshan Road	2400	600
8	Secondary arterial road	30	12、14	Duolun Road (Xinhua Road ~ Nanmenwai Street section), North Dagu Road (Yantai Street ~Qufu Street section), Xinhua Road (Jinzhou Road ~Duolun Road)	North Dagu Road	1500	375
9	By-pass	20	12、14、16、20	Xuzhou Road, Heping Road (Chifeng Road ~Yingkou Road section), Haerbin Road (Shanxi Road-North Dagu Road), Henan Road, Shanxi Road	Shaanxi Road	800	200

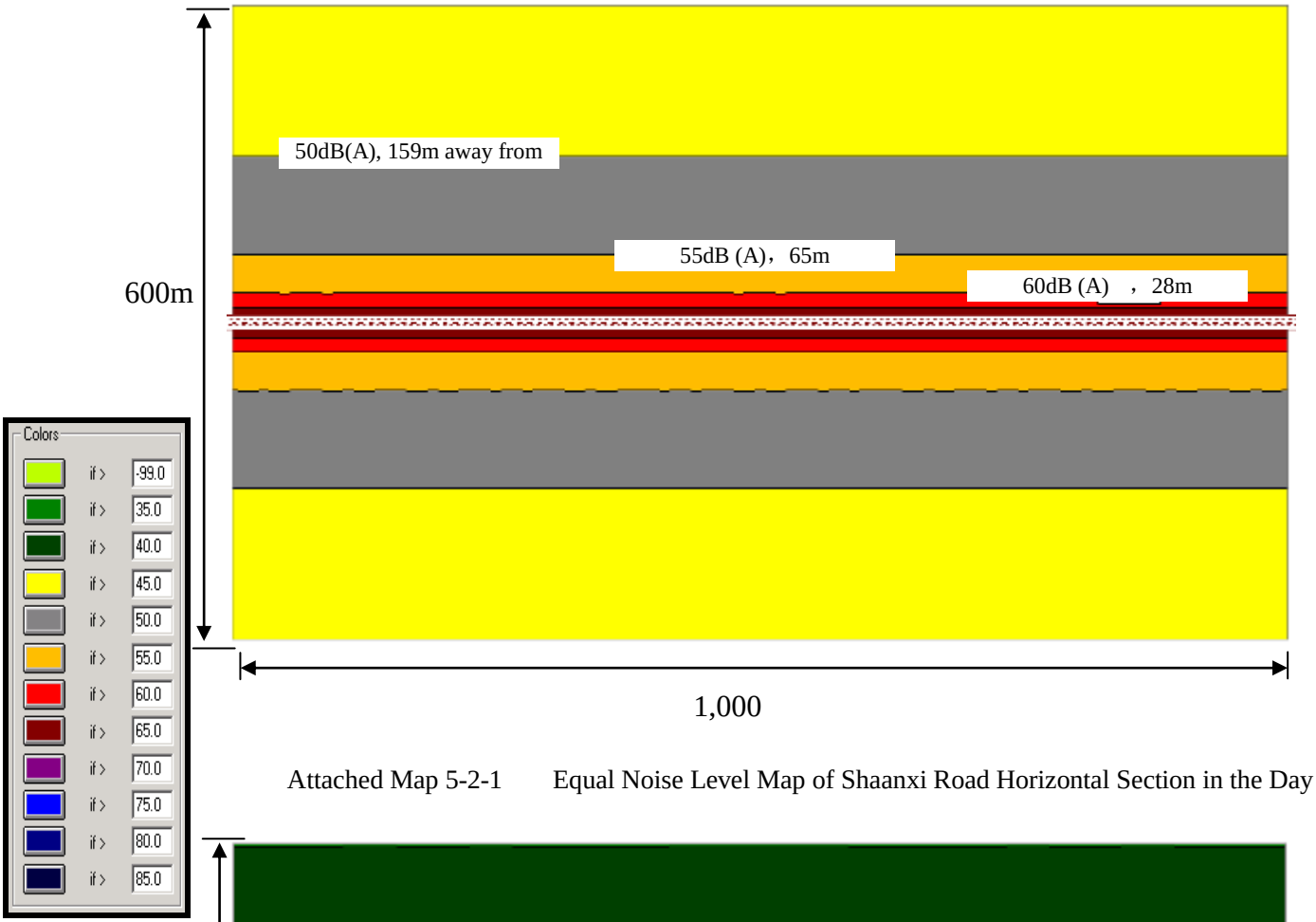
With reference to relative index of Urban Comprehensive Transport Planning of Tianjin and characteristics of the location area of environmental assessment involved roads, the parameters value of the assessment is illustrated as follows

a. Hourly vehicle flow of and night as per 4:1;

b. Percentage of heavy duty vehicle for main arterial road and secondary arterial road as per 20%, heavy duty vehicle for bypass as per 10%.

5.2.1.3 Assessment of traffic noise influence along road line

According to aforementioned parameters setting, make noise prediction of the selected Nanmenwai Street, Fu'an Street, Rongye Street, Heping Road, Beicheng Street, Baoding Road, North Dagu Road, and Shanxi Road. See horizontal section attenuation results at Table 5-2-1-2 (set a prediction point for every 10m interval distance away from the red line at a height of 1.2m); see vertical section attenuation results at Table 5-2-1-3 (predicted 10m away from red line); the see two-side standard distance calculation of typical road at Table 5-2-1-4. Equal noise level of horizontal section and vertical section is drawn as following map.



Attached Map 5-2-1 Equal Noise Level Map of Shaanxi Road Horizontal Section in the Day

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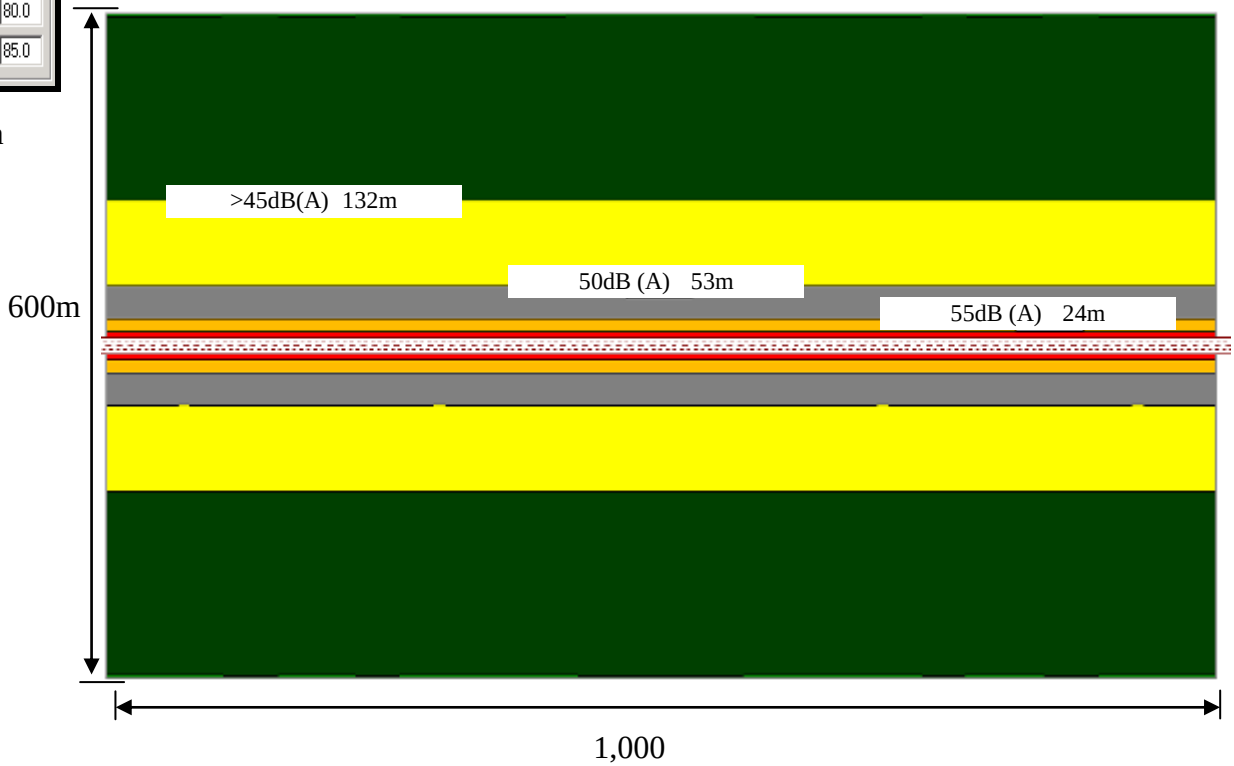
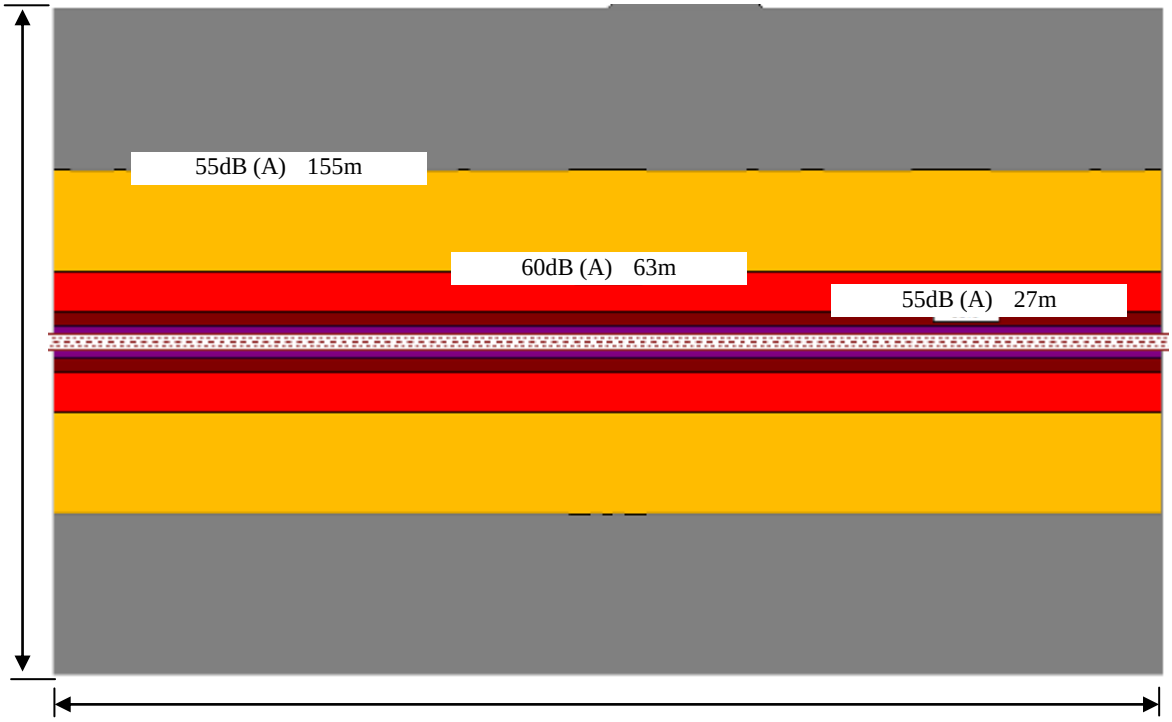
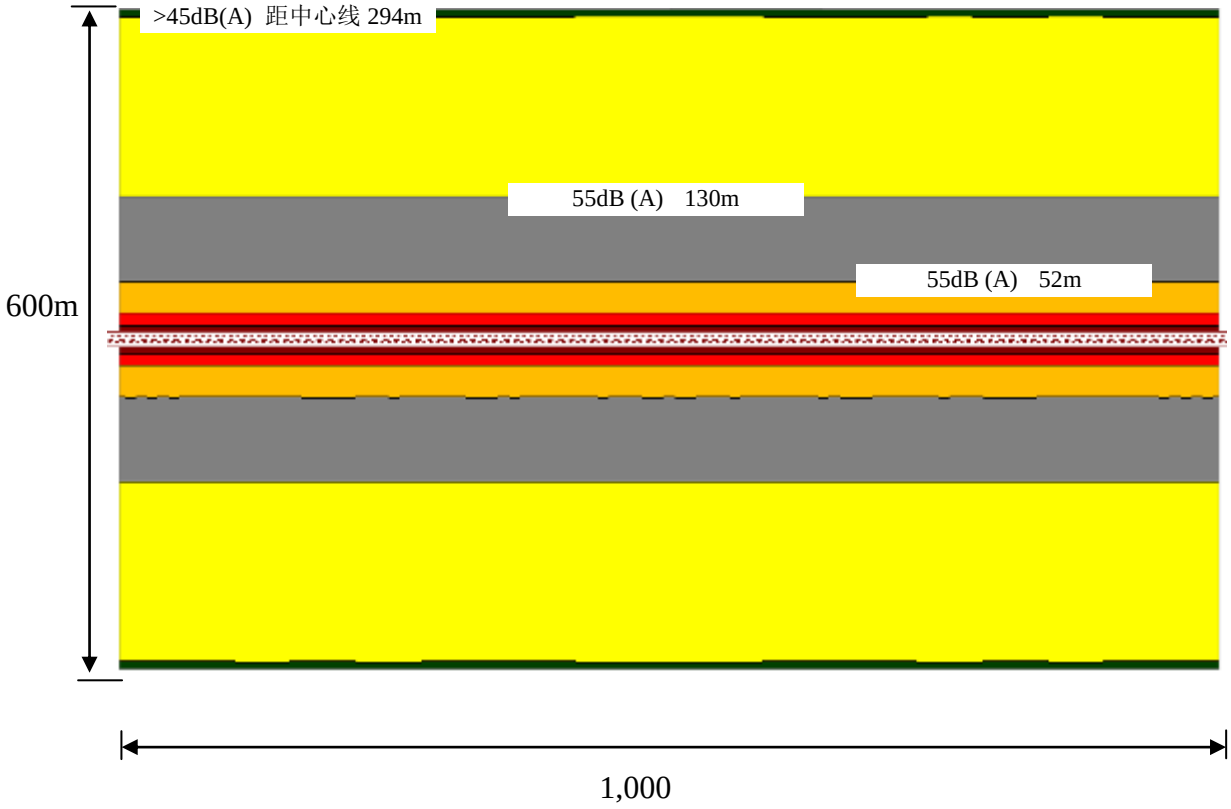


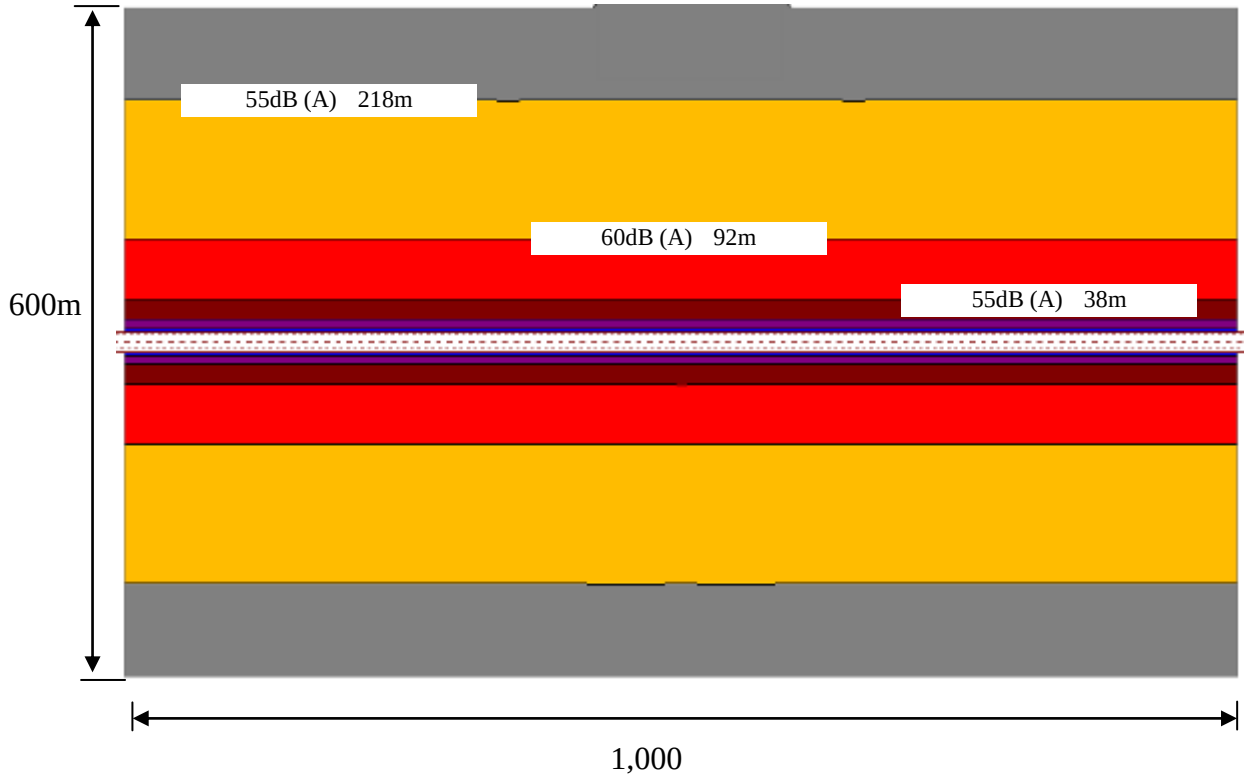
Attached Map 5-2-2 Equal Noise Level Map of Shaanxi Road Horizontal Section in the Night



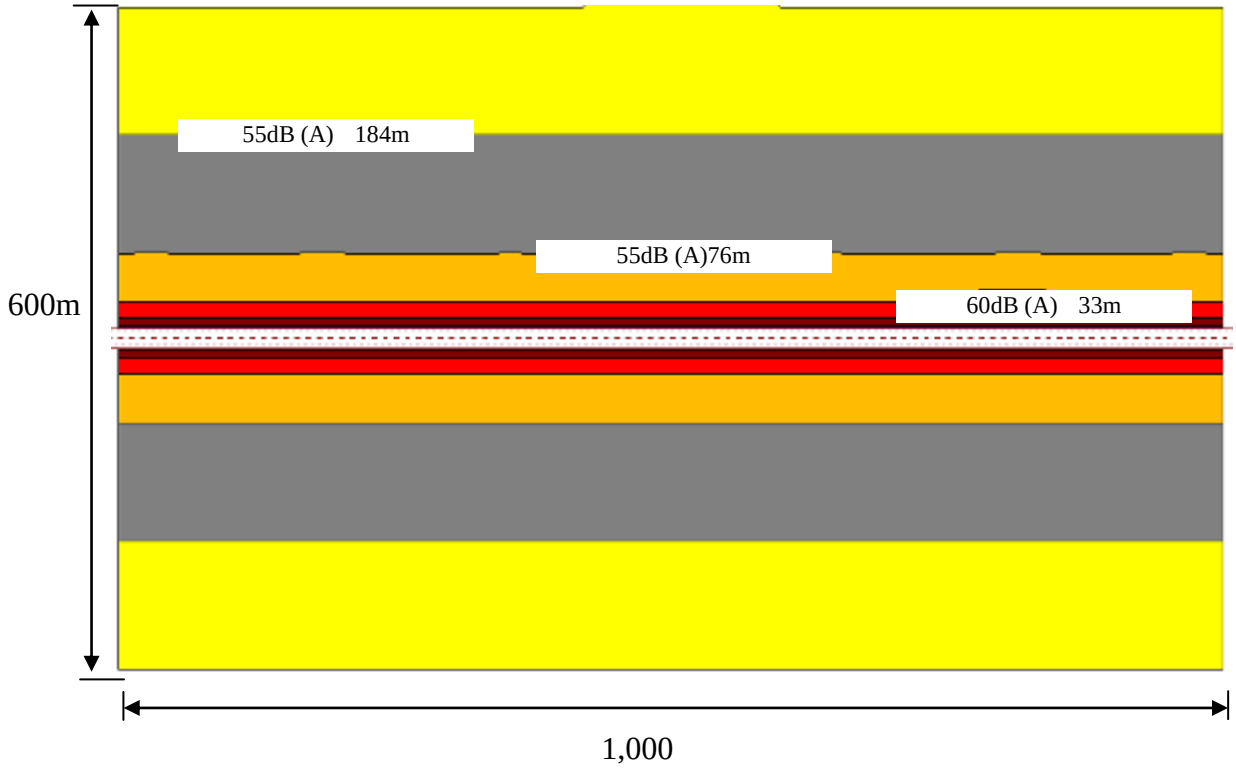
Attached Map 5-2-3 Equal Noise Level Map of North Dagu Road Horizontal Section in the Day



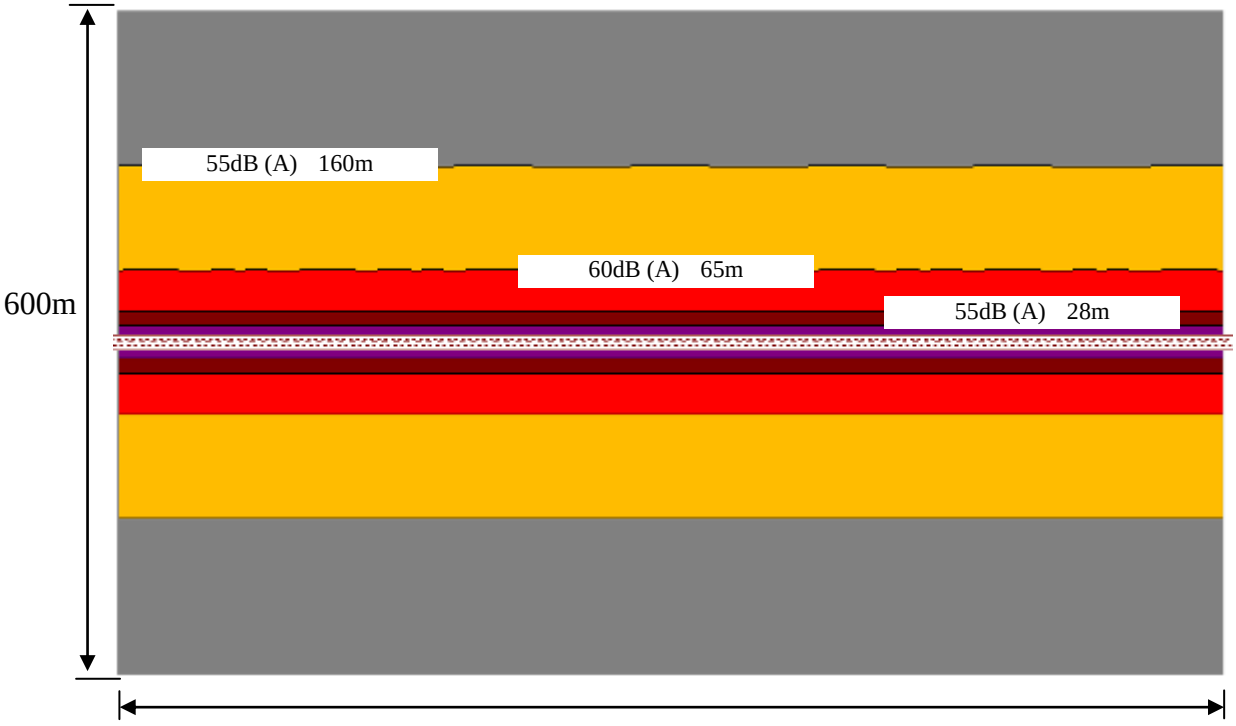
Attached Map 5-2-4 Equal Noise Level Map of North Dagu Road Horizontal Section at Night



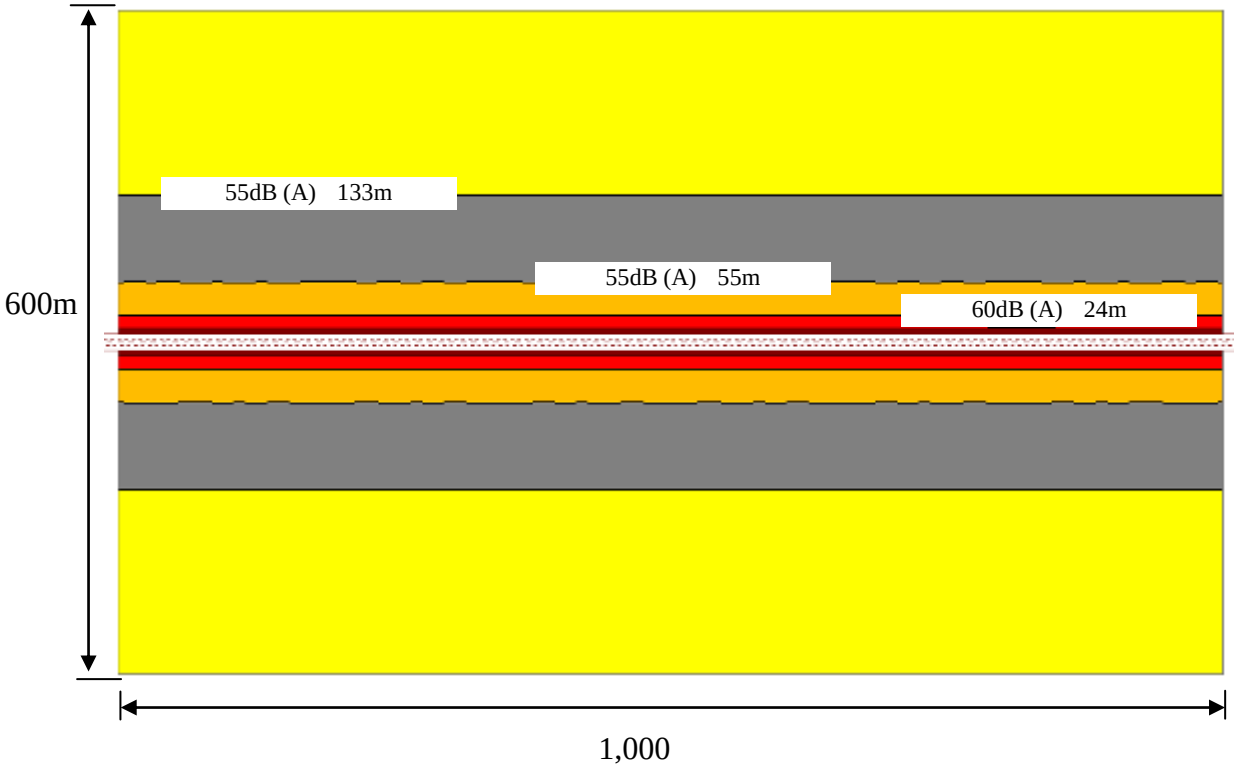
Attached Map 5-2-5 Equal Noise Level Map of Anshan Road Horizontal Section in the Day



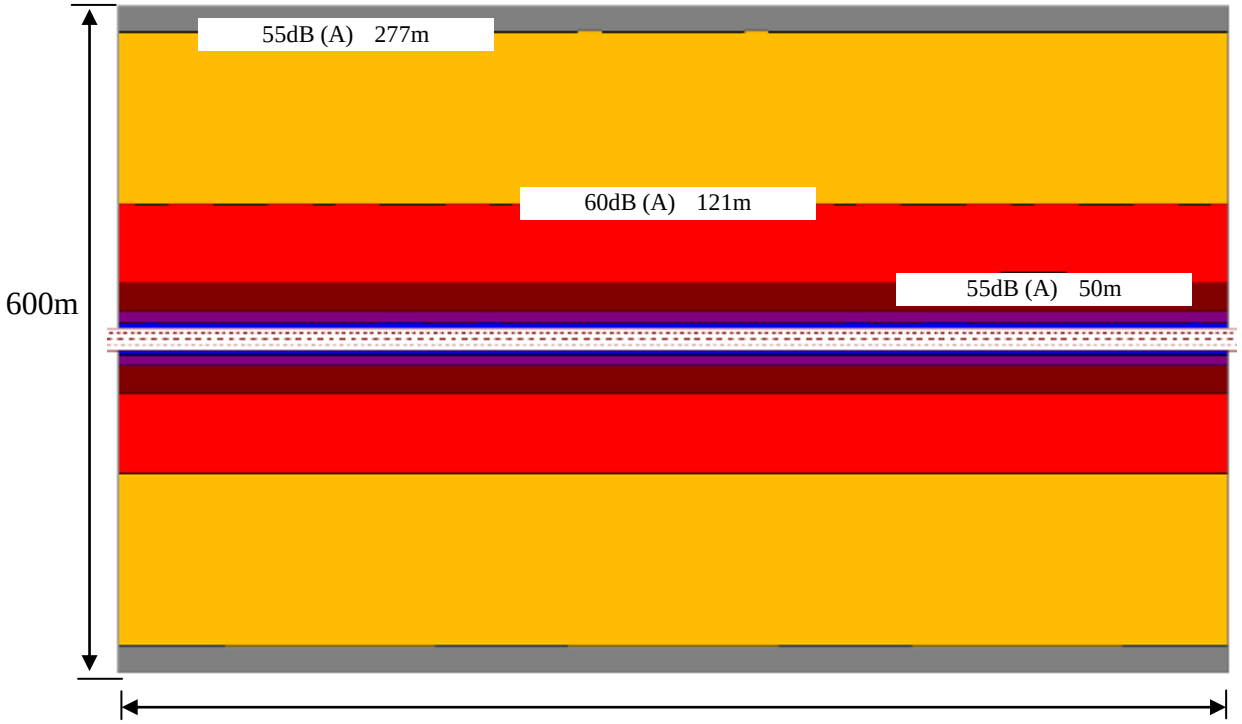
Attached Map 5-2-6 Equal Noise Level Map of Anshan Street Horizontal Section at Night



