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Environmental Impact Assessment

For

Western Changsha Terminal

Environmental Impact Assessment Center of

Hunan University

March 21, 2011

TABLE OF CONTENT

1. OVERVIEW

1.1 Background and Significance of the Project

China's transportation is facing significant challenges in energy saving and CO2 emission reduction. With rapid economy growth, transportation has become a major consumer of energy and a major source of CO2 emissions in China. According to the International Energy Agency (IEA), the transport sector accounted for more than 38% of total crude oil consumption in China in 2007. According to the Ministry of Transport (MOT), the amount of CO2 emissions generated from transport—roughly 290 million tons in 2004—is estimated to double by the end of 2015 and reach 1.1 billion tons in 2030.

To achieve energy saving and CO2 emission reduction amid the anticipated continuing rapid growth in transport demand, the transport sector must seize all opportunities in a strategic way to promote eco-transport—a way of sustainable transport development that is resources saving and environmentally friendly. Multi-modal integrated transport development in the rapidly growing city clusters is such an opportunity.

GoC established the National Strategy of "Resource-saving and Environment-Friendly Society" in 2004. In 2007, GoC started a new initiative targeting at the city clusters, and approved the city cluster of Changsha-Zhuzhou-Xiangtan as a pilot. In 2008, the government of Hunan Province and the Ministry of Transport have agreed to take joint initiatives to implement the pilot of the city-cluster based SUTS. A special attention is given to tapping the potential of inland waterway transport as a region-specific unique transport resource with sizable transport capacity, lower energy consumption, lighter pollution and lower requirements for land.

In this context, this project aims to develop and implement a strategy for city-cluster based sustainable urban transport systems (SUTS), focusing on capacity building, policy and institutional innovations, and with a pilot demonstration in the city cluster of Changsha-Zhuzhou-Xiangtan. It has an overall goal of increasing the efficiency of resource use, reducing transport energy consumption and GHG emissions while meeting the need for transport accessibility and mobility in city clusters. It is hoped that the project will create a national best/good practice model for city-cluster based low-carbon transport system. The success of the project will also provide an important reference for other developing countries.

The Western Changsha Terminal is selected for pilot demonstration of design. It is an existing bus terminal located in the Wangchengpo Economic Zone of Changsha. The terminal is designed to be dismantled and reconstructed in order to function as the hub for long-distance bus, urban public bus transport

and urban rail in the future.

At present, transport facilities of the existing Changsha West Bus Station are becoming old, and the bus station lack of reasonable management planning. The service provided by the station cannot meet the increasing passenger transport need. Therefore, to build a new advanced transport terminal is urgently necessary.

1.2 Policies, laws and institutional framework

1.2.1 EIA procedure in China

A complete and mature EIA management procedure has been established in the PRC. The EIA management procedure is based on *Environmental Protection Law*, *Management Regulations of Environment protection of Construction Project, Law of the People's Republic of China on the Environmental Impact Assessment*, and *Notice on Enhancing Management Work of EIA of the Construction Project loaned by International Finance Organization* (No. 324, MEP, 1993). The latter regulated the management procedures during each phase of environmental impact assessment for construction projects. The technical guidelines for environmental impact assessment published by Ministry of Environment Protection (MEP) indicate the requirements and technical methods in preparing EIA outlines and EIA reports.

As required by the EIAL and the construction project environmental inspection administration order, the Environmental Impact Assessment Technical Guideline[1] is provided by the Ministry of Environmental Protection (MEP). this includes (i) the assessment procedure after screening, (ii) an outline environmental assessment report model table of contents, (iii) an environmental impact assessment report (EIAR) model table of contents, (iv) analysis method for construction activities, (v) environmental investigation and survey method, (vi) impact estimation method, and (vii) impact evaluation method. This provides recommended detailed environmental impact estimation methods such as mathematical models for pollutant concentrations.

Screening. According to the EIAL (article 16), project environment reports are classified into three levels depending on their environmental impact magnitude: (i) an EIAR for projects with significant environmental impacts, (ii) an environmental impact registration table (EIRT) for projects with some environmental impacts, and (iii) an environment registration table (ERT) for projects with minor or no environmental impacts. An EIAR is a full set of

[1] HJ/T 2.1-03, promulgated on 20 October 2003.

environmental impact assessment report. An EIRT is an environmental assessment report with fewer requirements. Both the EIAR and EIRT should be prepared by qualified consultants. The MEP administers environmental consultants' licenses. For ERTs, the project owner can fill the project information without qualified consultants.

The MEP provides a table for projects' environmental classification.[2] Project owners have prime responsibility to determine the classification and prepare the EIAR, EIRT, or ERT. The MEP or local environment department approves the project owner's classification on the basis of submitted environmental documents.

1.2.2 EIA preparation of the Project

The Chinese EIA classification regulation requests an EIA report for the project.

The project is classified as Category B as per OP4.01 due to its limited scale of civil works and anticipated environmental and social impacts associated with the Western Changsha Terminal. Based on the environmental screening and assessment, the following safeguards policies are triggered: 1) OP4.01 Environmental Assessment; and 2) OP4.12 Involuntary Resettlement.

Accordingly, an EIA report was prepared by Environmental Impact Assessment Center of Changsha University in December 2010. The Hunan University conducted site survey to understand the surrounding environment of the project site, collect environmental baseline information. Environmental quality was monitored and analyzed. Based on the feasibility report provided by the IA, the draft EIA report was prepared.

Based on the EIA, the MOT engaged an independent EIA consultant to prepare English version EIA and EMP.

1.3 Assessment Principles

1.3.1 National Laws and Regulations

(1) *Environmental Protection Law of the PRC*, Dec. 26th, 1989
(2) *Environmental Impact Assessment of the PRC*, Sep., 2003
(3) *Water and Soil Conservation Law of the PRC*, June 29th, 1991
(4) *Land Administration Law of the PRC*, Aug. 28th, 2004
(5) *Law of the PRC on the Prevention and Control of Air Pollution*, April

[2] Ministry of Environmental Protection. 2002. *Construction Projects' Environmental Classification Table.* Beijing.

29th

(6) *Law of the PRC on the Prevention and Control of Water Pollution*, June 1st, 2008

(7) *Law of the PRC on the Prevention and Control of Pollution from Environmental Noise*, Oct. 29

(8) *Law of the PRC on the Prevention and Control of Environmental Pollution by Solid Waste*, Dec. 29th, 2004

(9) *Agriculture Law of the People's Republic of China*, Dec. 28th, 2002

(10) *Law of the PRC on the Urban and Rural Planning*, Oct. 28th, 2007

(11) *Rules of Environmental Protection Management for Construction Projects, issued by the State Council of PRC,* November 29, 1998;

(12) *Classification Inventory for Environment Protection of Engineering Project* issued by the MEP, January 1, 2003;

(13) *Measures Concerning Environmental Protection and Management for Transportation Construction Projects,* issued by MOC, May 22, 1990;

(14) *Notice to Strengthen the Environmental Impact Assessment and Management of Construction Projects Financed by Loan from International Financial Organizations*, jointly issued by MEP, the State Planning Commission, the Ministry of Finance and the People's Bank of China, June 21, 1993.

(15) *Public Consultation Method during Environmental Impact Assessment,* MEP, 2006

1.3.2 Local Regulations

(1) *Environmental Protection Regulations of Hunan Province*, May 2002

(2) *Surface Water Function Zoning in Hunan Province*, DB43/023-2005

(3) Regulation on Prevention and Control of Water Pollution for Catchment of the Xiangjiang River

(4) *Regulation on Construction Waste Transportation*, Changsha Municipal Government

(5) *Notice on Implementation of Air Pollution Control Measures*, Changsha Municipal Government, 2001

(6) *Management Method for Dust Control in Urban Area of Changsha City*, Changsha Municipal Government, 2005

(7) *Air Quality Zoning of Changsha City, Changsha* Municipal Government, 2005

(8) *Notice on Implementation of Second Phase Dust Control Measures*, Changsha City, 2004

(9) *Environmental Noise Functional Application Zoning in Urban Areas in Changsha City*, Changsha Municipal Government, 1994

(10) *EIA Technical Guideline for Controlling Dust from Construction Sites in Changsha*, Changsha EPB, 2008

1.3.3 World Bank Safeguard Policies

The following World Bank safeguards policies are triggered as a result of environmental and social issues screening. Because the the scale of work and potential social and environmental impacts are of temporary and limited nature, the project is categorized as B for EA purpose in accordance with OP4.01 Environmental Assessment.

(1) OP/BP4.01Environmental Assessment
(2) OP/BP4.12 Involuntary Resettlement

1.3.4 Technical Specification and Guidelines

(1) *General-EIA Technical Guideline*, HJ/T2.1-93;
(2) *Ambient Air- EIA Technical Guideline*, HJ/T2.2-2008;
(3) *Surface Water- EIA Technical Guideline*, HJ/T2.3-93;
(4) *Acoustic Environment- EIA Technical Guideline*, HJ/T2.4-2009
(5) *Technical guidelines for environmental impact assessment - Ecological environmental of nature resource development*, HJ/T19-1997, 1998.06
(6) *Technical Specifications of Soil and Water Conservation for Development and Construction Project*, SL204-98
(7) *Ambient Air Zoning Principal and Technical Method*, HJ14-1996
(8) *Environmental Noise Functional Application Zoning Principal and Technical Method*, GB/T15190-94
(9) *Technical Method for Dust Control in Urban Area,* HJ/T 393-207
(10) *Notice on the Noise Issue in the EIA for Road and Railway projects,* Huanfa [2003] 94

1.3.5 City Master Planning and Special Planning

(1) *Master Plan of Changsha City (2003-2020)*, Changsha Municipal Government
(2) Strategic Development Plan of Great Hexi Pilot Area of Changsha City
(3) Hunan Provincial 11th Five-Year Plan 2015 Long-term Plan of Transportation Station Development
(4) Changsha Municipal 11th Fiver-Year Plan of Transportation Development (2006-2010)

1.3.6 Related References

(1) *Feasibility Study Report of Western Changsha Terminal at Wangchengpo District*, Longxiang Transportation Development Group, December 2008
(2) *Revised Project Proposal of the Western Changsha Terminal at*

Wangchengpo District, Longxiang Transportation Development Group, September, 2010

(3) *Revised Project Design of the Western Changsha Terminal at Wangchengpo District*, Longxiang Transportation Development Group, January 2011

(4) *Environmental Assessment Report for the Western Changsha Terminal at Wangchengpo District*, Hunan University, January 2011

(5) *Preliminary Design of the Lituo Bus Station of Changsha City*, Hunan Longxiang Transportation Development Group, June 2009

(6) *Environmental Assessment Table for the Western Square of Changsha South Railway Station*, Changsha Research Institute of Environmental Sciences, July 2007

(7) *EIA report for the Line 2 Subway of Changsha City,* China Railway No. 4 Survey and Design Group Co. Ltd., February 2009

1.4 Environmental Screening and Assessment Classes

1.4.1 Surface Water

Waste water generated by the project includes domestic sewage, waste water from canteen and car washing. Domestic waster can be treated through septic tank, waste water from restaurant and car washing can be pre-treated by oil-filter tank and then discharge into urban sewer network to Yuelu Waste Water Treatment Plant. Therefore, the water assessment will focus on the impact on the Yuelu Waste Water Treatment Plant.

1.4.2 Ambient Air

The major air pollutants include vehicle emission and smoke from restaurant. The air emission source is not serious and the assessment is under Class III.

1.4.3 Noise

The project is located at the area of Class 4a area of National Noise Standards (GB3096) based on Noise Function Zoning where allow higher noise level. Therefore, the assessment is under Class III.

1.4.4 Ecology

The project is located in a built urban area which is not ecologically sensitive. There is no endangered or protected species in the area. Therefore, the ecology environment assessment will be simplified.

1.5 Assessment Scope

1.5.1 Water

The Xiangjiang river between the sections of Xiangjiang No.1 Bridge and Sanchaji.

1.5.2 Noise

According to Noise Impact Assessment Guideline (HJ/T2.4-2009), the noise assessment is under class III and the assessment scope is within the area 100 meters away from the boundary of transport terminal.

1.5.3 Air

The assessment scope is within the area 2.5km away from the transport terminal.

1.6 Assessment Standard

1.6.1 Air

Air quality standard implement Class II of *National Ambient Air Quality Standard (GB3095-96).*

Construction machines implement Class II of *Air Pollutant Emission Standard (GB16297-1996)* (Table 1-1).

Table 1-1 Air Pollutant Emission Standard (GB16297-1996) unit: mg/m^3

Pollutant	SO2	NOx	TSP
Class II Limit	550	240	120

Oil smoke from restaurant implements *Catering Industry Oil Smoke Emission Standard (GB18483-2001)*. The limit value is shown in table 1-2.

Table 1-2 Catering Industry Oil Smoke Emission Standard (GB18483-2001)

Item	Small	Medium	Large
Maximum emission permit□mg/m^3□	2.0		
Minimum smoke purification rate (%)	60	75	85

1.6.2 Water

Wuyi Bridge section of Xiangjiang River meets Class III of *Surface Water Quality Standard (*GB3838-*2002)*, and the Sanchaji section meets Class IV.

Before discharging into the urban sewer network, domestic sewage should be pretreated to meet Class III of *Integrated Waste Water Discharge Standard. (GB89078-1996)* (Table 1-3).

Table 1-3 Integrated Waste Water Discharge Standard unit: mg/L

Pollutants	pH	NH3-N	COD_{Cr}	BOD_5	oil
Class III	6～9	/	500	300	100

1.6.3 Noise

For noise during the construction, Noise Limits for Construction Sites (GB12523-90) will be applied, see Table 1-4 for detail.

Table 1-4 Noise Level Limits on Construction Site, LAeq, (dB)

Construction Stage	**Major Noise Sources**	**Noise Level Limits**	
		Day	Night
Earthwork	Bulldozers, excavators and loaders	75	55
Pile driving	All sorts of pile drivers	85	Construction prohibited
Structuring	Concrete mixers, vibrators, electric saws, etc.	70	55
Fitting up	Cranes, lifters, etc.	65	55

Note: 1. Noises listed in the table are the limits on construction sites which correspond to those in sensitive areas.2. If several construction phases are being undertaken simultaneously, the limit on the highest noise will serve as the standard.

For noise during the operation, Class III of Ambient Noise Standard (GB22337-2008) will be applied, see Table 1-5 for detail.

Table 1-5 Ambient Noise Standard（GB22337-2008）unit：dB（A）

Class	**Day**	**Night**
0	50	40
1	55	45
2	60	50
3	65	55

1.6.4 Solid Waste

For domestic solid waste, Municipal Domestic Solid Waste Landfill Standard (GB16889-2008) and requirement under PRC Law of Solid Waste Pollution

Control and Prevention will be applied.

For construction waste, *No. 139 Order on Municipal Construction Waste Management Regulation* issued by Ministry of Construction will be applied.

1.7 Assessment Parameters

Environmental assessment parameters are listed in Table 1-6.

Table 1-6 Environmental Assessment Parameters

Item	Parameters for baseline assessment	Prediction parameters
Ambient Air	SO_2, PM_{10}, NO_2	TSP, PM10, NO_2
Water	Temperature, pH, DO, Permanganate Index, COD, NH_3-N, BOD5, TP, F, Volatile Phenols, As, Hg, Cr+6, Pb, Oil	CODCr, BOD5, NH3-N
Noise	LAeq	LAeq
Ecology	Vegetation , animal, land use, soil erosion	Vegetation, animal, land use, soil erosion

1.8 Environmental Sensitive Sites

Environmental sensitive sites around the project site are shown in Figure 1-1, while those along the travel route during transition period are shown in Figure 1-2.

Figure 1-1 Environmental Sensitive Sites Around the Project Area

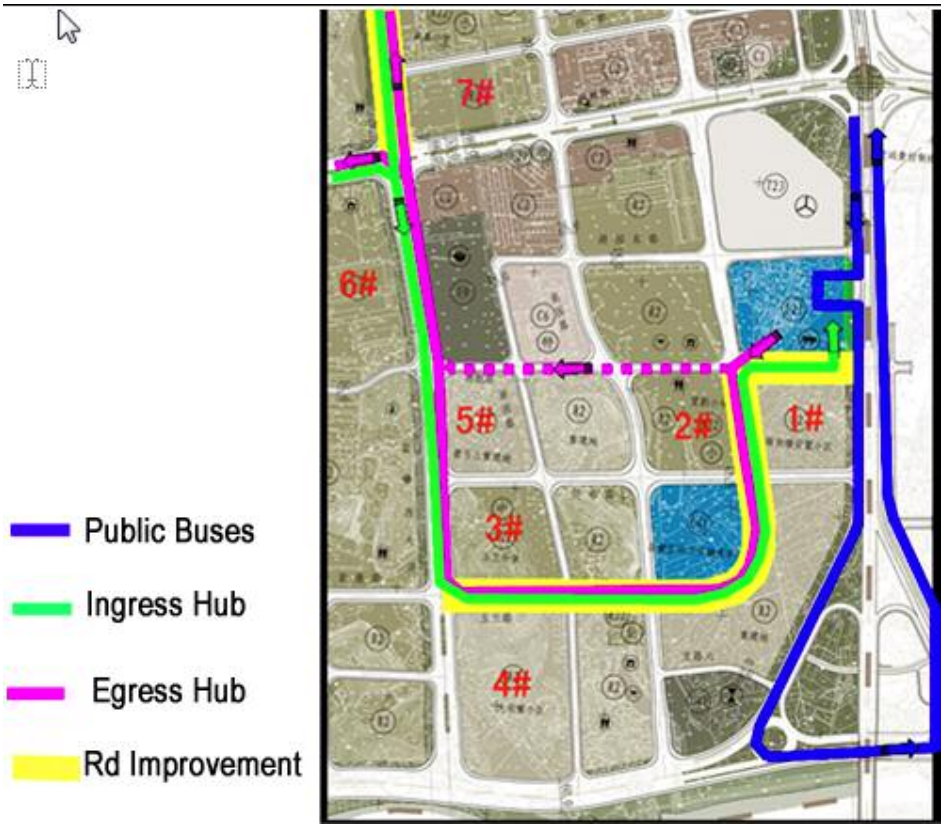

Figure 1-2 Environmental Sensitive Sites During Transition Period

1.8.1 Air and Noise Sensitive Sites

Air and noise sensitive sites include residential area and school around the project site. Details are shown in Table 1-7 and photo 1.