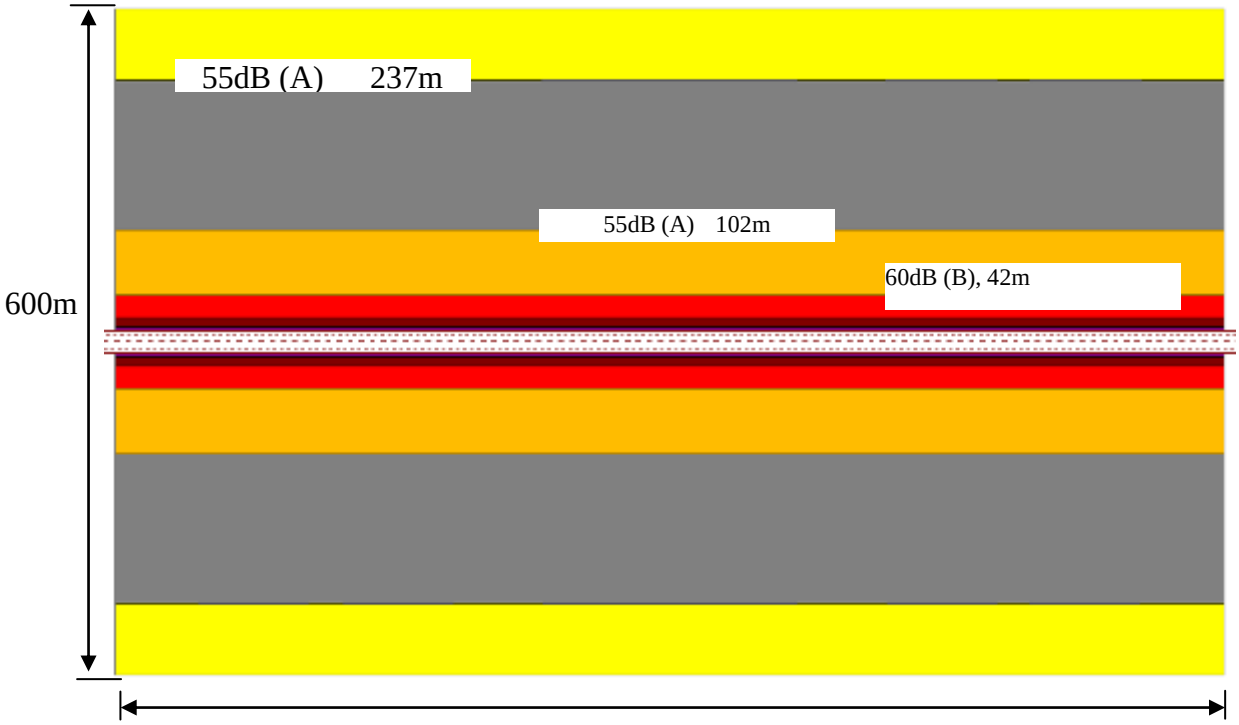
Attached Map 5-2-7 Equal Noise Level Map of Baoding Road Section in the Day



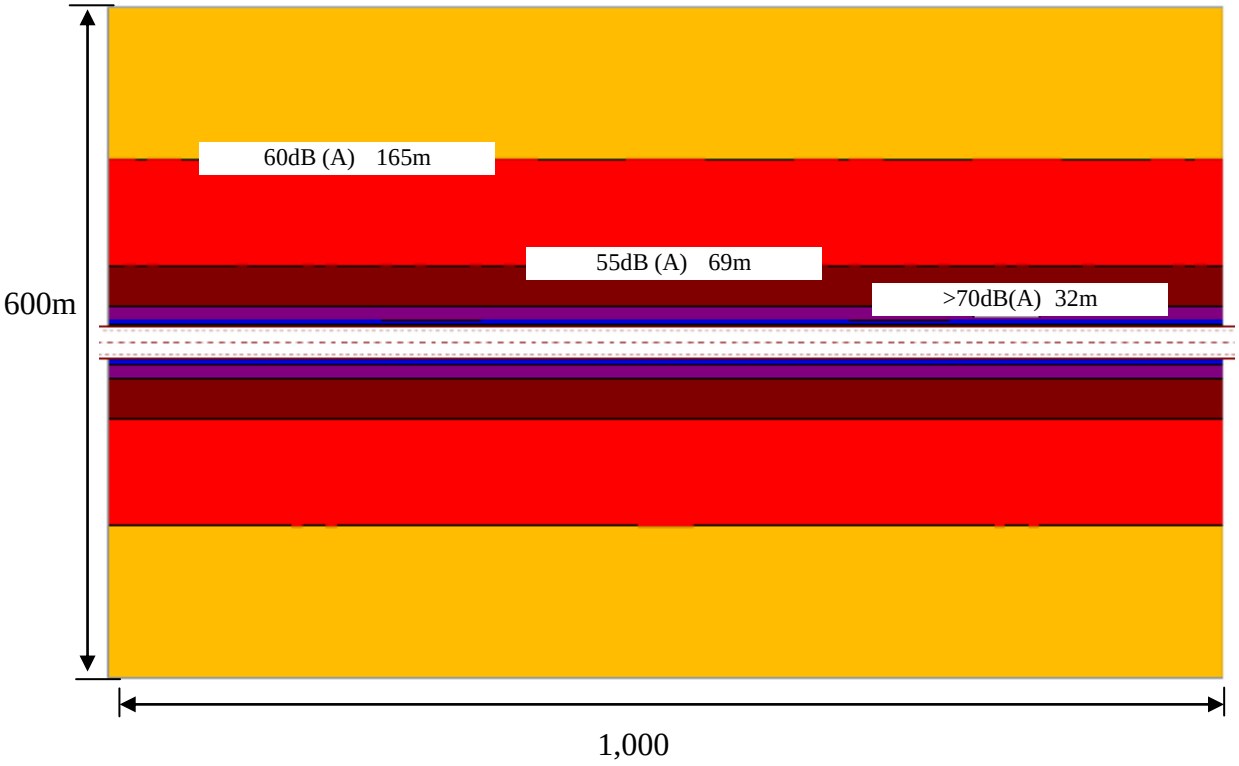
Attached Map 5-2-8 Equal Noise Level Map of Baoding Road Horizontal Section at Night



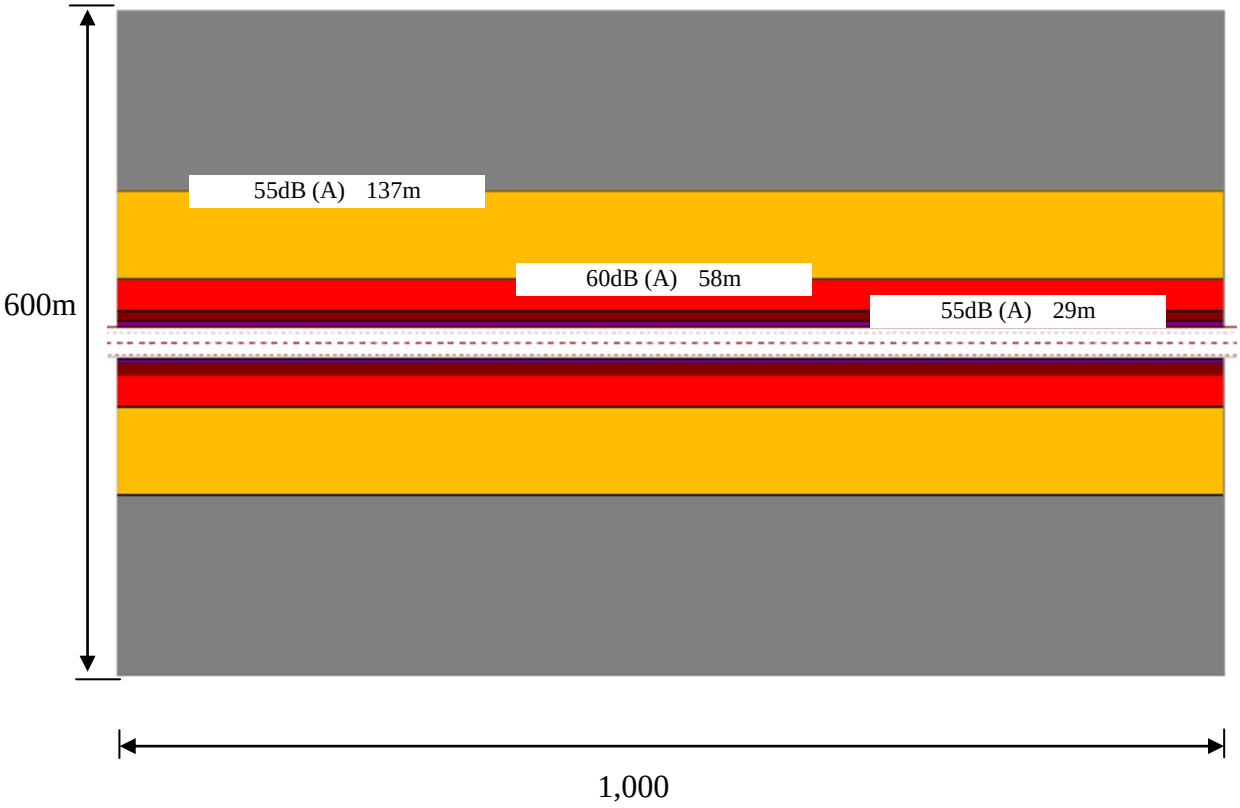
Attached Map 5-2-9 Equal Noise Level Map of Beicheng Street Horizontal Section in the Day



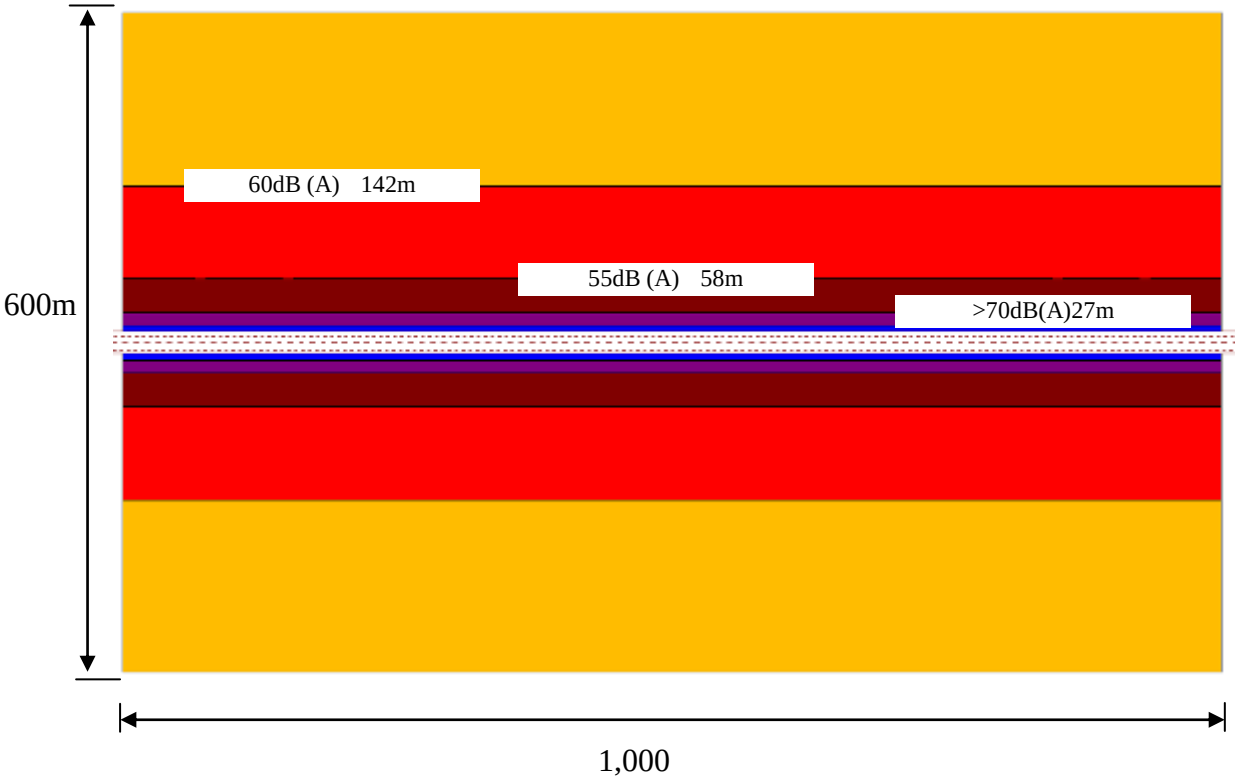
Attached Map 5-2-10 Equal Noise Level Map of Beicheng Street Horizontal Section at night



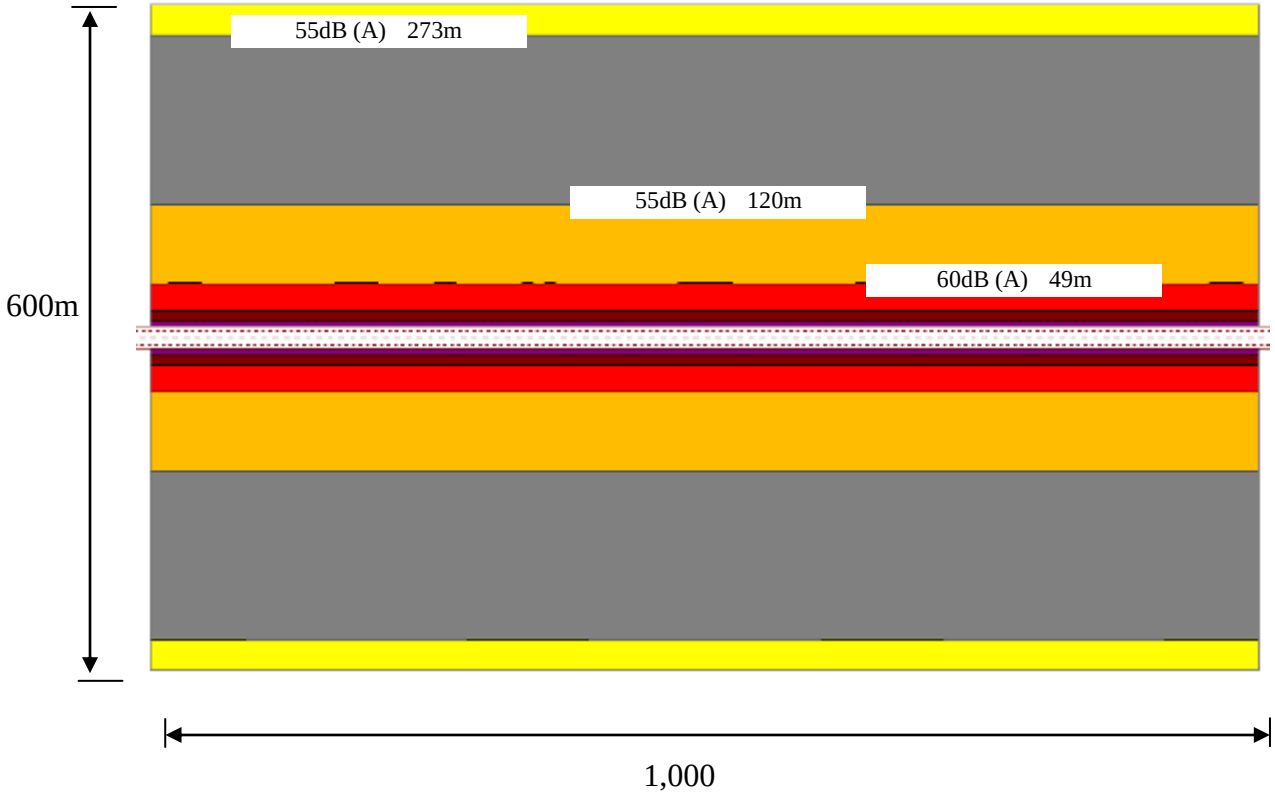
Attached Map 5-2-11 Equal Noise Level Map of Heping Horizontal Section in the day



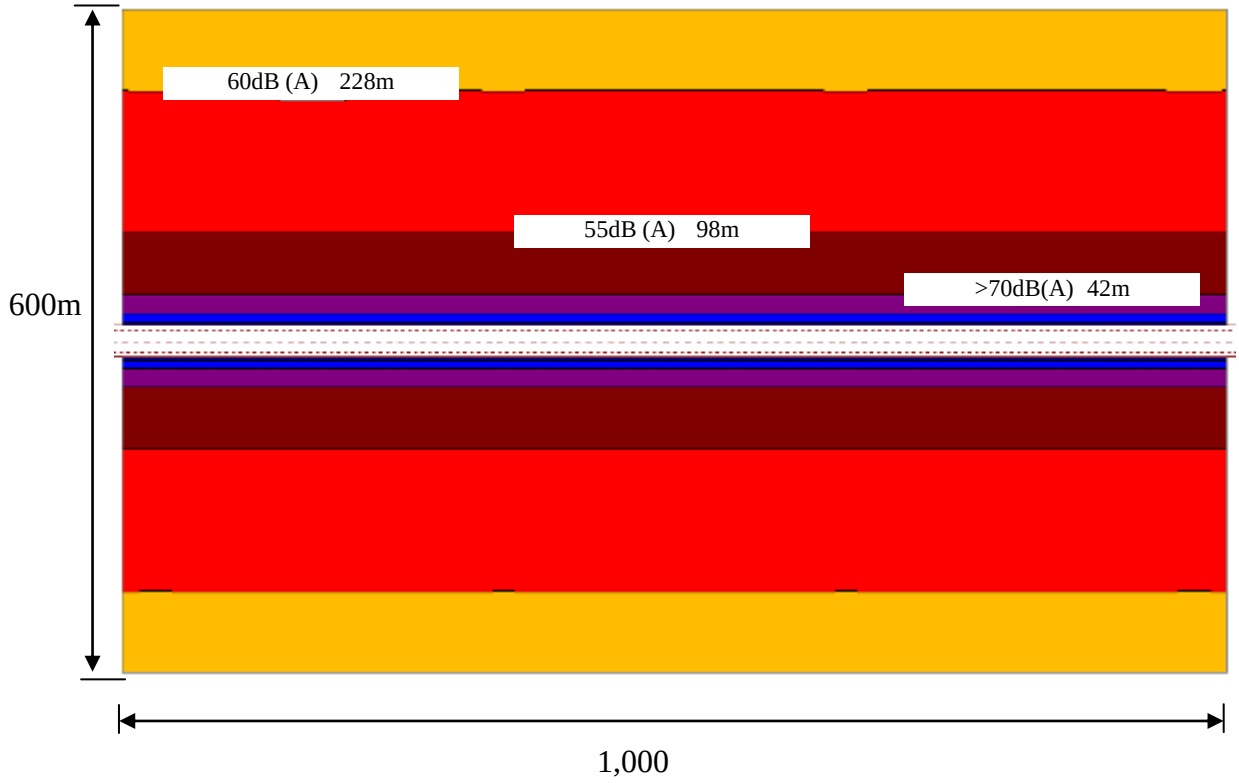
Attached Map 5-2-12 Equal Noise Level Map of Heping Road Horizontal Section at Night



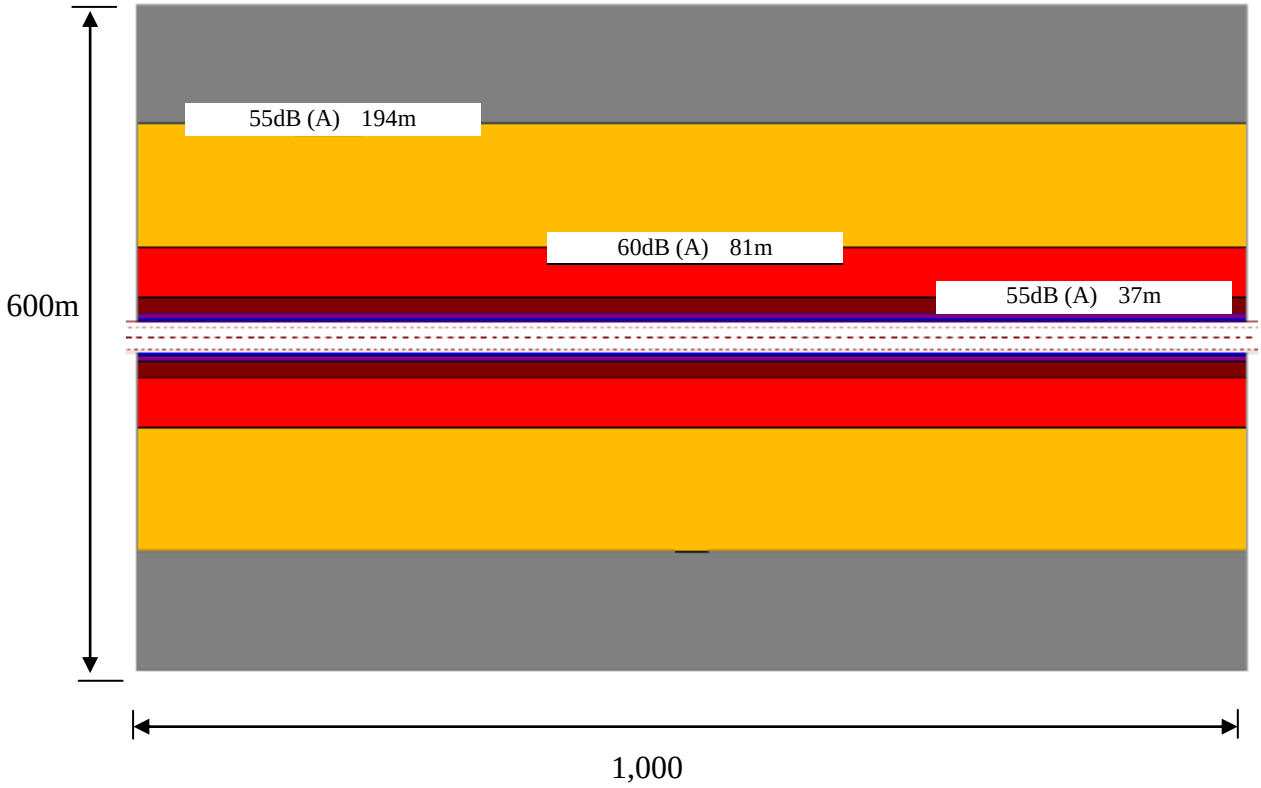
Attached Map 5-2-13 Equal Noise Level Map of Rongye Street Horizontal Section in the day



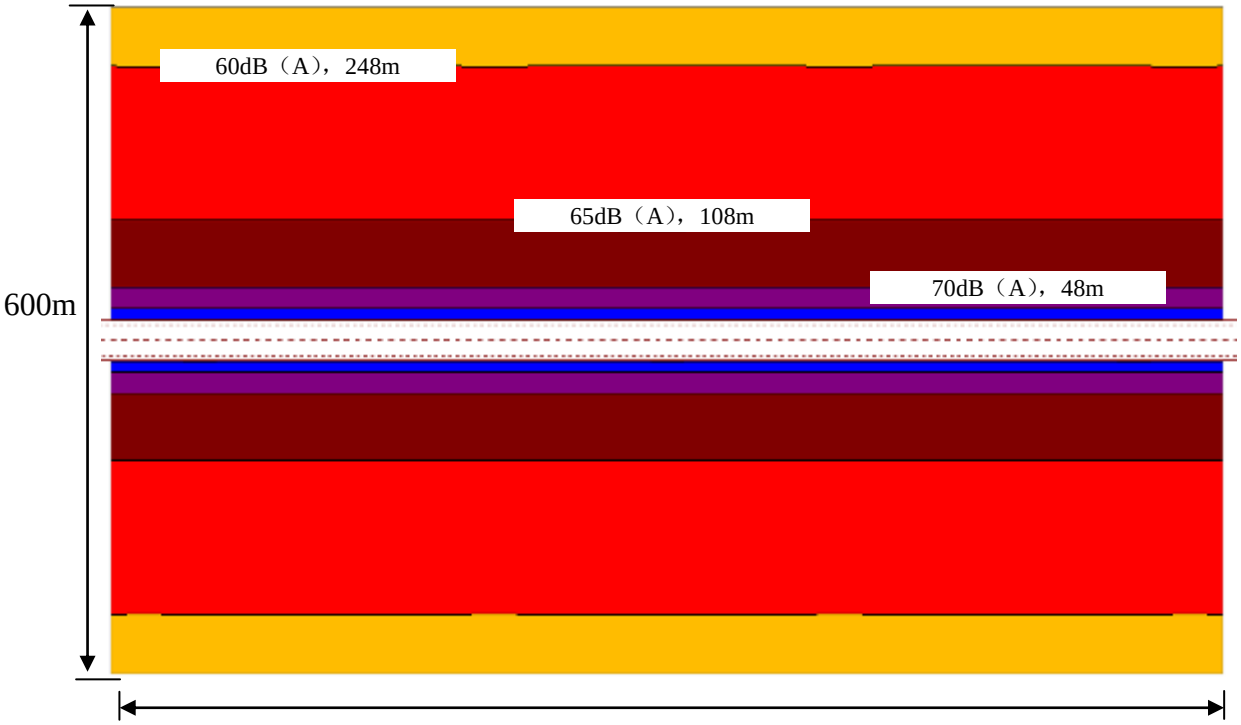
Attached Map 5-2-14 Equal Noise Level Map of Rongye Street Horizontal Section at Night



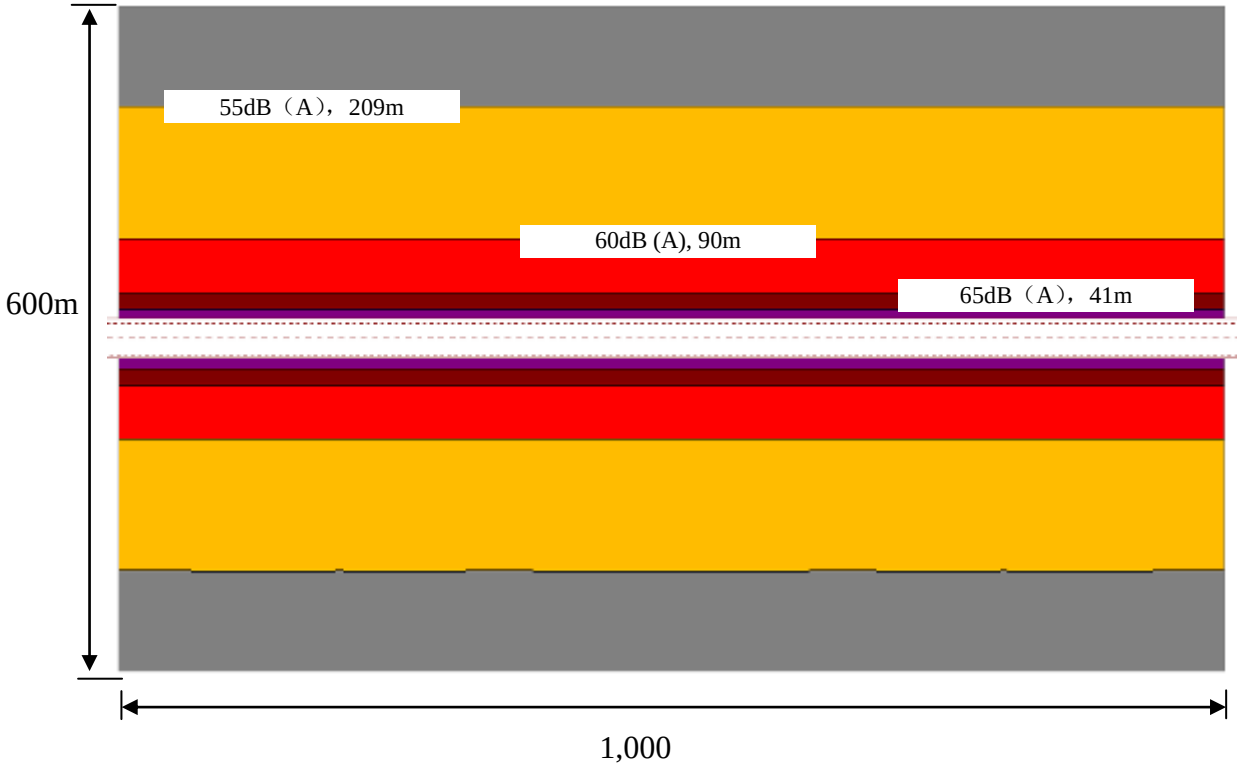
Attached Map 5-2-15 Equal Noise Level Map of Fu'an Street Horizontal Section in the Day



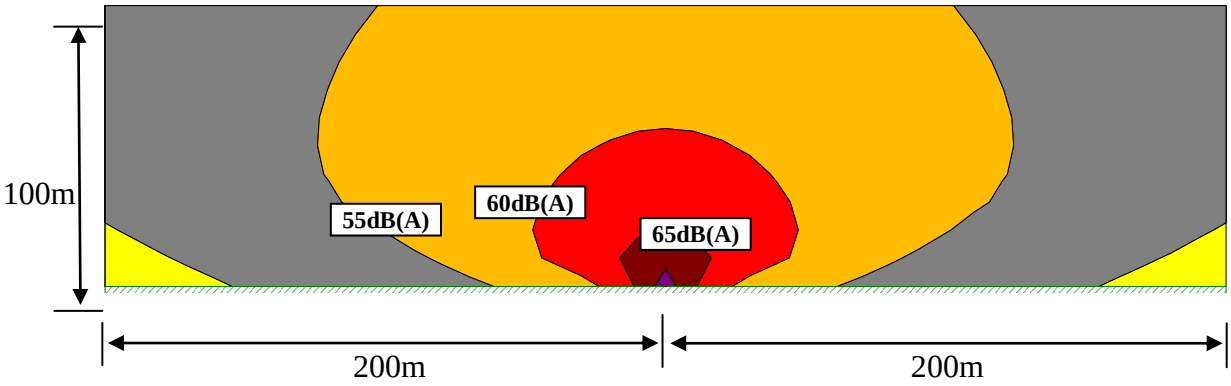
Attached Map 5-2-16 Equal Noise Level Map of Fu'an Street Horizontal Section at Night



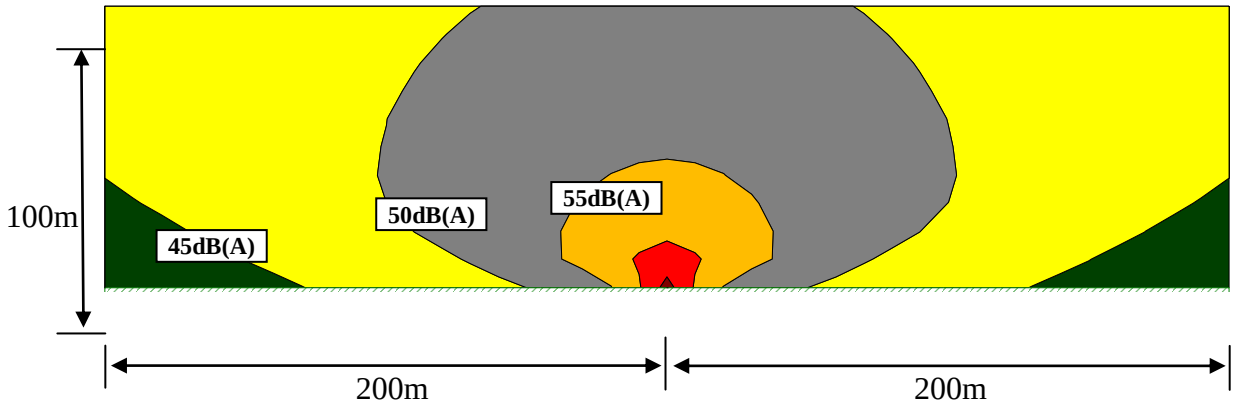
Attached Map 5-2-17 Equal Noise Level Map of Nanmenwai Street Horizontal Section in the Day



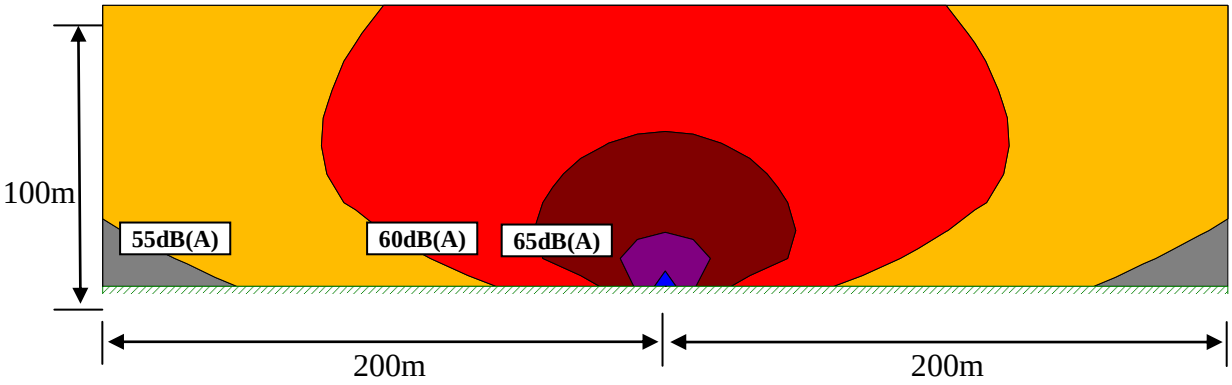
Attached Map 5-2-18 Equal Noise Level Map of Nanmenwai Street Horizontal Section at Night



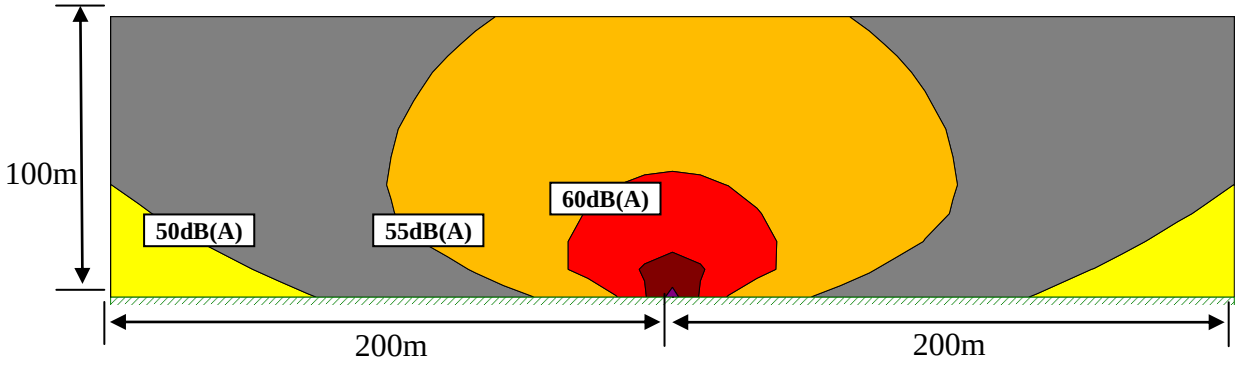
Attached Map 5-2-19 Equal Noise Level Map of Shaanxi Road Vertical Section in the Day



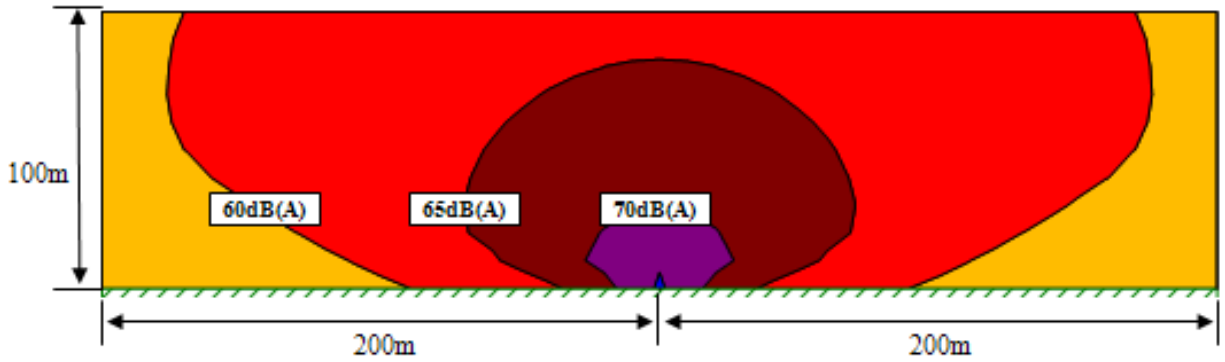
Attached Map 5-2-20 Equal Noise Level Map of Shanxi Road Vertical Section at Night



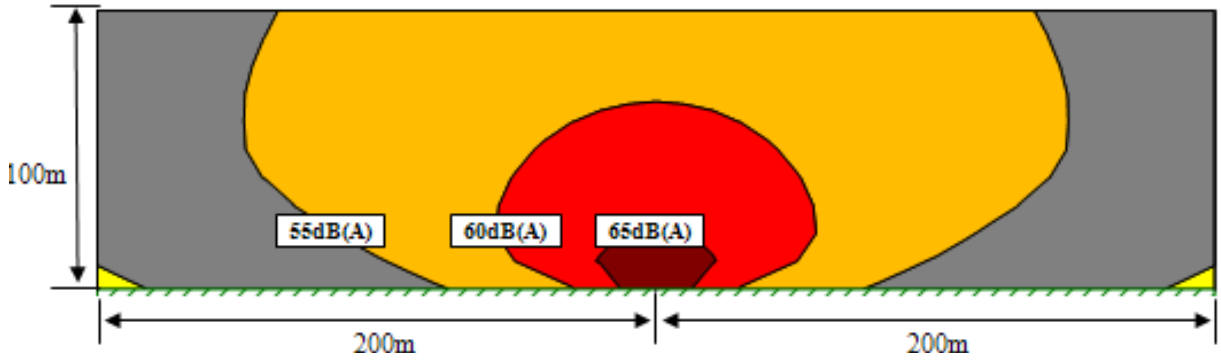
Attached Map 5-2-21 Equal Noise Level Map of North Dagu Road Vertical Section in the Day



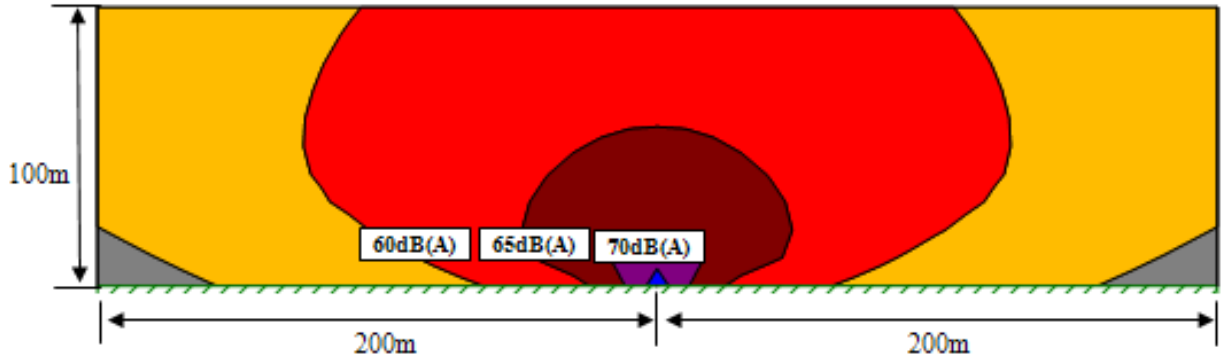
Attached Map 5-2-22 Equal Noise Level Map of North Dagu Road Vertical Section at Night



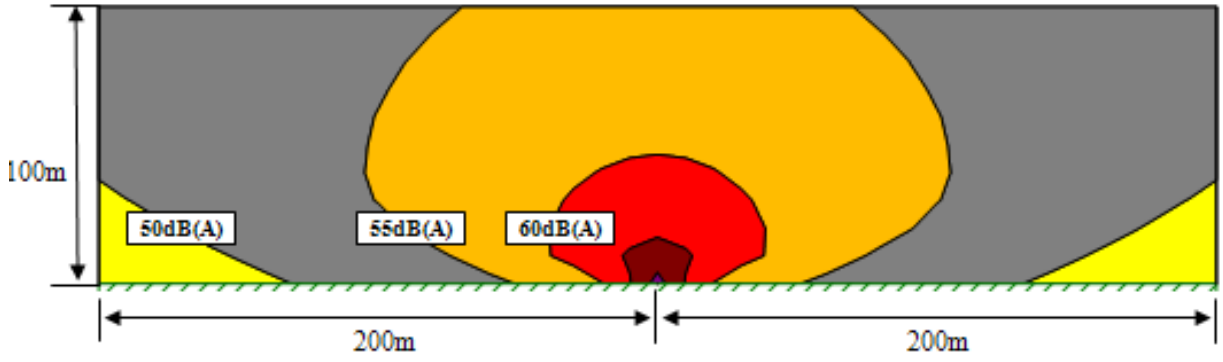
Attached Map 5-2-24 Anshan Street Equal Noise Level Map of North Dagu Road Vertical Section in the day



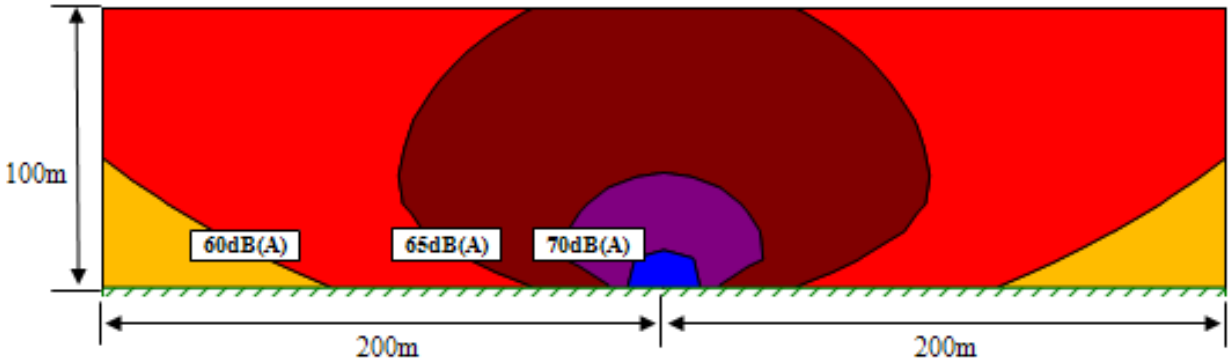
Attached Map 5-2-24 Anshan Street Equal Noise Level Map of North Dagu Road Vertical Section at Night



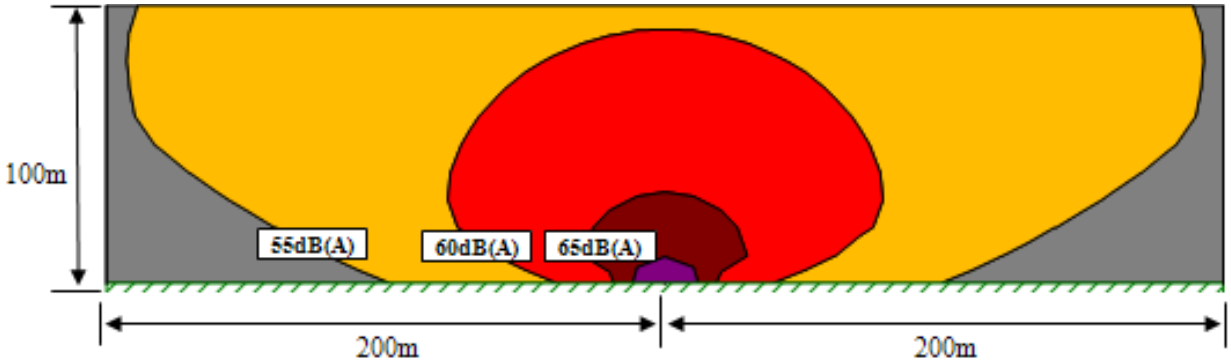
Attached Map 5-2-25 Baoding Road Equal Noise Level Map of North Dagu Road Vertical Section in the Day



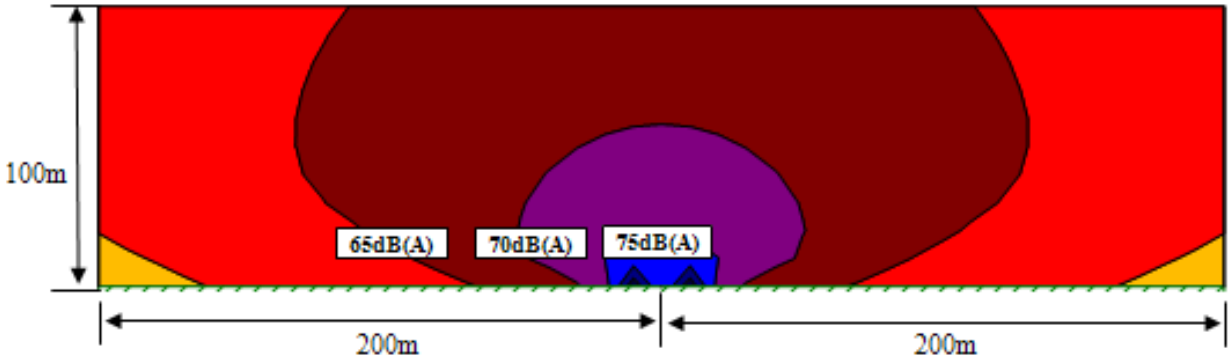
Attached Map 5-2-26 Baoding Road Equal Noise Level Map of North Dagu Road Vertical Section at Night



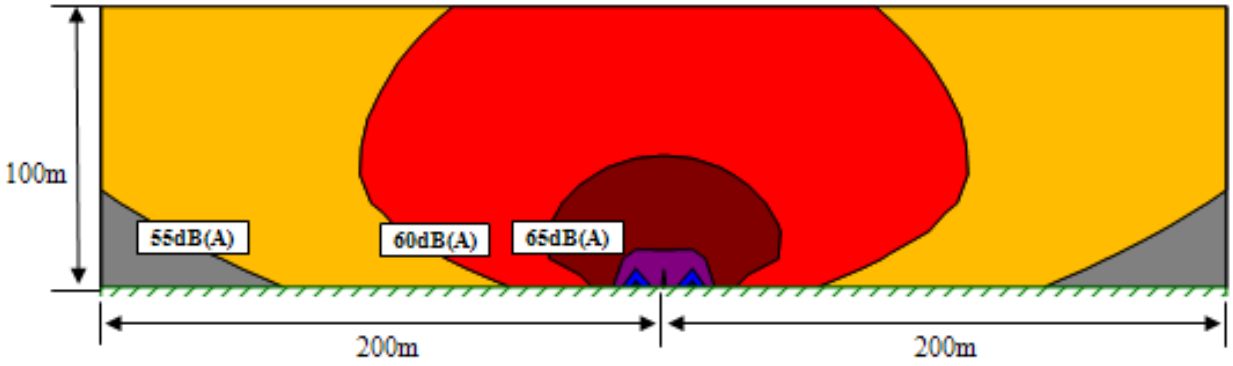
Attached Map 5-2-27 Equal Noise Level Map of Beicheng Street Vertical Section in the Day



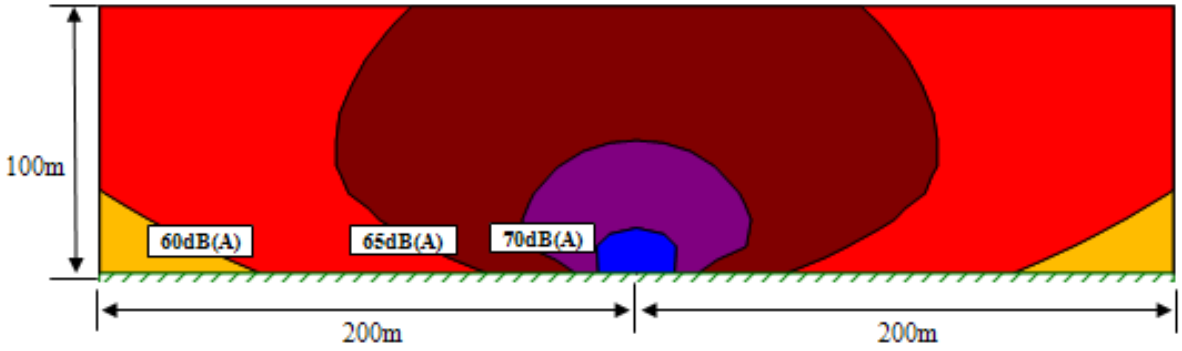
Attached Map 5-2-28 Equal Noise Level Map of Beicheng Street Vertical Section at Night



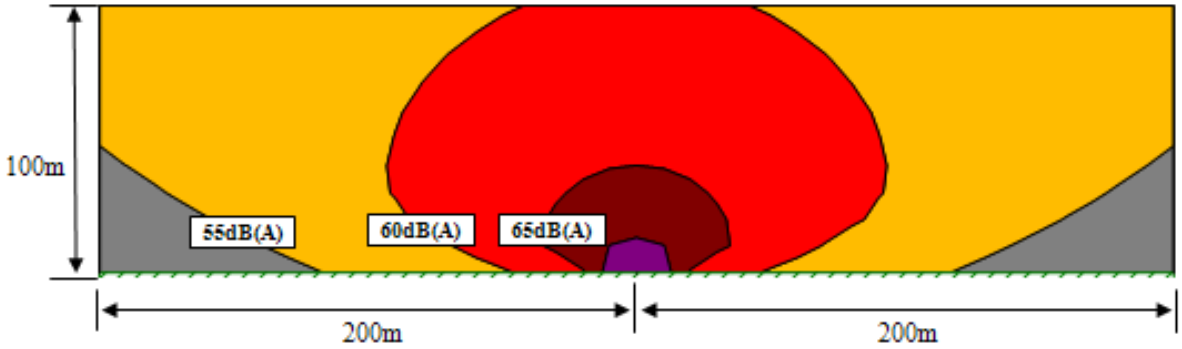
Attached Map 5-2-29 Equal Noise Level Map of Heping Road Vertical Section in the Day



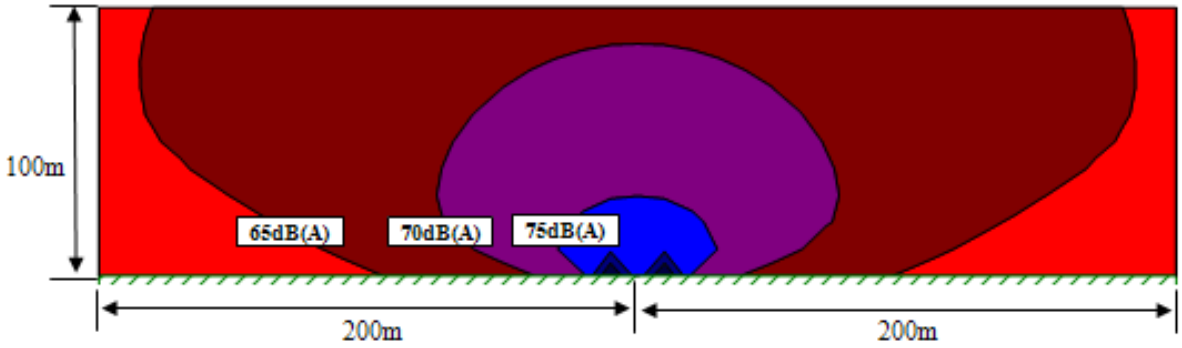
Attached Map 5-2-30 Equal Noise Level Map of Heping Road Vertical Section at Night



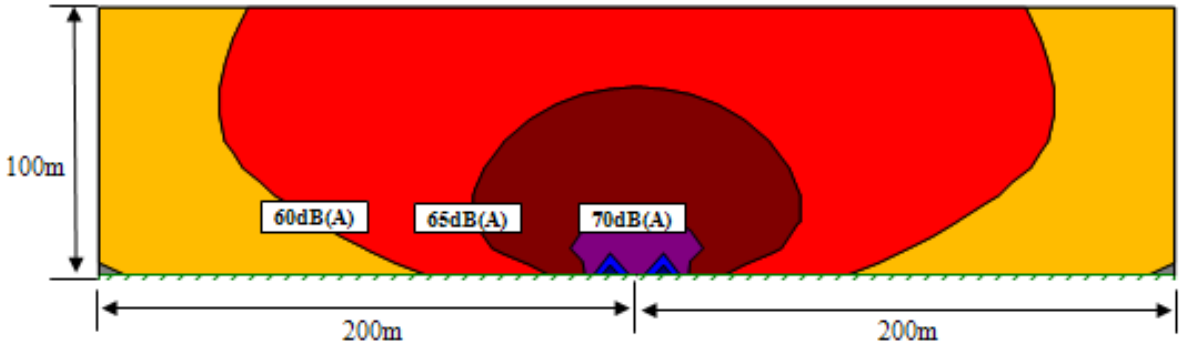
Attached Map 5-2-31 Equal Noise Level Map of Rongye Street Vertical Section in the Day



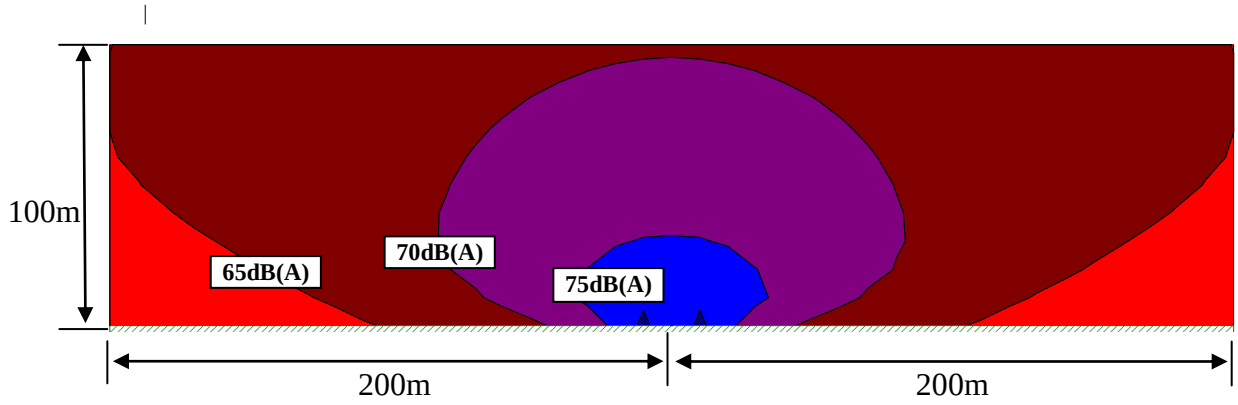
Attached Map 5-2-32 Equal Noise Level Map of Rongye Street Vertical Section at Night



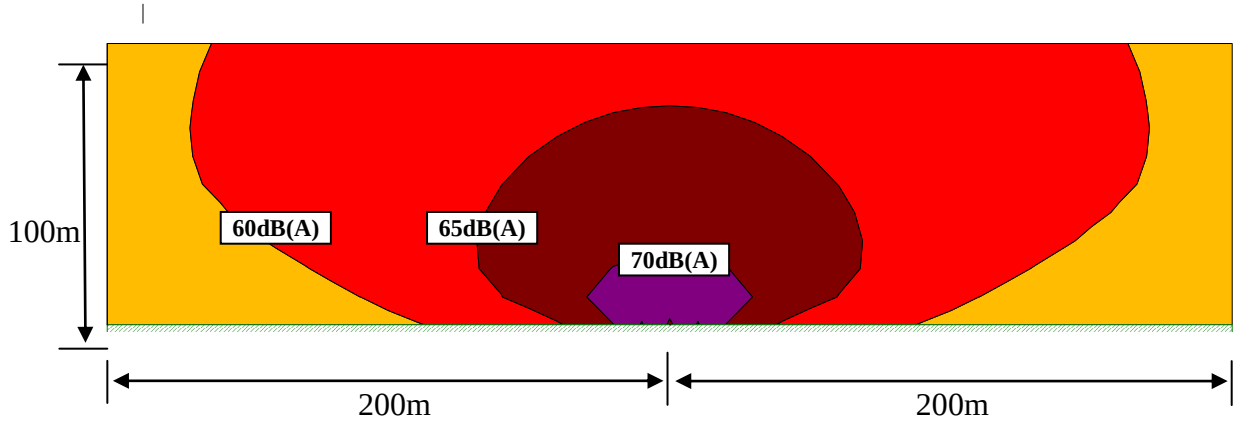
Attached Map 5-2-33 Equal Noise Level Map of Fu'an Street Vertical Section in the Day



Attached Map 5-2-34 Equal Noise Level Map of Fu'an Street Vertical Section at Night



Attached Map 5-2-35 Equal Noise Level Map of Nanmenwai Street Vertical Section in the Day



Attached Map 5-2-36 Equal Noise Level Map of Nanmenwai Street Vertical Section at Night

Attached Map 5-2-1-2 Noise calculation result with different distance from two roadsides of typical roads dB(A)

Distance from road center line(m)	Prediction results																	
	Nanmenwai		Fu'an Street		Rongye Street		Heping Road		Beicheng		Baoding Road		Anshan Road		North Dagu		Shaanxi Road	
	In the day	At night	In the day	At night	In the day	At night	In the day	At night	In the day	At night	In the day	At night	In the day	At night	In the day	At night	In the day	At night
10	67.6	61.6	72.5	66.5	-	-	72.7	66.7	-	-	-	-	-	-	-	-	-	-
15	64.6	58.6	69.5	63.5	72.6	66.6	69.7	63.7	74.1	68.1	-	-	75.1	69.1	-	-	-	-
20	62.2	56.1	67.1	61.1	70.0	64.0	67.2	61.2	71.5	65.5	75.0	69.0	72.5	66.5	77.0	71.0	-	-
25	60.5	54.5	65.5	59.4	67.9	61.9	65.6	59.6	69.5	63.5	72.4	66.3	70.4	64.4	74.4	68.3	76.8	70.8
30	59.3	53.3	64.3	58.2	66.6	60.5	64.4	58.4	68.1	62.1	70.5	64.5	69.1	63.0	72.5	66.5	74.2	68.2
40	57.7	51.6	62.6	56.5	64.7	58.7	62.7	56.7	66.3	60.3	68.3	62.3	67.2	61.2	70.3	64.3	71.3	65.3
50	56.4	50.4	61.3	55.3	63.4	57.4	61.5	55.5	65.0	59.0	66.9	60.8	65.9	59.9	68.9	62.8	69.6	63.6
60	55.4	49.4	60.3	54.3	62.4	56.4	60.5	54.4	63.9	57.9	65.8	59.8	64.9	58.8	67.8	61.8	68.5	62.4
70	54.5	48.5	59.4	53.4	61.5	55.5	59.6	53.6	63.1	57.1	64.9	58.9	64.0	58.0	66.9	60.9	67.5	61.5
80	53.8	47.8	58.7	52.7	60.8	54.8	58.9	52.9	62.3	56.3	64.1	58.1	63.3	57.3	66.1	60.1	66.7	60.7
90	53.2	47.1	58.1	52.1	60.1	54.1	58.3	52.2	61.7	55.7	63.5	57.4	62.6	56.6	65.5	59.4	66.0	60.0
100	52.6	46.6	57.5	51.5	59.5	53.5	57.7	51.7	61.1	55.1	62.9	56.8	62.0	56.0	64.9	58.8	65.4	59.4
110	52.0	46.0	56.9	50.9	59.0	53.0	57.1	51.1	60.6	54.5	62.3	56.3	61.5	55.5	64.3	58.3	64.9	58.9
120	51.5	45.5	56.5	50.4	58.5	52.5	56.6	50.6	60.1	54.0	61.8	55.8	61.0	55.0	63.8	57.8	64.4	58.3
130	51.1	45.1	56.0	50.0	58.1	52.0	56.2	50.2	59.6	53.6	61.4	55.3	60.5	54.5	63.3	57.3	63.9	57.9
140	50.7	44.6	55.6	49.6	57.6	51.6	55.8	49.7	59.2	53.2	60.9	54.9	60.1	54.1	62.9	56.9	63.5	57.5
150	50.3	44.3	55.2	49.2	57.2	51.2	55.4	49.3	58.8	52.8	60.5	54.5	59.7	53.7	62.5	56.5	63.1	57.1
160	49.9	43.9	54.8	48.8	56.9	50.9	55.0	49.0	58.4	52.4	60.1	54.1	59.4	53.3	62.1	56.1	62.7	56.7
170	49.5	43.5	54.5	48.4	56.5	50.5	54.6	48.6	58.1	52.0	59.8	53.8	59.0	53.0	61.8	55.8	62.3	56.3
180	49.2	43.2	54.1	48.1	56.2	50.1	54.3	48.3	57.7	51.7	59.5	53.4	58.7	52.6	61.5	55.4	62.0	56.0
190	48.9	42.9	53.8	47.8	55.8	49.8	54.0	47.9	57.4	51.4	59.1	53.1	58.3	52.3	61.1	55.1	61.7	55.6
200	48.6	42.5	53.5	47.5	55.5	49.5	53.7	47.6	57.1	51.1	58.8	52.8	58.0	52.0	60.8	54.8	61.3	55.3

Table 5-2-1-3 Noise prediction results at a 10m distance from red line of typical roads. dB(A)