Table 1-7 Air and Noise Sensitive Sites

Sensitive Sites	Location	Distance（m）	Standard
Guangxia Xinyun residential area	West Yulan Rd	100	GB3095-96：Class II GB3096-2008：Class II
Wangxin Jingyuan residential area	East 2nd ring Rd	95	
Chengxi Gongyu residential area	East 2nd ring Rd	95	
Nanjiatang residential area	South Youyuan Rd	100	
Wangxin primary School	South Youyuan Rd	120	GB3095-96：Class II GB3096-2008：Class I

Guangxia Xinyuan

Wangxin Jingyuan

Chengxi Gongyu

Nanjiatang

Wangxin Primary School

Wangxin Primary School

Photo 1-1 Environmental Sensitive Sites

1.8.2 Water

There is no water sensitive site around the project area. Waste water from the Hub will be discharged into urban sewer and to Yuelu Waste Water Treatment Plant. The treated water will discharged into Xiangjiang River.

Applied water standards for Xiangjiang are: Class III for the section to Wuyi Bridge, and Class IV for the section to Sanchaji Bridge.

1.8.3 Ecology

Prevent soil erosion of the area and spoil area.

1.9 Assessment Scope

Noise: project sites and the area within 100 meter away from the construction boundary.

Air: project sites and the surrounded area within 2.5km of the project boundary.

Water: Xiangjiang River of the section No. 1 Bridge to Sanchaji

2. DESCRIPTION OF THE PROJECT

2.1 Project Overview

- Project Name: Changsha Western Changsha Terminal Project
- Construction Unit: Changsha Transportation Hub Construction Investment Co., Ltd
- Construction Location: Great Hexi Pilot District West Bus Station (Figure 2-1)
- Project Investment: 1.64 billion RMB
- Construction Type: Reconstruction of the existing bust station (photo 2-1)

Figure 2-1 Location Map of the Project

Photo 2-1 Existing Changsha West Bust Station (looking at south-west)

2.2 Project Location

The project is located in the core area of modern service industry inside Changsha Great Hexi Pilot District, east of West 2nd Ring Road, north of Fenglin Road, west of Yulin Road, south of Youyuan East Road which faces a large-scale bus station in the south.

Proposed project location is in existing Changsha Bus West Station. The project area includes north and south parts, with area of 92.8mu and 64.4mu respectively. The project is to reconstruct a transit hub which integrates passenger transport, rail transport, urban public transport, and other transport modes (Figure 2-2).

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Figure 2-2 Western Changsha Terminal Project Layout

2.3 Project Components and Scale

The total land area of the project is 108359 m^2. The north area of 61835 m^2 is planned for passenger transport depot, main station house and commercial site. The south area of 42928 m^2 is to be bus departure, bus maintenance plant including gas filling stations. The main technical and economic indicators of the project north and south sections is shown in Table 2-1 and Table 2-2.

Table 2-1 Technical Indicators of the Project North Section

No.	Project Name	Unit	Quality
1	Total Land Area	m2	65341
2	Net Land Area	m2	60454
3	Total Construction Area	m2	257727
4	Ground Construction Area	m2	183431
Of which	Station House Construction Area	m2	25041
	Parking Building Construction Area	m2	32780
	Hotel Construction Area	m2	38792
	Office Construction Area	m2	33138
	Apartment Construction Area	m	21618
	Commercial Podium Construction Area	m2	32062
5	Underground Construction Area	m2	74296
Of which	Area of Station House Underground 1st Floor	m2	30474
	Area of Station House Underground 2nd Floor	m2	30814
	Area of Commercial District Underground 1st Floor	m2	6504
	Area of Commercial District Underground 2nd Floor	m2	6504
6	Building Density	%	74.5
7	FAR		3.54
8	Greening Rate	%	18.9

Table 2-2 Technical Indicators of the Project South Section

No.	Item	Unit	Quality
1	Total Land Area	m2	42928.23
2	Net Land Area	m2	39285.37
3	Total Construction Area	m2	70107.12
4	New-Built Building Construction Area	m2	183431
4.1	Gas Filling Station	m2	3588
4.2	Maintenance Station	m2	7215
5	Already-Built Building Area	m2	74296
5.1	Ground Construction Area	m2	30474
5.2	Underground Construction Area	m2	30814
6	Building Density	%	38.2
7	FAR		1.43

The ground part of this project includes 6 buildings, underground part 2 floors, of which the underground 2nd floor is as A6 second class personnel shelter (A6 peacetime and wartime combined parking lot), parking lot and equipment house, the underground 1st floor is as commercial house, parking lot and equipment house. The project content is shown in Table 2-3.

Table 2-3. Project Building and Structure Parameter List

No.	Project	Unit	Construction Area	Site Area
	The Main Station House (excluding	m^2	70,000	6,000

	the grid)			
1	Regular Waiting Room	m^2	6,500	
	Key Waiting Room	m^2	2,000	
2	Ticket Office	m^2	2,000	
3	The Baggage Office	m^2	850	
4	The Baggage Claim	m^2	350	
5	Integrated Service Room	m^2	1,600	
6	Conductor Room	m^2	300	
7	Lounge	m^2	550	
8	Dispatch Room	m^2	80	
9	Security Room	m^2	30	
10	Broadcast Room	m^2	20	
11	Medical Care Room	m^2	40	
12	Water Room	m^2	30	
13	Public Toilets	m^2	1,000	
14	Intelligent System Room	m^2	100	
15	Office Room	m^2	4,000	
16	Transportation Administration Management Office	m^2	600	
17	Intermodal Office	m^2	350	
18	Apartment for Drivers and Conductors	m^2	4,600	
19	Platform	m^2	5,000	
20	Changsha Great Hexi Pilot District Transport Information Center	m^2	40,000	
21	Integrated Service Building	m^2	110,000	5,000
22	Ground Parking Lot	m^2	30,000	30,000
23	Underground Parking Lot	m^2	45,000	45,000
24	Passenger Transport Maintenance Plant (Gas Filling Station)	m^2	5,000	
Total		m^2	260,000	

The specific situation of project individual buildings is shown in Table 2-4.

Table 2-4 Specific Parameter List of Individual Building

No.	Project	Length xWidth x Height（m）	Floor	Floor Height（m）	The Main Column Grid（m）	The Main Function
1	Parking Building	137x61.7 x27.2	-2	4.5	15x15	Parking Building
			-1	6	15x15	Parking Building

No.	Project	Length xWidth x Height（m）	Floor	Floor Height（m）	The Main Column Grid（m）	The Main Function
			1	7.2	15x15	Long-Distance and Short-Distance departure
			2~5	5	15x15	Parking Building
2	Station House	176x35 x23.4	-2	4.5	15x15	Peacetime and Wartime Combined Parking Building
			-1	6	15x15	Commercial
			1~2	7.2	15x15	Waiting Room, official business
			3	4.5	15x15	Commercial
			4	4.5	15x15	Official Business
3	Commerce	81x49x23.1	-2	4.5	8.4x8.4	Parking Building
			-1	6	8.4x8.4	Commercial
			1	5.1	8.4x8.4	Commercial
			1~5	4.5	8.4x8.4	Commercial
4	Apartment	35x38x 81	-2	4.5	8.4x8.4	Parking Building
			-1	6	8.4x8.4	Equipment House
			1	5.1	8.4x8.4	Hall and Shop
			2~5	4.5	8.4x8.4	Mall
			6~21	3.3	8.4x8.4	Apartment
5	Hotel	42x45x 98.7	-2	4.5	8.4x8.4	Hotel
			-1	6	8.4x8.4	Lobby
			1	5.1	8.4x8.4	Hall
			2~5	4.5	8.4x8.4	Hotel Ancillary
			6~26	3.6	8.4x8.4	Quest Room
6	Official Business	48.6x17.2x 98.7	-2	4.5	8.4x8.4	Parking Building
			-1	6	8.4x8.4	Parking Building
			1	5.1	8.4x8.4	Hall
			2~5	4.5	8.4x8.4	Commercial
			6~26	3.6	8.4x8.4	Official Business

2.4 Project Design

The main idea of this design is to integrate West Bus Station, public hub, rail stations and West 2nd Ring Road interchange to a transport hub. Meanwhile, commercial development within the area is also considered.
Two-story layout with dimensional design is adopted to separate traffic flow in different ways.

At north part, there is a passenger transport parking building, main station house and integrated commercial building within the area. And at the south part, there will be bus terminal, subway station, taxi station, parking lot and maintenance service. The underground parking lot in the station area is to meet the social vehicles parking.

In the front of the station, there is a large-scale greening square which is divided reasonably according to the function needs. Ring roads, colorful parquet square and large tract of lawn are the main compositions. Two asymmetrical commercial buildings and the main station house are to be built along Yulan Road, Fenglin Road and West 2nd Road, the passenger transport parking lot at the back of the main station house is planned to be 2-story, the upper traffic connects West 2nd Ring Road trough a viaduct, ensuring unobstructed traffic and enriching the whole station area.

The functions of each area and Project Layout are shown in Figure 2-3 and Figure 2-4.

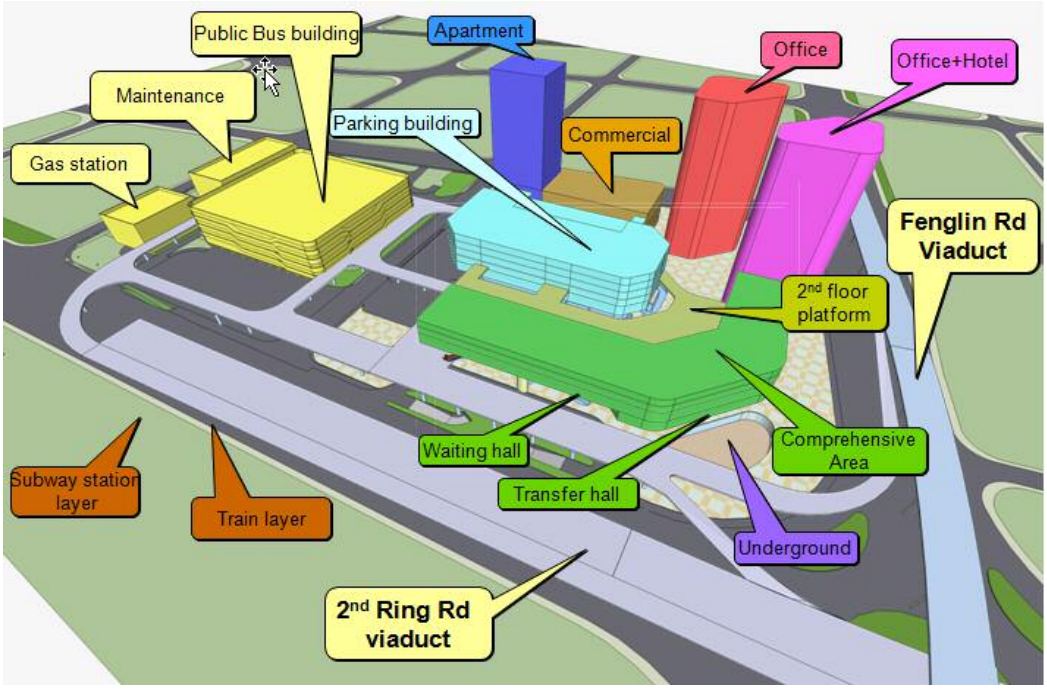


Figure 2-3 Function of Project areas

Figure 2-4 Planned Western Changsha Terminal Layout

2.5 Traffic Overview of the Roads around the Site

Fenglin Road. It's the main road which faces the Passenger Transport West Station, whose bi-directional traffic flow of per rush hour is 1900～2000pcu/h. Fenglin Road, Nanyuan Road to Lujing Road section is bi-directional 8 lanes, separate the vehicle traffic with security barrier, non-motorized vehicle lane and pedestrian are in the same cross-section. Fenglin Road Nanyuan Road to Yulan Road section has a bi-directional 4-lane viaduct and a 2-lane auxiliary road which sets up non-motorized vehicle lane. Fenglin Road Yulan Road to West 2nd Ring Road is bi-directional 6-lane, separates the vehicle traffic with green belt, non-motorized vehicle and motorized vehicle. Passengers get on

and off the taxi on Fenglin Road and Yulan Road to West 2nd Ring Road section which is for non-motorized vehicle, thus the traffic of this section is a mess.

Yulan Road. It's the sub-trunk road which is located in the west of Passenger Transport West Station, bi-directional 4-lane, bi-directional traffic flow marking separated, non-motorized vehicle lane and pedestrian are in the same section,. There is a barrier between motorized vehicle lane and pedestrian, the traffic on the motorized vehicle lane is a mess. The per rush hour traffic flow of those roads that are affected by Yulan Road is 1000pcu/h. The width of Yulan Road hasn't yet met the control regulatory requirements.

West 2nd Ring Road. It's the urban expressway which is located in the east of Passenger Transport West Station, the main line underpasses Fengling Road Viaduct with auxiliary roads on each side. The main line is bi-directional 6-lane, bi-directional traffic flow is separated through the central green belt; auxiliary road is 2-lane, non-motorized vehicle and motorized vehicle marking separated. The bi-directional traffic flow of West 2nd Ring Road is 2500～2700pcu/h, that of the auxiliary road is 1800pcu/h.

Planned Youyuan East Road. It will be between the Bus West Station and the building transit hub.

Yanhang Road. It's in the south of Passenger Transport West Station.

Street Establishment Status. North Fenglin Road, Fenglin Road and Yulan Road intersection adopts pedestrian crossing, sets up pedestrian signal phase. Fenglin Road, Yulan Road to West 2nd Ring Road sets up a twice pedestrain crossing facility taking the advantage of the central green belt.

Major peripheral intersection analysis. There are 2 major intersections around Passenger Transport West Station: Fenglin Road–Yulan Road intersection. Fenglin Road–West 2nd Ring Road intersection (bottom roundabout).

Fenglin Road is the main road, Yulan road the sub-trunk road. The east-west main line of Fenglin Road overpasses the interchange, whose auxiliary road level-crosses Yulan Road, signal light controlled with a 126s control cycle, 4-phase. Go straight and turn left transmeridionally, go straight and turn left

north and south with a 30s control cycle and 3s for yellow light. It is found now that east entrance has more traffic flow.

West 2nd Ring Road is the expressway which underpasses Fenglin Road Viaduct and level-crosses its auxiliary road, which adopts rotary intersection and sets specific right-turn lane.

2.6 Traffic Arrangement

The overall principle during traffic design is to spatially separate the traffic flows of long distance buses, public buses and social vehicles, and divert the vehicles ingress the ITH by viaducts.

- ⌘ Second floor plus viaducts are planned for long distance buses;
- ⌘ Ground level is for short distance buses and public buses
- ⌘ Basement 1 is for social vehicles and taxies;
- ⌘ Basement 2 is for subway. (Figure 2-5)

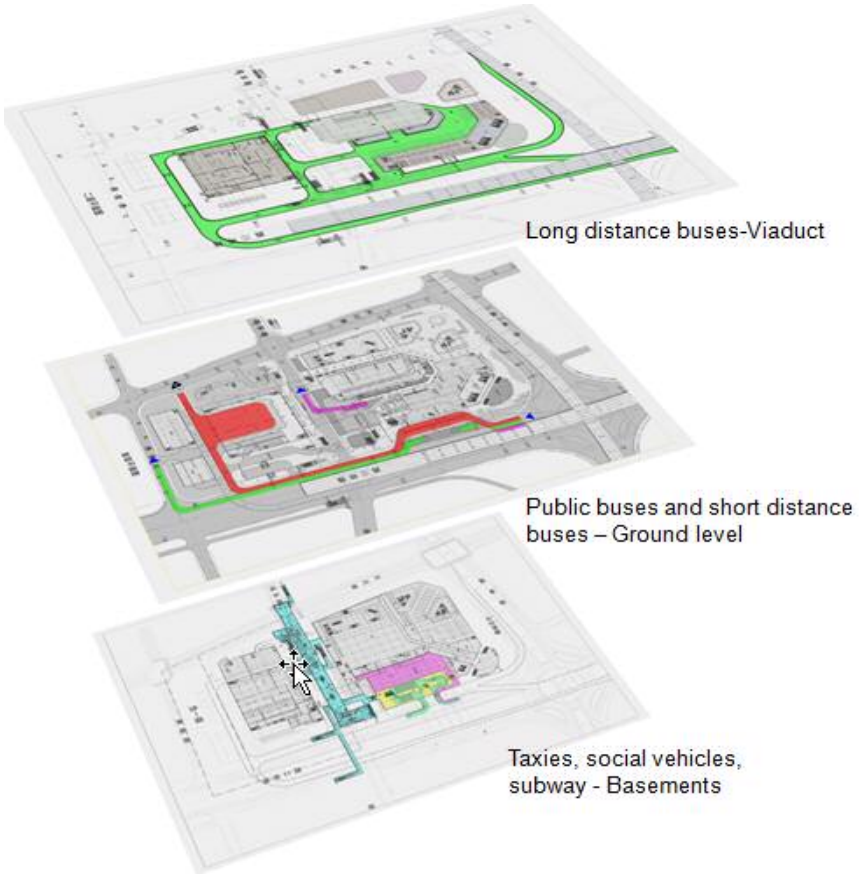


Figure 2-5 Traffic Arrangements for different layers

2.6.1 Long-distance Bus Traffic Flow

Westbound and northbound long distance buses are majority and a few southbound. Buses will ingress the ITH at north and egress at south by viaducts at second floor to avoid confliction with at grade traffic (Figure 2-6 and Figure 2-7). Ten unloading places are planned at the eastside of the viaduct. There are totally 39 departure places along the second floor of the station building. To meet parking need of waiting long-distance buses, a 4-story garage with 344 parking spaces will be built at west of the area.