Prediction point	Prediction results																	
	Nanmenwai Street		Fu'an Street		Rongye Street		Heping Road		Beicheng Street		Baoding Road		Anshan Road		North Dagu Road		Shaanxi Road	
	In the day	At night	In the day	At night	In the day	At night	In the day	At night	In the day	At night	In the day	At night	In the day	At night	In the day	At night	In the day	At night
1-loor	62.2	56.1	67.1	61.1	67.9	61.9	67.2	61.2	69.5	63.5	70.5	64.5	70.4	64.4	72.5	66.5	72.5	66.5
2-floor	64.1	58.1	69.0	63.0	69.9	63.9	69.2	63.2	71.4	65.4	72.4	66.4	72.4	66.3	74.4	68.4	74.4	68.4
3-floor	64.2	58.2	69.2	63.1	70.3	64.2	69.3	63.3	71.8	65.8	72.8	66.8	72.8	66.7	74.8	68.8	74.8	68.7
4-floor	64.1	58.1	69.0	63.0	70.2	64.2	69.2	63.2	71.8	65.8	72.9	66.9	72.7	66.7	74.9	68.9	74.9	68.9
5-level	63.9	57.8	68.8	62.8	70.1	64.1	69.0	62.9	71.6	65.6	72.8	66.8	72.6	66.6	74.8	68.8	74.8	68.8
6-level	63.6	57.6	68.5	62.5	69.9	63.8	68.7	62.6	71.4	65.4	72.6	66.6	72.4	66.3	74.6	68.6	74.7	68.7
7-floor	63.2	57.2	68.2	62.1	69.6	63.6	68.3	62.3	71.2	65.1	72.4	66.4	72.1	66.1	74.4	68.4	74.5	68.5
8-level	62.9	56.9	67.8	61.8	69.3	63.3	68.0	62.0	70.9	64.9	72.2	66.1	71.8	65.8	74.2	68.1	74.3	68.3
9-level	62.6	56.5	67.5	61.5	69.1	63.0	67.7	61.6	70.6	64.6	71.9	65.9	71.6	65.5	73.9	67.9	74.1	68.0
10-floor	62.2	56.2	67.1	61.1	68.8	62.8	67.3	61.3	70.3	64.3	71.7	65.6	71.3	65.2	73.7	67.6	73.8	67.8
11-floor	61.9	55.9	66.8	60.8	68.5	62.5	67.0	61.0	70.1	64.0	71.4	65.4	71.0	65.0	73.4	67.4	73.6	67.6
12-floor	61.6	55.6	66.5	60.5	68.2	62.2	66.7	60.7	69.8	63.8	71.2	65.1	70.7	64.7	73.2	67.1	73.4	67.4
13-floor	61.3	55.3	66.2	60.2	68.0	61.9	66.4	60.4	69.5	63.5	70.9	64.9	70.5	64.4	72.9	66.9	73.1	67.1
14-floor	61.0	55.0	65.9	59.9	67.7	61.7	66.1	60.1	69.3	63.2	70.7	64.7	70.2	64.2	72.7	66.7	72.9	66.9
15-floor	60.7	54.7	65.7	59.6	67.4	61.4	65.8	59.8	69.0	63.0	70.4	64.4	69.9	63.9	72.4	66.4	72.7	66.7
16-floor	60.5	54.4	65.4	59.4	67.2	61.2	65.6	59.5	68.7	62.7	70.2	64.2	69.7	63.7	72.2	66.2	72.5	66.5
17-floor	60.2	54.2	65.1	59.1	66.9	60.9	65.3	59.3	68.5	62.5	70.0	64.0	69.4	63.4	72.0	66.0	72.3	66.3
18-floor	60.0	53.9	64.9	58.9	66.7	60.7	65.0	59.0	68.3	62.3	69.8	63.8	69.2	63.2	71.8	65.8	72.1	66.1
19-floor	59.7	53.7	64.6	58.6	66.5	60.5	64.8	58.8	68.1	62.0	69.6	63.6	69.0	63.0	71.6	65.6	71.9	65.9
20-floor	59.5	53.5	64.4	58.4	66.3	60.3	64.6	58.5	67.8	61.8	69.4	63.3	68.8	62.7	71.4	65.3	71.7	65.7

Table 5-2-1-4 Required standard distance for two roadsides of typical roads (m)

Road name (grade, red line width m)	Class 1		Class 2		Class 3	
	In the day	At night	In the day	At night	In the day	At night
Shanxi Road (bypass, 12)	65	132	28	53	14	24
North Dagu Road (secondary road, 12)	155	294	63	130	27	52
Anshan Street (secondary road, 16)	218	392	92	184	38	76
Baoding Road (secondary road, 24)	160	301	65	133	28	55
Beicheng Street (secondary road, 30)	277	481	121	237	50	102
Heping Road (secondary road, 36)	357	597	165	307	69	137
Rongye Street (primary road, 30)	319	541	142	273	58	120
Fu'an Street (primary road, 36)	464	749	228	408	98	194
Nanmenwai Street (primary road, 50)	503	792	248	439	108	209

According to above calculation results and drawing of equal sound level maps, following conclusions could be made:

a. Two roadsides of different grade roads involved in the project are influenced obviously by traffic noise, and horizontal section prediction result shows that, as the prediction value of vehicle flow in operation period increases, the noise influence value will increase accordingly; as the distance from the road increases, the noise influence value will be decreased.

b. Noise values at red line of Shanxi Road (with a 10m distance from road center line) are 67.6 and 61.6dB(A) respectively in the day and at night, and attenuated to 48.6 and 42.5dB(A) with a 200m distance from road center line; standard distance prediction results indicate that, the noise value with a 28m distance from Shaanxi Road center line is below 60dB(A) in the day, and noise value with a 53m distance from the road center line is below 50dB(A) at night.

c. Noise values at red line of North Dagu Road (with a 10m distance from road center line) are 72.5 and 66.5dB(A) respectively in the day and at night, and

attenuated to 53.5 and 47.5dB(A) with a 200m distance from road center line; standard distance prediction results indicate that the noise value with a 63m distance from North Dagu Road center line is below 60dB(A) in the day, and the noise value with a 130m distance from the road center line is below 50dB(A) at night.

C. Noise values at red line of Anshan Street (with a 15m distance from road center line) are 72.6 and 66.6dB(A) respectively in the day and at night, and attenuated to 55.5 and 49.5dB(A) with a 200m distance from road center line; standard distance prediction results indicate that the noise value with a 92m distance from Anshan Street center line is below 60dB(A) in the day, and the noise value with a 184m distance from the road center line is below 50dB(A) at night.

D. Noise values at red line of Baoding Road (with a 10m distance from road center line) are 72.7 and 66.7dB(A) respectively in the day and at night, and attenuated to 53.7 and 47.6dB(A) with a 200m distance from road center line; standard distance prediction results indicate that the noise value with a 65m distance from Baoding Road center line is below 60dB(A) in the day, and the noise value with a 133m distance from the road center line is below 50dB(A) at night.

E. noise values at red line of Beicheng Street(with a 15m distance from road center line) are 74.1 and 68.1dB(A) respectively in the day and at night, and attenuated to 57.1 and 51.1dB(A) with a 200m distance from road center line; standard distance prediction results indicate that the noise value with a 121m distance from Beicheng Street center line is below 60dB(A) in the day, and the noise value with a 237m distance from the road center line is below 50dB(A) at night.

F. Noise values at red line of Heping Road (with a 20m distance from road center line) are 75.0 and 69.0dB(A) respectively in the day and at night, and attenuated to 58.8 and 52.8dB(A) with a 200m distance from road center line; standard distance prediction results indicate that the noise value with a 165m distance from Heping Road center line is below 60dB(A) in the day, and the noise value with a 307m distance from the road center line is below 50dB(A) at night.

G. Noise values at red line of Rongye Street (with a 15m distance from road center line) are 75.1 and 69.1dB(A) respectively in the day and at night, and attenuated to 58.0 and 52.0dB(A) with a 200m distance from road center line; standard distance prediction results indicate that the noise value with a 142m distance from Rongye Street center line is below 60dB(A) in the day, and the noise value with

a 273m distance from the road center line is below 50dB(A) at night.

H. Noise values at red line of Shanxi Road (with a 10m distance from road center line) are 77.0 and 71.0dB(A) respectively in the day and at night, and attenuated to 60.8 and 54.8dB(A) respectively with a 200m distance from road center line; standard distance prediction results indicate that the noise value with a 228m distance from Shanxi Road center line is below 60dB(A) in the day, and the noise value with a 408m distance from the road center line is below 50dB(A) at night.

I. Noise values at red line of Nanmenwai Street (with a 25m distance from road center line) are 76.8 and 70.8dB(A) respectively in the day and at night, and attenuated to 61.3 and 55.3dB(A) with a 200m distance from road center line; standard distance prediction results indicate that the noise value with a 248m distance from Nanmenwai Street center line is below 60dB(A) in the day, and the noise value with a 439m distance from the road center line is below 50dB(A) at night.

J. Vertical section prediction results indicate that the traffic noise for buildings at various floors with a 10m distance from different grade roads presents a "escalating—maximum value emerging—declining" tendency as with the increase of height. Noise maximum value as with a 10m distance from Nanmenwai Street, Fu'an Street, Rongye Street, Heping Road, Beicheng Street, Baoding Road, Anshan Street, North Dagu Road, Shaanxi Road is 64.2, 58.2db(A), 69.2, 63.1dB(A), 70.3, 64.2dB(A), 69.3, 63.3dB(A), 71.8, 65.8dB(A), 72.8, 66.8dB(A), 72.8, 66.7dB(A), 74.8, 6808dB(A), 74.8, 68.7dB(A), respectively in the day and at night; the maximum value is basically from 3rd ~5th floor.

Above calculation results are made under ideal conditions where two roadsides are open ground and without sheltering, in reality the central urban district will be focused on development and construction on the wayside. For areas with multiple rows of buildings, basically the traffic noise influence is obvious to the first row of buildings on the wayside, for other rows the influence is minor.

According the engineering design documentation, the 9 roads of Nanmenwai Street, Fu'an Street, Rongye Street, Heping Road, Beicheng Street, Baoding Road, Anshan Street, North Dagu Road, Shaanxi Road have represented the various gradient, cross section type and vehicle flow of 38 roads (exclude pedestrian street) involved in this environment assessment, therefore traffic noise influence to sound environment quality along the traffic lines of other roads in operation period can be referred to

above calculation results.

5.2.1.4 Traffic line planning suggestion

The site survey indicates that the roads involved in the project are in central district of Tianjin, but some undeveloped areas still exist along the traffic lines, which means that new environmental sensitive targets will emerge along the traffic lines in the future. In order to effectively control negative impacts of traffic noise to the development on future roadsides, combined with noise prediction results, this assessment brings forth following suggestions for future roadside planning in the project.

a. According to noise prediction results, the first row of buildings is best to be public building, commercial buildings, public green space or other non noise sensitive buildings, and is optimal to allocate along the road in parallel direction or locate noise sensitive functional areas on the side that is opposite to the road, to reduce traffic noise influence, besides to isolate the noise to second row of buildings, when conducting detailed construction planning with designated noise influence control distance on the roadsides along traffic lines in the project;

b. When conducting detailed planning on the roadsides along traffic lines in the project, it is inadvisable to build noise sensitive buildings at the first rows on the roadside, such as schoolrooms, hospital wards, residence bedrooms, enterprises, technology development units.

c. The planning administration authorities shall specify the interval distance between noise sensitive building and ground traffic facility in relevant planning documentation, to prevent obvious interference from ground traffic noise; the distance could be set with reference to the calculation results of the report and relative approval documentation of environmental protection administration authorities.

5.2.2 Analysis of sound environmental influence on public transport stations construction project in the operating period

5.2.2.1 Noise prediction mode introduction

Calculate boundary noise value and noise influence value of environmental protection object imposed by vehicle traffic noise by means of range attenuation, equal sound level mode and superposition mode, relevant prediction modes are as follows.

(1) Noise range attenuation mode

$L_p=L_{p0}-20\lg(r/r_o)-R$

In the mode: Lp - sound level at receiving point(the influenced point), dB(A)

Lp0 - sound level of noise source, dB(A);

R - distance from sound source to receiving point, m;

Ro - distance from reference location, taken 1m;

R - prevention structure of noise source and sound isolation index of house;

(2) noise superposition mode

L=L1+10lg[1+10-(L1-L2)/10] (L1>L2)

In the mode, :L – tatal sound level at the recept point, dB(A).

L1 - noise influence value of receiving point imposed by A sound source, dB(A);

(3) Equal sound level calculation mode

$$Leq(T) = 10\lg\left[\frac{1}{T}\sum_{i=1}^{n} t_i \cdot 10^{0.1L_{pi}}\right]$$

In the mode:ti - Sound action time of the number i sound source at prediction point(during period T);

Lpi - Sound level A generated at prediction point by number i sound source

T— Calculation of equal sound level time

(4) Noise influence time

Calculating total time of public transport vehicle entering and exiting per time as 1min (vehicle exiting 0.5min, entering 0.5min), operating time everyday is 6:30-18:30, which means no noise influence at night. Boundary and protection target noise influence the assessment, and the sound source strength all uses1 hour of equal sound level at the peak time.

Use the equation of noise range attenuation mode, superposition mode and equal sound level calculation mode to calculate noise value of the noise influence.

5.2.2.2 Public transport station noise prediction results

(1) Xiqing Pubic Transport Station

Table 5.2-1 Noise prediction result in the day dB(A)

Position	Shortest distance from drive circuit in station(m)	Equivalent influence value	Standard value
East boundary	8	53.9	60
South boundary	Entrance and exit	-	70
North boundary	8	53.9	60

Based on above calculation result, the noise influence value of public transport vehicles as to station east and north boundaries at the peak time is compliant with the day limit requirement of GB12348-2008 Emission Standard for Industrial Enterprises Noise at Boundary (Class 2).

(2) Qingnian Road Station

Table 5.2-2 Noise prediction result in the day dB(A)

Position	Shortest distance from drive circuit in station(m)	Equivalent influence value	Superposition value	Standard value
East boundary	17	43	–	55
South boundary	Entrance and exit	–	–	70
West boundary	Entrance and exit	-	–	70
North boundary	22	43	–	55
No.4 building of Gediao Spring	41	57.2	57.3	55
No.7 building of Gediao Spring	41	68.5	68.5	55

Based on above calculation result, the noise influence value of public transport vehicles as to station east and north boundaries at the peak time is compliant with the day limit requirement of GB12348-2008 Emission Standard for Industrial Enterprises Noise at Boundary (Class 1) For protection object the Gediao Spring Building No.4 and No.7, the noise influence superposition value is superior to GB3096-2008 Standards for Acoustic Environmental Quality (Class 1), since the status qua noise background value is superior to the standard, where noise increment is 0-0.1dB(A), which is merely no influence to sound environment status qua of Spring Style resident buildings.

(3) Nankai District People's Hospital Station

Table 5.2-3 Noise prediction result in the day dB(A)

Position	Shortest distance from drive circuit in station(m)	Equivalent influence value	Superposition value	Standard value
East boundary	6	49.4	–	60
West boundary	Entrance and exit	–	–	70
North boundary	Entrance and exit	–	–	70
Yameili	80	26.3	58.4	60
Nankai Foreign Languages School	53	30.1	57.6	60

Based on above calculation result, the noise influence value of public transport vehicles as to station east boundary at the peak time is compliant with day limit requirement of GB12348-2008 Emission Standard for Industrial Enterprises Noise at Boundary (Class 2). For protection objects Yamei Lane and Nankai foreign language middle school, the noise influence superposition value is compliant with day limit requirement of Standards for Acoustic Environmental Quality (Class 2).

(4) Beichen Science Park Comprehensive Hub Station

This station is divided into east zone and west zone with metro line No. 3 as boundary, the east zone is used for public transport station, while the west zone is used as parking lot for motorized and slow traffic vehicles. Therefore, noise influence prediction analysis is only conducted with the east zone.

Table 5.2-5 Noise prediction result in the day dB(A)

Position	Shortest distance from drive circuit in station(m)	Equivalent influence value	Standard value
East boundary	12	51.1	65
South boundary	Entrance and exit	-	70
West boundary	Entrance and exit	-	70

Based on above calculation result, the noise influence value of public transport vehicles as to station east boundary is compliant with day limit requirement of GB12348-2008 Emission Standard for Industrial Enterprises Noise at Boundary (Class 3).

(5) Beichen Liuyuan Comprehensive Hub Station

Table 5.2-6 Noise prediction result in the day dB(A)

Position	Drive circulation route at the station Closest Distance (m)	Equivalent influence value	Background value	Superposition value	Standard value
East boundary	24	43.2	–	–	55
South boundary	38	39.1	–	–	55
West boundary	Entrance and exit	-	–	–	70
North boundary	13	48.6	–	–	55
Honey Baby Kindergarten	22	44.0	59. 6	59.7	55
Xijing Yuan Community	40	38.6	58. 5	58.5	55

Based on above calculation result, the noise influence value of public transport vehicles as to station east, south and north boundaries at the peak time is compliant with the day limit requirement of GB12348-2008 Emission Standard for Industrial Enterprises Noise at Boundary (Class 1). For protection object the Qiani Babay Kindergarten, Yijingyuan Community resident buildings, the noise influence superposition value is superior to GB3096-2008 Standards for Acoustic Environmental Quality (Class 1), since the status qua noise background value is superior to the standard, where noise increment is 0-0.1dB(A), which is basically no influence to sound environment status qua.

Combined with public transport noise prediction result, in order to control the negative influence of station traffic noise to the environment, the assessment brings forth following suggestions with regards to operation of public transport station in the project.

(1) Set up speed limit signage in visible location of the station entrance and exit or deploy road humps in the driving line of public transport vehicles, in order to strictly limit speed of vehicles in and out of the station;

(2) Public transport vehicles shall be running strictly in adhere to scheduled time and planned route, prohibited from start up before 6:00AM, prohibited from running arbitrarily in the station area, horn-blowing is prohibited from all vehicles in the station.

(3) Reasonably schedule the departures, reduce the vehicle flow in the station at best efforts, make and strictly implement corresponding institution of vehicle overhaul and maintenance.

(4) Enhance traffic dispersion in the station, and prevent vehicles from vehicle noise due to frequent startup.

(5) All vehicles should depart the station after startup in time, reducing the idling operation period as short as possible;

(6) Enhance environment protection education to public transport vehicle drivers and administration of public transport vehicle, prohibit vehicles from long period of idling in the parking area before departure, prohibit from uncovered vehicle overhaul and test in the parking area, prohibit from synchronized startup and idling for multiple vehicles.

(7) Select and use hybrid power public transport vehicle to the greatest extent, for station that is out of limits of the noise influence to sensitive spots, it is able to reduce noise influence of the public transport vehicles outstandingly.

6 Ambient Air Impact Prediction and Assessment

6.1 Environmental Impact Analysis in the Construction Period:

6.1.1 Construction period pollutants production approaches

As per analysis of similar municipal road project construction, the atmosphere pollutants generated in the project construction period are mainly the fugitive construction dust and asphalt smoke generated in the transport and pavement of asphalt. According to Regulations of Tianjin Municipality on Prevention and Control of Air Pollution, the project construction must use ready-mix concrete and ready-mix asphalt, concrete mixing plant and asphalt mixing plant are not allowed at the construction site. Construction engineering contents and pollutants production approaches are involved with project content, see Table 6.1-1.

Table 6-1-1 Construction engineering contents and pollutants production approaches

Project content	Principal pollutant	Production approaches and causes
Road transformation	Raise dust	Concrete, brick buildings demolition, volume source emission
Roadbed treatment	Raise dust	Earth excavation, lower surface source emission
Paving asphalt road surface	Asphalt smoke	Unorganized lower surface source emission
Construction material transport, load and dump	Raise dust	Bulk material spill and leakage, reshipment, earth surface dust
Construction material stacking	Raise dust	Raise dust by wind
Construction waste cleaning	Raise dust	Waste loading and unloading

6.1.2 Raise Dust Environmental Impact Analysis in the Construction Period:

(1) Road raise dust by transport vehicles

Road raise dust caused by transport vehicles in the construction area takes up more than 50% of total site raise dust. Road raise dust volume is attributed to factors including transport vehicle speed, load weight, contact area of tires and ground, road dust load, and relative humidity, etc. According to similar project construction experience, the majority of transport vehicles in the construction area will be running on dirt road or shortcut that is badly conditioned during the construction period, where the road dust load is high and the pollution is severe. According to relative documentation, if no control measure is conducted, TSP concentration is more that 10mg/m3 with a 50m distance of downwind direction to roadside; TSP concentration

is more that 5mg/m3 with a 150m distance of downwind direction to roadside.

(2) Construction operation raise dust

The construction operation raise dust of the project mainly comes from: earth excavation of roadbed construction and laying of underground pipeline, earth-rock backfill and on-site temporary stacking, on-site distribution and stacking of construction material(lime, sand, cement, brink, etc.), raise dust generated by construction waste clearance and stacking, etc.

Beijing Environmental Science Research Institute has measured the raise dust conditions for four municipal projects (two enclosed, the other two unenclosed), under wind speed of 2.4m/s, see the results at Table 6.1-2.

According to the measurement results, construction raise dust is severe for unenclosed construction, where the pollution range could approach as far as 250m in downwind direction of the site, and the average TSP concentration of influenced area is 0.756mg/m3 which is 1.87 times of the contrast point and 2.52 times of atmosphere environment quality standard. Under condition of enclosed construction, the raise dust is significantly improved with contrast to unenclosed construction, where the raise dust pollution range is within 200m in downwind direction of the site and the TSP concentration could be reduced by a quarter in the polluted area. Average TSP concentration of influenced area is 0.585mg/m3, which is 1.4 times of the contrast point and 1.95 times of atmosphere environment quality standard.

Table 6.1-2 Environmental pollution status of construction raise dust

Name of construction sites	Enclosing condition	TSP Concentration (mg/m3)						
		Downwind direction of the site						Upwind direction of the contrast point
		20m	50m	100m	150m	200m	250m	
South 2nd Ring Tiantan section project	None	1.54	0.981	0.635	0.611	0.504	0.401	0.404
South 2nd Ring Taoran Ting	None	1.467	0.863	0.568	0.570	0.519	0.411	
Average			1.503	0.922	0.602	0.591	0.512	
West 2nd Ring transformation project	Enclosing metal Plate	0.943	0.577	0.416	0.421	0.417	0.420	0.419
West Chegongzhuang Road project	Enclosure with strip cloth	1.105	0.674	0.453	0.420	0.421	0.417	

Average		1.042	0.626	0.435	0.421	0.419	

If watering to prevent dust on vehicle running roads and areas that easily generate raise dust (4-5 times per day) in the construction period, the raise dust could be reduced by 50%-70%, test results of watering dust prevention is show in Table 6.1-3.

Table 6.1-3 Test Results Of Watering Dust Suppression In Construction Period

Unit: mg/m3

Distance (m)		5	20	50	100
TSP hourly average concentration	10.14	2.89	1.15	0.86	
	2.01	1.40	0.67	0.60	
Rejection ratio (%)		80.2	51.6	41.7	30.2

Above data indicates that, effective watering dust prevention could substantially reduce the pollution extent of construction raise dust. However, Tianjian is located in the North, the climate is dry with massive evaporation, and the effective duration of watering dust prevention is short, therefore it has to be combined with measures such as timely clearance of road surface dust to control raise dust pollution.

In view of the environment protection objects specified by the project are less than 100m from the construction site, which will be influenced by construction raise dust; those under major influence are environment protection objects such as pedestrians passing in the construction road section and residences within a 50m range of the construction site, etc.

(3) Analysis of asphalt smoke environmental influence

According to “it is prohibited from storing, processing, producing or using substances that generate malodorous gas in populated district and other areas that need special protection. Those emit malodorous gas must implement measures to prevent surrounding residents from being polluted” in Article 28 of Regulations of Tianjin Municipality on Prevention and Control of Air Pollution, asphalt mixing plant is not allowed in construction site of the project, ready-use asphalt is applied for all. Based on urban road construction status of Tianjin and other domestic cities, the asphalt smoke will not impose major influence to residence communities with a distance of more than 50m to construction site if using ready-mix asphalt for pavement, and nowadays modified asphalt of expediting setting is often used and the minor the

asphalt smoke could be diffused rapidly under uncovered operation. Therefore, only if the project development schedule properly and shorten the on-site pending time of asphalt transport vehicle, the asphalt smoke will not impose obvious influence to environment protection objects.

6.2 The assessment of ambient air impact

6.2.1 Influence analysis of exhaust emission of public transport vehicles

Main pollutant in project operation period is mainly attributed to exhaust emitted by vehicles when entering and exiting stations, running slowly on road, idling, and startup, and the pollutant factors are CO and NOx. The exhaust coefficient is show in the following Table.

Table 6.2-1 Motorized vehicle pollutant exhaust coefficient Unit: mg/unit*m

Contamination Factor	Pollutant emission factor
CO	29.1
NO_x	5.1

Travel distance in station and daily departures of each public transport station are shown as follows:

Table 6.2-2 Motorized vehicle travel distance and departures of each station statics

Serial Number	Project	Travel in station(m)	Departures(unit*times)
1	Xiqing poly-technic University	70	224
2	Xiqing Caozhuang Station	340	280
3	Nankai Qingnian Road Station	50	112
4	Nankai People's Hospital Station	80	56
5	Beichen Science Park Station	240	336
6	Beichen Liuyuan Station	130	224
7	Dongli Development Zone	200	392
8	Dongli District Fangshan Road Station	100	168

9	Dongli District No.4 Bridge Station	110	224

Exhaust emission prediction is as follows:

Table 6.2-3 Motorized vehicle pollutant emission volume prediction Unit kg/a.

Serial Number	Project	CO	NO_x
1	Xiqing poly-technic University	167	29
2	Xiqing Caozhuang Station	1011	177
3	Nankai Qingnian Road Station	59	10
4	Nankai People's Hospital Station	48	8
5	Beichen Science Park Station	857	150
6	Beichen Liuyuan Station	309	54
7	Dongli Development Zone	833	146
8	Dongli District Fangshan Road Station	178	31
9	Dongli District No.4 Bridge Station	262	46

Public transport vehicles stop uncovered, and exhaust emission volume is minor with a discontinuity pattern, besides, the project location area is open and wide therefore will be advantageous for pollutant diffusion, it is estimated that public transport vehicle emission will not significantly impose influence to surrounding environment in operation period. Obsolete vehicle models are prohibited in project operation period,

In order to implement and comply with Notice of the State Council Concerning Atmosphere Pollution Prevention and Governance Plan (GF [2013] No.37) and the spirit Beauty Tianjin Development Outline by the Communist Party Tianjin Committee People’s Government (JDF [2013] No.19), according to requirement of The Notice of Oils Quality Upgrade Pricing Policy by National Development and Reform Commission Concerning (FGJG [2013] No.1845), Tianjin People’s Government decides that from December 31,2014, the gasoline and diesel supply of

the city shall be compliant with national stage 5 standard. Oils quality update is a significant measure to reduce atmosphere pollution, improve ecological environment and build beautiful Tianjin. As per investigation, after motor gasoline standard is upgraded to national stage 5 from national stage 4, Sulfur content limit index is reduced to 10ppm from 50ppm. As a result, after the project in put into operation, the exhaust emission of CO and NOx will be further reduced.

Besides, new-generation gas-electric hybrid public transport vehicles are universally adopted by six districts of our city. The new-generation gas-electric hybrid public transport vehicle is capable to save 35% of petroleum consumption, and it is suggested that operating units consistently increase the percentage of new-generation gas-electric hybrid public transport vehicles in operation to further reduce exhaust emission.

6.2.2 Kitchen lampblack

Each public transport station is planned to set up staff canteen. Gas emissions and cooking lampblack will be generated in the kitchen cooking process. Lampblack will be exhausted as per flue-gas cleaning devices, which will be exhausted with gas emissions via roof exhaust funnel Staff canteen is planned to set up with 1-2 cooking ranges, adopting natural gas as the fuel. According to oil fumes monitoring results of Tianjin Environment Monitoring Center with relative enterprises, canteen lampblack concentration is approximately 6-10mg/m3

6.2.2.1 Kitchen gas waste exhaust

Kitchen cooking gas waste exhaust mainly comes from cooking and food processing. Gas waste exhaust must be collected with gas-collected hood before exhausted, natural gas is clean energy and its exhaust pollutant is minor which will not impose obvious influence to environment.

6.2.2.2 Catering lampblack

The food cooking process will generate lampblack, which will be collected with gas-collected hood to exhaust. According to GB18483-2001 Emission standard of cooking fume, top limit of lampblack emission concentration is 2.0mg/m3. The kitchen in the project is a kind of small stove, must be equipped with lampblack cleaning facility which has a bottom lampblack removal rate of 60%. At the same time it also has to meet the following requirements:

a. Catering kitchen must be equipped with lampblack cleaning facility and

ensured to operate in adhere to requirement, unorganized emission is considered as out of limits.

b. Exhaust funnel outlet length should straight pipe that is at least 4.5 times of its diameter (or equivalent diameter).

c. The outlet orientation of exhaust funnel should be avoided from buildings easy to be influenced.

d. Sealing of the exhaust system should be intact, prohibited from manually dilute the pollutant concentration of the exhaust funnel.

6.2.2.3 Standardization requirement of exhaust outlet

According to relative requirements of No.71 document in 2002 of Tianjin Environment Protection Monitoring the Notice of Enhancing Exhaust Outlet Standardization Operation of Tianjin and No. 57 document in 2007 of Tianjin Environment Protection Monitoring the Notice of Issuing Tianjin Pollution Source Exhaust Outlet Standardization Technical Requirement, waste exhaust outlet should be standardized, as per following detailed requirements:

(1) The exhaust channel should be set up with sampling port and sampling monitoring platform to facilitate sampling and monitoring.

(2) Number of sampling port, point and position should be set up according to Method of Particulate Matter Measuring and Gaseous Pollutant Sampling in the Fixed Pollution Source Exhaust (GB/T16157-1996).

(3) Environment protection logotype of waste exhaust outlet should be set up on visible ground near the exhaust channel.

6.2.3 Influence prediction of vehicle exhaust emission

6.2.3.1 Calculation of pollutant emission source strength

After the project is put into operation, main atmosphere pollutants are NOX, CO, HC of passing vehicles exhaust emissions, and the assessment is conducted mainly on the environmental influence of NOX.

Current methods for calculating motorized vehicle pollutant emission source strength:

Analogy method: use recommended date of Road Assessment Regulations of Environmental Influence on Road Construction Project and relative motorized vehicle pollutant emission documentations, and make corrections according the specific conditions of the project.

Computing method: Calculate with calculation mode of motorized vehicle pollutant

emission source strength and obtain result of pollutant emission source strength for various types of vehicle under different circumstances. The commonly used calculation mode is Mobile 5 Mode which is developed with US National Environment Protection Bureau, and this mode has been implemented in the environment assessment of a number of transportation projects.

This report uses the recommended value in Road Assessment Regulations of Environmental Influence on Road Construction Project (JTGB03-2006) as emission source strength, see in the following Table.

Table 6.2-1 Single vehicle emission factor Mg/unit m

Average Speed (km/h)		≤50	60
Small vehicle	NO_X	1.77	2.37
Medium-load vehicle	NO_X	5.40	6.30
Large vehicle	NO_X	10.44	10.48

6.2.3.2 Road section width selection principle

The environmental assessment will select the roads with typical cross section width to conduct prediction. This environment assessment involves with road of different red lines, corresponding road lanes are approximately: red line width of less than 20m, the road is 2 bi ~directional lanes; red line width of 20m ~35m, the road is 4 bi-directional lanes; red line width of above 40m, the road is 6 - 8 bi-directional lanes.

See Table 6.2-2 for the selected road sections and detailed conditions of the environment assessment prediction; see Table 6.2-3 for vehicle flow of roads with different section.

Table 6.2-3 Planned basis conditions of prediction&assessment road sections

Serial Number	Name	Grade	Width of red line:
1	Xuzhou Road	By-pass	20 (2 bi-directional lanes)
2	Duolun Road	Secondary arterial road	20 (2 bi-directional lanes)
3	Xing'an Road	Secondary arterial road	25 (4 bi-directional lanes)
4	North Dagu Road	Main arterial road	40m 6 bi-directional lanes
5	Middle Chengxiang Road	Main arterial road	60 (8 bi-directional lanes)

Table 8-2-3 Vehicle flow of roads with different sectionpcu/hour

Serial Number	Road Name	Red line width and number of lanes(m)	Predicted total vehicle flow
1	Xuzhou Road	20 (2 bi-directional lanes)	800
2	Duolun Road	20 (2 bi-directional lanes)	1200
3	Xing'an Road	25 (4 bi-directional lanes)	2400
4	North Dagu Road	40m 6 bi-directional lanes	4800
5	Middle Chengxiang Road	60 (8 bi-directional lanes)	6400

*when predicting, percentage of heavy duty vehicles for primary road and secondary road is taken at 20%, for bypass is taken at 10%.

6.2.3.3 Dispersion of pollutants

(1 statement of calculation

(3) Template parameter description

Use Caline4 Mode to make diffusion calculation. Calculate with regards to heating period, non-heating period and most disadvantageous condition. According to requirements of Caline4 mode, heating period and non-heating period use Tianjin regular monitoring meteorological data, for heating period, average wind speed: 3.0m/s, average temperature: 10℃; for non-heating period, average wind speed:2.4m/s, average temperature:25℃; for the most disadvantageous condition: wind speed:0.5m/s, E class stability, and peak vehicle flow.

b Vehicle flow description

According to motorized vehicle time distribution statistics of status qua Tianjin main traffic roads, peak hourly vehicle flow is 1.5 times of average vehicle flow in the day, and night vehicle flow is 50% of average vehicle flow.

Use peak vehicle flow data while calculating the most disadvantageous condition, use 2 hours of peak vehicle flow, 4 hours of non-peak vehicle flow data and 2 hours of night vehicle flow while calculating the heating period and the non-heating period

C. Background value range description

NO2 background value is referred to the data of Tianjin Environment Quality Report in 2009, for heating period it is 0.049mg/m3, for non-heating period it is 0.037mg/m3, the NO2 background value of the most disadvantageous condition is taken at 3 times of the heating period therefore it is 0.147mg/m3.

(2) The results and analysis of the calculations

According to above mode and parameters, calculate downwind NO2 concentration of roads with different section in Table 6.2-4.

Table 6.2-4 Downwind NO2 concentration of roads calculation results

Cross section of road \ Calculation Results		15m	30m	50m	80m	100m	150m	200m
20m bypass	0.094	0.094	0.080	0.070	0.067	0.063	0.059	0.057
	0.097	0.097	0.076	0.064	0.058	0.053	0.049	0.047
	0.656	0.656	0.457	0.363	0.301	0.278	0.244	0.227
20m Secondary artery line	0.127	0.127	0.100	0.086	0.076	0.072	0.065	0.063
	0.138	0.138	0.103	0.082	0.070	0.066	0.060	0.055
	1.007	1.007	0.681	0.523	0.418	0.379	0.324	0.291
25m Secondary artery line	0.228	0.228	0.164	0.129	0.107	0.098	0.086	0.080
	0.265	0.265	0.183	0.138	0.109	0.086	0.082	0.074
	1.761	1.761	1.075	0.782	0.595	0.537	0.428	0.379
40m Major Arterial	0.525	0.525	0.361	0.265	0.199	0.176	0.143	0.115
	0.647	0.647	0.429	0.304	0.224	0.193	0.152	0.129
	4.733	4.733	2.595	1.870	1.406	1.223	0.942	0.790
60m Major Arterial	0.733	0.733	0.527	0.378	0.275	0.238	0.187	0.160
	0.922	0.922	0.633	0.442	0.314	0.269	0.205	0.173
	7.252	7.252	3.765	2.646	1.958	1.695	1.303	1.106

A. For bypass with a 20m section, the roadside NO2 concentration with a more than 15m distance from road center line in heating period and non-heating period meets daily average concentration requirement of GB3095-1996 Ambient Air Quality Standard (Class II), the roadside NO2 concentration with a more than 200m distance from road center line under the most disadvantageous condition meets once concentration requirement of Ambient Air Quality Standard (Class II).

B. For secondary road with a 20m section, the roadside NO2 concentration within a 15m range in heating period and non-heating period is out of the daily average concentration requirement of GB3095-1996 Ambient Air Quality Standard (Class II), the concentration out of the 30m distance meets standard requirement; prediction point concentration within a 200m range under the most disadvantageous condition is out of limits.

C. For secondary road with a 25m section, the roadside NO2 concentration within a 50m range in heating period and non-heating period is out of the daily average concentration requirement of GB3095-1996 Ambient Air Quality Standard (Class II), the concentration out of the 80m distance meets standard requirement; prediction point NO2 concentration within a 200m range under the most

disadvantageous condition is out of limits.

d. For primary road with a 40m section, the roadside NO2 concentration within a 150m range in heating period is out of limits, prediction point NO2 concentrations within a 200m range on roadside in non-heating period and under the most disadvantageous condition are both out of limits.

e. For primary road with a 90m section, prediction point NO2 concentration within a 200m range on roadside in heating period, non-heating period and under the most disadvantageous period are out of limits.

f. As the increase of road section width, out-of-limit range of NO2 concentration is escalating, mainly because the vehicle flow will be growing accordingly with the increase of road section breath.

7 Water Environmental Impact Analysis

7.1 Water Environmental Impact Analysis in the Construction Period:

7.1.1 Domestic sewage

Construction staff have a simple style of living, creating minor domestic wastewater. Domestic water mainly comes from daily living wastewater and toilet water of the construction staff. The wastewater contains various organic substances such as animal and vegetable oil, food residue, detergent and so on, if not processed and drained directly will impose negative influence to the quality of surrounding surface water body.

Based on the project development scale, and analogized with similar project, the population of on-site construction staff at the peak time is about 200, domestic water demand as per 100L/(person day), pollutant discharge coefficient as per 90%, and the production of gross sewage will be about 18m3/day, and the main pollutants are COD, animal and vegetable oil, SS, etc., and the content is, COD: 200-300mg/L, animal and vegetable oil: 50mg/L, SS: 80-100mg/L. As domestic wastewater volume is minor, and after processed through septic-tank could be used to farm irrigation, imposing minor environmental influence. After project completion, the influence of domestic wastewater of construction staff will disappear.

7.1.2 Vehicle washing

Vehicle washing water volume in construction period is minor, and the main pollutants are SS and petroleum etc. According to water quality and volume of vehicle washing water, similar domestic project usually adopt the governance measure of building up cement evaporation pond, which is, vehicle washing water is drained into the evaporation pond which is to be backfilled with earth and leveled up, then the solid substance after subsidence will be transported and disposed regularly by environmental sanitation units; this assessment suggests that construction unit to reuse the vehicle washing water after recycling treatment to save water resource. Conclusively, vehicle washing water on construction site must be governed with effective measures, prohibited from direct drainage into nearby municipal pipeline network.

Under the precondition that the project construction is strictly in adhere to above pollution prevention and governance measures, the domestic wastewater and vehicle washing water generated by construction should not impose negative influence to

surface water environment quality along the traffic line.

7.2 Analysis of environment impact in operation period

The project wastewater mainly comes from staff domestic wastewater, toilet wastewater and oily wastewater of small-type kitchen, staff wastewater and public toilet wastewater will be subsided via septic-tank, oily wastewater processed via oil separator will be drained with other domestic wastewater, therefore, the project drainage water quality is basically similar to the water quality of general urban resident domestic wastewater. Analogized with general domestic wastewater quality monitoring result, predict wastewater quality status of all stations in project operation period, see the value in the following Table.

Table 7.2-1 Prediction of wastewater drainage quality Unit: mg/l

Factor	Ph	SS	COD_{Cr}	BOD_5	Petroleum	Ammonia nitrogen	Total phosphorus	Animal and vegetable oil
Emission concentration	7.2	250	350	200	15	30	2.7	40
Integrated Wastewater Discharge Standard (Class III)	6～9	400	500	300	20	35	3.0	100

Based on the analog result, the predicted main pollutants concentrations are compliant with the requirement of DB12/356-2008 Integrated Wastewater Discharge Standard (Class III), could discharge within standard limits. Wastewater will be discharged to local treatment plant via municipal sewage pipelines, which is feasible; the production of wastewater volume in operation period is minor, which will not impose obvious influence to operating load of sewage treatment plant.

Project wastewater volume in operation period is as follows:

Table 7.2-2 Prediction of water pollutant drainage volume Unit kg/a.

Serial Number	Project	Sewage	COD_{Cr}	Ammonia nitrogen	Petroleum
1	Xiqing Caozhuang Station	4172	1.46	0.13	0.06
2	Nankai Qingnian Road Station	1872	0.66	0.06	0.03
3	Nankai People's Hospital Station	961	0.34	0.03	0.01

4	Beichen Science Park Station	5617	1.97	0.17	0.08
5	Beichen Liuyuan Station	5470	1.91	0.16	0.08
6	Total	18092	6.34	0.55	0.26

Based on No.57 Document in 2007 of Tianjin Environment Protection Monitoring Tianjin Environment Protection Bureau the Notice of Issuing Tianjin Pollution Source Exhaust Outlet Standardization Technical Requirement, and [2002] No.71 Tianjin Environment Protection Monitoring the Notice of Enhancing Exhaust Outlet Standardization Operation of Tianjin, each traffic hub public transport center should be set up with one wastewater discharge outlet which should be standardized; besides, the discharge outlet should be convenient for sampling and highlighted with signage, etc.

8 Environmental impact analysis of solid wastes

8.1 Environmental impact analysis of solid wastes in construction period

The solid waste is mainly excavated earth-rock as well as construction waste and domestic waste produced from construction surflaes during construction period.

According to initial estimates of engineering design data, the earth-rock excavated for project construction should be used to the greatest extent after full deployment with engineering excavation volume of 128700m³, fill quantity of 147800m³ and digging soil of 103000m³. The waste soil in this project shall be transported to other projects underway simultaneously for utilization by transport unit selected and approved respectively by building unit and government under deployment of spoil management department.

Since parts of the solid waste is in linear distribution along roads during construction period, it will directly destroy vegetation and pollute water bodies along the roads in case of improper stacking or treatment not in a timely manner; it will produce raise dust with wind after stacking for a long time, affecting nearby residents. Consequently, it is necessary to strengthen construction management, clear and dispose of solid waste in time during road construction, so as to reduce or prevent such impacts.

There are around 200 construction staffs at the construction site during peak hours, who will produce about 0.20t domestic waste per day. The domestic wastes produced by construction staff such as food residue, plastic package and waste battery will influence the landscape and greatly pollute the environment if random stacked. Waste piled disorderly will cause a foul smell and attracted lots of mosquitoes and rats, posing a risk to the health of construction staff. Waste failed to be disposed of will produce foul liquid and seriously pollute the water body and soil, especially the waste battery which contains plenty of heavy metal.

Domestic waste produced by construction staff will be transported to sanitation departments for concentrated treatment after collection; construction waste produced shall be cleared and transported to building landfill uniformly and timely by spoil management department of Tianjin for treatment; it is expected that the solid waste produced during project construction period will impose less impact on surrounding environment after taking above measures.

In a bid to control secondary pollution to environment by solid waste produced during construction in the process of stacking and transportation, the building unit must take

the following pollution control measures:

(1) The construction unit must handle the spoil discharge procedures in strictly accordance with regulations, discharge waste soil in specified receiving locations after obtaining approval from relevant competent departments of Tianjin and try to put soil in place at a time to prevent repeatedly polluting the environment due to reversed transportation

(2) It is necessary to try to avoid loading, unloading and transporting the waste soil in rainy season and tamp the slope for waste soil stacking to prevent water and soil loss because of rain wash. Parapet wall and guard board shall be set up for stacking waste soil if possible.

(3) For waste soil transportation, well-closed specialty transport vehicles meeting the requirements must be used and according to relevant regulations, overload is forbidden to prevent scattered spoils.

(4) For construction waste and discarded construction materials, separate collection and treatment are required, wherein utility material shall be used nearby preferentially and paper, wooden, metal and glass wastes can be sold to recycling center.

(5) In the residential camp for construction staff, full-time sanitation worker must be appointed to take charge of uniformly collecting domestic waste in camping area and entrusting local city sanitation department to clear and dispose of waste in time.

By taking the above pollution control measures, it is expected that the solid waste produced during construction period in the project will be properly treated without secondary pollution to the environment.

8.2 Environmental impact analysis of solid wastes in operation period

It mainly comes from food waste and waste package produced by employee in the station together with domestic waste generated in the bus and oily waste in public transport maintenance location. Since passengers stay for a shorter period of time in stations, there’s no waste produced basically. The domestic waste in public transport station will be cleared by city sanitation department; collection device for domestic waste will be equipped in the station while implementing waste bagging; temporary collection container for domestic waste shall be equipped in buses to ensure that solid waste can be disposed of in time, preventing secondary pollution.

If the domestic waste produced by employee is based on 0.5kg/per capita d, the domestic waste output shall be calculated as per the following formula:

$V_1 = 0.365 f_v \times N$

Wherein: V1 refers to the domestic waste output, t/a;

f_v — fv refers to the discharge coefficient, where in the assessment, it is based on 0.5kg/per capita d;

N — Predict population;

If the waste on the bus is calculated based on 0.01kg/per capita, then daily waste generated on the bus will be 0.03t. Accordingly, the calculated total output of domestic waste in the project shall be as follows.

Table 8.2-1 Solid Waste Output List

Serial Number	Project	Employee (person)	Passenger flow (person)	Output produced by employee (kg)	Output produced by passenger flow (kg)	Subtotal (t/a)
1	Xiqing Caozhuang Station	80	500	40	5	45
2	Nankai Qingnian Road Station	30	250	15	3	18
3	Nankai People's Hospital Station	15	130	8	1	9
4	Beichen Science Park Station	90	750	45	8	53
5	Beichen Liuyuan Station	60	850	30	9	39
6	Total					164

The oily solid waste produced from maintenance in public transport station belongs to hazardous solid waste (namely, HWO8 used mineral oil), so it should be handed over to the units with qualification of relevant hazardous waste treatment for recycling and reusing after being collected intensively by building unit, avoiding polluting the environment.

9 Ecological and landscape environmental impact assessment

9.1 Ecological environment impact prediction and assessment

9.1.1 Environmental Impact Analysis During the Construction Period:

A certain amount of permanent occupied lands will be increased due to road construction in the project; and greenbelt, border trees, lawn and shrub along the roads will be removed in the process of project construction. Therefore, green area will be reduced in ecosystem together with overall vegetation coverage and regulating effect of ecosystem will also be impaired to some extent during construction.

For the purpose of mitigating the impacts of construction on greening along the roads, it is necessary to try to protect the existing grown trees in road area during construction period; in case of removal is required, the plants and trees should be transplanted somewhere else as much as possible; it will be better to transplant them in the community nearby where similar project is undertaken to make sure their survival rate and compensate plants and trees destroyed due to permanent occupied land in the project.

9.1.2 Analysis of environment impact in operation period

(1) Greening principles

Road greening construction is the framework of urban greening and the main body of city green network. Definite requirements for urban road greening are set out in Urban Road Greening Plan and Design Code and Tianjin Urban Greening Regulations. Therefore, the building unit shall implement greening work along the roads according to local actual conditions of each road by strictly following the above regulations and standards targeting at the characteristics of the project involving many roads and with different surrounding environments of roads. Pursuant to relevant laws, regulations and construction standards, the greening work in the project shall observe the following principles:

a. Rate of green space of road with planned width of red lines being 40-50m shall not be less than 25% and that of road with planned width of red lines less than 40m shall not be less than 20%.

b. Arbor shall be planted primarily for road greening, while planting shrub and ground cover plants for mixture, bare soil is not allowed;

c. Valuable existing trees are better to be reserved during road construction;

d. Matching the species with the site shall be complied with during plant cultivation, while taking ecological habits of accompanying plants into consideration; for soil disagreeing with greening, it shall be improved for greening;

e. It is necessary to make overall arrangements for mutual location between greening trees and public utility and make sure the site conditions and growing space required for trees.

f. The green area reduced because of project construction shall be resumed somewhere else in the city to compensate the overall green area;

g. Irrigation facilities shall be equipped for road greenbelt as required; the exposure and gradient of road greenbelt shall be complied with drainage requirements and combined with urban drainage system to prevent stagnant water within greenbelt and water and soil loss;

h. The road greening mode shall be beneficial to water and energy conservation and reduction of maintenance management cost.

(2) Analysis of green equivalent

Road greening can play a role in improving the microclimate around the roads by scientific design, despite various limitations on the road greening and some limitation on its ecological benefits. According to relevant data, refer to Table 9-1-1 for the green equivalent of greening patterns frequently used currently.

Table 9-1-1 Green equivalent of typical vegetation

Vegetation Type	Area	Green equivalent
Dense grassland	$1m^2$	1
Flowerbed	$1m^2$	0.7
1m high hedgerow	$1m^2$	1.6
Vertical wall greening	$1m^2$	0.6
Large shrub or small arbor	1 株	1.5
Erythrina indica of 5 years above	1 株	17

The above table shows that arbors of five years above have the maximum green equivalent, while flower bed and wall have the minimum green equivalent. According to the concept of green equivalent, the following suggestions are put forward for road greening in this project:

a. Hedgerow shall be planted properly in central separation belt and motor vehicle/non-motor vehicle separation belt, so as to obtain higher green equivalent than that of grassland or flowerbed and play the role of hedgerow closely planted in sound isolation and noise reduction.

b. Because arbors have the maximum green equivalent, trees shall be primarily planted for road greening. It will be better to select trees with the DBH (diameter at breast height) of 10-15cm as border trees. In case of too thin DBH, the greening effect can not be achieved for a long period in the future; in case of too thick, it is very difficult to guarantee the survival rate and gives rise to the increase of investment.

c. In general, small ornamental fruit-effect, flowering and foliage arbor, instead of large arbors, can be planted in greenbelt between sidewalk and buildings, such as pomegranate, euonymus bungeanus, acer truncatum, syringa reticulate, mountain peach, flowering peach and prunus cerasifera. Flowering shrubs shall be planted more with staggered flower season. In this way, higher green equivalent and landscape beautification can be achieved at the same time.

d. Such vines as honeysuckle, polygonum aubertii, rambler, cypress vine and morning glory can be planted on building walls on both sides of the roads.

9.1.3 Heat island analysis

Heat island effect is also known as “atmospheric thermal pollution effect”. It refers to that the air temperature in big cities is higher than that in surrounding areas, leading to climatic variation anomalies and increase of energy consumption and imposing impacts on life and health of residents. The reason why air temperature indicated by isotherm gives rise to heat island effect is that the covering of earth surface is firstly subject to inorganization and more and more earth surface is covered by buildings, concrete and pitch, with reduced greenbelt and water, weakened evaporation and

atmospheres failed to be cooled down.

Observed experiment is carried out for the influence of different earth surface conditions on air temperature in Environment Impact Report of Comprehensive Development and Transformation of Tianjin Haihe River Planning. Different earth surface conditions will cause different earth temperatures and thus marked difference of air temperature due to its capability of absorbing solar radiation and its difference in water content. Through observed experiment of different earth surfaces' air temperature, the influence of different earth surface on air temperature can be learned, refer to Table 9-1-3 through 9-1-5 for results.

Table 9-1-3 Observed results of air temperature under different earth surface conditions in urban area of Tianjin (℃)

Surface / Month	14:00			23:00		
	Water surface	Land	Air temperature difference	Water surface	Land	Air temperature difference
January	3.0	5.8	2.8	-2.9	-5.3	2.4
April	21.9	29.6	7.7	10.4	12.2	1.8
July	22.7	40.8	18.1	20.7	27.6	6.9
October	22.4	28.5	6.1	17.5	14.1	3.4
Year	17.5	26.2	8.7	11.4	12.2	0.8

Table 9-1-4 The air temperature comparison between lawn and cement road of Tianjin auditorium (℃)

Weather / Surface	Overcast Sky		Clear day	
	Morningtide	Noon	Morningtide	Noon
Turfed Area	22.2	30.8	22.5	32.0
Cement Road	23.6	34.2	25.8	38.0
Air temperature difference	1.4	3.4	3.3	6.0

Table 9-1-5 The air temperature comparison between trees and asphalt road of Tianjin grand hotel

Weather / Surface	Overcast Sky		Clear day	
	Morningtide	Noon	Morningtide	Noon
Timber	18.6	24.3	19.0	25.0
Blacktop	21.8	25.6	23.5	31.5
Air temperature difference	3.2	1.3	4.5	6.5

Because of irrational time arrangement for experiment, the lateral comparability of experimental data is poorer, but the experimental data at each measure point are still of great significance. Seen from Table 9-1-3, the air temperature on land surface in the day in each season is higher that that of water surface and their difference widens with the enhanced solar radiation. The difference in Summer is larger, amounting to 18.1℃, while that in Winter is smaller, but still reaching 2.8℃. The difference in the nighttime is obviously smaller than that in the day. The land surface temperature in Spring and Summer is respectively 1.8℃ and 6.9℃ higher than that of water surface, while the water surface temperature in Autumn and Winter is 3.4℃ and 2.4℃ higher than that of land surface temperature. Seen from Table 9-1-4 and 9-1-5 that, the vegetation conditions of earth surface also have greater effect on air temperature and the cooling effect of water surface is superior to that of forests which is superior to lawn. The larger the area is, the more obvious the cooling effect will become.

Relevant research groups of Beijing Institute of Landscape Architecture and Hangzhou Botanical Garden reach into the following conclusions during long-term researches and observation and experiment:

● The concentration areas of “heat island” in Beijing share the generality of low greening rate, crowded buildings, concentrated population and common man-made heat source, and three-dimensional urban afforestation should be extensively promoted, together with introducing urban wind and increasing urban water coverage, which are all effective means to reduce the “heat island” effects, wherein afforestation is of the most significant. Taking Beijing as an example, where in hot summer, every hectare of green space could absorb 1.8t CO2 and about 2t dust per day averagely, as

well as 81MJ heat from surroundings, equivalent to the refrigeration effects by over 1800 sets of 1KW air conditions. In addition, research also indicates that when the greening rate is more than 40%, the "heat island" effect could be obviously remitted and if the figure is increased to 60% and the scale of green space could be more than 3 hectares, local temperature could even be similar to that in outskirts.

● Avenue tree (planetree) has cooling functions and could reduce 0.5-1℃ in summer and enhance 3-5% of relative humidity.

● Various plants have complicatedly different afforestation and cooling effects. In total, those with tall and dense crown could have more distinct temperature reducing effects and trees are better than lawns.

● The temperature at the surface of plant is largely lower than that in artificial underlying surface and 4-8℃ could be reduced in summer.

● Temperature is negatively proportional to the greening rate and positively to ratio of building. The relationship between temperature and building rate is more dense than that between temperature and greening rate, so buildings have a larger impact on temperature. As for the greening rate, the maximum cooling intensity is of 2.2℃ averagely and the maximum temperature increasing intensity of the building rate is 2.4℃.

● Green land area is too small and the effects of temperature dropping is not obvious, which means that the larger the green land area is, the higher the temperature dropping reliability will be. When building area is small, the relationship performance will be significant, namely, buildings will present higher building rate within small scope, thus significantly enhance the effects of temperature; however, when the building area is larger, the temperature increase will be more significant.

The overall land area in Tianjin will be relatively increased upon the completion of the project. Though it is beneficial to urban traffic, the area covered by concrete and pitch will be increased, which will absolutely lead to the aggravation of urban heat island effect. Especially, at the preliminary stage, the effect of road afforestation is not yet formed, when the heat island effect is of most obvious influence. As a result, in order to reduce the contribution of urban heat island effect resulted from the project, this evaluation proposes as follows after referring to practical data and research conclusions:

(1) For the purpose of decreasing the intensity of urban heat island effect, the

building unit shall properly make sure the qualification of greening rate of roads to design road afforestation strictly in line with relevant laws and regulations. Original green lands, especially tall trees, shall be preserved to the greatest extent.

(2) The afforestation shall be scientific, with more luxuriant trees being planted and various tree varieties shall be mixed and reasonably matched with lawns, realizing the combination of science and aesthetics.

(3) Three-dimensional afforestation shall be developed, planing some vines plants along buildings for enclosure. According to researches done by Ministry of Land Infrastructure and Transport, if Tokyo Metropolitan District intents to intensify the afforestation by planting trees and glasses in parks, on both banks of rivers, in front of buildings and on roofs, to increase about 1100 hectares of green land, the temperature even in hot summer could decrease by 0.3℃ averagely and the areas with "tropical night" will be decreased by 10.9%.

(4) To improve road paving material and structure, pavement with water-retaining and water-permeability properties can be used. The water-retaining pavement road test in Toranomon, Minato-ku, Tokyo indicates that, although the road cost is higher than ordinary roads, its temperature in summer can drop by 10℃.

9.1.4 Analysis on ecological environmental influence of soil borrowing and spoiling and construction waste

Since the project has many sub-projects distributing in urban center and suburbs, the construction sites are in a large amount and relatively scattered and different sections have different conditions of uses, the quantity of excavation and filling and the amount of soil boiling and spoiling vary a lot. The assessment briefly analyzes the ecological environmental influence of soil borrowing and spoiling and the staking of construction waste referring to Tianjin's equivalent construction projects based on the features of the project.

Soil borrowing and spoiling and the staking of construction waste will definitely have certain influence on ecological environment, mainly on the disturbance of original animal and plant habitat and vegetation damage by soil borrowing and spoiling; low-lying land, drainage system change and partial stagnant water led by soil borrowing; soil structure destruction, fertility declining and soil productivity reduction after soil borrowing.

The borrowed soils of the project are commercial soil and are provided by

professional soil borrowing company, while the waste soil is mainly from old road structures and accordingly generated building garbage, which should be cleaned of by local project waste soil treatment company of the construction site. The building unit shall put ecological protection and recovery articles into the soil borrowing and spoiling agreement to make sure the waste soil could be disposed of timely and properly. The spoil of the project shall be transported to and used for other projects under construction at the same time by the government recognized transport unit selected by the building unit under the deployment of the waste soil management department.

9.1.5 Influence Analysis of Soil and Water Loss

All surfaces disturbed in the process of project construction will suffer from soil and water loss after being washed by rain due to soil loose. Soil loose may be caused during construction in the following links: during the excavation, filling and formation of roadbeds, the vegetation on the surface will be damaged, and original soil structure will be destroyed and become sloping fields; since the roadbed and the ground on two sides have relative attitude difference, surface runoff is easily to come into being that will bring away soil grain, thus leading to soil and water loss finally. In construction, slag materials of earth and rock on the construction site will also unavoidably generate soil and water loss in case of rainstorm and other situations.

According to site investigation, the project is in flat plain area and the prediction scope of soil and water loss is mainly to protect and prevent the project construction area within responsibility, including public transport station project and metro transit project.

9.1.5.1 The area whose original landform is disturbed and whose land and vegetation are damaged

According to investigation, the project is not built up with any soil borrowing yard or permanent spoil area, and the occupation and disturbance of original landform and the damage of land and vegetation in the period of construction are mainly caused by excavating and filling project and temporary soil staking.

According to statistics, the area of permanent occupied land is 518000m², including 486000 m² for metro transit and 32000 m² for five public transport stations; the temporary occupied area is 10000 m². The area of disturbed original landform and damaged land and vegetation by the project is totally 518000 m².

9.1.5.2 Prediction of soil and water loss

(1) Prediction mode

The amount of soil and water loss is caused by soil borrowing, excavating, disturbing and damaging the original landform in construction, and the calculation formula of each index is as follows:

The amount of soil and water loss of original landform W0:

$$W_0 = \sum P_i F_i T = PFT$$

The overall soil and water loss during the production and construction in the project area (the amount of soil and water loss of soil and water loss area) W:

$$W = \sum P_i A_i F_i T = PAFT$$

The amount of soil and water loss newly added due to the production and construction in the project area Wc:

$$W_c = W - W_0$$

In above formulas: P—erosion modulus of original landform, in t/(km²a); A—accelerated erosion quotients;

F—the area of soil and water loss maybe caused, km²; T—prediction time, in year;

(2) Prediction results

According to site investigation, the background value of soil erosion and soil erosion modulus upon disturbance of original landform within the disturbance scope of project construction are set. Refer to Table 9.1-5 for predicted results of the amount of soil and water loss on disturbed surface in construction and natural recovery periods.

Table 9.1-5 Predicted Results of the Amount of Soil and Water Loss on Disturbed Surface in Construction Period

Prediction units	Forecast period	Background value of soil erosion	Erosion modules upon disturbance	Erosional surface	Erosion time	Background Amount Of Soil Erosion	Predicted erosion loss	New erosion loss
		t/km²a	t/km²a	hm²	a	t	t	t
Metro transit project	Construction period	985	4150	1.3	2	429	903	474
	First year of natural recovery period	985	2075	0.22	1	286	418	132
	Second year of natural recovery period	985	1038	0.22	1	91	96	5

Prediction units	Forecast period	Background value of soil erosion	Erosion modules upon disturbance	Erosional surface	Erosion time	Background Amount Of Soil Erosion	Predicted erosion loss	New erosion loss
		t/km ²a	t/km ²a	hm ²	a	t	t	t
	Subtotal					806	1417	611
Public transport station construction project	Construction period	1320	4150	5.4	2	187	589	402
	First year of natural recovery period	1320	2075	1.44	1	187	294	107
	Second year of natural recovery period	1320	1038	1.44	1	32	25	-7
	Subtotal					407	909	502
Temporary Stock yard	Construction period	1400	6000	1.0	5	87	374	287
	First year of natural recovery period	1400	1800	2.08	1	29	37	8
	Second year of natural recovery period	1400	1400	2.08	1	29	29	0
	Subtotal					146	441	295
Total	Construction period			59.79		1561	3382	1721
	Natural recovery			13.74		797	1385	593
	Total					2358	4767	1579

The amount of soil and water loss is predicted to be 2358t, including 1561t generated in construction period (containing the construction preparation period), 797t in natural recovery period and 1579t of newly added amount of water and soil loss.