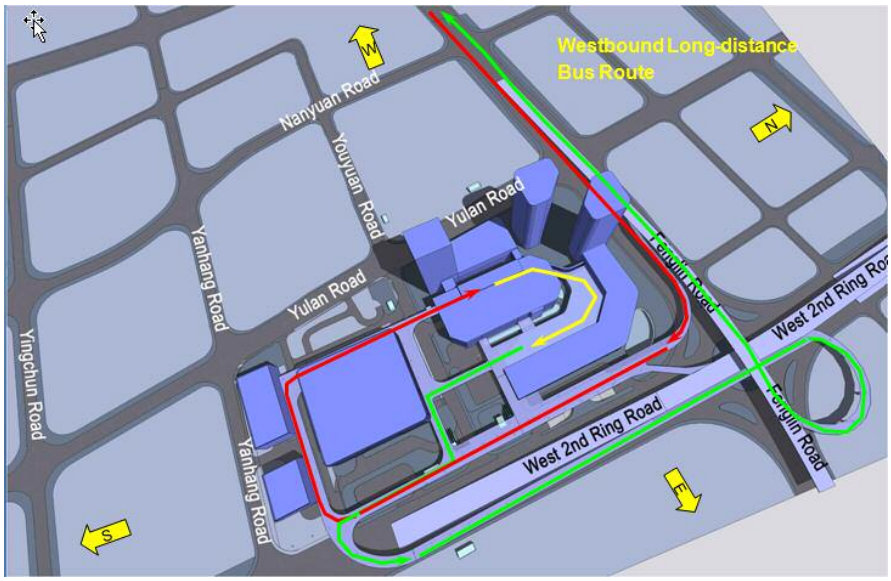


Figure 2-6 Westbound Long-distance Bus Traffic Flow

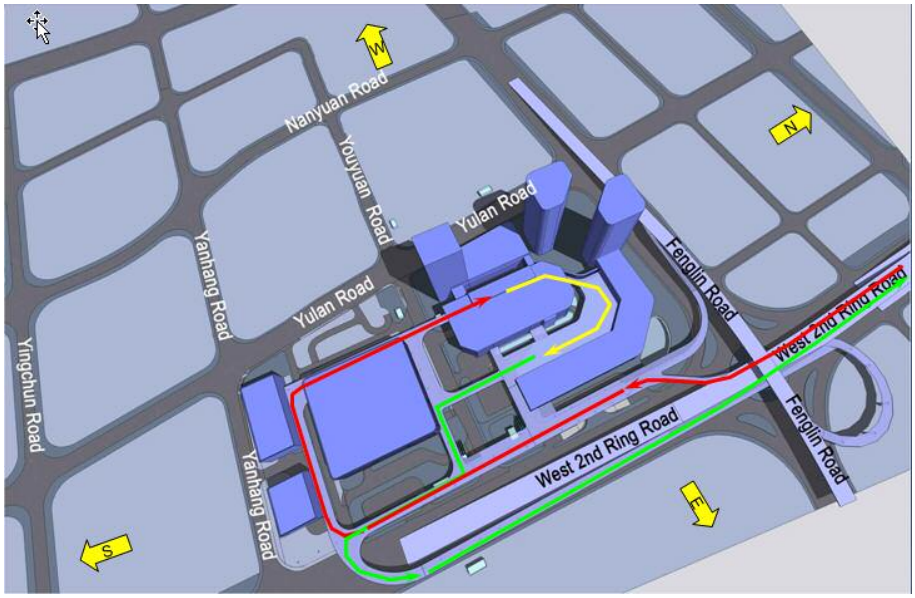


Figure 2-7 Northbound Short-distance Bus Traffic Flow

2.6.2 Short-distance Bus Traffic Flow

Short distance bus ingress and egress the ITH at grade level. Unloading area with 10 unloading places is designed at east of the public bus garage to suit passengers' convenience to access public buses, taxis and subway. The passenger pickup area is located at first floor of the long-distance bus parking building with 34 departure places and 30 parking places. Buses egress the ITH by Youyuan Road - Yulan Road – Fenglin road. (Figure 2-8).

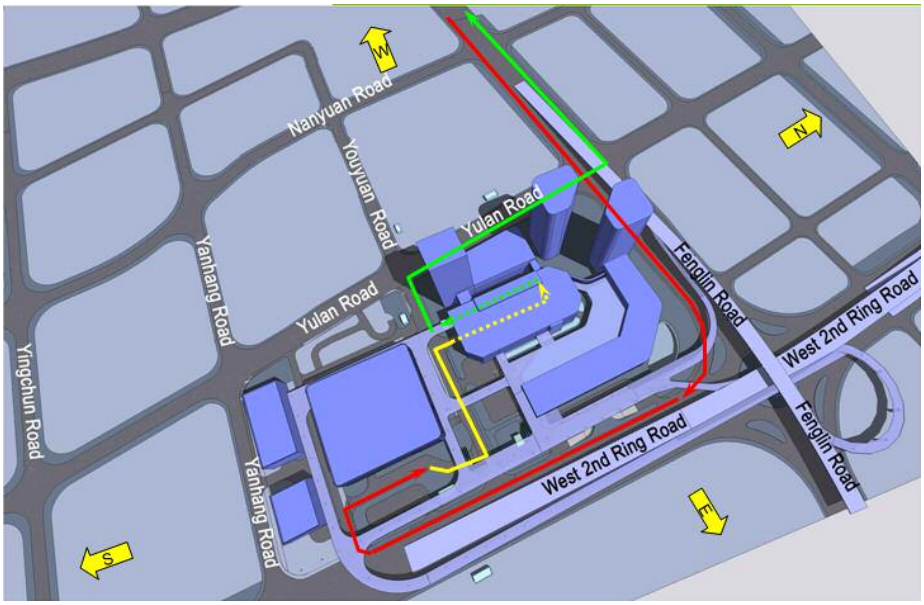


Figure 2-8 Westbound Short-distance Bus Traffic Flow

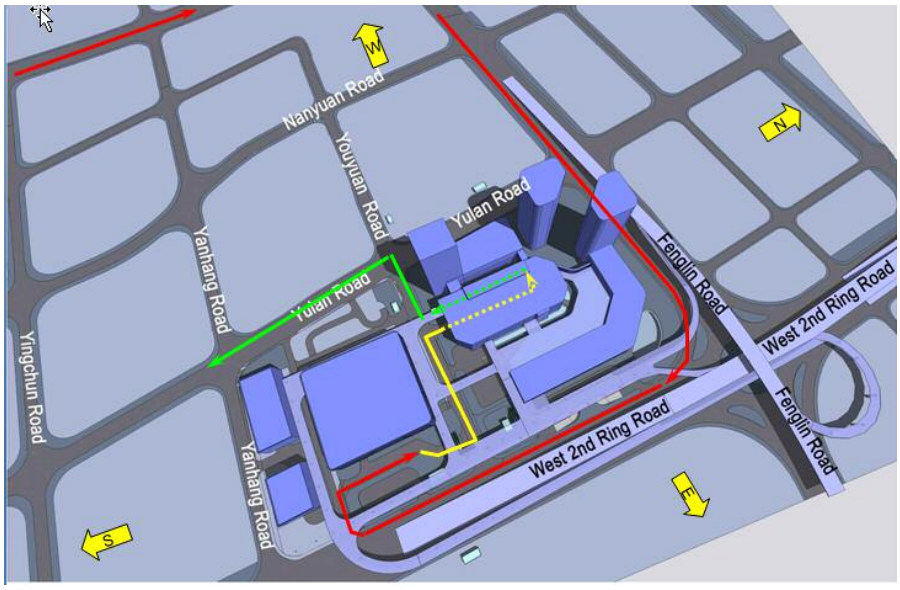


Figure 2-9 Southbound Short-distance Bus Traffic Flow

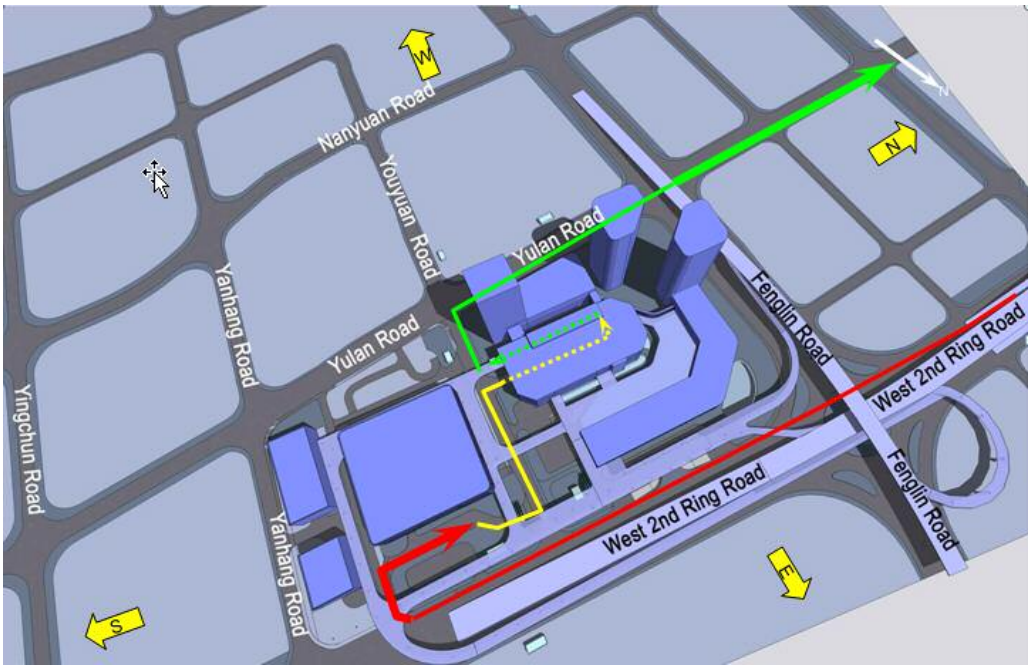


Figure 2-10 Northbound Short-distance Bus Traffic Flow

2.6.3 Urban Public Bus Traffic Flow

To avoid confliction of the urban public bus traffic flow with long and short distance bus traffic flow, the urban public bus traffic is designed to ingress and egress the ITH at grade level, then travel along the hub clockwise to the urban road network (Figure 2-11).

Public bus unloading area is designed at the east side of the station building. Passenger picking up area is designed at the first floor of the public bus garage building. Totally 19 departure spaces is arranged.

To promote the passenger's convenience, unloading stops are also designed near the major entrance and exit of the ITH for the bypass public bus routes.

For Bus Rapid Transport, bus flow is designed as ingress ITH at east and egress at west. Four departure spaces are designed at south area of the station building.

2.6.4 Taxi Traffic Flow

Three taxi parking bays is designed around the ITH. The first one is located at the major entrance and exit of the ITH, mainly for passengers from the station building and subway. The second one is located at north of the station building for unloading of bypass taxies. The third one is located at east of the ITH, mainly for passengers from the public buses, subway, long and short

distance buses, 4 lanes allowing parking 40 taxies at same time is designed at basement 1 for unloading. Moreover, at east of the public bus building, a taxi driver rest area is arranged with 20 parking spaces. (Figure 2-12).

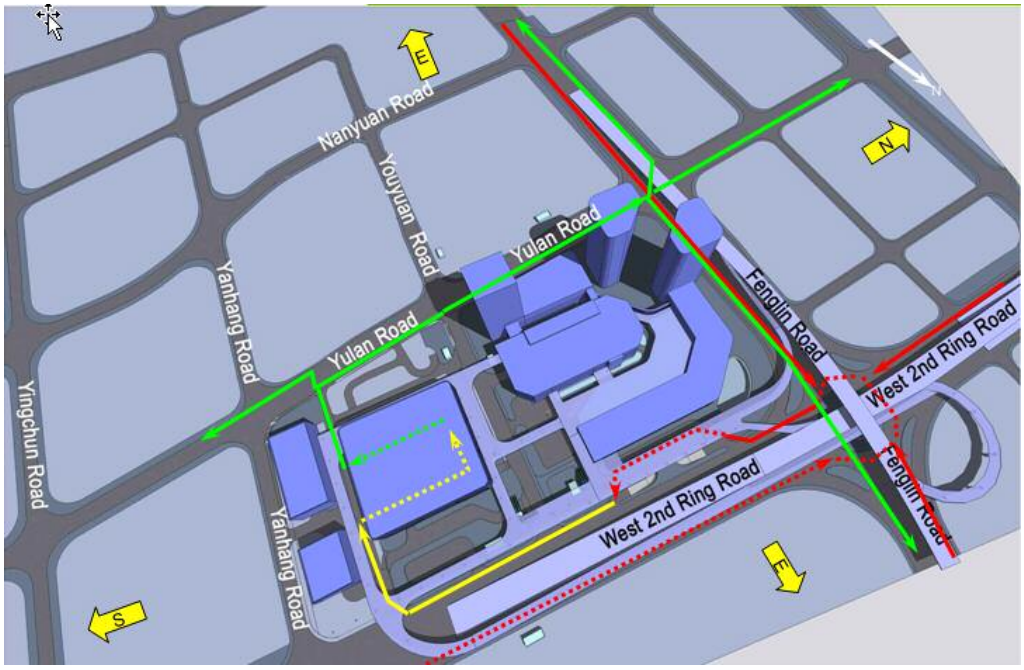


Figure 2-11 Urban Public Bus Traffic Flow

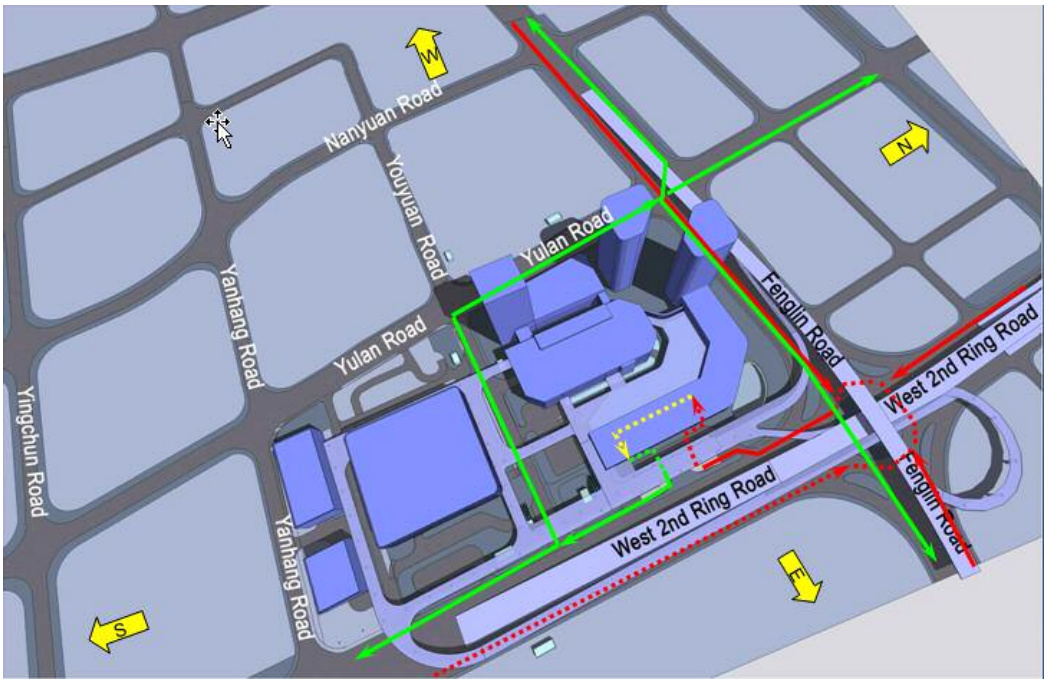


Figure 2-11 Taxi Traffic Flow

2.6.5 Social Vehicle Traffic Flow

Four entrances and exits to underground garage are designed around the ITH. Parking area for social vehicles is designed at basement 2, while part of the basement 1 is reserved for the station staff car parking. Totally 1172 parking spaces are designed.

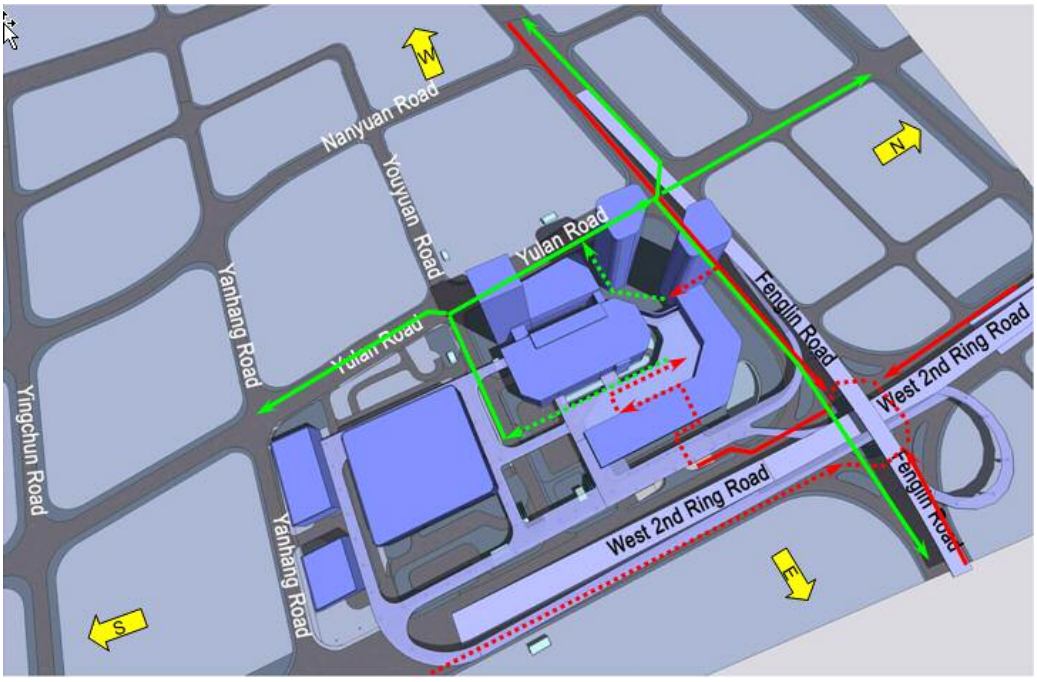


Figure 2-12 Social Vehicle Traffic Flow

2.6.6 Passenger Flow

(1) Passengers Exit the ITH

Passengers took long distance bus: Unloading area of long distance bus is designed at the elevated viaduct, the junction area of the 2nd west ring road and Youyuan road. Passengers can go down to ground level by taking escalator and then transfer to public bus, taxi, subway or social vehicle. The passenger flow is shown in Figure 2-13.