Consequently, it is significantly necessary to implement soil and water conservation at the same time of main project design, construction and production in construction. If no soil and water conservation measures are not taken, the bare surface, especially the loose slag will be materially rushed away by rainstorm that may cause deposit, threatening the roads and water conservancy projects and directing influencing the life and production of residents along the line.

9.1.5.3 Soil and water loss influence and damage that maybe caused

The damage of soil and water loss is usually potential. If control is only started upon occurrence, it will not only lead to such problems as land resource damage, land

productivity declining and soil depositing in water systems, but will require of high treatment difficulty and costs; therefore, it is essential to comprehensively analyze the predicted results of soil and water loss based on previously relevant experiences, so as to predict the potential damage of the loss and take corresponding preventive actions.

(1) Damage and influence on land resource

Project construction requires of land acquisition and construction will damage original landform, destroy water conservation facilities, with the growth layer of vegetation being excavated, stripped off or buried, thus permanently changing the properties of original land use and reducing land resource.

(2) Reduce the impact on the ecological environment

Temporary discarded slag in construction shall be piled in temporary stack yards, or otherwise the loose piled soil will cause soil and water loss when raining if no effective measures are taken; while drought will generate raise dust and deteriorate the regional environment. The damage of vegetation along the line also destroys the integrity of relevant landscape.

(3) Influence on water body and water conservancy project

The soil erosion modulus will be increased and large amount of newly added soil and water loss will be led into during road construction, which will increase the sediment contents in rivers and ponds along the line, thus affect water quality; partial soil nourishment will loss and thus lead to water surface pollution and affect water quality.

(4) Influence on road safety

Slopes on two sides of the roadbed are easy to be out of balance after being flushed by rainstorm runoff, thus damaging road facilities and affecting their normal operation.

9.2 Analysis of influence on landscape

9.2.1 Analysis of the townscape influence in the construction period

(1) During construction process, it will affect all kinds of pipelines and pipes ground and underground in municipal engineering in cities inevitably, such as supply and drainage pipes, gas pipelines, heat distribution pipelines, communication power lines. Some pipelines are also needed to be removed and changed, which will cause destruction of city roads and affect civil landscape.

(2) In construction process, it will affect urban sanitation and urban landscape to

stack foundation excavation, earthwork, building materials, especially temporarily stack construction soil and construction waste.

(3) Generally, in construction sites, it will set such quarantine measures as enclosing walls and guard bars, which will bring certain damage to civil landscape.

9.2.2 Analysis of the townscape influence in the operation period

The project strengths the proportion of road greening and reasonable allocation through greening restoration measures. It does not only have comprehensive environmental benefit including protecting road surface, reducing traffic dust and traffic noise, adjusting and improving road microclimate, but also improves landscape environment along roads furthermore and beautifies road appearance.

(1) First, road appearance is the feeling that people acquire through activities along roads. The pros and cons of road greening have great influence on city appearance and the look of cities. The regions which are divided by green lines on both sides of roads are mainly public green landscape belts. When roads extend to city centers, the width of green landscape belts will become narrow gradually. In addition, there are high-rise buildings on both sides of inner rings and middle rings, which seems that streets are narrow. The barrier function of greening can weaken sense of oppression that building give to people. In terms of color, blue sky and green trees are both calming color, which can make people feel calm.

(2) Plant is one of the factors that create cities' beautiful space. With many aesthetic factors including lines, shape, color and aspect change which are peculiar to plants and strong features formed by different trees, viewing periods and means of configuration coordinated with street lamps, waiting area, garbage bins, flower terrace, sculptures, they cannot only form colorful street landscape, beautify streetscape and Tianjin, but also improve city personal status, increase city affinity and provide recreation for urban residents.

(3) Road green space can embellish cities and add shading around street building art to make it stand out. Meanwhile, it can also hide ugliness and shield buildings and structures that affect the view of streetscape and urban appearance. Neat and orderly

greening can provide visual unity and form a kind of peculiar street style.

(4) Green belts along both sides of road also can satisfy high-rise residences' demand of thirsting for green space.

Generally, road greening contents mainly include setting green belt separation and shade trees. On conditional roads, it can also set green belts and landscape sketch on the sidewalks. After each road section of the project is constructed, overall landscape level will have certain improvement compared with that of before construction. However, there are few road sections have occupied original isolation belts or sidewalk greening after widening. In this way, though they are wide, landscape and ecological level of roads are reduced. In this case, construction units should afforest in cities and other places and make total afforested area get compensation. Meanwhile, in design, they should increase intensity of demolition approximately. In particular, planning architectures within red road lines should remove with road reconstruction to the greatest extent. In design, main roads can set greening patterns including shade trees, isolation belts and green islands according to circumstances. And they must set green belts between sidewalks and architectures to the greatest extent to protect internal environment of architectures along the roads from being disturbed by road traffic less.

10 Impact Assessment on Social Environment

Inevitably, the project's road construction will have certain influence on social environment including traffic along the line, economy, public facilities, and so on. Construction units and each construction unit must adopt effective measures and reduce adverse effect that the project may cause to social environment to acceptable degree.

10.1 Traffic Impact Analysis

During construction period of the project, it occupies city roads and disturb city traffic because of engineering requirements. As for different road sections, because of different construction contents, influence degree and influence scopes are not the same either.

Construction contents of some places are complex. Existing road surface is needed to be widened or wiped out or laid again. According to statistical materials, vehicle flow of construction reform sections has reduced substantially compared with pre-construction. Commonly, it is 1/3 to 1/2 of previous roads. The reduced vehicles must be shunted to other roads. Thereby, it causes traffic pressure to these diversion roads. In addition, come-and-go of construction transportation vehicles has also aggravated traffic loading of surrounding roads. Meanwhile, the road sections where are constructing often adopt measures of half construction and half traffic at the construction sites in order to avoid traffic interruption. Half range channel is relatively narrow at large. Its road condition is worse. Vehicle speed can't be enhanced. Thus, traffic jam phenomenon often appears. Obviously, construction process inevitably leads to dynamic changes of original urban traffic and disturb normal transportation pattern, which will bring adverse effect on residents' going out, work and life. In many cases, it will extend transit times of residents and transportation vehicles. Sometimes, it has to reroute and go by a roundabout route, which extends traffic routes relatively.

The contents of construction in some sections are quite simple such as shortcut renovation and replacement of street lamps with minor quantity of construction and shorter period of construction. In terms of these sections, it is advised to make construction schedule and conduct construction without interruption of normal traffic, which will have little impact on urban traffic. The construction unit should limit scope of construction to be nearby shortcut and pile construction materials at the roadside as

much as possible so as to occupy little space of motor way and maintain normal traffic.

The above effects of adverse traffic are temporary, which will disappear as construction is completed. The Project will increase the density of road network in the area, improve traffic environment and realize smooth traffic in the area as soon as it is completed. The construction of the Project is of positive significance to increase of density of urban road network, improvement of structure of road network and optimization of traffic order in Tianjin, which will greatly improve the environment or urban traffic and create convenient and rapid traffic conditions for travel of citizens.

10.2 Analysis of impact on public facilities

Power, communication facilities, drainage, gas, heating pipeline and other public facilities are laid along some existing sections in the project. The project of road network smoothness in the Project is expected to demolish, reroute, transform etc. existing facilities, which will have certain impact on local power supply, communication service, drainage, heating, gas supply etc. In line design, it is advised to reduce demolition of these public facilities as much as possible. Meanwhile, the construction unit should make consultations with authorities concerned, propose policies and repair facilities for replacement before making construction. In general case, normal use of these facilities will not be suspended and life of residents nearby along the line will not be clearly influenced.

Transformation of road works in the Project is able to offer carrier and opportunity for construction of municipal pipeline networks, drainage for instance, in the area, boost improvement of urban water supply and drainage, fuel gas and other supporting pipelines and enhancement of level of service of municipal infrastructures, improve living conditions of local residents and effectively promote construction of harmonious society.

10.3 Socio-economic impact analysis

Overall, the construction of the Project will have two impacts on social economy: on the one hand, local traffic and transportation will be made inconvenient in construction of many sections. In congestion in particular, it will prolong the time of vehicles of traffic and transportation and passengers on travel so as to increase costs of traffic and make influenced individuals and units suffer certain economic losses; on the other hand, road construction is required of participation of design unit, building

company, transportation company, construction material manufacturer and other numerous sections and units. Meanwhile, it is required of recruiting substantial construction workers and supply life materials and social services for them, which will drive job increase in the area, bring certain economic revenues to companies, enterprises and employees and advance development of national economy.

Moreover, the construction of the project will greatly improve current conditions of traffic in Tianjin and raise the level of service of municipal infrastructures, which will be conducive to promoting overall image of Tianjin, improving investment environment in Tianjin, creating a good business atmosphere for enterprises and public institutions, and reducing operation costs of enterprises so as to boost development of social economy.

10.4 Influence on cultural relic protection buildings

According to the construction method of this project, machines causing vibration mainly include: excavator, bulldozer, road roller, drilling bottler, air compressor, heavy transporter, etc. Refer to Table 10.4-1 for vibration intensities at different distances of construction machinery.

Table 10.4-1 Main construction equipment vibration value Unit: dB

Construction machinery	Distance of 10m from vibration source	Distance of 30m from vibration source
Excavator	80	71
Bulldozer	79	69
Road roller	82	71
Air compressor	81	70
Well cementing	63	/
Heavy equipment transporter	74	64

It can be seen from the above table that vibration caused by construction machines gradually decreases as the distance increases. Vibration of Level Z at the point 30m away from the vibration source is less than 72dB, which complies with the requirements of 72dB vibration standards for nights in “mixing zone” in the Environmental Vibration Standards in Urban Regions. But the range within 10-20m from the vibration source is influenced, especially that night construction may cause obvious influence to surrounding sensitive points. Therefore it is necessary to intensify control and management of construction machines causing strong vibration.

According to the relationship between the project and lines of cultural relic unit, the project area involves relatively more relic protection units, especially centralized in

downtown area. After communicating and confirming with relevant heritage sectors, it involves 54 cultural relic protection units and scenic buildings, 2 key cultural relics sites under state protection, 41 Tianjin Municipal cultural relic protection units, 7 regional cultural relic protection units and 4 unclassified cultural relic protection units. After site survey, project construction will not occupy cultural relic protection range, and all of the buildings are outside the red line range, to which construction will not cause direct embezzlement and damage.

According to relevant regulations in the Law of the People's Republic of China on Protection of Cultural Relics, Regulations for Implementation of the Law of the People's Republic of China on Protection of Cultural Relics, and Tianjin Municipal Cultural Relic Protection Regulations, in order to furthest reduce the project influence on cultural relics, the building unit plans to take the following measures to intensify the protection of cultural relics during construction process. It is necessary to restrict construction acitivities strictly within the boundary of righ-of-way, with proper fencing measures. Education of cultural property will be provided to workers to avoid potential impacts on these buildings. Construction activities will be communcaited to the building owners. In case of chance-find, contractors will promptly stop working to protect the site, promptly report to administrative departments for cultural relics and explore and protect to prevent anyone from moving or damaging.

11 Analysis on environmental risk

This project belongs to large-scaled municipal engineering project, and there inevitably exists various accident risks during construction due to the influence of construction method, organization and management, personnel organization, construction environment, construction period and other factors. Activities which may cause major influence to environment mainly include the damage of water supply and drainage pipe and gas pipe due to construction, the explosion of diesel, gasoline fuel and other inflammable and explosive materials used during construction, etc.

(1) Environmental risks caused by damaged water supply and drainage pipe

Most of such risks are caused due to being ignorant of existing underground pipe layout situation in construction region or improper usage of construction machines. Following consequences mainly include sewage and tap water overflowing on roads, resulting in water collection on road surface, and even engineering soil erosion and deposit in drainage pipe. By turning off valves or repairing leakage points, it is able to eliminate such accidents, which basically will not cause large influence on population health and environment quality.

(2) Environmental risks caused by damaged gas pipe

Once the gas pipe is damaged, it will directly cause gas or natural gas leakage and then influence the quality of surrounding atmospheric environment. The more severe influence of such accidents is the existing burning and explosion risk of leaked gas, and rapid increase of gas or natural gas in the air will cause population suffocation. Besides, it will take a certain time period after the occurrence of such accidents for the pollutant concentration in air to reduce to the original level.

(3) Environmental risk caused by burning and explosion of diesel and gasoline

Improper construction management may cause accident burning and even explosion of diesel and gasoline stored in construction site. CO and NOX due to burning of diesel and gasoline will directly pollutes the environmental air, but such accident influence range is within the construction site and basically will not cause larger influence to environmental-sensitive targets outside the construction site. Currently, with relevant departments greatly advocating civilized construction and intensifying site management, the occurrence rate of such accidents has been reduced to a quite low value. Besides, it is generally not allowed to store flammable and explosive

materials when constructing in urban build-up areas. Therefore, there is not much chance of occurrence of such accidents.

There are multiple accident types during the construction period of the above project, most accidents mainly cause personal injury and property loss, and only few accidents will cause direct and obvious influence to the environment. It can be seen from the analysis on accident occurrence reasons that most of the accidents are caused due to improper management and operation mistake, and such situations are caused due to not being clear about the layout direction and burial depth of existing pipelines. Therefore, most of the accidents can be avoided by intensifying construction management, intensifying responsibility awareness and detailed and thorough investigation before construction. Municipal works constructions in Tianjin City basically have not caused no accidents with larger environment risk in recent years.

12 Analysis on cumulative effects with other construction projects in the same period

12.1 Analysis on cumulative positive effects with other construction projects in the same period

Part of the stations in metro transit project and public transport station project in this project are constructed together with metro project. Main synchronous construction sites include No. 5 and 6 lines, most stations on which are located in regions with heavier traffic, such as near the department store. Metro construction has caused traffic congestion to the surrounding environment; however, if metro transit is constructed together with metro construction, it will not obviously aggravate traffic congestion in the surrounding environment. If it starts metro transit project after completing the metro project, it will increase traffic congestion time in this region, and populations taking metro line No.5 and 6 will also be affected. Therefore, synchronous project construction can reduce surrounding traffic congestion time and is beneficial to passengers taking metro line No.5 and 6 to travel around.

In the project, we will upgrade the urban slow traffic system in all partial sections of core zone of the center city area, strengthen the construction of public bicycle demonstration project and add public bicycle rental service points to enable to enhance the integration of public transport system and other green travel, promote the citizens to prefer to public transport for travel, reduce the number of non-motor vehicles and improve the travel proportion of green transport. Thus, the implementation of the project will facilitate to promote the low-carbon transport methods, improve the air quality level in Beijing, Tianjin and Hebei through “vehicle control-emission reduction-haze reduction”, deepen the cooperation with Beijing and Hebei in the fields of ecological and environmental protection, and make greater efforts to treat haze to jointly prevent and control air pollution and improve urban ecological environment.

Urban public transport has the advantages of energy conservation, efficiency and environment protection. Preferential development of public transport is the bound requirement for easing the traffic jam, transforming the urban transport development mode, improving the living quality of people, and improving the basic public service of governments, and is also the strategic choice for building the resource-saving and environment friendly society. The Guiding Suggestions of the State Council on

Preferential Development of Public Transport points that “in urban public transport planning, we shall scientifically set the network layout, and optimize to set important transport nodes for convenient transit to implement functional divisions of various public transport modes, enhance the coordination of individual motor transport as well as walking and bicycles, and promote the convenient connection of transport in and out of the city and integrated development of urban public transport.” The Suggestions for Implementation of Preferential Development of Urban Public Transport in Tianjin points to build the new urban public transport pattern that takes the rail transport as the framework, public buses as the main body, other public transport methods as the supplement, intelligent management system as the method and transport hub as the connection, and strive to realize the construction target of building a public transport city.

12.2 Analysis on accumulative negative efficiency influence with other construction projects in the same period

Part of the stations in metro transit project and public transport station project in this project are constructed together with metro project. Take the rail transit No. 5 and 6 Lines in Tianjin under construction as an example. No. 6 Line construction has been started in December, 2013, and will be completed and operate test run by late 2016; its construction is basically in the same period as World Bank Loan preferred public transport project with loan With the development of metro lines, other metro lines will be constructed one by one, which may be constructed in the same period with this project. Location relationship figure between the project and the metro line No.5 and 6 Lines under construction is as follows.

Station reconstruction in metro transit of this project is conducted in the same period with the project of metro line No.5 and 6. In case of several closely related projects are constructed at the same time, accessing of plenty of construction vehicles, transportation and handling of construction materials and other construction activities will further aggravate pollution influence from dust, vehicle exhaust and noise on residents along the transportation road, and aggravate adverse influence on safe traveling of residents along the line. Besides, simultaneous construction of several projects will cause heavier traffic pressure to traffic along the line, and increase traffic accident occurrence rate.

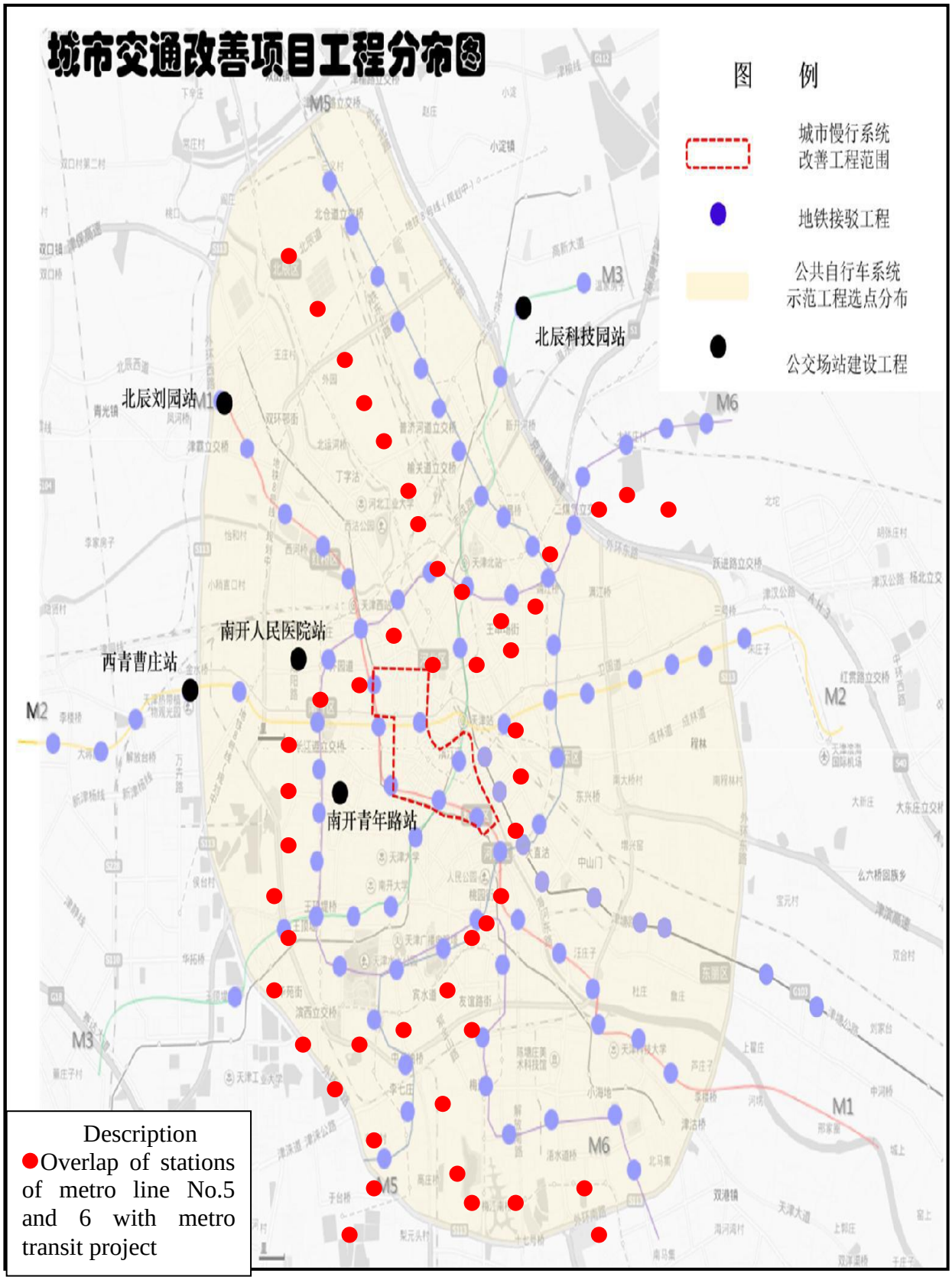
For simultaneous construction projects, it is necessary to combine with the

characteristics of this project and other projects, and noise and flying dust mitigation measures for simultaneous construction have been explained in other special items. In this section, it mainly proposes the following two measures:

(1) Simultaneously set up temporary sites, including construction camp, stock yard, etc. to reduce temporary land occupation.

(2) Spoil resulted from metro transit project and metro project can be mutually utilized to reduce earth excavation and wasting amount.

(3) Intensify the coordination between all the project construction units, conduct unified arrangement to construction machines, construction transportation vehicle traveling lines, transportation time, etc., ensure smoothness and normal operation of roads near the project, and furthest reduce traffic accident.



Attached Map 12Location Relationship Figure between the Project and the metro line No.5 and 6 Under Construction

13 Public participation

13.1 The purpose of public participation

According to the regulations in the Law of the People's Republic of China on Environmental Impact Assessment, the project needs public participation when assessing environmental impact, and main purposes are as follows:

(1) Enable the public to know about and fully recognize the project to obtain better environmental and economic benefits for the project.

(2) Enable the public to know about the influence on environment of the project, being an important approach to coordinate project construction and social influence.

(3) Enable the public to know about the measures to eliminate or relieve environmental impact, and confirm rationality and feasibility of environmental protection measures.

(4) Give chances for the public, especially for those influenced citizens, to express their opinions, propose the public's opinions and requirements on the project, practically protect the benefits of influenced public, and utilize public judgment to improve environment decision quality. Promote the public to deepen their understanding to basic situation of this project and its potential environmental impact, and collect the public's opinions, suggestions and requirements on the project.

Public participation aims at collecting opinions, requirements and willing on project construction of influenced public and it needs to submit the summarized public opinions to administrative component department as reference for project approval.

13.2 Implementation requirements on public participation

According to Law of the People's Republic of China on Environmental Impact Assessment, the Temporary Act of Environmental Impact Assessment of Public Participation (HF [2006] No.28), World Back Business Policy OP4.01 Environmental Assessment and World Bank Business Policy BP17.05 Public Participation, mainly investigate the area along the Urban Transport Improvement Project of Tianjin by Using the World Bank Loans. Those to be investigated mainly include relevant local functional departments and mass group, relevant enterprise and public institutions, schools and directly influenced residents, etc.

13.3 Public participation contents and mode

Investigation modes for public participation mainly include on-line publication, newspaper publication, panel discussion, and visiting and issuing public opinion

questionnaires, with active cooperation with project building unit and various aspects during investigation. Tianjin Environmental Impact Assessment Center organizes special persons to make investigation about adopted modes of public opinion questionnaire in the planned sections of the Urban Transport Improvement Project of Tianjin by Using the World Bank Loans. Personnel of the investigation group firstly introduce basic situations of the planned project in details to the respondents, including project overview, scale, significance and positive and negative impacts and others which project construction may bring to, then the respondents fill in the Public Participation Questionnaire about Environmental Impact Assessment for Urban Transport Improvement Project of Tianjin by Using the World Bank Loans, and finally clear up and summarize for analysis.

Objects to which public participation questionnaires are issued to include influenced residents, schools, hospitals and the public within environment-sensitive targets along the line, and there are 100 investigation samples in total. Collect the attitudes, opinions, suggestions and requirements on this project engineering by asking the respondents to fill the questionnaires, and finally conduct statistic analysis to investigation results and conclude different attitudes, opinions, suggestions and requirements of various persons on this project.

13.4 Statistic analysis on public participation investigation results

13.4.1 Basic investigation situation

Modes of issuing questionnaire along the line and convening small-scaled forum.

13.4.1.1 Questionnaire

(1) Basic questionnaire situation

There are 140 questionnaires in total issued in this investigation (slow traffic system project: 100 pieces, metro transit: 20 pieces, and public transport station: 20pieces); refer to Table 13.4-1 for basic situation. Pictures of current investigation are as follows:

(2) Questionnaire opinions collection

Refer to Table 13.4-1 for investigation results of the questionnaires for each sub-project.

Table 13.4-1 Basic situation of the public participation in investigation

Sub-item Name / Survey item		Slow traffic system sub-project	Metro transit sub-project	Public transport station sub-project
Survey time		2015.7.12-2015.7.15	2015.7.12-2015.7.15.	2015.7.12-2015.7.15
Survey site		Communities and residential areas along the line	Communities and residential areas along the stations	Communities and residential areas along the
Survey way		Issue questionnaire	Issue questionnaire	Issue questionnaire
Quantity of issued		100	20	20
Quantity of collected		100	20	20
The composition of occupation	10	10	2 2	1
	10	10	2	5
	30	30	6	7
	32	32	5	4
	18	18	5	3
Gender	52	52	13	11
	48	48	7	9
Educational background	31	31	6	6
	52	52	12	9
	17	17	2	5

Table 13.4-2 Public opinion summary table

Item		The number of people	Accounted percentage of effective questionnaire (%)
1. How do you know the information about the Urban Transport Improvement Project of Tianjin by Using the World Bank Loans	A Website	14	10
	B Newspaper	20	14
	C Television	0	0
	D This questionnaire	106	76
	E. Others	0	0
2. Which current environmental issue aspects does your local region have	A Non	20	14
	B. noise pollution	47	33
	C. atmospheric pollution; air pollution	65	46
	D Others	8	7

3. Are you satisfied with the environment situation of your current living or working places	A Yes	25	18
	B. More satisfactory	35	25
	C. Dissatisfied	30	21
	D. cannot be designated as; not deserve the name of; to be indifferent; don't mind	50	36
4. Are you satisfied with the traffic traveling in your current living or working places	A Yes	16	12
	B. More satisfactory	31	22
	C. Dissatisfied	72	51
	D. cannot be designated as; not deserve the name of; to be indifferent; don't mind	21	15
5. Which environmental problems will the project cause	A Noise	61	44
	B Dust	62	44
	C Vibration	28	20
	D. Construction Waste	38	27
	E. Gridlock	88	63
	F Others	3	2
6. Which negative impacts may the project cause to your work and life	A Non	22	16
	B Rest	41	29
	C Learning and work	56	40
	D Traveling	62	44
	E Income	5	4
	F. Other aspects	7	5
7. What's your general attitude to this Project	A Actively support	122	87
	B Basically support	15	11
	C Oppose	0	0
	D. cannot be designated as; not deserve the name of; to be indifferent; don't mind	3	2

(3) Analysis on questionnaire statistic results

It can be seen after taking all the above statistic analysis results that most of the investigated public hold supporting or basically supporting attitude to the project construction, but care more about the negative impacts of the construction and operation on the public. Building unit shall intensify governance to construction noise and flying dust, try to keep traffic smooth, and prevent pollution well during operation, especially the works in terms of ecological recovery and noise pollution control.

13.4.1.2 Rap session

This investigation invited the neighborhood committee representatives obviously influenced by the project to the Tianjin Environmental Impact Assessment Center to

have a small forum on July 15, 2015.

During the forum, project group members introduced project overview to the neighborhood committee representatives, all of which expressed that they supported the project construction. They recognized that incomplete current traffic facility and serious traffic congestion would influence residence traveling to different extents, therefore they were quite supportive to the project construction.

13.5 Information disclosure

13.5.1 On-line Publicity

The environmental assessment group published announcements about public participation on it's the website of Tianjin Environmental Assessment Center for twice respectively on June 25, 2015 and July 10, 2015, which introduced project situation, environmental assessment progress, preliminary results of project feasibility, relevant comments on environmental assessment, and information feedback methods and modes. Refer to Figure 13.5.1 and 13.5.2 for relevant pictures.

Figure 13.5-1 The first publication online

Figure 13.5-2 Disclsoure of draft EIA online

13.5.2 Media publication

The project conducts media publication on Bohai Morning News on July 23, 2015 for

the public to browse and download the simplified EIA report from the website of Tianjin Environmental Assessment Center, and refer to Figure 13.5-3.

The final full EA documents were disclosed again in the website of Tianjin Environmental Assessment Center on Septmber 8, 2015.

13.6 Public opinion feedback

13.6.1 Feedback of information announcement opinion

Refer to Table 13.6-1 for the feedback of this information publication opinions.

Table 13.6-1 Feedback of information announcement opinion

Display time	Display mode:	Feedback
June, 2015 (First time)	On-line Publicity	Some residents in Heping District sent emails to query about project progress and construction arrangement
July 2015 (Second time)	On-line Publicity	Some residents from Nankai District and Heping District asked about specific project situations through email, telephone and other forms
	Bohai Morning News	There were some residents calling to ask about project construction scope, hoping to start the construction as soon as possible.

13.6.2 Feedback of visiting opinions along the line

Refer to Table 13.6-2 for feedback of visiting opinions along the line

Table 13.6-2 Feedback of visiting opinions along the line

Sub-item	Place	Time	Participation mode	Problems	Feedback of environmental assessment party
Slow traffic system sub-project	Residents' committee	The first round 2015/6	Questionnaire survey	① Construction influence on traveling ② It is hoped that it can notify about construction in advance ③ Since there are more residents and units in the project area, the road will not be closed during construction to ensure residents living and normal work of units in the local region. ④ Does the project involve in demolition? If yes, please notify truthfully	① Formulate road traffic management planning during construction, and inform of traffic control, road bypass lines, time and places in advance. ② Do not construct from 22:00 pm. to 8:00 am. in residence area and near schools to reduce noise influence on residents and schools ③ Roads are not closed during construction, and there will be corridor left and road block, sign, etc. ④ The project is to optimize and reconstruct the current roads, and will not change red line width. Therefore, it does not involve in demolition
	School, residential area and hospital	The first round 2015/6	Questionnaire survey		
		The second round 2015/7	Visiting along the line		
Metro transit sub-project	Neighborhood committ	The first round 2015/6	Questionnaire survey	① Metro construction	① The construction unit will intensify contact with

	tees and surrounding residents	The second round 2015/7	Visiting along the line	influence on traffic surrounding the project ② Will the construction surrounding metro cause influence on surrounding temporary parking lots and other facilities.	public security traffic administrative department, rationally control traffic flow and direction at the construction site and practically conduct traffic dispersion ② During construction, it will choose other temporary parking berths for occupied temporary parking berths to reduce influence on resident traveling
Public transport station sub-project	Neighborhood committees and surrounding residents	The first round 2015/6	Questionnaire survey	① Influence of dust and noise at night during public transport station construction ② Some communities require that buses under operation shall not blow horn and drive at limited speed when entering and leaving public transport station	① This environmental assessment has proposed limited night construction time, covering the coming and going haul vehicles with tarpaulin and other measures. ③ Set sign boards at public transport stations during operation period

14 Environment protection measures

14.1 Social environmental protection measures

The project construction is finally aimed at improving the traffic environment in Tianjin City, and promoting the harmonious development of the society. Therefore, it is necessary to take necessary prevention measures for the social environment influence resulted in construction process, and ensure to furthest reduce the negative impacts on the society.

(1) Impact mitigation measures

In order to try to reduce the influence on urban residents living and urban traffic by project construction, vehicle driving lines on relevant roads during construction shall be distributed and planned in uniform to avoid traffic congestion; comprehensive arrangement shall be conducted to construction machines and traveling lines of construction transportation vehicles, with relevant restriction regulations being released to ensure smoothness and normal operation of urban traffic, in combination with line changing information in advance through broadcast, television, network, newspaper and other media.

It is necessary to set sign boards in striking positions on construction site to explain main project contents, construction time, completion time and other contents, try to make the public understand the inconvenience brought by the construction, and mark with contact person, complaint hotline and other information on the sign board.

In case of constructing near schools, hospitals and other special sensitive targets, it is necessary to set safe and convenient temporary roads at places where students and patients access, especially for construction near hospital, when the emergency passageway can not be influenced, ensuring normal accessing of ambulances.

(2) Infrastructure supporting measures

Before project construction, it is necessary prepare in various aspects, conduct detailed investigation to power supply, communication, water supply and drainage, gas and other supporting public facilities of roads involved in the project, and confirm demolition and movement schemes for relevant pipelines with relevant departments through negotiation in advance, make various emergence preparation and replacement schemes, ensure not to influence normal supply and operation of water, electricity, gas, communication and other facilities when cutting off various pipelines and pipes during construction, and ensure the normal status of social life. Try not to influence

residents' daily life during pipeline movement and the modification for power, telephone, tap water, etc. shall be completed during non-peak usage period.

Since it needs to consume certain amount of water, power and other energies during road construction, the construction unit shall contact with relevant departments in advance and confirm pipeline connection schemes to avoid conflict with civil energy supply. It is necessary to well prepare for connection of temporary pipelines and reconstruct water and power pipelines for sections with insufficient capacity at local points to prevent temporary water outage and power outage and influence on normal power and water supply of residents and enterprise and public institutions along the line.

(3) Measures of historic preservation

Generally, facilities with vibration will cause noise at the same time, and since vibration is communicated through ground media, its decay rate is higher than noise. Therefore, for vibration, generally, vibration prevention distance for one same facility is less than the noise prevention distance. Therefore, noise prevention and mitigation measures are suitable for vibration. If noise control measures are implemented, vibration influence on environment will also be under control.

It is proved after site exploration that historic buildings surrounding the project are all located outside the red line range; therefore, construction will not cause direct encroachment or damage. It is necessary to conduct cultural relics exploration within the construction site before construction, and promptly stop working to protect the site if any cultural relic is found. Promptly report to administrative departments for cultural relics and explore and protect to prevent anyone from moving or damaging.

14.2 Ecological environmental protection measures

14.2.1 Ecological Protection Measures During the Construction

(1) The spoil of the project shall be transported to and used for other projects under construction at the same time by the government recognized transport unit selected by the building unit under the deployment of the waste soil management department. As the area of project design is large, the building unit will entrust different building units for construction. Since contents for each construction sub-project for this project vary from each other and earth excavation situation varies a lot, it is suggested to add relevant regulations on earth excavation and discarding when the construction part signing contracts with construction units for all the road

sections. The construction unit is required to select transportation unit recognized by the government and transport spoil in strict accordance with the requirements of spoil departments; construction spoil shall be discharged to specified places, to ensure each construction unit to conduct earth excavation and discarding according to environmental protection requirements.

(2) Rationally coordinate earth excavation and filling, avoid earth excavation and filling on rainy days to prevent rain wash from causing water and soil loss, polluting water or blocking water discharge pipes. According relevant regulations in Tianjin Construction Waste Project Spoil Management Regulations, spoil management department shall arrange unified spoil transportation lines and avoid main residential areas.

(3) It generally takes advanced ecological design to reduce the loss for ecological influence reduction. Construction shall be conducted within the land requisition scope, temporary land requisition for construction shall be controlled within the red line of planned road, and construction shortcuts mainly utilize road foundation to reduce construction range, reduce occupation to green land and intensify protection to forest and grass land. Newly built construction camps shall be set in centralization or utilize residence points and enterprises along the line, and try to avoid placing around or disperse placement; domestic wastes of construction personnel shall be treated together and transported outside the construction area, and it is eradicate to throw around and influence local ecological environment.

(4) During construction implementation, it will remove or move certain amount of boarder trees on the two sides of the road. Most of the boarder trees on the two sides of the road are poplar, willow and other greening trees, which do not need special protection. Vegetation coverage will be reduced, and ecological system regulating function will be weakened. However, the ecological influence due to vegetation deterioration during construction is temporary, which will disappear with the project completion. For temporarily occupied land during construction, it is necessary to recover and reconstruct the ecological environment in time after construction. New greening area on the road after project completion is about 66794.58m2, and the greening area after implementing planting project will be larger than that that prior to project construction, which can effectively recover ecological environment impact. For urban greening, it is necessary to perform relevant

regulations within the scope of construction, report temporarily occupied green land for approval and report for approval before recovering, cutting down or moving trees. It is not allowed to arbitrarily trim trees, and ancient and rare trees or precious trees have to be specially protected according to relevant requirements once being found.

(5) Plants and trees influenced by reconstructed road in project construction have to be transplanted to other places which are better to be within Tianjin urban area, and it needs to try to keep them alive and compensate trees and plants damaged by permanent project land occupation.

(6) During road building and reconstruction, it needs to try to build flower bed and lawn and plant other common ornamental trees near isolation trip and buildings to compensate for the reduced greening area.

(7) In order to ensure the safety of construction and traffic vehicles along the line, it is necessary to set up safety fence, safety warning lamp and indication signs on construction site; in view of city view, isolation fence can be covered with advertisement for beautifying.

(8) Demolition and earth excavation during construction shall be orderly started in different areas to avoid messing up landscapes along the line, and if it is not beautiful, it can set up baffle plate (made of wood, glass, iron sheet, etc.) to reduce view pollution.

(9) Strictly control the range of construction site during construction, try to reduce the trample on original greening trees and street accessorial buildings on urban roads by project water discharge, construction waste and activities of construction transport vehicles and personnel, and reduce negative influence on city environmental health and city view.

14.2.2 Ecological compensation measures

Move the trees on separation belt and sidewalk on the original roads which are damaged due to road widening, and keep them alive; plant trees and grasses at intersection and other open spaces after road construction, and set flower bed and lawn and plant common ornamental trees in spaces near buildings. The green land area which is reduced due to project construction can be recovered in other places in the city, increasing overall greening area. According to regulations in Standards of Planting Trees and Grasses in Roads for Tianjin Urban, greening rate of roads with planned red line width of 40-50m shall not be less than 25%; and that of roads with

planned red line width less than 40m shall not be less than 20%.

Equip with sculpture shapes, greening gardens, beautiful and practical trash can, seats, etc. in open spaces between intersection and street sides and buildings, which can not only improve city environment and beautify road view, but also improve city taste, increase city affinity and provide a resting environment for city residents. Greening works on some road sections may be implemented in steps and building unit shall think in long term, such as reserving trees planting space when reconstructing sidewalks to reduce repeated excavation construction on the same road section.

14.3 Prevention measures for air pollution

14.3.1 Prevention measures for environment air pollution during construction

It needs to take feasible measures to prevent dust pollution during construction periods of all the sub-projects of the project, especially that it is necessary to intensify control on construction dust near the construction site in the six districts in the city with close-set environmental sensitive spots. In Tianjin Air Pollution Prevention Regulations, Temporary Method for Dust Control from the Construction Site of Building Project in Tianjin, Tianjin Clean Air Act Scheme and other several files, it has provided quite clear prevention measures for construction dust, which shall be performed strictly. Combined with project characteristics, the assessment provides the following prevention measures:

(1) Formulate and implement dust pollution treatment scheme on construction site and incorporate dust pollution control on construction site into enterprise credit management system as important basis for bidding; each project construction site shall be marked with the name of building unit, name of project principal, contact number, commencement and planned completion dates, construction permit approval number and other sign boards and environment protection measure board.

(2) The entire construction site shall take closing, high fencing, spraying and other project measures, except that the working surface has to be hardened, all other places on the site need to be covered or greened, and earth shall be stored in a centralized manner and take coverage or solidification and other measures; there shall be environmental protection measures to prevent leakage and spraying pollution in the building project construction scheme, and dust control specifications shall be formulated.

(3) The construction site shall be set up with fence to separate the construction

site from outside surroundings, and fence setting height, material selection, entrance and exit setting, width shall comply with relevant regulations; meanwhile, it is necessary to implement simple greening and other measures on open space which will not be developed temporarily;

(4) It needs to try to avoid influence to regional traffic at site entrance and exit, meanwhile set car washing facilities at construction site entrance and exit, arrange special persons to clean wheels and vehicle body and clean up the entrance and exit to ensure that vehicles should start off without mud, and it also needs to be civilly loaded and unloaded during vehicle transportation.

(5) It is necessary to formulate spray cleaning system for the construction site of the building project, and assign special person to be responsible for water spraying and cleaning, at least twice one day (work starting and work leaving); besides, as there are much more dust in reshipping bulk materials, transportation and other procedures, it needs to try best to operate under weather condition with no heavy wind, and it is prohibited to conduct works which can cause plenty of dust when the wind is above Level IV and is quite heavy.

(6) The construction site shall be frequently kept clean, engineering spoil needs to be cleaned up in time, and sidewalk shall be kept clean, tidy and smooth; in case of running by dry earthwork which can easily cause dust, it needs to spray water to control dust, and try to shorten dusting operation time.

(7) Keep the completeness of carriage carrying spoil and construction materials, do not overload during transportation, maintain normal vehicle speed to prevent spilling during transportation, and cover all the transported materials with tarpaulin.

(8) Rationally plan construction transportation vehicle driving roads, and drive according to specified lines; assign special person to clean up soil scattered on road surface and transport out in time; for road sections with higher environment requirements, it is necessary to choose night transportation according to actual situation to reduce dust influence on environment; select transportation modes according to specific conditions, try to adopt large-tonnage dump truck and mechanical loading to reduce transfer link and prohibit overloading transportation.

(9) Regularly conduct supervision to construction dust, construction machine, construction transportation vehicle exhaust, etc; strictly prohibit to use inferior fuel, intensify machinery maintenance to fully burn up power fuel and reduce waste gas

discharge capacity.

(10) The entire project has to adopt commercial asphalt concrete, and it is strictly prohibited to burn any wasted objects and materials which will produce poisonous and harmful gas, smoke and stench on construction site, and it needs to use closed devices to carry molten pitch and other toxic materials; if there is canteen set on the site, it needs to use clean energy, and it is prohibited to use coal-fired kitchen range or store cement and lime in open air during wood construction process to reduce works which need to digest lime, mix with dust on site or cause serious dust pollution; It is strictly prohibited to use wasted construction materials as fuel for burning, and recover ground roads and plants on land occupied by construction after construction completes.

(12) According to relevant requirements of Tianjin Municipal People's Government Office Notice about Forwarding Tianjin Dust Control Regulations about House Demolition Planned by Municipal Bureau of Land and Housing, demolition houses shall be enclosed according to relevant municipal regulations to avoid waste soil spilling; when removing houses and cleaning and transporting project waste soil, it needs to spray water to control dust, and avoid dust pollution; construction site for house demolition shall be enclosed with high fence, sprayed with water to comprehensively control dust, demolition waste and waste soil shall be cleaned and transported out in time, for those which can not be cleaned or transported temporarily, it shall set up storage site, and take coverage, water spraying and other dust-proof measures; in case of running by wind above Level 5 (including Level 5), it needs to stop house demolition construction.

(13) Intensify management, implement management responsibility system, advocate civilized construction, equip with costs for safe and civilized construction measures and ensure to use special fund for special purpose; refer to relevant requirements in Technical Specifications for Urban Fugitive Dust Pollution Prevention and Control (HJ/T393-2007) for technical details of specific implementation of dust prevention measures.

(14) Implement Tianjin municipal heavily polluted weather contingency plan, and stop working on the construction site according to requirements in contingency plan and to heavily polluted weather forecasting grade.

14.3.2 Environment air pollution prevention measures during operation

The main air pollution sources of this project during operation include buses entering and leaving public transport station and vehicle exhaust after road reconstruction. It is prohibited to select obsolete vehicles during project operation, but to use new vehicles with qualified quality and exhaust discharge complying with environmental protection requirements, and ensure good vehicle conditions during operation. The specific measures are as follows:

(1) In order to implement and comply with Notice of the State Council Concerning Atmosphere Pollution Prevention and Governance Plan (GF [2013] No.37) and the spirit Beauty Tianjin Development Outline by the Communist Party Tianjin Committee People's Government (JDF [2013] No.19), according to requirement of The Notice of Oils Quality Upgrade Pricing Policy by National Development and Reform Commission Concerning (FGJG [2013] No.1845), Tianjin People's Government decides that from December 31,2014, the gasoline and diesel supply of the city shall be compliant with national stage 5 standard. Oils quality update is a significant measure to reduce atmosphere pollution, improve ecological environment and build beautiful Tianjin. As per investigation, after motor gasoline standard is upgraded to national stage 5 from national stage 4, Sulfur content limit index is reduced to 10ppm from 50ppm. As a result, after the project in put into operation, the exhaust emission of CO and NOx will be further reduced. 、NO_x 排放量会进一步减少。

(2) Buses in the six districts of Tianjin has widely adopted the new generation of gas-electric hybrid buses. The new-generation gas-electric hybrid public transport vehicle is capable to save 35% of petroleum consumption, and it is suggested that operating units consistently increase the percentage of new-generation gas-electric hybrid public transport vehicles in operation to further reduce exhaust emission.

(3) Intensify road maintenance to keep road in a good operating status and reduce vehicle congestion;

(4) Strengthen vehicle maintenance control to ensure vehicle safety and reduce discharge capacity of exotic gas. Strictly perform national exhaust discharge standards, and vehicles with no exhaust discharge qualification certificate are not allowed to run on the road;

(5) Strictly perform the national vehicle exhaust discharge standards, intensify

annual inspection, road inspection and spot-check system for trial and operating vehicles, intensify vehicle control law enforcement, and control motor vehicle exhaust discharge capacity.

(6) Limit tractor and loading diesel motor vehicles to run on urban roads;

(7) Intensify vehicle maintenance to ensure normal and safe operation of vehicles. Intensify transportation management and ensure safe, civilized and medium-speed vehicle driving;

(8) Further improve traveling conditions of city intersections and traffic arteries to reduce the discharge of harmful substances;

(9) Encourage and support the production and consumption of superior fuel oil, and take measures to reduce the pollution of atmospheric environment by harmful substances in the fuel oil.

(10) Encourage the production and use of compressed natural gas, liquefied petroleum gas, electricity and other clean energies as motor vehicle fuel, and those new vehicles which use clean energy and reach to the discharge standards for the next phase and those operating vehicles which use clean energy and whose discharge is superior to the current discharge standard can exempt spot-check for motor vehicle exhaust;

(11) Intensify greening in interchange area and on road sides, plant arbor, shrub and other trees which can assimilate and absorb pollutants in vehicle exhaust and lawn to control waste gas to spread to surrounding environment, and do greening maintenance well;

(12) Perform environment supervision system, regularly supervise environment air quality along the road line, especially for the supervision on schools, residence areas and other environment air sensitive spots, and formulate environment quality reporting system to take necessary measures according to actual pollution situation to reduce negative impacts.

14.4 Water environmental pollution prevention and control measures

14.4.1 Pollution control cost in construction period

During project construction, the construction unit shall organize and design the discharge of ground water, and strictly prevent vehicle washing water and domestic sewage resulted from construction from discharging and flowing disorderly and polluting environment. Natural rainfall will cause road surface runoff during road

operation, which will cause certain influence to ground water environment. The assessment provides the following prevention measures according to project nature and approaches which may cause water environment pollution:

(1) Construction sewage during project construction contains certain amount of sediment and oil; if it is directly discharged to sewer or spills out and flows randomly without being processed, it will cause adverse influence to water discharge function of the sewer and surrounding ground water environment, and may cause soil pollution. Therefore, construction wastewater shall be simply treated according to actual situations before discharging to municipal pipe network;

(2) It is suggested to respectively build rain water diversion channel and filtering and sedimentation tank within the scope of construction;

(3) Domestic waste, construction waste, maintenance waste and other wastes shall be collected and stored in classification, and these wastes shall be prevented from entering water near the project and causing water pollution;

(4) If vehicle washing water during construction is less in quantity, it can build cement evaporation pond, which shall be buried and flattened after construction and the solids after vehicle washing water sedimentation shall be regularly cleaned up and cleaned and disposed by relevant department in a unified manner;

(5) Design unit shall lead road runoff water into city rainwater pipe network and discharge the same to planned rain water collection water according to relevant plannings when designing water discharge;

(6) There are about 200 construction staff at the rush hours of project construction, generating about 18t/d of domestic sewage, which is relatively less, with main pollutants including COD, animal and vegetable oil, SS, etc. The project plans to set septic-tank near construction camp, and domestic sewage shall be discharged to municipal pipe network after being processed by septic-tank.

14.4.2 Prevention and control measures for water pollution

The source of water environment pollution during operation mainly comes from oil wastewater resulted from vehicle maintenance at public transport station and ground washing, domestic sewage of working staff and transfer passengers and road runoff sewage resulted form rainfall flushing road surface.

According to design materials, all public transport stations implement the sewage, wastewater and rainwater diversion system, and rainwater is discharged to municipal rainwater pipe network after being collected in station rainwater pipe network. Build 1 septic-tank and 1 oil separation tank inside each station, domestic sewage shall be pre-treated by septic-tank, and oil wastewater is discharged to the municipal pipe network after reaching to Level III standards of Integrated sewage Discharge Standard (GB8978-1996) after being pre-treated by oil separation tank.

14.5 Pollution prevention and control measures for solid waste

14.5.1 Pollution prevention measures for solid waste

Solid wastes during construction mainly include spoil resulted from project construction, construction waste and domestic wastes of construction personnel. In order to further properly process solid wastes resulted from the project, the project shall comply with the principles of "reduction, recycling and harmlessness", and take the following measures:

(1) Any solid waste is prohibited to place in surrounding environment randomly.

(2) Recycle solid waste resources. Try to reuse solid wastes of the project as much as possible, and intensify to recycle complete bricks, reinforcement bar and waste iron in construction waste; crush useful waste residue to make into sand pulp after sorting out construction wastes, which can be used in road building. Coordinate the usage of excavation soil for each road and pivotal project, and furthest reduce spoil (slug) amount resulted from project construction.

(3) Do solid waste storage and transportation well near residence areas, schools, hospitals and other sensitive spots along the line, cover temporary storage site with plastic thin film or straw mattress, and set up water saving ditches at surrounding area to prevent water and soil loss.

(4) Domestic wastes of construction personnel shall be stored together, and timely cleaned and transported to city waste disposal yard. Construction wastes shall be timely cleaned up and transported, under unified control of local much department. Since construction solid wastes are distributed in linear along the road, and if they are stored improperly or not disposed in time, it will directly damage the ecological environment along the road. Therefore, it is necessary to intensify construction management to timely clean up and dispose of, so as to reduce and prevent influence from solid wastes.

14.5.2 Solid waste influence mitigation measures during operation period

For domestic wastes at each public transport station during operation, it needs to build centralized waste storage points inside the station, and the sanitation department of the place where the project locates shall regularly clean up the wastes and transport them to domestic wastes disposal site or specified place for centralized disposal.

For dangerous solid wastes produced at public transport stations (belonging to HW08 used mineral oil), it needs to take the following measures: ① during vehicle maintenance, take prevention measures to prevent engine oil spraying, leakage and dropping, and waste oil collecting measures, and take anti-leakage and oil-absorption measures for ground of maintenance workshop; ② it needs to adopt steel barrel, steel tank or plastic products and other containers, and all the containers or storage tanks which are filled and to be transported shall be clearly marked with contents type and harm instruction, quantity and enclosing date, and set up identification marks for dangerous wastes; ③ it needs to implement the "quintuplet piece" system when transferring dangerous wastes, to ensure transportation safety, prevent illegal transfer and illegal disposal, ensure safe supervision of dangerous wastes, prevent dangerous wastes pollution accidents, and hand to the unit which is qualified to dispose of relevant dangerous wastes for treatment.

14.6 Protection and control measures for noise

14.6.1 Prevention and control measures for noise pollution in the construction period

According to Management Methods on Prevention and Control of Environment Noise Pollution of Tianjin (Tianjin Municipal People's Government Order No.6 in 2003), it proposes the following construction noise prevention measures to reduce influence on surrounding sound environment:

(1) Reasonable arrange the construction site

Rationally and scientifically laying out construction site is the main approach to reduce construction noise, and it will reduce influencing range if the solid vibration sources on construction site are in relative centralization; it is allowed to place fixed

machinery equipmentsuch as air compressor and generator in temporary room on construction site, which is set up with acoustic panel or sound absorbing materials inside.

(2) Reasonably arrange the construction time.

On the premise of ensuring project schedule, rationally arrange work time, and try to arrange construction with large noise intensity in daytime (avoid noon break); and avoid kids and patients resting time for construction near kindergartens and hospitals; during secondary and graduation and admission test for primary school students, building unit shall strictly perform the prohibitive and limited regulations on noise pollution prevention issued by environmental protection administrative departments; strictly limit construction with strong noise during nights. It is prohibited to conduct construction of electric saw, air pick, electric hammer and other machinery equipment from 23:00pm on the current day to 6:00am on the next day near residence areas, hospitals and other sensitive targets along the line; if construction is near schools, the construction unit shall negotiate with schools about the operation time of large machines to avoid interference of normal teaching and examination; in case of constructing near schools, hospitals and other environment protection targets which are sensitive to acoustic environment, it is necessary to make comprehensive arrangement to construction period, and try to shorten construction time to reduce negative influence. For projects which have to conduct continuous construction due to technical requirements, building unit and construction unit shall adjust the construction time as 24-hour continuous construction on the premise of being approved by and filed at municipal construction committee and municipal environmental protection bureau, and notify and negotiate with the public which may be influenced, and construct after coming to an agreement.

(3) Rationally arrange driving lines and time for construction transportation vehicles

Construction transportation vehicles, especially for large transportation vehicles, shall confirm rational transportation lines and time according to regulations of relevant

departments, and avoid residential areas, schools, hospitals, science research institutes and other sensitive targets and time periods which can easily cause influence.

(4) Rationally select construction machinery equipment

Construction unit shall try to use various construction equipment with lower noise and lower vibration, and try to have damping and sound insulation accessory facilities; prevent several sets of machinery equipment with high noise from being used on one site and in one time period; construction machinery equipment discharging highly intensive noise shall be equipped with sound isolation baffle or sound absorption screen on the side near sensitive spot to reduce construction noise influence on environment.

(5) Do propaganda work well, advocate scientific management and civilized construction

Due to limitations on technical conditions and objective environment on construction site, construction noise and vibration may still cause certain influence to surrounding environment even after adopting corresponding control policies and measures. Therefore, it is necessary to do propaganda work well to residents and relevant units which may be influenced along the line; Intensify scientific management of construction site, and educate construction personnel about environmental protection awareness; construction unit shall conduct civilized construction in strict accordance with relevant requirements in Regulations of Tianjin Municipality on Civilized Construction Management in Construction Projects, to try to reduce aggravation of construction noise due to artificial factor.

(6) Intensify environment management, and accept environment supervision from environmental protection departments

In order to effectively control construction noise influence on city environment, besides implementing relevant control measures, it is necessary to intensify environment supervision during construction period according to JHF [2004] No.314 Notice on Developing Traffic Project Environment Supervision; Construction unit shall actively accept supervision and inspection of environmental protection

department according to relevant national and local laws, orders, regulations and rules; Building unit shall incorporate relevant construction noise control into contracting contents during project contracting, and assign special persons to ensure implementation of construction noise control measures during construction and project supervision.

(7) Construction unit needs to implement all the construction management systems

Construction unit shall carefully implement Tianjin (1998) No. 228 file Notice about Further Intensifying Night Construction Noise Management, Management Methods on Prevention and Control of Environment Noise Pollution of Tianjin, Regulations of Tianjin Municipality on Civilized Construction Management in Construction Projects, the “quiet project” implemented by Tianjin Municipal Government and other relevant national and local regulations.

(8) Operating persons of pile driver, bulldozer, leveling machine, excavator and other facilities with strong noise source shall wear earplug, and intensify self protection for operating persons.

14.6.2 Protection and control measures for noise in the operation period

1 Public transport station noise pollution prevention measures

(1) Set up speed limit signage in visible location of the station entrance and exit or deploy road humps in the driving line of public transport vehicles, in order to strictly limit speed of vehicles in and out of the station;

(2) Public transport vehicles shall be running strictly in adhere to scheduled time and planned route, prohibited from start up before 6:00AM, prohibited from running arbitrarily in the station area, horn-blowing is prohibited from all vehicles in the station.

(3) Reasonably schedule the departures, reduce the vehicle flow in the station at best efforts, make and strictly implement corresponding institution of vehicle overhaul and maintenance.

(4) Enhance traffic dispersion in the station, and prevent vehicles from vehicle noise due to frequent startup.

(5) All vehicles should depart the station after startup in time, reducing the idling

operation period as short as possible;

(6) Enhance environment protection education to public transport vehicle drivers and administration of public transport vehicle, prohibit vehicles from long period of idling in the parking area before departure, prohibit from uncovered vehicle overhaul and test in the parking area, prohibit from synchronized startup and idling for multiple vehicles.

(7) Select and use hybrid power public transport vehicle to the greatest extent, for station that is out of limits of the noise influence to sensitive spots, it is able to reduce noise influence of the public transport vehicles outstandingly.

2 Environmental protection mitigation measures for slow traffic system project

Road traffic noise prevention measures mainly include line adjustment, movement, acoustic barrier, enclosure wall, regular sound isolation window, ventilation and sound isolation window, noise reduction greening, etc. The sub-project of slow traffic system of this project is mainly to reconstruct the existing roads, reduce motorways and increase bicycle ways on the premise of not changing red line width. Traffic noise influence is somehow weakened. Predict the reconstructed roads according to current vehicle flow, and in areas where there are multiple rows of buildings set along the road; generally, traffic noise influence on the first row of buildings facing the road is relatively obvious, and the influence on the first row which does not face the road is slight. Take the following measures for the roads and surrounding sensitive spots:

(1) Road-related noise prevention measures

1) Reconstruct road and intensify greening belt on road sides, and reduce road noise influence and reduce road ecological influence;

2) Intensify road maintenance and ensure road flatness;

3) Intensify motor vehicle management, and ensure excellent operating state of motor vehicles on road;

4) It it prohibited to blow horn on urban roads.

(2) Road management measures

1) Intensify road maintenance, ensure road surface flatness, and avoid increasing traffic noise due to bad road condition causing vehicle pounding, etc.;

2) Ensure good operation status of motor vehicles on roads, intensify motor vehicle management and inspection, and prohibit disqualified vehicles to drive on roads, especially for loading vehicles.

3) Set speed limiting marks and traffic lights at road crossing intersections or the places where residence areas gather, ensure even-speed driving of vehicles, and prohibit to blow horns;

4) Intensify supervision on road traffic noise, and take remedial measures in time if any noise exceeding standards, to reduce residents interference of traffic noise.

(3) Requirements on control of planned construction along the line

The site survey indicates that the roads involved in the project are in central district of Tianjin, but some undeveloped areas still exist along the traffic lines, which means that new environmental sensitive targets will emerge along the traffic lines in the future. In order to effectively control negative impacts of traffic noise to the development on future roadsides, combined with noise prediction results, this assessment brings forth following suggestions for future roadside planning in the project.

a. According to noise prediction results, the first row of buildings is best to be public building, commercial buildings, public green space or other non noise sensitive buildings, and is optimal to allocate along the road in parallel direction or locate noise sensitive functional areas on the side that is opposite to the road, to reduce traffic noise influence, besides to isolate the noise to second row of buildings, when conducting detailed construction planning with designated noise influence control distance on the roadsides along traffic lines in the project;

b. When conducting detailed planning on the roadsides along traffic lines in the project, it is inadvisable to build noise sensitive buildings at the first rows on the roadside, such as schoolrooms, hospital wards, residence bedrooms, enterprises, technology development units.

c. The planning administration authorities shall specify the interval distance between noise sensitive building and ground traffic facility in relevant planning documentation, to prevent obvious interference from ground traffic noise; the distance could be set with reference to the calculation results of the report and relative approval documentation of environmental protection administration authorities.

14.7 Environment risk prevention measures

The key measure to prevent environment risk during construction is to intensify construction management, and specific requirements are as follows:

(1) Intensify construction management and responsibility awareness;

(2) Before municipal project construction, it is necessary to send construction scheme to water supply, water discharge, power supply, fuel gas and other relevant departments, and construct after obtaining agreement or being approved;

(3) Closely investigate the construction area before construction, clarify existing fuel gas, water, electricity and municipal pipe networks, such as visiting section, etc.;

(4) Assess accident risks, find out the most possible accident types, formulate contingency plans for accident prevention measures, and establish accident emergency group;

(5) The building unit shall regularly organize professional persons to examine relevant persons of construction unit, mainly checking knowledge about environment and safety operation;

(6) Intensify training on safety awareness, operation skills, emergency treatment method, etc. to construction personnel

15 Environmental and economic loss analysis

15.1 Direct economic input for the projects

According to the materials provided by building unit, the total investment for the project is RMB 1.426 billion, mainly used in project design, project construction, equipment purchase, pipeline cutting and change, etc. Specifically, the investment for road network smoothness project is RMB 1.39 billion and RMB 36 million for technical assistance projects. About 43.5% of the gross investment comes from World Bank loan, and the left 56.5% of construction fund is raised by the building unit.

15.2 Environmental protection investment estimation

In order to realize harmonious unification of economic, social and environmental benefits of the project, environment protection input has been emphasized during project construction, and a series of environmental protection measures is taken to furthest reduce project influence on environment. The total investment amount for project environmental protection is estimated to be about rmb 27.09 million, accounting 2.6% of the gross investment. Refer to Table 15.2-1 for specific environmental protection investment estimation.