Passengers took short distance bus: Unloading area for short distance bus is designed at east of the public bus building. Passengers can transfer taxi, subway and public buses at east or west side. (Figure 2-14).

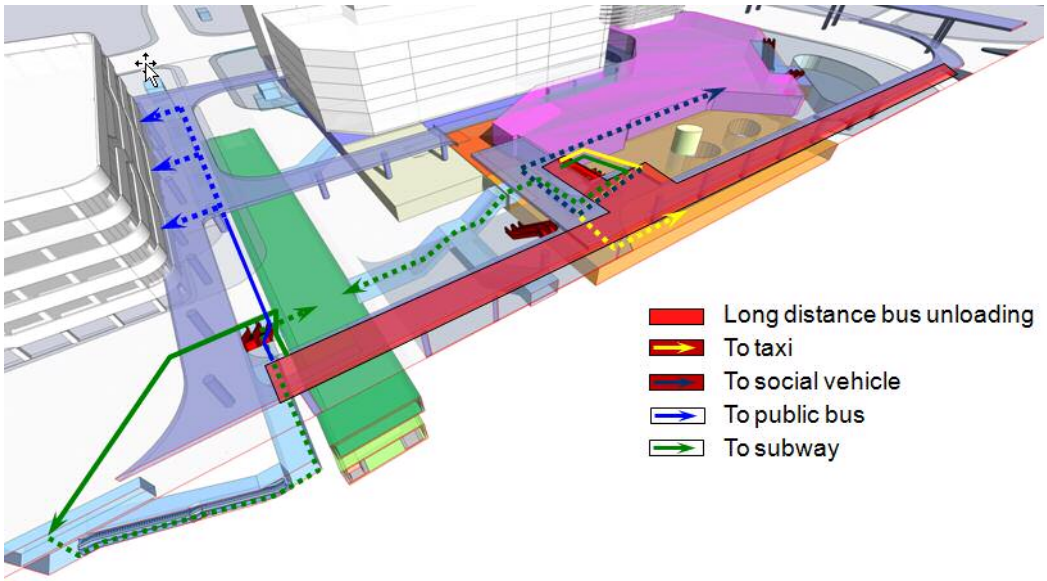


Figure 2-13 Passenger from Long-distance bus Exit the ITH

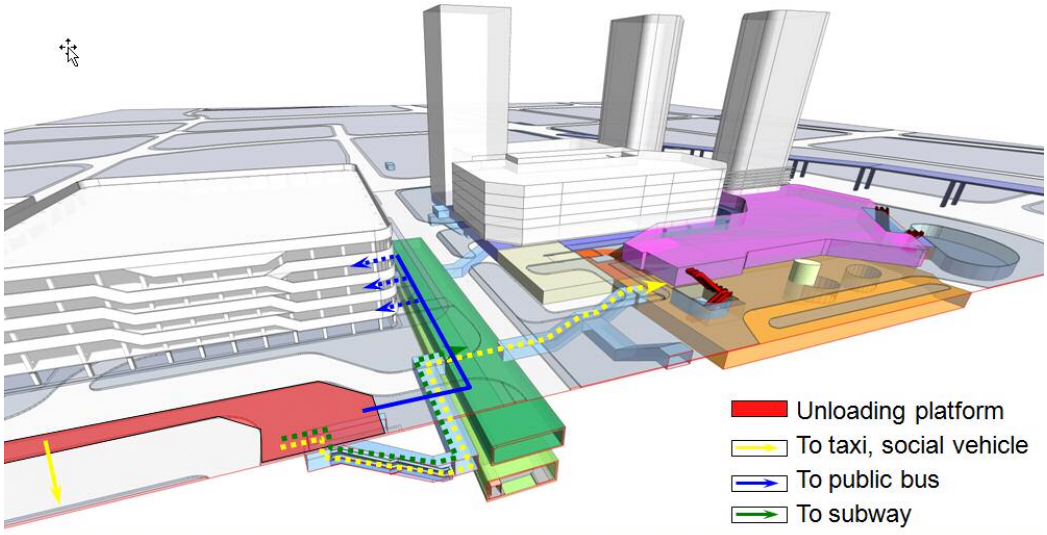


Figure 2-14 Passenger from short distance bus Exit the ITH

(2) Passengers Enter the ITH

According to the principle of “zero-transit”, unloading areas are designed close to the west 2nd ring road. Passengers can easily enter the station ticket building and then diverted to passenger picking up area of long distance or short distance buses (Figure 2-15).

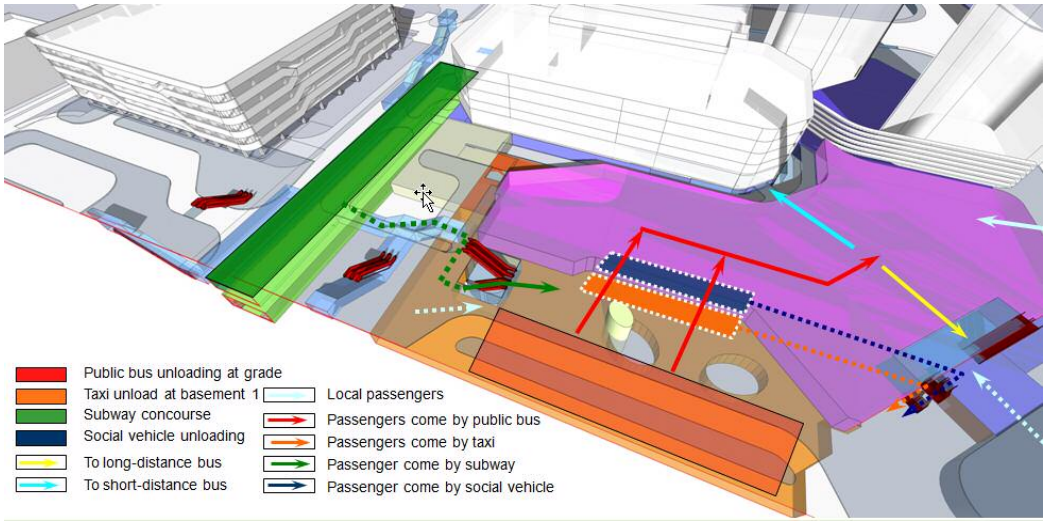


Figure 2-15 Routes of Passenger Enter the ITH

2.7 Roads and Traffic Facility Construction

To meet the increased traffic need, the Fenglin Road will be widened to 12 meters and the West 2nd ring road will be extended from 3 lanes to 4 lanes.

Add viaducts: to achieve traffic flow spatial separation, to meet the increasing coach traffic line demand, to reduce the traffic pressure of coach to the urban surface roads, viaducts will be constructed to connect with West 2nd Ring Road, taking the advantage of viaduct system to effectively evacuate the traffic flow.

2.8 Relevant Facilities

2.8.1 Water supply system.

Water source for the ITH is from the Chang urban water supply network. Two pipelines from West 2nd Ring road and Fenglin Road will be constructed to connect with the bus station internal water supply network.

The estimated maximum daily water consumption is 3,115 cubic meters with peak hourly water consumption of 326 cubic meters (Table 2-5).

Table 2-5 Estimated Water Consumption

No.	Water User	People (person)	Quota L/d	Daily Maximum (m^3/d)	Hours per day	Hourly Maximum (m^3/h)
1	Apartment	1267	180	228.1	24	24.7
2	Commercial building	56011	8	448.1	12	56.0
3	Hotel	294	300	88.2	24	9.2
4	Bus station	800	50	40.0	12	8.3
5	Passengers	70000	6	420.0	16	39.4
6	No.1 Office Building	6628	50	331.4	10	66.3
7	No. 2 Office Building	1684	150	252.6	12	42.1
8	Sub-total			1808.4		246.0
9	Air conditioner			900.0	24	37.5
10	Contingency			406.3		42.5
11	Total			3114.6		326.0

2.8.2 Fire Fighting

Assuming water need for outdoor fire fighting is 30L/s, fire lasting for 3 hours, water need for indoor fire fighting is 40L/s and lasting for 3 hours, the estimated water needed for one fire fighting is 532.8 cubic meters.

Fire fighting facilities will be installed including 600 m^3 water storage tank, water supply network, pump station, fire hydrant, water syringe, water mist fire suppressing system, fire extinguisher.

2.8.3 Sewer network

Sewer network will be constructed to connect with the urban network at West 2nd Ring Road and Fenglin Road. The system will separate rain water and waste water. Waste water will be pre-treated through septic tank and oil filter before discharging into the urban network.

2.8.4 Greening

Planted Roof will be used for the buildings of the bus station as sun-shading

to reduce to energy consumption and to improve the regional air quality. Trees will be planted to shadow the parking cars where possible. Trees and grasses will be planted at road side and square to reduce dust and traffic noise pollution. The greening rate of the transit hub is designed as 18.9%.

2.8.5 Energy saving design

Curtain wall and environmental friendly roof materials will be used for buildings to save energy for air conditioning.

2.8.6 Environmental Protection Design

Wind and solar power will be used. Energy metering system will be installed to scientific allocate energy using. All electronic equipment will meet the requirement set in *Environmental Electromagnetic Wave Standard.*

2.8.7 Water hygiene

Drinking water for passengers will be stored in stainless steel water tank and installing with ozone generator to prevent secondary pollution.

2.8.8 Commercial building construction

Considering the passenger transportation itself has lower profit, the project will also construct commercial buildings including hotel, restaurant and shopping center to increase the profitability and to suit the passengers' convenience.

2.9 Construction Arrangement

2.9.1 Water supply

Water for construction will be piped from urban water supply network at Fenglin road.

2.9.2 Construction Materials

Cement, steel, wood, sand and gravel will be bought from Changsha City and surrounding area.

2.9.3 Access road

Fenglin road and West 2nd Ring Road will be used as assess road for construction material transportation.

2.9.4 Work Camp

Considering the tight area of the construction area, suggest rent nearby houses as work camp.

2.9.5 Temporary Bus Parking

Due to the project is to re-construct the West Bus Station, the existing parking lot will be temporarily moved to the rented area at west of Fenglin Road during the 2.5 years construction period.

2.10 Transition Period Transportation Arrangement

To reduce the impact on the normal passenger transport of the existing bus station during construction, the local government and the IA has carefully planned proposed a temporary transportation proposal for the period of construction. Discussion has been made between relevant agencies. In May 27, 2010, the Changsha Municipal government held a meeting to discuss transport arrangement proposal. Attendances include Changsha government office, communication bureau, public affair bureau, public security, transport management bureau, passenger transport management department and Western Changsha Terminal Construction and Investment Co. Ltd, Changsha Planning and Design Institute.

2.10.1 General Description of the Proposal

(1) Advanced Actions Before Construction of the project

- Principle: locally transition to divert traffic
- Make good use of the new public bus garage
- Rent an area of 23 mu at north of Yanhang Road as temporary bus station
- Use the newly built but not open to traffic road as long distance bus waiting area
- Construct the viaduct at the transition field area in advance
- Widen and improve the Yulan road and Yanhang road in advance
- Construct Yuejing road in advance

(2) Land Taken

Land use for transition period is shown in Table 2-6 and Figure 2-16. The new public bus garage will temporarily used as passenger pick up area and a constructed section of the Jinxing road will be temporarily used as long distance bus waiting area.

Table 2-6 Land taken for the transition

Item	Area	Number of vehicle parking
Long distance waiting hall	2552.8m^2	
Short distance waiting area	1161.7 m^2	
Arriving parking	5474.8 m^2	7
Long distance Departure parking	10449 m^2	32
Short distance departure parking	7775.8 m^2	52
Public bus, and taxies parking	14993.6 m^2	
Reserved power charging area	172.5 m^2	
Total land taken	42580.2 m^2	
Wall	516m	
Stainless steel pole	1038m	

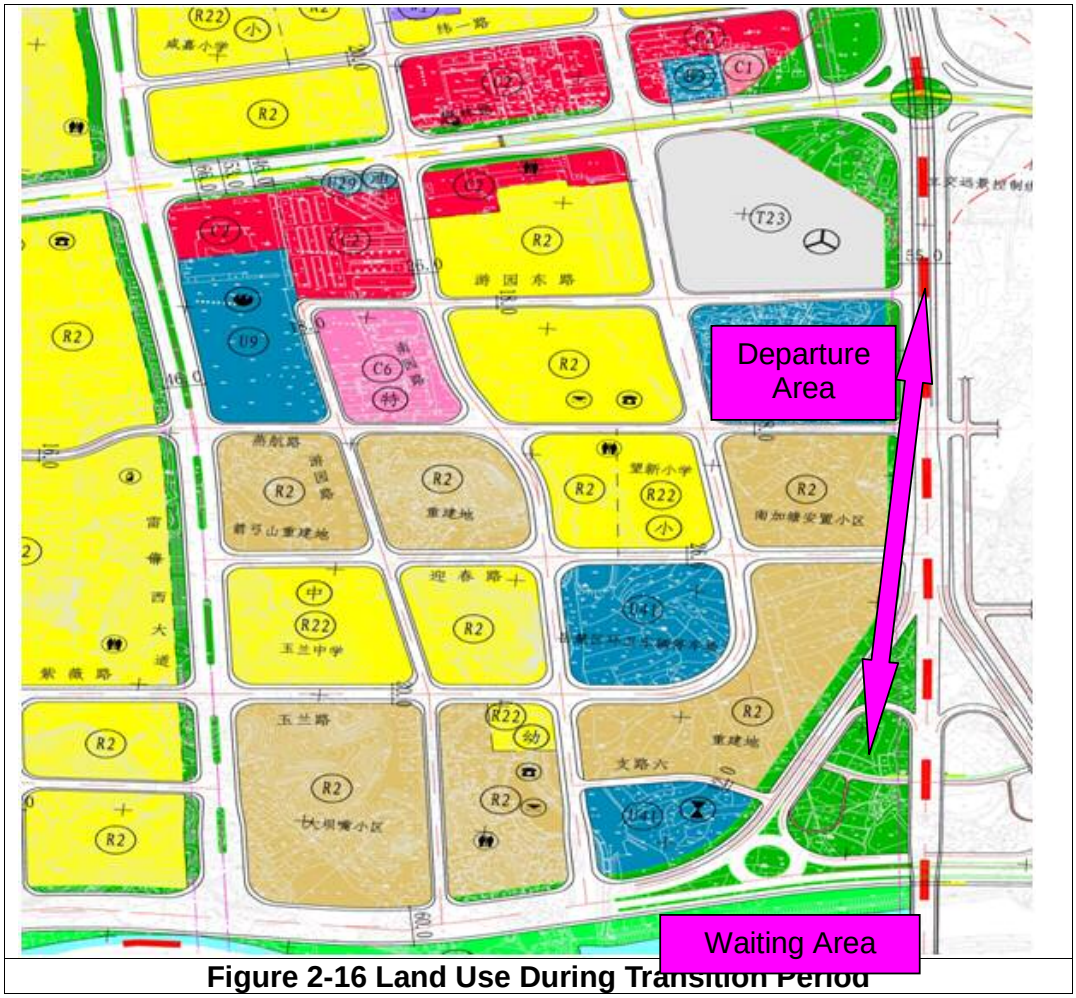


Figure 2-16 Land Use During Transition Period

2.10.2 Traffic Arrangement During Transition

(1) Traffic Flow Design

Public buses travel at east part, long and short distance buses travel at west. Two transport routes will be separated at grade level and avoid travel through the gate of Wangxin Primary School.

a) Public buses: locate at the east side of existing public bus station, both of arriving and departure will be at eastern part. Entering at north-eastern area near 2nd ring road, waiting at underground, departure at south-eastern part to 2nd ring road, for totally 9 buses routes. Separate passenger walking flat was designed to avoid traffic disturbance.

b) Long distance buses: entering and departure at western part. The exit is set at southern part near Yanhang road, sharing drop off area with short distance buses. Buses need to be wait travel to parking area at southern area through Yulan road. Totally 93 waiting lots were planned. Buses no need to be wait travel through Yulan road to western departure area. 32 departure lots is planned. Pedestrian walking platform is designed for passengers.

c) Traffic flow for short distance buses is entering the station at west part and departure at east. The buses will enter the station at south-eastern part, then travel to south-western area for departure. Totally 52 parking lots is planned. Separate passengers waling platform is design to avoid traffic disturbance.

d) Taxies and other social cars load and unload at east part. They will enter and departure at the areas same as that for public buses. The traffic flows for the two will be divided by pedestrian walking platform. Three bus routes and 24 car parking lots is designed. Social cars will park at temporary parking area close to 2nd ring road and separate the traffic flow with other vehicles to avoid disturbance with other public traffic flows.

(2) Estimated Passenger Volume

a) Long distance: assuming departure frequency of once per 30 minutes at peak hours, the total daily capacity is 24,667 passengers.
b) Short distance: assuming departure frequency of once per 30 minutes at peak hours, the total daily capacity is 19,500 passengers.
c) Therefore, there will be totally 44,167 passengers travel from the station.

(3) Estimated Traffic Volume

Traffic volume during transition period is shown in Table 2-7.

Table 2-7 Predicted Traffic Volume during Transition (unit: pcu/h)

	Designed Capacity		Average traffic volume		Average V/C	
	E-W/S-N	W-E/N-S	E-W/S-N	W-E/N-S	E-W/S-N	W-E/N-S
Fengli viaduct	3137	3137	2024	2154	0.65	0.69
Fengli side road	3035	3035	2411	2688	0.79	0.89
Side road of 2nd ring road	2720	2720	2029	2529	0.75	0.93
Yulan Road	2720	2720	2495	2035	0.92	0.75
Youyuan Road	2008	-	1500	-	0.75	-
Yanhang Road	1242	1242	978	890	0.79	0.72

Note: Yulan Road is north to south road, the rest are east to west roads.

2.11 Resettlement Plan

To ensure smooth progress of construction of the ITH, the resettlement organization was established with the local government, including Yuelu District government (YDG) and Wangchengpo Sub-district office for all the activities related to resettlement. The land acquisition and resettlement of the terminal will be carried out by YDG.

2.11.1 Land Acquisition

As the terminal is to be enlarged on the campus of existing Changsha West Bus Station (CWBS), it will permanently occupy an area of 175mu. According to the survey, besides the land area of existing CWBS, 18.1mu collective land will be required in Jiangongshan Community (JGSC) of Wangchengpo Sub-district Office, of which, 8.75mu will be farmland. There are no people to be resettled for production, as the people affected have been transferred into urban residents who are not living on the farmland. The temporary loss of land will have a total of 7.5mu of state-owned construction land. The details are shown in Table 2-8.

Table 2-8 Project land loss of Changsha West Terminal

Permanent occupied of land (mu)	Temporarily

					occupied of land (mu)
State-owned land	Collective land			Subtotal	State-owned land
Construction land	Farm-land	Housing plot	others		Construction land
156.9	8.75	6.17	3.19	18.11	7.5

2.11.2 Resettlement

There are two kinds of residential houses to be relocated in the project affected area. The first is the residential houses on the collective land, ie, the houses of residents of Jiangongshan Community which was originally Jiangongshan village. There are 8 households to be affected by residential house which are mainly of brick-concrete and brick-wood structure, and 46 households of transitional sheds which were built and used by the households when they were relocated for other project in the past. The second is the residential houses on the state-owned land, ie, the residential house of employee from Changsha West Bus Station. There are 56 households to be relocated with an area of 4,138m^2 of brick-concrete structure. The total area to be demolished is 11,398m^2 with details shown in Table 2-9.

Table 2-9 Residential House to be Removed by the Project

			Quantity of different structure (m^2)				APs	AHs
			Brick-concrete	Brick-wood	Shed	Subtotal		
C-land	JGSC	Resident house	634.5	2775.7	90.4	3500.6	44	8
C-land	JGSC	Transitional			3759.6	3759.6	163	46
S-land	CWBS	Resident house	4137.9			4137.9	180	56
Total			4772.4	2775.7	3850.0	11398.1	387	110

2.11.3 Mitigation Measures of Land Rehabilitation

(1) Land Rehabilitation

The land to be acquired by the project is namely farmland, and the actual condition is barren land for more than ten year, as the local residents have

been change, during the period of 1994-1999, into urban residents who are not living on the farmland. The residents were production resettled during the transition of personal identity, and accepted into the urban basic social insurance system. The monetary compensation will be adopted as the rehabilitation measure.

The monetary compensation, including land compensation and resettlement subsidy, will be paid to the village authority who originally owned the land with deduction of 20% of compensation for urban basic social insurance. The village authority will distribute the cash to the displaced people on the decision made by the village committee.

(2) Housing relocation and replacement measure

Cash compensation will be paid to displaced people by residential housing on collective land or state-owned land, and source of security housing will be provide by the government for the displace people who can buy the house of suitable size for themselves.

(a) The households living on the collective land will be paid by in accordance with the standards specified in the RAP, if not resettled in other previous project, can buy the new house(s) in neighboring Shanshuixincheng, a newly-built residential quarter, which is the source of security housing provide by the government, based on their own economic conditions and interests. The area provided by the government of security housing is 80square meters per head with buying price of CNY 1,200 per square meters. The market price of housing in the residential quarter is CNY 4,200-4,500 per square meters. The subsidy for the area of security housing will be directly paid to the house provider by the government. If the displace people buy a house with an area more than that by house security policy, the extra area will be bought with market price. In order not to increase the displace people's living cost, the property overhead cost charged in the residential quarter will be balanced by the business house of 5 square meters, arranged by the government for each displaced household.

(b) The households living on the state-owned land will be paid at the evaluated price, and choose the replacement measure of buying security housing by government or cash subsidy.

The sources of economic security housing provided by the government are Jingheyuan, Shanshuixingcheng and Chengxinyuan in the surrounding area with construction size of 70-90square meters and buying price of CNY 2,700 per square meters, while the selling price is CNY 4,200-4,500 per square meters on market. The residential house of displaced people has an area of about 74 square meters in the evaluated replacement price of CNY 3,800 per square meters with a uniform style of 2 bedrooms. If the displaced people buy the economic security house, their housing conditions will be surely improved; if they are not willing to buy the economic security house, they can buy commercial house in the residential quarter or second house in the market whichever they prefer based on their own economic conditions and interests. In such case, cash subsidy will be provided by the government as CNY 50,000 of buying house subsidy and CNY4,000 of finding housing source for each displaced household.

(3) Business rehabilitation of enterprises

The only enterprise to be affected by the project is Changsha West Bus Station (CWBS) under Hunan Longxiang Transport Group Co, which is one of four stakeholders of CITC. Before the demolition of existing passenger building is undertaken, the temporary passenger building will be built on the collective land to be required for the project for transition of passenger transportation□the south end of Jinxing Road will be temporarily used as parking lot for passenger vehicles. When construction of the new passenger building is completed, the temporary passenger building will be demolished for construction of garage and gas-station. During the transitional period of passenger vehicles moving in and out of the temporary passenger building with limited capacity, some shift of passenger vehicles will be readjusted to other bus stations located in south, north and east Changsha. The schedule of bus shift readjustment has been publicly informed by media of television, broadcast and newspaper since November 3, 2010. The bus operation will be

relocated to the bus parking and maintenance building which has been completed, so there will have no impact on the bus operation.

(4) Business rehabilitation of shop

The DMS data shows that there are 11 shops with 20 operators in the passenger building of CWBS along the street. As Changsha is commercially well-developed, it is easy for shop operators to find similar shop with similar premises of leasing in surrounding area, so cash compensation will be used for shop rehabilitation.

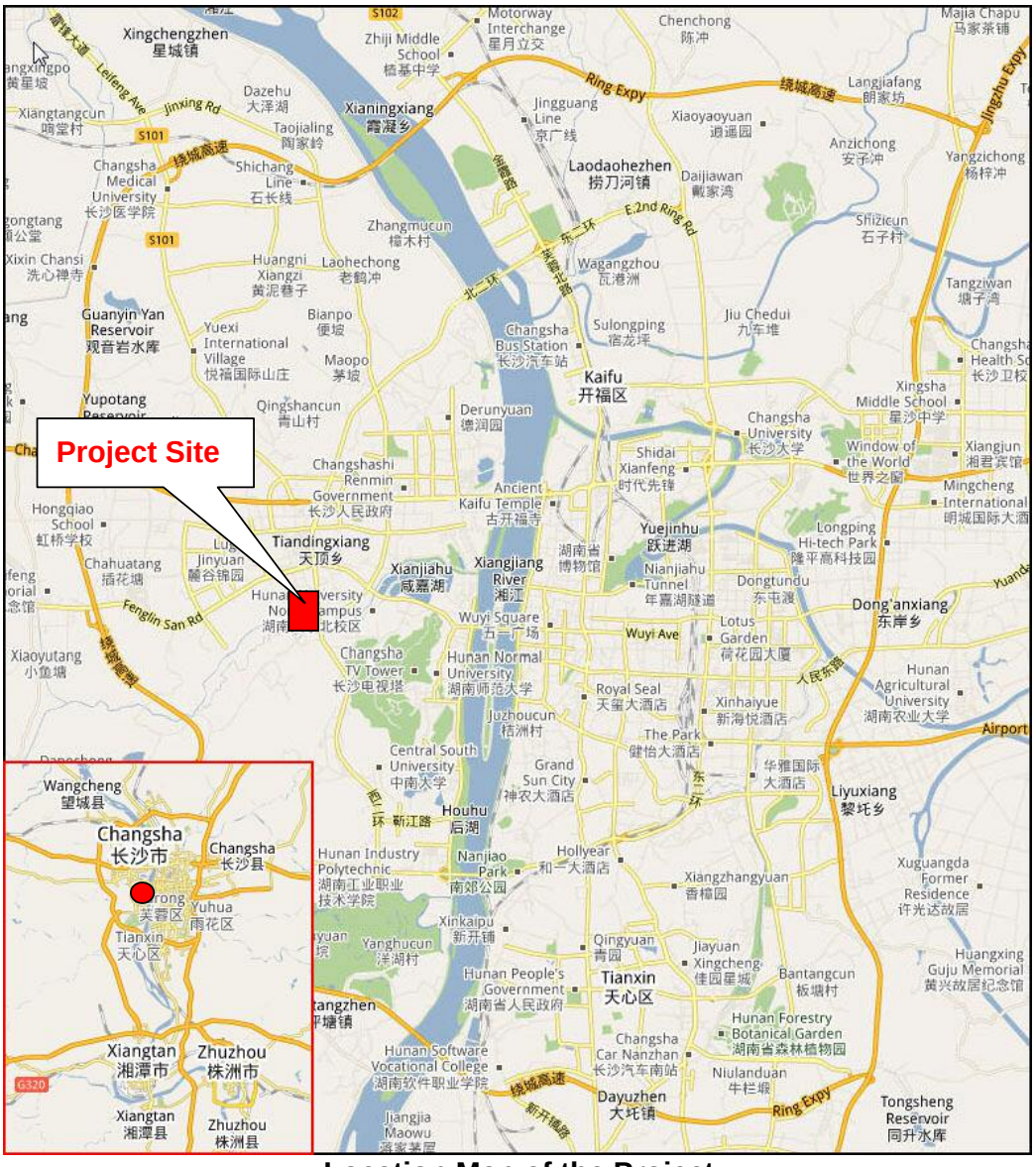
As the compensation for the shop will be paid to its owner, the shop operators will be paid by lump sum of moving allowance.

3. DESCRIPTION OF ENVIRONMENT (BASE LINE)

3.1 Natural Environment

3.1.1 Geographical Location

The project is located in the core modern service area of Great Hexi Pioneer Area. The area is bordered by west second ring road to the east, Yanhang road to the south, Yulan road to the west, Fenglin road to the north.



Location Map of the Project

3.1.2 Topography

The location of West Changsha Integrated Transport Terminal (Changsha Wangchengpo Passenger Transport Station) is 3.5 kilometer away from Xiang River, locating on second-level mesa. The location is topographical formation whose topsoil is brown gray, black gray and so on, soft plastic ~ plastic soft, rich vegetation roots, slice thickness is 0.5 ~ 1.10m; under it is quaternary alluvial layer, the majority is hard plastic red and yellow sub-clay silt, deep-seated is gravel rocks and the tertiary red sandstone.

The peripheral constructions show that there is no mobile fracture zone, landslide, cave or other bad geological phenomena or liquefied soil layer, thus the location is suitable for construction. The underground water is rich, but the water level is a little bit low for the building elevation, which will not affect the construction.

According to the Seismic Oscillation Parameter Zonation Map of China (2001-08-01 construction) issued by National Quality and Technical Supervision Bureau, the proposed location is Changsha, Hunan Province, whose characteristic cycle seismic oscillation response spectrum is 0.35S, peak acceleration is 0.05g. Considering the project is a first-level passenger transport station, the seismic measure takes the standards of 7-degree zone as model.

3.1.4 Climate

Changsha belongs to subtropical humid monsoon climate zone. Affected by the monsoon circulation, entrenched by low-latitude oceanic warm and wet air mass in summer, its extreme temperature was up to 43℃ in the history; controlled by Siberia cold air mass, south suffers from cold snap which brings rain, snow and frost; in the transition zone of alternating cold and warm between spring and summer, the frontal surface and cyclone activity increases which brings wet and rainy season; autumn is dry.

Basic meteorological parameters are as follows:

Highest temperature recorded： 43℃
Lowest temperature recorded： -8.6℃

Average annual temperature： 17.0℃
Average air pressure： 1008.2hPa
Average annual rainfall： 1394.6mm
Minimum annual rainfall： 1018.2mm
Maximum annual rainfall： 1751.2mm
Perennial dominant wind direction： Northwest wind
Summer dominant wind direction： South
Average annual wind speed 2.4m/s

3.1.5 Rivers

Xiang River is 5 kilometer away to the east of the project. From Xiang River 1st
Bridge to Xiang River 2nd Bridge is Changsha whose length is 4 km. The water flow experiences abundant, flood, ping and dry. The average annual water flow is 2131.0m^3/s, dry season flow is 410.0m^3/s (guaranteed rate of 90%), the average annual water level 27.31m, the lowest water level 23.25m, the highest water level 37.37m, the average flow velocity 0.45m/s, the minimum flow velocity 0.20m/ s; Average sand contained amount 0.1 ~ 0.2kg/m^3.

3.1.6 Seismic Intensity

According to the China Seismic Intensity List (GB/T 17742-1999) and the Seismic Ground Motion Parameter Zoning Map of China (GB 18306-2001), the seismic intensity in Changsha area belongs to class VI, with peak earthquake accelerated speed of 0.05g.

3.2 Social Environment

The project is located at the core service zone of Great Hexi Pioneer Area in Yuelu district. In 2007, the State Council approved the city cluster of CZT as a pilot of resource saving and environmental friendly society construction. Great Hexi Pioneer Area is in the core zone of CZT city cluster.

3.2.1 Brief Introduction of Great Hexi Pioneer Area

Great Hexi Pioneer Area is located at west of Xiangjiang River. The total area

is 1200 Km^2 including Yuelu District, High-Tech district, Wangcheng county and Ningxiang county.

The development plan of the Great Hexi Pioneer Area gives prominence to industry development, ecology environment protection, infrastructure construction and pilot area development. The objectives of the plan include:

- Per capita GDP reach to the front rank of the provincial cities;
- Contribution rate of high-tech industry reach more than 70%;
- High-tech industry output more than 400 billion CNY;
- Urban annual per capita disposable income reaches 60,000 CNY;
- Rural annual per capita disposable income more than 40,000 CNY;
- To build Great Hexi a livable new district with construction area of 200 km^2 and population of 1.5 million;
- Total production output of 300 billion.

3.2.2 Economy

In 2009, the GDP in Yuelu Disrict is CNY 35,009.8 million, 15.7% growth over last year, of which: CNY 1,540.23 million of primary industry, 2.6% growth; CNY 17,698.09 million of secondary industry, an increase of 19.0%; CNY 15,771.52 million of tertiary industry with an increase of 13.1%. Per capita GDP reached CNY 51,186. The local fiscal revenue totals CNY 1,400.88 million in 2009, which is 22.5% more than that in 2008. The average income per capita of urban residents is CNY 19,425, which is 8.2% higher than last year, and that of rural residents is CNY 9,613, increased by 13.7%.

By the end of 2009, the resident population in the district is 694,057, which is 20,173 increases over that of last year, while registered population is of 625,527 people with a male/female ratio of 1:0.978. The birth rate is 11.3‰ in 2009, and death rate is 5.6‰, so the population natural growth rate is 5.7‰.

3.2.3 Current Passenger Bus Station Status in Changsha

There are 23 passenger and cargo stations in Changsha, 8 of which are passenger transport stations, 15 of which are cargo stations. The Ministry of Transportation approved 8 passenger transport stations, 3 of which are the

main hub stations, 5 of which are county (city) stations. The three long-distance bus terminal in Changsha: East Station, West Railway Station, South Station daily passenger volume larger Changsha an important component of long-distance passenger transport, highway main hub for the Changsha City Bus Terminal.

Zhang Gongling East Station is located in Furong District, covering about 90 acres, the main city by the great road connections from the train station 7.8KM, designed as a passenger station, the average daily passenger capacity of 10,000 people sent over the main passenger lines sent to Changsha North and east.

South Station is located at Shop Dongjing Yuhua District, covering about 150 acres, mainly connected by the Shaoshan City, from the train station 13.9KM, designed as a passenger station, the average daily passenger capacity of 10,000 people sent over the main passenger lines made To the south of Changsha.

West Point is located Yuelu district, covering about 90 acres, mainly by the National Highway 319 connecting the old city from the train station 10.6KM, designed as a terminal, sending the average daily passenger capacity of more than 10,000 people, the main passenger lines sent to Changsha West.

3.2.4 Drainage System

There are mainly three catchment areas in the west area of Xiangjiang River including Lunan, Wangchengpo and Sanchaji catchments. Separation of rain water and sewer system has been constructed at most of the areas.

The project area is located at Wangchengpo catchment. Waste water from the project will be discharged into urban sewer network at west 2nd ring road and Fenglin road after pre-treatment, and then pumped at Wangchengpo pump station and finally to Yuelu Waste Water Treatment Plant.

Yuelu WWTP has a treatment capacity of 300,000 tons/day and an actual treatment volume of 137,400 tons/day in 2009. The waste water generated by the ITH is estimated 2000 tons/day, accounting for 0.67% of the Yuelu WWTP treatment capacity. Therefore, construction of the project is reasonable in

terms of waste water treatment.

3.3 Environment Baseline

In order to evaluate the environmental quality of the project site, Environmental Protection Monitoring Center of Hunan University is commissioned to monitor and analysis the environmental quality of the proposed project area and the surrounding area during 28th to 30th December, 2010.