Table 15.2-1 Investment Estimation Table of Environment Protection Unit: RMB 10,000

Period of time	Contents		Investment	
			Estimated	Total
Construction period	Social environment	Investigation of ground and underground pipelines, etc.	150	198
		Media Information	4	
		Sign boards on construction site	4	
		Temporary alternative facilities for power, fuel gas and other pipelines	40	
	Ecological measures	Storage, maintenance and others of earth excavation and discarding	10	90
		Supplementary plants, tree transplantation, etc.	40	
		Ecological recovery of earth borrowing spots	40	
	Atmosphere	Hardening treatment of construction site	30	112

		Clean up vehicle wheels	10	
		Watering system	30	
		Enclose the entire construction site	40	
		Monitoring	2	
	Noise vibration	Equipment damping and other noise prevention	100	102
		Monitoring	2	
	Sewage	Simple treatment of domestic sewage during construction	4	14
		Treatment of wastewater of vehicle washing	10	
	Solid waste	Project spoil treatment	10	20
		Domestic wastes treatment	10	
	Total		-	536
Operating period	Dynamic compensation	Replant flowers, grass, trees, and other greening measures	800	820
		City sculpture and gardens	20	
	Atmosphere	Road maintenance	50	52
		Monitoring	2	
	Noise	Sound isolation and other noise prevention	1294	1296
		Monitoring	2	
	Total		-	2168
Training on environmental protection technician			5	5
Total			-	2709

The environmental protection investment in Table 15.2-1 does not involve in project demolition cost and the cost for normal road greening according to relevant standards. Among the above environmental protection investment, RMB 5.35 million is used in pollution prevention during construction; in order to avoid causing serious interference to normal living of residents near construction lines, it needs to investigate about existing ground and underground pipelines of corresponding road sections, and take corresponding replacing measures to ensure that water, power, gas and other supplies for residents are not cut off during construction; timely publish various notices, notify the residents which may be influenced through television, newspaper, network and other medias, set construction sign boards at obvious places on the construction site to obtain public understanding and reduce influence on social environment; RMB 900 thousand is invested in ecological compensation, plants recovery, etc. on site during construction; it has invested RMB 2.14 million in

construction site hardening, fence, water spray, noise damping, sound isolation, vibration reduction, etc. of construction machines; and RMB 140 thousand is invested in construction wastewater treatment and solid waste disposal.

Total environmental protection investment during construction is about RMB 21.68 million, mainly for project ecological compensation, noise prevention for residential houses influenced by noise near the road and other sensitive targets, etc.

Invest costs for environment supervision in both construction period and operation period to master actual environmental influence after the project implements environmental protection measures, according to which environmental protection measures can be adjusted and completed.

It can be seen that the project environmental protection investment has strong pertinence, which can furthest reduce negative environmental influence of the project on the premise of sufficiently inputting environmental protection investment and practically implementing environmental protection measures.

15.3 Comprehensive benefits analysis

According to relevant calculations of the project's feasibility study report, the project itself has obvious economic benefits, its internal yield rate is much larger than social discount rate and its payback period is less than 8 years; all in all, the project is feasible, seen from national economy.

Besides, the construction of the project can greatly improve traffic situation in the place where the project locates and improve municipal infrastructure service level, which is greatly important to realize Tianjin municipal planning positioning and promote further development of the city. The construction of the project is beneficial to promote social economy development, improve overall image of Tianjin City, enhance investment environment of Tianjin City, create a better operating environment for enterprises and public institutions and greatly reduce intermediate cost of enterprise operation, and its economic benefits are embodied in the macro category of the whole society.

16 Environmental management and monitoring plan

16.1 Environmental management and monitoring targets

To ensure to effectively implement the environmental protection measures suggested in the assessment and inspect the actual effect of environmental protection measures, scientific and systemic environmental management and monitoring plans must be formulated to minimize the adverse effect on the economy, society and environment in Tianjin from the construction and operation of the project, gain economic benefit, social benefit and environmental benefit of this project to the maximum extent possible, and provide local environmental protection administration with scientific basis for supervision and management of this project.

16.2 Environmental Management Plan

16.2.1 Environmental management system

(1) Institutional setup

According to related national provisions and actual project demands, this project shall be set up with special environmental management organization to take charge of environment supervision, management and monitoring during construction and operation, as well as timely monitor and master the pollution situations contrasting with national environmental protection codes and standards. These requirements shall be included into construction contract and operation management contract.

Since environmental management contents in construction period are quite different from that of operation period, additionally, they are different in working time limit by temporality and chronicity, therefore, independent environmental management organization shall be set up, with corresponding responsible systems performing at relevant stages. Upon the completion of the construction, relevant management organization will be immediately canceled, while the management organization of operation period will be set up. Based on specific situations, these organizations may exist simultaneously for certain period.

Its environmental management system is formed by management agency, executive agency and supervisory agency based on the engineering characteristics and construction body and other situations of this project. Refer to Figure 16.2-1 for details.

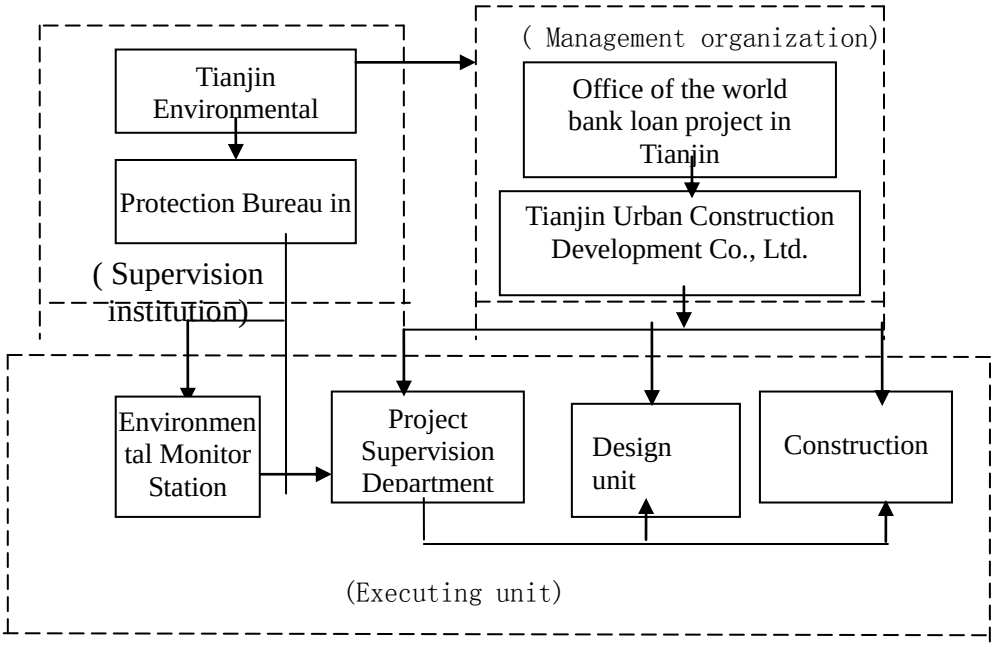


Figure 16.2-1 Schematic Diagram of Environmental Management Agency for this Project

（2）The main administrative responsibilities

a. PMO of TCAC

As the competent authority of industry, the TPMO is responsible for implementing various environmental protection policies, guidelines and regulations issued nationally and by the national and the Ministry of Communications; formulating environmental protection measures and rules of this department; organizing, preparing and monitoring the implementation of environmental protection planning; being in charge of environmental protection statistics; monitoring and managing the pollution control of affiliated units of this project; preparing and implementing the contingency plan of environmental pollution accident; arranging environmental monitoring, scientific research and information service of this department; as well as promoting advanced environmental protection technology.

b. Tianjin Urban Construction &Development Co., Ltd.

As a construction institution assigned by the TPMO, Tianjin Municipal Constuction Development Co., Ltd. is responsible for thoroughly carrying out environment

management measures and rules released by superior competent departments; organizing and preparing environmental protection planning of this project, and monitoring the implementation; taking charge of environmental protection statistics of the entire road and report to relevant departments; being in charge of environmental management and displacement and resettlement service of this project, as well as urging and inspecting the service and maintenance of environmental facilities for this project.

16.2.2 Principles of environmental supervision

In the light of "Notice on Carrying out the Environmental Supervision of Transport Engineering" (JHF[2004] No.314) and "Implementation Program on Carrying out Environmental Supervision of Transport Project" issued by the Ministry of Communications, environmental supervision of this project is based on relevant national and local laws and regulations and documents of environmental protection, environmental impact statement, related technical manuals and design documents and the like. Environmental supervision of this project covers ecological protection, ecological restoration, greening, pollution prevention and control and other aspects related to environmental protection. The project environmental supervision shall be an important part of project supervision, which should be integrated into project supervision system. Due to large scale, long construction period and many environment sensitive points of this project, environmental supervision shall be enhanced during construction period.

16.2.3 Organization and implementation of environmental supervision

(1) Supervision qualification requirements

The building unit shall entrust qualified unit with project supervision qualification to conduct the environmental supervision, and related personnel shall be trained professionally in the aspect of environmental protection; in addition, the qualification of project environmental supervision unit and personnel shall be subject to relevant regulations of project supervision from the Ministry of Communications.

(2) Project bidding, contract and other documents management

Based on related requirements of environmental impact statement, project design and other documents of this project, the building unit shall prepare the environmental supervision plan during construction, and designate clearly environmental protection responsibilities and tasks of the construction unit and project supervision unit in the construction bidding documents, construction contract, project supervision bidding documents and supervision contract.

(3) Basis of environmental supervision

Mainly depend on relevant national and local environmental protection laws, regulations and documents, environmental impact statement of this project and other related technical manuals, design documents, project and environmental quality standards, etc.

(4) Environmental monitoring institution

The chief supervision office of the project is responsible for unified supervision of engineering and environment of construction project. In general, one part-time or full-time deputy chief supervisor for project environmental supervision could be designated to mainly in charge of environmental supervision of this project.

(5) Environmental supervision assessment

Project supervision assessment should include related contents about project environmental supervision; in addition, summary report about project supervision situations should be submitted, which could be used as one of data for single acceptance of environmental protection. When implementing single assessment and acceptance of environmental protection, personnel in charge of environmental protection coming from transport management department should be participated in.

16.2.4 Environmental Supervision & Management Plan

Environmental supervision program is only available in construction period.

(1) Organization and implementation of environmental supervision

Competent administrative departments at all levels are in charge of directing and managing the environmental supervision service in construction period, and the building unit could establish a special “Office of Letters and Calls” and complaints

hotline so as to receive complaints from the public; meanwhile, special persons should be assigned to address problems within limit time. In addition, the environmental supervision in the construction period can be combined with regular environmental supervision work of competent environmental departments. For instance, the “12369” complaints hotline for environmental protection in Tianjin has been accepted widely by the public and plenty of complaints calls focus on noise interference from various kinds of projects. Information fed back from the hotlines of administrative departments who are familiar to the public may be able to more thoroughly show the real pollution situations in this construction period fully. Relevant departments may judge the implementation of environmental protection measures in construction period from site investigation information and complaints statistics, and adopt further rewards and punishment measures.

Project supervision system is adopted in the whole project, and supervising engineers should gain related environmental knowledge, strengthen environmental awareness, and conduct comprehensive quality management to the project as per the requirements of engineering quality and environmental protection. The following aspects can be adopted:

a. At the time of contract awarding, the building unit will list environmental protection measures of the construction period into contract wording to ask the construction unit to implement strictly; and effective reward and punishment mechanism is suggested.

b. The construction unit shall construct in accordance with the requirements of project contract and national and local environmental protection laws and regulations, and realize clean and civilized construction as per environmental protection measures and suggestions stated in environmental impact statement.

c. The supervision departments with corresponding qualification should be entrusted to supervise the project; meanwhile, full-time environmental supervising engineers should be assigned to monitor the construction unit and implement environmental protection measures in construction period.

d. The construction units should appoint a full-time (part-time) manager on the construction site, responsible for the control and the management of various pollution sources on-site. Especially for the construction facilities of high noises and strong vibration, the construction time should be controlled strictly.

e. The project's supervisor is also responsible for promotion work of project construction simultaneously. Because the technological conditions and the construction environments are limited, even though the corresponding control measures have been adopted, the resulting environment pollution is still inevitable during construction. Thus, promotion work should be conducted well to residents along the line and affected areas so as to gain their understanding and coordination to complete project construction smoothly.

(2) Major Contents of environmental supervision focus

Environmental supervision in construction mainly focus on all kinds of pollution factors, especially construction noise and dust problems which are easy to disturb residents. On the basis of engineering features and environment characteristics of this project, this assessment presents the key contents in the construction period as follows:

① Construction noise

Supervision agency should monitor the construction unit to control construction machinery noise, such as the prohibition of construction at night, the installation of sound proof and vibration reduction pedestal, etc. for fixable facilities and whether the construction around schools would affect normal teaching and examination. Visit residents and conduct field monitoring and survey to check the implementation situation of construction noise control measures truly and veritably.

② As to construction dust, it is required to examine whether the construction unit adopts qualified fences, and check the establishment and implementation of watering and cleaning system, stacking and covering measures of muck and other bulk materials, spilling and leakage prevention measures, etc.

③ Waste water

Wastewater in construction period could be discharged only after being simply treated; domestic sewage should be discharged into local sewage pipe network nearby; vehicle washing water should be precipitated and treated before discharging; wastewater treatment level also could be judged in the light of environmental quality around the site and whether the drainage pipeline in the construction area is blocked.

④ Solid waste

Solid waste supervision in construction period focuses on whether the spoil incurred by construction is stored and transported as per relevant regulations, whether secondary pollution prevention measures in environmental impact statement are implemented, and whether related qualified units are entrusted to dispose of hazardous wastes that may be involved in.

⑤ Ecological Environment

Examination mainly focuses on whether construction spoil is discharged at designated place, and existing woods protection situations during construction, site vegetation and ecological restoration after construction, etc.

⑥ Social environment

With regard to social environment, main work includes whether effective measures are adopted to mitigate the adverse effect from traffic, and the implementation situations of compensation for demolition, as well as whether current municipal supply facilities are interrupted for a long term and other aspects.

16.3 Environmental monitoring plan

Environmental monitoring plan is enacted for the purposes of examining the implementation situations and governance effect for various environmental protection measures, checking the effects of implemented environmental protection scheme based on monitoring results, proposing further environmental protection measures and providing scientific basis for implementing various measures and environment management of this project.

Refer to table 16-3-1 for environmental monitoring plan in construction period and operation period of this project.

Table 16.3-1 Environmental monitoring plan

Class	Item		Monitoring method	
			Construction period	Operating period
Ambient air	Pollutant sources		Construction raised dust	Motor vehicle exhaust
	Monitoring factors		TSP、PM_{10}	CO、NO_2
	Executive standard	Quality standard	GB3095-1996 Ambient Air Quality Standard	GB3095-1996 Ambient Air Quality Standard
		Emission standard	—	Limits and Measurement methods for Emissions from Light-duty Vehicles (GB18352.1-2001)
	Monitoring location		Sensitivity targets at and nearby the construction site	Set up the point location combined with the requirements of environmental quality and monitor regularly.
	monitoring frequency		Two day/ month in construction tension period and one time on the morning and in the afternoon respectively everyday	One time every winter and spring respectively, 1-2 days per time, and continuous monitoring for 24h per day
	Implemented by		Environmental Monitor Station	Environmental Monitor Station
	Responsible organization		Tianjin Municipal Construction & Development Co., Ltd.	Tianjin Municipal Construction & Development Co., Ltd.
	Supervision institution		Local Environmental Protection Bureaus	Local Environmental Protection Bureaus
Environmental noise	Pollutant sources		Noise from construction machinery	Traffic noise
	Monitoring factors		L_{Aeq}(dB)	L_{Aeq}(dB)
	Executive standard	Quality standard	GB3096-93 Standard for Environmental Noise of Urban Area	GB3096-93 Standard for Environmental Noise of Urban Area
		Emission standard	GB12523－90 Noise limit for construction site at boundary	—
		Measurement standard	GB／T14623－93 Standard of Environmental Noise of Urban Area	GB／T14623－93 Standard of Environmental Noise of Urban Area
	Monitoring location		Noise sensitive points at construction field and nearby area of project	Monitor regularly combined with environmental quality in Tianjin
	monitoring frequency		1day/month, twice per day (daytime and nighttime)	2 time/year, 2 day/time, and one time separately in the day and at night.
	Implemented by		Environmental Monitor Station	Environmental Monitor Station

	Responsible organization	Tianjin Urban Roads and Pipe Network Auxiliary Construction Investment Co., Ltd.	Tianjin Urban Roads and Pipe Network Auxiliary Construction Investment Co., Ltd.
	Supervision institution	Local Environmental Protection Bureaus	Local Environmental Protection Bureaus
Surface Water	Pollutant sources	Wastewater of construction camp	—
	Monitoring factors	SS, BOD, COD, ammonia nitrogen and petroleum	—
	Executive standard	GB8978-1996 Integrated Wastewater Discharge Standard (Class III)	—
	Monitoring location	Sewage discharge outlet at construction site	—
	monitoring frequency	Monitor once monthly, 1-2days per time and select the sewage at normal discharge time per day	—
	Implemented by	Environmental Monitor Station	—
	Responsible organization	Tianjin Urban Roads and Pipe Network Auxiliary Construction Investment Co., Ltd.	—
	Supervision institution	Local Environmental Protection Bureaus	—

When the monitoring plan is implemented concretely, local environment monitoring station shall make a detailed and feasible monitoring plan based on actual facts, covering monitoring point location, time interval, frequency, monitoring factors, etc. Environment management department and the building unit can evaluate whether the implemented environmental protection measures have achieved a desired effect based on environmental supervising results, adjust environmental protection management plan timely, promote further implementation of various environmental protection measures and take remedial action for some substandard situations.

In addition, based on monitoring situations of road traffic noise and vehicle exhaust in some international and domestic cities, it is recommended that automatic noise monitor, automatic vehicle exhaust monitor and other devices can be set at typical road sections or as required for this project, continuous monitoring is conducted to road pollution, and the monitoring data should be reported timely to the public or on-line transferred to relevant competent departments.

17 Conclusions and suggestions

17.1 Project Overview

The total investment of the project is RMB 1.426 billion, wherein, RMB 0.62 billion is the loan applied with the World Bank, and the rest is from the municipal finance. The project content includes two parts: road network smoothing project and technical support project. The project is planned to commence in 2015 and end in 2019.

The road network smoothing project includes green transport (slow traffic system) improvement project in the core zone of center city area, metro transit project, public bicycle system demonstration project and public transport station construction project:

① Green transport (slow traffic system) improvement project in the core zone of center city area: we plan to upgrade 42 roads within the scope of about 7.2 km2 in the center city area of Tianjin, and the total length of roads involved is about 49.7 km.

② Metro transit project. This project constructs connection facilities in peripheries of 111 stations in total of metro line No. 1, 2, 3, 5, 6 and 9 of Tianjin, which covers 486,588m2 in total.

③ Public bicycle system demonstration project. This project constructs a sound public bicycle operation management system, arranges 446 public bicycle rent stations in total in peripheries of metro stations and purchases 12,370 public bicycles.

④ Public transport station construction project. A total of 5 public transport stations are constructed downtown, covering 32,000m2 and 13,200m2 in the area of land and building area respectively.

17.2 Present condition of environmental quality

(1) Social environment

The project involves 204 various environment sensitive targets in each district in Tianjin, among which, there are 134 sensitive points for residences, 7 for hospitals, 8 for various schools and 1 for kindergarten; all sensitive points cover the total population of about 14,350.

This project involves 54 culture relic protection sites and style buildings, of which there are 2 key cultural relic sites under the state protection, 41 culture relic protection sites under Tianjin municipal protection, 7 culture relic protection sites under district protection and 4 culture relics with unconfirmed protection grade.

(2) Ambient air

According to the 2013 annual report, in Tianjin, the average concentration of sulfur

dioxide (SO2) was 59mg/m3, lower than the annual average concentration standard (60mg/m3); the average concentration of nitrogen dioxide (NO2) was 54mg/m3, 0.4 times greater than the annual average concentration standard (40mg/m3); the average concentration of inhalable particle (PM10) was 150mg/m3, 1.1 times greater than the annual average concentration standard (70mg/m3); the average concentration of fine particle (PM25) was 96mg/m3, 1.7 times greater than the annual average concentration standard (35mg/m3)

Over the years, the concentration of sulfur dioxide and nitrogen dioxide had decreased significantly and in the recent two years, the concentration risen a little; the concentration of inhalable particle had decreased significantly, but raised significantly in 2013.

(3) Acoustic environment

In light of Tianjin Environmental Quality Statement, the average day-time sound level of environmental noise in city area in Tianjin is 54.9dB (A), and the acoustic environment quality is rated as "better". The average sound level of Tianjin road traffic is 68.0 dB (A), and the acoustic environment quality is rated as "good"; the sound level of road traffic noise in city area focuses on 66-70 dB (A), and that of 30 km road section is more than 70 dB (A).

The monitoring statistical results about acoustic environment quality in selected site show that the day-time monitoring data could reach the standard basically, while some current night-time noise sound values exceed the specified standard.

(4) Ecological Environment

The proposed area along the roads of project is mainly as the urban artificial ecological system leading by human beings and based on transportation, featuring rare natural vegetation, sparse distribution of artificial vegetation and simplex biodiversity. Most of current roads are made green by arbors and a few shrubs on sidewalks, and no trees or rare trees are planted on sidewalks on part roads due to narrow sidewalks; and the new requisition lands are occupied by enterprises and a few orchards.

17.3 Plan compliance

Confirm to Tianjin General Urban Plan (2005-2020) and other regulations.

17.4 Main Environmental Impacts

(1) Social environment

Previous narrow and crowded roads and unsmooth traffic conditions are changed

through project construction; adverse effects on residents travel and other aspects would be incurred during construction period; by relevant alternative facilities, adverse effect is generated obviously on nearby residents' living when removing part of original electricity and communication network along the road; in general, the road construction at project location will promote significantly the economy development of Tianjin and even the overall country. Effect on culture relics around the site.

(2) Water Environment

Domestic sewage could be discharged into municipal sewage pipe network nearby in construction period; the volume of water incurred for vehicle washing is little, which has no obvious significance to water environment after necessary treatment measures.

After the project puts into operation, the wastewater generated is mainly staff domestic sewage, sanitary sewage and oily wastewater from small kitchens, among which, staff domestic sewage and public sanitary sewage are precipitated via septic-tank, while the oily wastewater is discharged with other domestic sewage together after treated via oil separator; the key pollutant concentration of the discharged sewage in operation is forecasted to be able to meet the (Level 3) standard of Integrated Wastewater Discharge Standard (DB12/356-2008).

(3) Ambient air

Fences and effective watering and dust suppression measures are taken in construction to minimize construction dust effect on environment; in general, asphalt fume has no obvious effect on the area 50m away from the construction site. Public transport vehicles stop uncovered, and exhaust emission volume is minor with a discontinuity pattern, besides, the project location area is open and wide therefore will be advantageous for pollutant diffusion, it is estimated that public transport vehicle emission will not significantly impose influence to surrounding environment in operation period. Obsolete vehicle models are prohibited in project operation period,

(4) Acoustic environment

Noise incurred by mechanical equipment has certain effect on ambient environment in construction; therefore, necessary control measures should be adopted as per relevant requirements. In the light of predicted results, vehicle in and out of the public transport station would have a certain effect on ambient environment after the project is put into operation.

(5) Solid waste

Solid wastes in construction period are derived from spoil, construction rubbish, etc., which would not produce secondary pollution to the environment through separate collection, recovery of available materials, outward transport to treatment for other parts and other measures.

(6) Ecology landscape

In construction process of this project, part green land and road green belt would be removed for the reasons of road broadening and transformation and existing vegetation would be destroyed on site due to borrowing earth; at this time, corresponding greening compensation, trees transplantation, vegetation recovery and other measures can be taken to minimize the effect on ecology; the construction site would also affect the urban landscape to some extent, while such effect would disappear when this construction is finished. More scientific and rational road greening would be conducted as per related standard upon the completion of project, which will be in favor of the improvement of landscape environment along the road.

(7) Environmental risks

Main impacts possible on environmental quality during construction period of this project include: drainage pipeline and gas pipeline destruction due to construction, diesel, gasoline and other flammable and combustible explosion during construction, etc. However, as long as construction management and consciousness of responsibility are strengthened, most of these accidents could be avoided.

17.5 Public participation investigation

This project conducts public participation as per relevant requirements of Law of the People’s Republic of China on Environmental Impact Assessment and the Temporary Act of Environmental Impact Assessment of Public Participation. Firstly, twice disclose the information contents required to be publicized, and then collect public opinions by means of public participation questionnaire. Totally 100 effective public participation questionnaires are collected. According to statistical results, most of those surveyed show their support and basic support opinions for this project construction; what public concerned commonly focus on noise and dust control during road construction, inconvenient citizens' activities in construction period, traffic noise in operation period, etc.

17.6 Environment protection measures

(1) Social environmental protection measures

In order to relieve project construction effect on traffic, conduct unified distribution and planning and release routine change information via media in advance in construction period; complete displacement, resettlement and compensation in the light of relevant requirements and standards; before construction, make a survey of public utility network related to this project, and make a preparation for emergency. Road engineering of this project could be constructed to the greatest extent after confirming related municipal pipe network and other supporting facilities construction scheme, so as to avoid reduplicate impact on environment due to repeated construction at the same road section.

(2) Ecological environmental protection measures

Regulations on soil borrowing and disposal shall be supplemented in the contract signed by the building unit and the construction unit, the expense for greening compensation and others should be included in the cost of soil project, and spoil shall be disposed at designated place; arrange earth excavation and backfilling properly; pay attention to nearby vegetation protection during the construction; the greening work along roads' sides shall meet the requirements of greening standards stipulated on Tianjin Urban Road Greening Construction Standard; after the construction, it needs to restore damaged vegetation and reduce landscape pollution during the construction.

(3) Atmospheric environmental protection measures

During construction, it needs to abide by the requirements of Regulations of Tianjin Municipality on Prevention and Control of Air Pollution and other rules, and properly carry out dust prevention and control measures, which mainly includes the construction plan for preventing leakage harmful to the environment, hardening the floor on construction site, specially arranging people to clean vehicles and the entrance and exit, and reasonably settling places for stacking bulk material, etc.

(4) Water Environment protection measures

During construction, discharge of surface water shall be designed and organized by the construction unit and disorderly drainage shall be forbidden; waste water from the construction shall be simply disposed before flowing into municipal pipe network; and it needs to build rain drainage channel and filtering and sediment tanks separately. During operation, pay attention to snow-melting agent, which might lead to green land pollution caused by melting snow; the road surface runoff shall be led to

corresponding receiving water as planned.

(5) Protection and control measures for noise

Measures necessarily taken towards noise prevention during the construction include: the construction unit shall construct abiding by relevant laws and regulations of the state and Tianjin City; arrange the construction site and working hours in a reasonable way; strictly control construction work with strong vibration during nighttime; negotiate with school authority to confirm working hours for construction with noise pollution when constructing near sensitive objects like school; propose scientific management and civilized construction; and prepare popularization work for influenced nearby inhabitants and organizations.

In order to reduce noise pollution from transportation during operation, the building unit shall ensure high quality project by exercising tight control on the construction quality and optimizing bus models and specifications.

(6) Solid Waste Prevention and control Measures

Solid waste such as construction debris shall be grouped and classified. Reuse or apply recyclable waste to nearby road filling, and transport non-recycling waste to designated place for disposal by relevant sectors under disposal agreement; try to transport spoil to the designated place at one time to avoid pollution cause by repeated transportation; transport spoil by sealed or well-covered vehicles, avoiding overload transportation and leakage of spoil; entrust disposal of possible dangerous waste to qualified sector; list pollution prevention measures onto spoil disposal agreement, which shall be implemented by relevant sectors accordingly.

(7) Risk prevention and control measures

Before the construction, the building unit shall carry out a thorough investigation on existing municipal pipe network, send construction plan to relevant sectors for water supply, drainage, power supply and gas supply, and start construction and formulate accident emergency plans after the plan is approved by above mentioned relevant sectors.

17.7 Environmental management and monitoring plan

Due to the inevitable existence of environmental pollution during the construction and the operation, it is necessary to make a systematic and scientific plan for environment management and supervisory control, make sure all measures are put into effect and check out the real effects after implementing these measures. Environment

management and monitoring control shall be done under the supervision of Tianjin Environmental Protection Bureau and environmental protection bureaus at district level; meanwhile, it needs to strengthen management on dust and noise during the construction and environment protection during the operation, and do supervisory control on environment well during construction and operation.

17.8 Analysis on profits and loss of environmental economy

The total capital for the project is RMB 1.587 billion, of which RMB 27.09 million is for environment protection, which accounts for 2.1% of the total investment. The investment during construction is mainly distributed to perform prevention measures against noise and dust pollution, as well as measures to alleviate negative influence on the society, while the investment during operation is mainly used for drainage pipe network, road greening, dwelling houses sensitive to noise pollution, etc. Under the condition of abundant investment on environment protection and practicable execution of environment protection measures, the project is expected to reduce the effect on environment to the acceptable extent.

17.9 Overall assessment results

The project is in accordance with the urban overall planning, and will bring obvious social, environmental and economic benefits. During construction and operation, the project will affect the environment at different levels; however, the effect will be effectively minimized by adopting various protection measures. Under the condition of seriously implementing each and every pollution prevention measure mentioned in the report, the project is environmentally feasible.

17.10 Recommendations

(1) It is suggest to reserve 30-50m belt distance on both sides of roads for anti-noise protection in the planning.

(2) It is suggest to make sufficient planning during the construction of the project, mutually coordinate short-term and long-term plannings, as well as road and supporting facility plannings, avoid repetitive input of manpower, materials and money for the same road section, and reduce the negative effects on the society and the environment.

(3) During construction, it is allowed to try on various means to reduce noise, for example, erecting the surface of new road by mixing with old waste tires and road surface with sound absorption functions, thus reducing noise pollution from

transportation from the source. Such test sections are suggested to locate on districts requiring higher standards for anti-noise protection.

(4) The design of passageways at both sides of roads without barrier shall be scientific and reasonable and it is suggest take the passage of non-motor vehicles into consideration to avoid disadvantages from co-existence of motor and non-motor vehicles.

(5) It is suggest to adjust the position of greening belts on wider sidewalks, locate greening belts on the outside of sidewalks, selectively choose the shapes and plants for greening belts to reach the effect of anti-noise protection and reduce the effect on sensitive objects nearby roads.

(6) It is recommended that automatic noise monitor, automatic vehicle exhaust monitor and other devices can be set at public transport stations, for continuous monitoring to pollution in surrounding environment during operation, and the monitoring data should be reported timely.