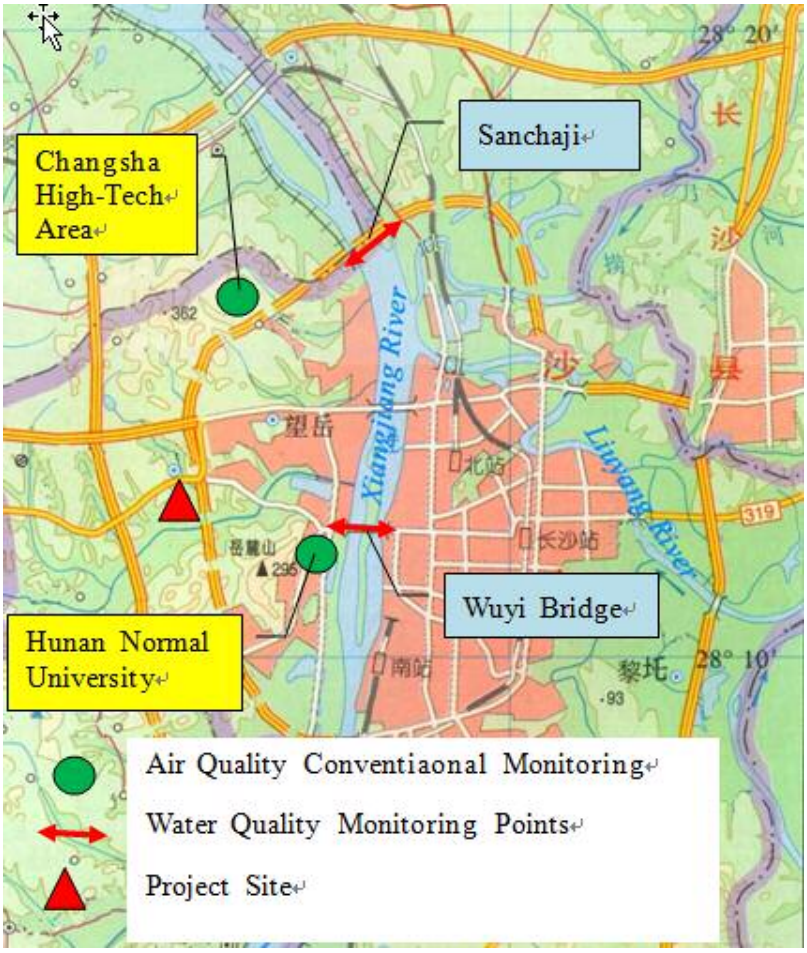


Figure 3-1 Air and Water Monitoring Locations

The proposed project area is located in the existing Changsha West Passenger Bus Station of whose main function is passenger transport with no polluting industries or other major sources of pollution surrounded, the main

polluting source is transport noise and air pollution caused by automotive passenger transport.

3.3.1 Ambient Air

Air quality evaluation of the project area based on 2007 to 2009 monitoring data of Changsha high-tech industrial zones and Hunan Normal University, monitoring and analyzing atmospheric environment of Bus West Station and its surroundings. Requirements for sampling sites, sampling environment, sampling height and sampling frequency are implemented according to "Environmental Monitoring Standards", monitoring methods shown in table 3-1, statistical results shown in Table 3-2.

Table 3-1 Monitoring Project and Sampling Method

Pollutant	Sampling Method	Analysis Method	Source
PM10	Glass fiber filter	Gravimetric analysis	GB/T 6921-1986
SO2	Fluid absorption	Formaldehyde absorption-pararosaniline spectrophotometry	GB/T 15262-1994
NO2	Fluid absorption	Naphthylethylenediamine hydrochloride colorimetry	GB/T 8969-1988

Table 3-2 Ambient Air Quality Monitoring Unit：mg/m^3

Monitoring point	Time	SO2		NO2		PM10	
		Annual average	Daily exceeding rate	Annual average	Daily exceeding rate	Daily exceeding rate	Annual average
HuNan Normal University	2007	0.065	0	0.040	0	0.101	0
	2008	0.053	0	0.041	0	0.095	0
	2009	0.041	0	0.040	0	0.093	10.0□
High Tech Industrial Area	2007	0.063	8.0%	0.033	0	0.105	12%
	2008	0.048	0	0.035	0	0.098	0
	2009	0.039	0	0.032	0	0.092	0
Class II standard		0.06	-	0.08	-	0.1	-

The monitoring results demonstrate that during 2007 to 2009, air condition index are almost qualified within Grade II of "Ambient Air Quality Standards" except that annual average of SO_2, PM10 slightly exceeded the standards in 2007. In general, air condition in this region is good.

3.3.2 Noise

In order to evaluate the noise level of project location, Environmental Protection Monitoring Centre of Hunan University is commissioned to monitor and analyze the sound surrounding Bus West Station area during 28th to 31th December 2010.

Figure 3-2 Noise Monitoring Sites

According to characteristics of the proposed project area and its surrounding environment, Bus West station is divided into sound functional areas properly, and implemented of appropriate standards, specific division are shown in Table 3-3.

Table 3-3 Noise Function Division of Project Location

Zoning	Class	Environmental noise limits LAeq□dB	
		Daytime	Night
Within Bus West Station	3	65	55
Next to transport road region	4a	70	55
Peripheral residential l& commercial	2	60	50
Residential area	1	55	45

Environmental noise monitoring results of equivalent continuous A level in daytime are shown in Table 3-4.

Table 3-4 Environmental Noise Monitoring Results of Evaluated Area

LAeq□dB

Monitoring point	Sound Function Division	30 December		31 December	
		Daytime	Night	Daytime	Night
1#	2	68.3	50.6	73.3	51.5
2#	4a	71.3	51.2	76.7	52.5
3#	4a	67.5	48.2	76.5	53.8
4#	1	50.5	41.5	64.7	40.6
5#	1	48.5	40.2	49.7	40.3
6#	2	56.7	45.5	53.8	43.2
7#	3	61.7	53.2	64.2	50.7

As shown in Table 3-4, environmental noise monitoring results of monitoring sites 1 #, 2 #, 3 #, 4 # slightly exceeded the standard, which are mainly caused by traffic noise.

3.3.3 Water Quality

The river in the project area is Xiangjiang River. Water quality was monitored at two sections: Wuyi Bridge section and Sanchaji section. Water quality monitoring results is shown in Table 3-5.

Table 3-5 Monitoring Results of Xiang River 1st Bridge~ Xiang River 2nd Bridge Water Quality □Unit□mg/L except pH□

Section	Year	Item	pH	DO	Permanganate Index	BOD	NH3-N	Volatile Phenol	As	Hg	Cr^{+6}	Pb	Cd	Oil	Cu	Zn	TP	COD_{Cr}
Wuyi bridge	2007	Min.	7.49	4.9	1.9	1	0.02	0.001	0.0038	0.00002	0.002	0.001	0.0001	0.02	0.001	0.01	0.02	6
		Max.	7.91	10.3	3.4	1	1.37	0.003	0.0206	0.00007	0.002	0.001	0.0021	0.02	0.003	0.08	0.14	19.5
		Annual average	7.75	7.1	2.5	1	0.67	0.001	0.0101	0.00002	0.002	0.001	0.0006	0.02	0.002	0.02	0.06	10.8
		Exceeding (%)	0	13.89	0	0	19.44	0	0	0	0	0	0	0	0	0	0	0
	2008	Min.	7.58	5.1	1.7	1	0.08	0.001	0.0057	0.00002	0.002	0.001	0.0001	0.02	0.001	0.01	0.03	6.1
		Max.	8.04	11.1	3.2	2.1	2.71	0.003	0.0239	0.00002	0.002	0.001	0.0012	0.02	0.005	0.04	0.1	19.7
		Annual average	7.79	7.2	2.4	1	0.64	0.001	0.0144	0.00002	0.002	0.001	0.0004	0.02	0.002	0.02	0.06	12.1
		Exceeding (%)	0	0	0	0	22.22	0	0	0	0	0	0	0	0	0	0	0
	2009	Min.	7.53	/	2.1	/	0.57	0.002L	0.0042	0.00005L	/	0.002l	0.0006	0.05L	/	/	/	/
		Max.	8.07	/	3.1	/	0.98	0.003	0.0256	0.0001	/	0.002l	0.0021	0.05L	/	/	/	/
		Annual average	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
		Exceeding (%)	0	/	0	/	0	0	0	0	/	0	0	0	/	/	/	/
	Class III standard		6-9	5	6	4	1	0.005	0.05	0.0001	0.05	0.05	0.005	0.05	1	1	0.2	20

Continued

Section	Year	Item	pH	DO	Permanganate Index	BOD	NH3-N	Volatile Phenol	As	Hg	Cr+6	Pb	Cd	Oil	Cu	Zn	TP	CODCr
Sanchaji	2007	Min.	7.43	4.3	1.9	1.0	0.16	0.001	0.0036	0.00002	0.002	0.001	0.0001	0.02	0.001	0.01	0.03	6.6
		Max.	7.97	10.0	4.4	3.7	2.62	0.003	0.0260	0.00009	0.002	0.001	0.0019	0.02	0.003	0.07	0.29	19.7
		Annual average	7.72	6.8	2.6	1.3	0.93	0.001	0.0109	0.00003	0.002	0.001	0.0006	0.02	0.002	0.02	0.08	12.2
		Exceeding (%)	0	0	0	0	11.11	0	0	0	0	0	0	0	0	0	0	0
	2008	Min.	7.50	3.6	1.7	1.0	0.12	0.001	0.0055	0.00002	0.002	0.001	0.0001	0.02	0.001	0.01	0.03	6.0
		Max.	8.00	11.0	5.3	3.7	4.44	0.003	0.0244	0.00002	0.002	0.001	0.0011	0.02	0.013	0.03	0.51	19.7
		Annual average	7.75	6.9	2.7	1.4	0.87	0.001	0.0139	0.00002	0.002	0.001	0.0003	0.02	0.003	0.01	0.09	14.9
		Exceeding (%)	0	0	0	0	11.11	0	0	0	0	0	0	0	0	0	2.78	0
	Class IV standard		6-9	3	10	6	1.5	0.01	0.1	0.001	0.05	0.050	0.005	0.5	1.0	2.0	0.3	30

The monitoring results show that the NH3-N concentration exceeds the standard at both sections in 2007 and 2008. It is mainly because the untreated domestic water directly discharged into Xiangjiang River. Since 2009 when the Yuelu Waste Water Treatment was put into operation, the water quality of the Xiangjiang River improved greatly. It can meet Class III Surface Water Standards at the section of Wuyi Bridge. The total phosphor exceeds the standard in 2008, mainly because the industry water discharge and aquiculture activities around the area.

3.3.4 Vibration

Based on the characteristic of traffic vibration and its intensity, considering the environmental sensitive sites location, the assessment scope for vibration impact is determined as 100 meters from the project boundary.

There are totally five vibration sensitive sites around the project areas (same as noise sensitive), including 4 residential areas and one school. The applicable vibration assessment standard is shown in table 3-6.

Table 3-6 Applied Vibration Assessment Standards

Standard	Limit	Applicable scope
Urban Area Vibration Standard (GB10070-88)	Residential area: Daytime 70dB, Night 67dB	For sensitive sites located within class I noise function zone
	Mix and commercial area：Daytime 75dB，Night time 72dB	For sensitive sites located within class II noise function zone
	Road side：Daytime 75 dB，nighttime 72 dB	For sensitive sites located within class IV noise function zone

(1) Monitoring equipments: include AWA6256 vibration analyzer for environmental vibration monitoring, B&K3560C and 4570B for vibration speed monitoring.

(2) Monitoring time: once at day time (6:00-20:00) and once at night time (20:00-24:00).

(3) Monitoring method: PRC Environmental Vibration Monitoring Method for Urban Area. Method for situation of irregular vibration is applied. Continually monitoring 20 minutes and record the accumulate percentage VLz10 as results.

(4) Monitoring locations: include 5 monitoring section and 7 monitoring points (figure 3-2).

(5) Monitoring results are shown in table 3-7.

Table 3-7 Environmental Vibration Monitoring Results

Sensitive site	Monitoring sites	Distance (m)	Vibration（VL_{Z10}），dB		Standards (dB)		Exceeding (dB)		Source*
			Day	Night	Day	Night	Day	Night	
Guangxia Xinyuan	V1-1	65m	55.3	54.1	75	72	/	/	□□
	V1-2	55m	50.8	49.2	75	72	/		□□
	V1-3		51.8	48.9	70	67	/	/	□□
Wangxing Jingyuan	V2-1	55m	54.7	52.1	75	72	/	/	□□
Chengxi Gongyu	V3-1	90	52.6	50.1	70	67	/	/	□□
Nanjiatang	V4-1	80	54.1	51.5	70	67	/	/	□□
Wangxin school	V5-1	75	49.8	47.8	70	67	/	/	①

Note: * □ means road traffic; □ means human activities

Monitoring results show that the VLz10 value ranges 49.8 to 54.7 dB at day time and 47.8 to 54.1 dB at night time. It meets the national Urban Environmental Vibration Standards for residential and educational areas.

3.3.5 Solid Waste

Currently, the solid waste in the project areas is domestic solid waste from passengers and staff of the bus station. There are about 43,000 people in the station every day. Each person generate solid waste amount of 0.5kg/d, thus the total domestic solid waste generated is about 21.5 tons per day. These solid wastes will be collected and transported to Heimifeng Land Fill site through No.1 Solid Waste Transfer Station.

3.3.5 Ecology Environment

The Western Changsha Terminal will be expanded at the location of existing bus station. It is surrounded by Fenglin Road to the north, Yulan Road to the west, Yanhan Road to the south and second ring road to the east. The total area is 61,835 square meters.

There is no rare or endangered animal and plant in the surrounded area of the project.

3.3.6 Physical Cultural Resources

Based on the survey conducted by the EIA team for the Changsha No.2 subway project, there is no physical cultural resource in the project area.

4. ALTERNATIVE COMPARISON

4.1 With and Without Project Alternatives

The Without project scenario is not a reasonable solution due to the following reasons.

Reconstruct Changsha Bus West Station is the need of passenger transport development.

(1) Passenger transport demand conflicts with the supply of station conflicts. The bus and passenger transport of Bus West Station are arranged in the north block, bus entrance in the west; passenger transport entrance and bus exit in the northeast corner. Traffic flow in weekdays is 1600 trips/d, that in rush hour is 130 trips/h, traffic flow at week ands and holidays is 1400 trips/d, that in rush hour is 200 trips/h. Furthermore, vehicles mainly park in the north block, through west and northeast entrance to park in and drive out, which leads to the conflicts between passenger transport demand and the supply of stations.

(2) The chaotic traffic and transport are poorly managed, and there is no corresponding management between the Changsha Bus West Station bus flow and passenger flow, which are mutually affected. This also happens to coach and short-distance passenger transport. The underpass connects Yulan Road and Fenglin Road beneath have different directional traffic flow (turn left, turn around), the pedestrians and vehicles are mutually affected. The main entrance of passenger transport has a variety of traffic flow, which leads to operational inefficiencies.

(3) The connection between general traffic organization and P&R is poor. This is due to chaotic traffic and poor organizational management.

(4) The Bus West Station needs an integrated transport solution. The current scale of the station can’t meet the passenger transport demand, meanwhile the bus terminals lie in the west. In the planning, Rail Line 2 is on the project location, West 2nd Road-Fenglin Road interchange on the northeast corner. All the factors are relevant to the reconstruction to form an integrated passenger transport hub.

It’s a transport hub integrates Changsha external and intercity transportation.

(5) Changsha external and intercity transportation hub. The Bus West Station combining bus transport, urban regular public transport, rail transport, taxis, and other modes of transport is based on “two kinds society” and the new industrialization, urbanization, new village construction model area. It should reflect the connection between all kinds of transport mode and the organic functions.

(6) Changsha main bus transport hub is a national composite hub (Changsha, Zhuzhou, Xiangtan) planned by national bus transport hub. The Bus West Station is a first-level station, both directional and regional. Its transmission volume is more than 20,000 persons/d, holiday transmission volume is more than 60,000 persons/d.

(7) It’s the center of bus terminals. There are 11 bus lines, 3 midway bus lines and 5 minibus lines in the Bus West Station. Regular public transport will be improved in the West Station and become the terminal station and passenger transport centre.

(8) It’s the hub of Rail Line 2. The Bus West Station is an important hub of Rail Line 2. According to the latest planning of Rail Line 2, Line 2 is to go through Youyuan East Road to Long Wanggang Road.

(9) It’s the access point of other transport modes. There are other transport modes and parking lots in the Bus West Station, it’s the access point.

Constructing “Changsha Western Changsha Terminal (Changsha Wangchengpo Bus Station)" is the need for innovating road transport technology and service improvement. For a long time, the single function and extensive operation of the Bus West Station can’t meet passengers’ demand. Travelling comfort, transport rapidity, information network service and other high-quality service system is difficult to establish. Facilities inadequate, shortage of information and lower management level making it only sells tickets and departs which cannot achieve dimension-scaled, standardized, programmed and informationized operation and service and are not suitable to the market economy and social development demand. Therefore, the

construction of “Changsha Western Changsha Terminal" is to bring opportunities for innovating road transport technology and service improvement, and in the meantime, set an example to transportation in other provinces

Constructing "Changsha Western Changsha Terminal” (Changsha Wangchengpo Bus Station) " is the need for sustainable urban development.

In the revised General Changsha City Planning, the necessity of sustainable development has been highlighted. Sustainable development is important prerequisite to establish an integrated bus station. Traffic congestion, traffic noise, exhaust pollution, traffic accidents and so on are obsessing cities/towns in China. Therefore, through proper planning and organization, constructing an integrated transport hub, which is dimensions scaled, standardized, programmed and informationized can effectively address the relationship between development and environment

4.2 Alternative Locations

There is no alternative location since the proposed location is in the core area of Pilot District. It is determined in the Changsha City Transportation Development Plan.

(1) Changsha Great Hexi Pilot District Spatial Development Strategy Planning. Changsha Great Hexi Pilot District is a multi-group network of transportation routes of the regional urban spatial structure based on “one axis two strips” spatial structure, namely, “one core three poles” regional spatial development model. The regional development model of “one core three poles” is : cities and towns within the Pilot District around the leading industries and main functions forms “a modern service core area, two ecological conservation sub-area and three industry service area”. The Bus West Station is located on the “one core” – modern service core, which locates on the east-west transportation corridor and is an important part of Great Hexi Pilot District.

(2) The Bus West Station Transport Hub and surrounding land exploitation demand. From the prospective of Great Hexi Pilot District spatial structure, the positioning of modern service core area is the main spatial carrier to enhance

the Pilot District service capability, including Bing River core area, New & High Tech Industrial Development Zone and Leifeng Industrial core area. Bing River core area centers on the municipal government, it's the future urban core area which is to carry the administrative, financial, conference, tourism, cultural, commercial, and residential and other functions to reflect the high quality image of Bing River. Leifeng Industrial core area is located on the middle of Changning industry corridor, focusing on products exhibition, information services, administration, sports and livable functions. Therefore, there is strong land exploitation demand around the Bus West Station; the functional positioning should comply with this demand. Meanwhile, relying on the comprehensive development of transport hub to bring passenger flow, and the integrated development of the transport hub model has become the domestic and international trends and research priorities. The Bus West Station has the conditions from the prospective of location and traffic factors.

The ITH is located within the core area of Great Hexi pilot area. It has the following advantages:

(1) Convenient for people come and go and for transfer other. The transit hub includes road passenger long distance transportation, urban public bus station, taxi parking. There is a line 2 subway station located here. It is convenient for people transfer to other kind of transportation tools and saving transfer time.

(2) Traffic flow is reasonable and easy to come in and go out. The transit hub is adjacent to west 2nd ring road to the east, Fenglin road to the north. These two roads are trunk road of Changsha City with good traffic condition. It will not cause traffic jam in the area.

(3) The area has enough space for expanding. The land has been reserved by Hunan Longxiang Transportation Group and currently used for West Bus Station. The area is flat with no old trees and cultural relics around. It has advantages of good construction condition with stable geology condition, access to water, power and telecommunication.

Therefore, the project location is reasonable.

4.3 Alternative Project Layouts

Two options of project layout were proposed. The original one is to build two major buildings including one information center and a multi-functional building (Figure 4-1); the revised project will build three buildings including a hotel, an office building and an apartment building (Figure 4-2).

Figure 4-1 Previous project Layout

Figure 4-2 Revised Project Layout (Recommended)

The revised layout is more reasonable in terms of traffic channel, aesthetic of buildings, convenience to passengers, and profitability. The two alternatives

have no significant difference in terms of environmental impact.

4.4.1 Reasonability Analysis of Project Layout

The project area will be divided by Youyuan Road into south part and north part.

The north area includes three major parts including the major passenger building, and three commercial buildings.

The south area is for public bus parking lot, gas station and bus maintenance station. The parking building has been constructed and will be connect with passenger bus station building at north part through viaduct. The stations can provide service to the public and passenger buses at each floor.

(1) Passenger building

Four floors passenger building will be constructed along both of Fenglin road to the north and West 2nd Ring Road to the east. First floor is for ticket office, waiting hall and other integrated service. Second floor is planned as waiting area and departure area. Third floor is passenger recreation area. Fourth floor is for driver rest.

The passenger building is closer to the West 2nd Ring road, shortened the distance between the viaduct and the road that is east to channel the traffic flow. Therefore the location is reasonable.

(2) Long Distance Bus Parking and Departure

Departure area is located along the second floor of passenger building with total 39 bus parking spaces. The five floors parking building will be located at the center surrounded by the departure area, mainly for buses waiting for departure. It will have 344 parking spaces.

The center long distance bus parking building is adjacent to the departure area. It can easily channel the traffic flow.

(3) Commercial Area

The commercial area is planned for hotel, apartment, shopping center. It is located at the west part of the project area that adjacent to the commercial street. This area is isolated with the traffic flow in east part.

(4) Public Bus Parking Building

Located at southern part of the transit hub, the public bus parking building will be connected with the passenger building through viaduct. It will prevent the traffic conflict with the long distance traffic flow.

(5) Maintenance Shop and Gas Station

Maintenance shop will be located at the south edge area of the transit hub. It will not affect the traffic flow.

Gas station is near the maintenance shop to the east and the public bus parking building to the north. It is convenient for bus gas filling.

(6) Environmental Protection Facilities

The environmental protection facilities designed include underground refuse transfer station, septic tank, oil filter tank and smoke flue. Refuse transfer station will be located at northeast corner of the area where is the downwind with less people active. It is near the west 2^{nd} ring road that easy for waste transportation. Septic tank is located at north part adjacent to Fenglin Road. It has the advantages of shortest sewer pipe length for both collection and discharging to urban sewer network. Oil filter tank is set at the area between public bus parking building and maintenance shop to reduce the discharging distance of waste water. Smoke flues are designed at the downwind direction of the office building.

In conclusion, except the gas station is close the residential area that might affect the people nearby in case of accident, the layout of rest infrastructures is reasonable.

4.4.2 Reasonability Analysis of Viaduct and Road Construction

To channel the traffic stream, the project proposes to build viaduct connecting with west 2nd ring road. This will avoid traffic conflict of long distance bus departure and local traffic. Moreover, it will spatially separate the long distance bus traffic flow with the local public bus flow. Therefore, the construction of viaduct is necessary to efficiently divert traffic.

The project planned to widen the Fenglin Road by 12 meters, the auxiliary road of west 2nd ring road from 3 lanes to 4 lanes. These will help to speed of the buses passing through the entrance and exit in a short time.

4.4.3 Reasonability Analysis of Traffic Flow Design

According to the “Zero Transit” principle, passengers by social vehicles, buses, taxis get off near west 2nd ring road. Through the ticket building, passengers will be diverted by long distance and short distance. Moreover, at the southeast corner of the transit hub, a subway station will be constructed.

The traffic flow design spatially separate long distance passenger transportation, public buses, taxies, social vehicles, subway. Such arrangement will ensure a smoothly traffic flow.

4.4 Consistency with Relevant Plans

Changsha Municipal Government planned to expand the city, including building west area of Xiangjiang River as Great Hexi Pilot Area. The objective of the plan is to construct the area as energy saving and environmental friendly pilot area, high-tech industry area, sample area of urban fringe, livable area with nice ecological environment. The total area of the plan is 1,200 square kilometers. To achieve these people oriented objectives, environment will be improved and infrastructure will be developed in advance. Under the above background, to build a transit hub with road, passenger transportation, subway, and public bus is urgently necessary.

The construction of national roads of NH107, NH320, NH319 and expressways of Beijing to Zhuhai, Xiangtan to Shaoyang, and Changsha to

Changde has greatly improved the road transportation. About 80%-90% of transportation volume is by road.

At present, Changsha city has three long distance passenger stations including east bus station, west bus station and south bus station. With the rapid increase of volume of passenger transportation, the existing transportation capacity could not meet the need. Therefore, to construct a larger scale and advanced transit hub is imminence.

The Changsha Municipal Government has included the west bus station expanding in the *Changsha Bus Station 10th five year development plan and 2020 long-term development plan.*

The total land use area is 61835 square meters. The ITH will be constructed at the location of existing West Bus Station. This area is allocated for transportation in the Changsha City Land Use Plan.

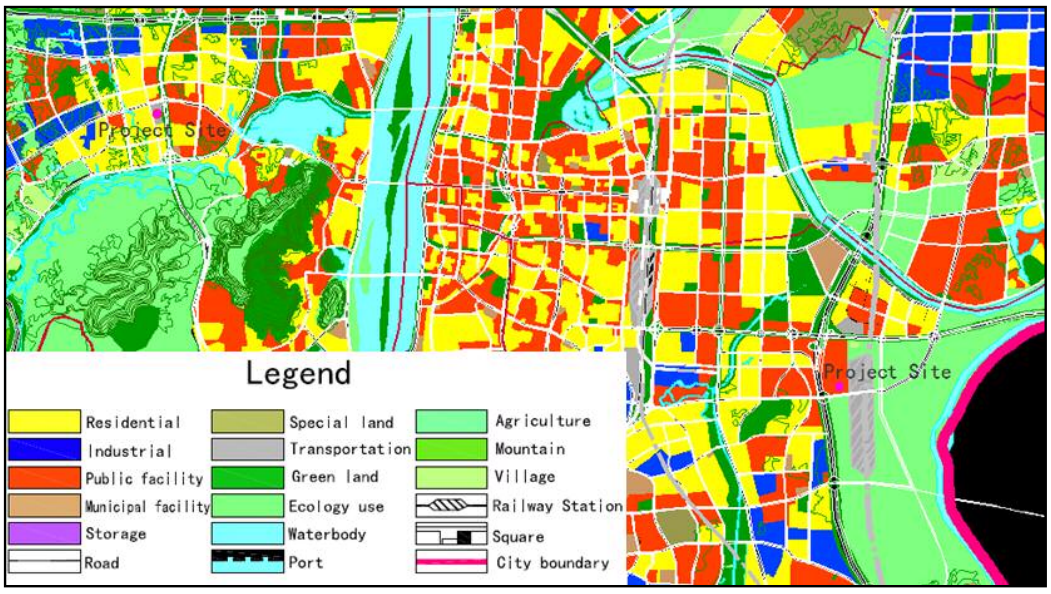


Figure 4-3 Changsha Land Use Plan

In a word, the Western Changsha Terminal project is consistence with *Changsha Master Plan and Transportation Development Plan as well as the Land Use Plan.*

5. ASSESSMENT OF IMPACTS AND MIGIGATION

As all transit hub construction projects, the project will have the potential to cause direct, indirect, or cumulative impacts to the social and natural environments. The project is anticipated to have beneficial impacts related to increased mobility and promote economic development. Manageable adverse impacts are primarily related to (i) noise; (ii) community impacts such as resettlement and community severance; (iii) induced and scenic impacts; and; (iv) impacts during construction and operation.

The project has implemented approach to minimize environmental and social impacts:

(1) Sound Engineering. The project has been designed with state-of-the-art engineering.

(2) Comprehensive Mitigation Plans include detailed environmental design plans, energy saving design, environmental management plans, construction management, resettlement action plans have been prepared in order to minimize unavoidable impacts from the project.

5.1 Air Quality

5.1.1 Sensitive Sites

Air pollution sensitive site near the project is shown in Table 5-1.

Table 5-1 Air pollution and Noise Sensitive Area

Sensitive Site	Location	Distance (m)*
Guangxia Xiyun Residential Area	West of Yunan Rd	100
Wangxing Jingyun Residential Area	East of 2nd Ring Rd	95
Chengxi Residential Area	East of 2nd Ring Rd	95
Nanjiatang Residential Area	South of Youyuan Rd	100
Wangxin Primary School	South of Youyuan Rd	120

Note: * means the distance between sensitive site and nearest construction site

5.1.2 Pollution Source

Dust arise from construction site is mainly caused by vehicle transportation, amount for about 60% of the total. With assumption of 100 vehicles working on site in the peak period, each vehicle travel 100 km with speed of 10 km per

hour, ground cleanness is 0.5 kg/m^2, the estimated dust generated is 1,894 kilogram per day.

(1) Dust from stockpile and construction sites

Dust generated from material storage sites and excavated sites can be estimated as follows:

$$Q = 2.1 (V - V_0)^3 e^{-1.023w}$$

Where: Q——generated dust amount, kg/(t·a)□

V——average wind speed, m/s□

V_0——dust generation wind speed, m/s□

W——water content, %□

V_0 is closely related with particular size and its water content, therefore, watering the excavated and material storage sites is an effective measure to control dust.

(2) Dust from vehicle transportation.

It is reported that dust generated by transportation vehicles accounts for 60%ofthe total dust amount. At dry condition, dust generated by transportation vehicles can be estimated as follows.

$$Q \square 0.123(V/5)(W/6.8)0.85(P/0.5)0.75$$

Where □Q——vehicle generated dust amount, kg/(km•vehicle)□

V——vehicle speed□km/h□

W——vehicle load□tons□

P——road surface dust, kg/m^2.

Table 5-2 shows the dust generation amount of an 10t truck travel 1 km at different road surfaces with different speeds.

Table 5-2 Transportation Vehicle Dust Generation (unit: kg/km.vehicle)

P(kg/m^2)	0.1	0.2	0.3	0.4	0.5	1

Vehicle speed(km/h)						
5	0.051	0.086	0.116	0.144	0.171	0.287
10	0.102	0.171	0.232	0.289	0.341	0.574
15	0.153	0.257	0.349	0.433	0.512	0.861
20	0.255	0.429	0.582	0.722	0.853	1.435

From table 5-2 can be seen that at same road surface condition, the faster the truck, the more dust generated. And under the same speed, the dirty the road surface, the more dust generated. Therefore, to control the vehicle speed and keep the road surface clean are effective measures to reduce transportation dust. Watering 4-5 times per day can reduce about 70% of the dust. Table 5-3 shows the dust suppression results by watering construction sites.

Table 5-3 Experimental results of watering construction sites

Distance (m)		5	20	50	100
Hourly TSP concentration (mg/m^3)	Without watering	10.14	2.89	1.15	0.86
	Watering	2.01	1.40	0.67	0.60

It can be seen from table 5-3 that 4-5 times watering the construction site will effectively control the dust generation. The impact area of TSP pollution can be controlled within 20 to 50 meters.

(3) Vehicle emission

Per vehicle kilometer emission includes: CO: 5.25g, THC 2.08g, NOx 1.044g. About 100 vehicles will be used during peak construction period and average travel distance is 100km. The estimated vehicle emissions are: CO 52.5kg, THC20.8kg and NOx 10.44kg.

Average traffic volume of the existing west bus station is 12,919 actual vehicles per day, including 10,155 buses, 2,500 taxies, 264 social vehicles. According to monitoring results for similar bus station, average emission factors are: NO2: 0.0037g/s, CO: 0.1309 g/s and THC: 0.0279 g/s. The total estimated vehicle emissions are: CO: 201.5kg/d, NO2: 5.76 kg/d, THC: 43.6 kg/d.

5.1.3 Construction Phase

(1) Dust Impact

Airborne dust will be a primary air contaminant during the construction phase. The sources of the dust will be unpaved access roads, disposal areas, materials storage areas and transportation. The factors affected dust airborne will include climate conditions and type of construction activities. The impact area can be up to 150 meters from the source of dust. According to the *Regulation on Changsha Dust Control Measures for Construction Site* issued by Changsha EPB in 2004, mitigation measures to overcome these localized, potentially adverse impacts include:

(i) The project implementation agency should specially-assigned person for construction site dust control and management. Two litter persons should be hired for the construction site cleaning.

(ii) Fence the construction site with wall that not less than 2.5 meter high.

(iii) Cover the building under construction with dust-clothes at 1.5 meters outside of the building, or with dust prevention net with density not less than 2,000 mesh per 100 squire centimeters. The total area of dust prevention clothes is about 176,000 square meters. These measures should be taken before construction and the dust prevention clothes should be at least 2 meters higher than that of the working height.

(iv) Construction site clean management system should be developed considering the different air pollution index, temperature, humidity.

(v) For construction sites inside of the transit hub, man-powered water spring or water syringe will be used. For the 100 meters of road outside of the transit hub, sprinkling truck will be used together with man-power road cleaning. When air pollution index higher than 100 or wind force scale more than 4 classes during dry season, site or road cleaning should be frequently conducted after water spring,

and no earth work is allowed. When air pollution index is less than 50, site cleaning frequency can be reduced accordingly.

(vi) Construction team will be required by contracts to provide water spray vehicles to water the unpaved ground, storage piles and other areas where airborne dust may originate. The water spray operation will be carried out in dry and windy day, In average, construction site and road should be watered 4 to 6 times with 5 cubic meter water each time.

(vii) In case of temporary construction waste or earth stored at site for more than two days, the site should be covered with dust prevention clothes. The total cover area is about 1000 square meters. Construction power materials should be stored in houses or sealed.

(viii) Avoid truck overloading; vehicles delivering fine materials to the sites must be covered. The exit of the construction site will be set at the east side near second ring road. At the inside of the entrance gate, vehicle washing platform will be set. Two persons will be assigned for car washing with cleaning machine. The 8 meters width access road from the gate to the construction site should be hardened. The road at the distance 100m from the gate should be kept clean.

(ix) Forbid burning waste construction materials. Solvents and volatile materials and clean energy will be used properly. Enclose the demolition sites and road construction sites with colored fencing. Trucks carrying earth, sand, or stone will be covered with tarps. Proper timetables, routes, and materials classification should be developed.

(x) Pre-construction monitoring of existing ambient air quality will be undertaken.

(2) Vehicle Emission

Construction machinery during site cleaning, leveling, and construction material and waste transportation will cause vehicle emission with major pollutant of CO and NO_2. The impact will be limited within the construction period. Mitigation measures include:

(i) Vehicles properly maintained and passing annual inspection tests supervised by Changsha EPB. All the construction vehicles should meet the Limit on Vehicle Emission standard (GB3847-2005), issued by Ministry of Environment in 2005.

(ii) Construction vehicles should use cleaner fuel.

5.1.4 Transition Period

Table 5-4 shows the estimated traffic volume during transition period.

Table 5-4 Traffic Volume during Transition Period (unit: pcu)

Road	Design capacity（pcu/h）	Existing traffic		Estimated traffic	
		Peak hour traffic (Pcu)	V/C	Peak hour traffic (pcu)	Increased Traffic (pcu)
Side road of Fenglin road	5624	3788	0.674	3961	173
Side road of 2nd ring road	5624	3286	0.584	3520	234
Yulan road	4037	2141	0.530	2410	269
Youyuan road	2740	942	0.344	1169	227
Yanhang Road	2232	1086	0.487	1318	232

Based on the methodology listed in the EIA specification for road projects, assuming the vehicle type ratio of small/ medium /large at 6/3/1, the vehicle emission for the transition period is estimated as shown in Table 5-5

Table 5-5 Vehicle emission during transition period

CO	THC	NO2
187.45	69.90	15.25

From table 5-5 can be seen, during transition period, the traffic increase is small and the increased vehicle emission is small accordingly. Therefore, the impact during transition period is slight.

5.1.5 Operation Phase

During operation, there will be no coal burning facilities within the transit hub. Then energy for the hub will be from electricity, natural gas and solar power. Therefore, air pollution will be controlled from the source.

The major air pollution source will be vehicle emission from parking garage, waste from gas filling station, maintenance work shop and smoke from restaurant.

(1) Vehicle Emission Impact

Vehicle garage will equip with ventilation device, inside vehicle emission will be exhausted at outside.

Underground garages are located at the basement 1 and basement 2 of the public bus garage and basement 1 and basement 2 of commercial building. The vehicle emission will be released to outside through the exhaust fan. The air vent is set at widen area with better dispersion condition to avoid accumulation; and leeward to hotel and office buildings together with greening measures to reduce impact. The impact is slight.

Outdoor parking area is located at open area that has good dispersion condition, together with trees planting around to absorb vehicle emission. Thus, the impact on air quality is not significant.

Mitigation Measures

To mitigate the impact of vehicle emissions, Changsha EPB will follow the national vehicle emission control strategies specified by the Ministry of Environmental Protection such as:

(i) Enforcing stricter emission standards (e.g., step IV of GB18352-3-2005 and GB17691-2005) by July 2010.

(ii) Enforcing an inspection and maintenance program for all existing vehicles, including (a) annual emission checks and random roadside testing; (b) installing emission control devices that require vehicles to be repaired or updated if they cannot meet required

standards; (c) development of a quality audit system to assess the quality of vehicle emission tests and to prevent fraud and corruption; (d) upgrading vehicle testing facilities as needed; and (e) promoting environmental awareness regarding vehicle emissions;

(iii) Encouraging use of alternative or cleaner fuels by modifying existing vehicles to dual-fuel engine vehicles, and establishing cleaner filling stations such as compressed natural gas stations; and

(iv) Forcing the retirement of vehicles that are more than 8–10 years old and have failed the emission inspection test three consecutive times, and encouraging retirement of old vehicles through subsidies and enforcement.

(2) Gas Station VOCs Impact

All gasoline stations have the potential to emit VOCs that increase on-the-ground ozone, causing significant lung ailments for surrounding populations.

Waste gas emission mainly comes from gas evaporation during gas filling, and oil tank unloading. Gas evaporation from gas filling is the key source during gas station operation accounting for a higher percentage of the total emission amount. The project is estimated to generate volatile hydrocarbon 1,248kg per year. Generally speaking, evaporation during gas filling will not cause high density pollution due to the volatile hydrocarbon will regularly release to the air.

In contract, the pollution intensity will be much higher during oil tank unloading because it happens within a short period. According to information from similar gas stations, the impact area is 50 meters from the tank and the impact period is about 20 minutes.

In common situation, the emission from both the vehicle gas filling and oil tank unloading can meet Class II standard of Air Pollutant Emission Standards (GB16297-1996).

Mitigation measures include:

(i) Gas station design should strictly follow the Code for design and construction of automobile gasoline and gas filling station (GB50156-2002). Acceptance check should be conducted by relevant agency after completion of the construction. Certification on operation of dangerous chemical materials should be obtained before operation.

(ii) To reduce releases of volatile organic compounds (VOC) and relevant ozone problems, *a vapor recovery system for filling gasoline* should be installed.

(iii) A vapor recovery system reduces volatile organic compounds and other hazardous air pollutants during gasoline refueling. It collects vapors at the fill pipe and returns them to the underground storage tank. Stage I vapor recovery systems connect tubes from the storage tank to the cargo tanker to capture harmful vapors. Stage II recovery systems capture vapors through the pump hose, when vehicles are refueled, and transfer them back to the storage tank. Both system stages conserve gasoline by decreasing evaporation rates. Without vapor recovery chemical, equilibrium in the storage tanks would be lost because air would be introduced into the system; gasoline would be lost to evaporation. Most importantly, harmful air pollutants are not released into the atmosphere, improving air quality which in turn protects public health.

(iv) To reduce VOC releasing, *a vapor recovery system for unloading gasoline* should be installed. It is suggested that the gas pump nozzle should be immerged at less than 200 mm from bottom of the tank. DN100mm soft pipe connects storage tank with the vehicle tank with sealed quick joint. After unloading, no residual oil is allowed in the soft pipe. Meanwhile, vapor recovery system for unloading gasoline should be installed, which can reduce 93% of oil lost.

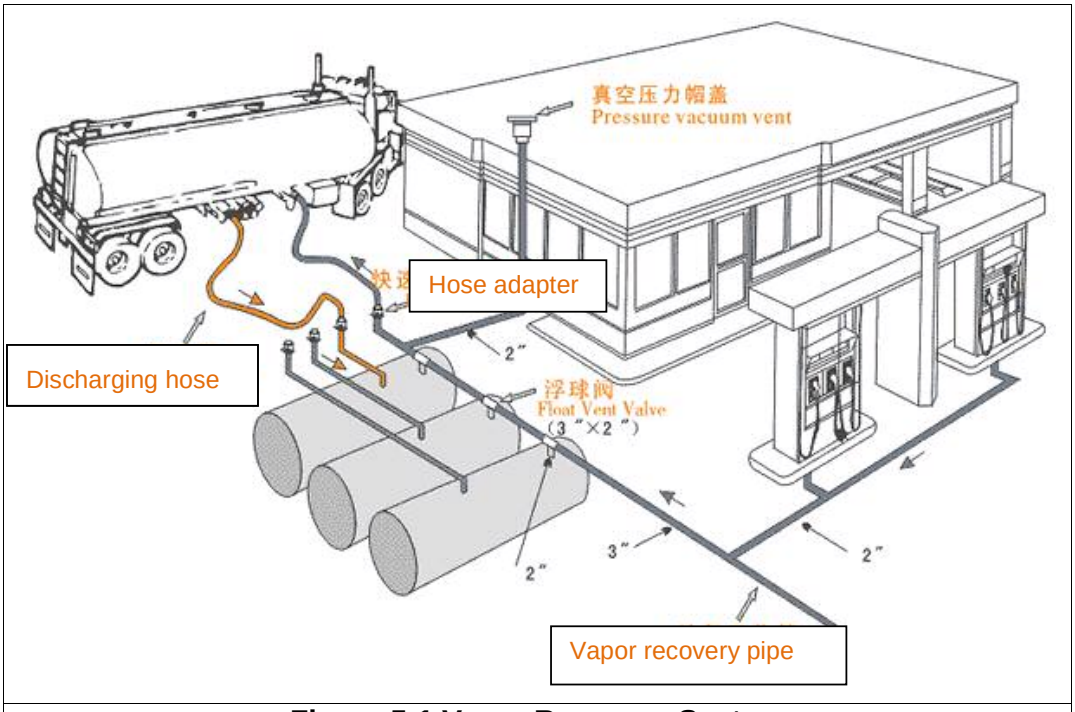


Figure 5-1 Vapor Recovery System

(v) All the connection pipes, hoses, valves should be sealed that ensure no leakage under the pressure of 750Pa. Underground storage gasoline tank should be installed with electronic level gauge.

(vi) Liquid resistance should be tested by filling 10 liter gasoline before covering the oil pipe network. Soft pipes should be equipped with breakaway coupling valve. Stop gas filling when the oil level reach automatic stopping level.

(vii) With implementation of the above mentioned mitigation measures, total emission can be reduced by 76%. Moreover, the vapor recovery system can bring economic benefit.

(viii) Except the above mentioned hardware facilities, management measures should be also strengthened. The operation of the gas station should strictly follow requirements under *Safety Code for Operation at Gas Stations*（*AQ3010-2007*）.The requirements mainly include:

- Requirements on gas filling;
- Requirements on gas unloading;

- Requirements on oil level monitoring;
- Requirements on facility utilization, maintenance and check;
- Requirements on storage tank cleaning, anti-fire, lightning protection, anti-electrostatic;
- Requirements on power generation and power supply;
- Requirements on safety management; management regulation; emergency and etc.

This safety code is very detail. The project clients and the staff of the gas station should learn it very carefully and get the certification before operation.

(3) Waste Gas from Maintenance Work Shop

During vehicle spray-paint, waste gas containing paint will be generated and thus affect the environment.

It is suggested that paint filter system to be installed in the spray-paint room, together with paint absorbing materials floor, to reduce the concentration of paints. The room should be installed with ventilation system.

The project owner should strengthen the labor protection for painting workers. Work shop should ventilate regularly. Workers should be provided with respirator, gloves, tight work clothes and regularly health inspection.

With implementation the above mentioned mitigation measures, the emission can meet national Air Pollutant Emission Standard (GB16297-1996).

(4) Restaurant Smoke

Restaurants are located at the podium part of commercial building. The restaurant smoke will be treated with oil filter then pipe exhausted at top of the tall building where has better diversion. After pre-treatment by the smoke exhaust ventilator, the smoke will be further purified through deposition process in the vertical shaft. The smoke concentration will meet Class II of *Air Pollutant Emission Standard (GB16297-1996)* and *Oil Smoke Emission Standard for Catering (GB18483-2001) .*The restaurant smoke will not cause

significant impact.

5.2 Water Quality

5.2.1 Water Sensitive Sites

Xiangjiang River is the only sensitive water body close to the project region. The section between No.1 Xiangjiang Bridge and No.2 Xiangjiang Bridge is involved.

5.2.2 Construction Phase

During construction, waste water generated includes sanitary sewage from construction workers and waste water from construction machines, car washing and site washing.

(1) Sanitary sewage

Assuming each worker consuming 200 liters of water per day, the 1,500 workers and management staff will generate about 240 cubic meters of sanitary sewage per day. The major pollutants include 6kg of BOD_5 and 9.6kg of CODcr, if not treated properly, would affect the water quality of the receiving environment.

(2) Construction Waste Water

At the excavated area, a small amount of waste water will be infiltrated into the foundation ditch. The major pollutants include SS: 150-300mg/L, CODcr 20-150mg/L.

(3) Construction Machine and Car Washing

Construction machine and transportation vehicle washing will generate a certain amount of waste water with major pollutants of CODcr 25-200mg/L, oil 10-30 mg/L and SS 500-4000mg/L.

(4) Gas Station

The project oil storage tank will be located underground, except selection a good quality tank, the quality of construction is also a key factor to guarantee a better operation condition of the tank. Poor quality tank or construction might cause oil leakage and thus affect the ground water quality.

Mitigation measures include:

(i) Domestic waste water will be treated at oil separation tank and septic tank. The treated water will be discharged into urban sewer network at the location of Fenglin road and west 2nd ring road.

(ii) Waste water from foundation ditch and car washing will be treated by three stages sedimentation tanks with capacity of 80 cubic meters and 30 cubic meters respectively. The treated water will be recycled.

(iii) Gas station construction include construction material, equipment procurement, civil work, equipment installation, pipe network installation, installation of electronic facilities, anti-erode engineering and etc. It is required that at every stage, the construction should strictly follow the requirements of Code for design and construction of automobile gasoline and gas filling station (GB50156-2002). The contractors should have class III or above qualification for construction enterprises. During construction, a qualified supervision company should supervise the whole process of the construction, especially should pay attention to the storage tank, pipe network construction.

5.2.3 Operation Phase

Waste water generated during operation includes sanitary sewage and waste water from maintenance shop, gas station and car washing. The major pollutants include CODcr, BOD_5, NH_3-N, SS, oil.

Sanitary sewage will be generated by passengers and working staff. Similar transit hub information showed that each passenger will consume water at

level of 15 liters per day water and each staff will consume 50 liters per day. About 300 staff in the transit hub serve for 70,000 passengers per day. The total water consumption is 1,065 m^3/d and 80% of them will be wastewater. The total waste water quantity will be 852 m^3/d.

The transit hub includes area of 43.21 ha of grunge, 1.235ha of green, 1.08ha of gas station and maintenance shop. According to Urban Water Supply Plan Specification (GB50282-98), washing water allocated are 20m^3/ha per day, for grunge and passenger station, 10m3/ha per day for greening, 40m^3/ha per day for maintenance and repair shop and gas station. The total water consumption will be 919.8m^3. Assuming 90% of them is waste water, and then 827.8m^3/d waste water will be generated.

Table 5-6 Waste water quality and amount

Source	Quantity□m3/d□	Quality (mg/L)					
		CODcr	BOD5	NH3-N	SS	Cooking oil	Petrol
Domestic sewage	852	250	150	30	200	15	/
Road and square washing	789	150	100	10	150	/	60
Maintenance shop, gas station, car washing	39	150	80	10	150	/	70
Total	1680	-	-	-	-	-	-

It can be seen from the above table that daily waste water is 277 cubic meters with 337.2kg/d of CODcr, 209.8kg/d of BOD_5, 33.84kg/d of NH3-N and 294.6kg/d of SS.

During operation, 1,680 cubic meter of waste water will be generated in total, see table 5-5 for detail. It will obviously impact the surrounding environment of subsidiary facilities, especially the surrounding water body if directly discharged without any measures.

To minimize the impact on water quality, wastewater treatment facilities will be built at the transit hub to pre-treat waste water from motor vehicle maintenance and repair shop, car washing operations, as well as other domestic facilities. After oil removal and pre-treatment at sedimentation tanks, waster water will meet the applicable discharge standards as per Integrated

Wastewater Discharge Standards (GB8978-1996). The pre-treated waste water will be finally discharge into Yuelu Waste Water Treatment Plant through the urban sewer network.

The Yuelu Waste Water Treatment Plant has a daily treatment capacity of 300,000 cubic meters. Its service area is 69.87 square kilometer, including the project area. Waste water will be treated through improved A^2/O process and finally discharged into Xiangjiang River. The transit project will generated 1,680 cubic meters waste water which is within the capacity of the treatment plant. The pollutants from the transit hub is mainly CODcr, BOD5, NH3-N, SS, cooking oil and petrol all of them are within the treatment scope of the treatment plant.

5.3 Noise Impact

5.3.1 Noise Sensitive Areas

Same as air pollution sensitive sites as described in section 5.1.

5.3.2 Construction Phase

The project is to expand the existing west bus station to a transit hub. The project location is close to several noise sensitive spots hereabout, thus the construction noises may affect the environment of nearby areas.

(1) Traffic Noise

Transportation vehicle noise levels are list in table 5-7.

Table 5-7 Noise level form of main transportation vehicles

Construction period	Transported material	Type of vehicle	Noise level [dB(A)]
Earth work	Construction waste and material	Heavy loaded truck	90
Structure	Steel and concrete	Concrete mixing	80～85
Decoration	Decoration material	Light truck	75

(2) Construction Machine Noise

Commonly used construction machinery are excavators, air compressors, pile drivers, vibrating tampers, hoists and etc., whose noise levels in the operation are listed in table 5-8:

Table 5-8 Noise level form of main construction machinery

Construction phase	Source	Noise level dB（A）
Earth work	excavator	78～96
	Air compressor	75～85
	Pile-driver	90～95
	Hoist	95～105
	Loader	98
	Paver	92
	Bulldozer	94
	Grader	94
	Road roller	92
	Vibrating tamper	100～105
Structure construction	Concrete pump	90～100
	vibrator	100～105
	Sawing machine	90～95
	welder	90～95
	Air compressor	75～85
Decoration and installation	Electric drill	95～100
	Electric hammer	100～105
	Hand counter bit	95～100
	Grinding wheel saw	105
	Carpenter's plane	90～100
	Stone cutting	100～110
	Angle polishing machine	100～115

A significant increase in noise is expected during construction, due to various construction and transport activities. While noise levels may be severe, they will be temporary and localized. It is estimated that without mitigation measures, nose level can meet the PRC standard of Noise Limits for Construction Sites (GB12524-90) of up to 150 meters away from the sources during the day and 500 meters at night. In addition, large amounts of construction materials and waste materials will be transported to and from the construction sites, frequently during the 12–13-hours workday for the construction period. As a result, areas through which haul roads pass or that are adjacent will frequently experience noise at 70–80 decibel in audible scale. Activities with intensive noise levels will not only have an impact on the residents, but may cause injury to construction workers operating the

equipment.

These mitigation measures are essential for construction activities to meet PRC construction site noise limits and to protect sensitive receptors:

(i) Equipment generating low levels of noise will be utilized as a first priority, and all machinery will be properly maintained to minimize noise. Noise reduction devices or methods such as temporary noise barrier will be applied.

(ii) To reduce noise at night, the operation of machinery generating high levels of noise, such as piling, will be restricted to between 7:00 a.m. to 12:00 a.m. and 2:00 p.m. to 10:00 p.m. in accordance with PRC regulations. The movement of heavy vehicles along urban roads will also be restricted to between 7:00 a.m. and 10:00 p.m.

(iii) The construction unit will reach an agreement with the Wangxin primary school regarding heavy machinery work to avoid any unnecessary disturbances. If there are construction activities that must be continued during the day and night, the construction unit will reach an agreement with residents nearby and may give compensation to the most severely affected residents.

(iv) Transportation vehicles should slow down the speed when passing through environmental sensitive sites including Nanjiatang, Wangxingyuan, Chengxi, Guangxiao Xinyuan, and Wangxing primary school and no horn is allowed.

(v) A unit for dealing with complaints from nearby residents will be set up to facilitate communication with residents and to solve any conflicts between the construction unit and residents.

5.3.4 Transition Period

Assessment scope is the project sites and the areas within 200 meters from the center of the roads.

(1) Prediction Model

Prediction model in Environmental Impact Assessment Guideline for Noise (HJ2.4-2009) is applied. The model is as following:

$$L_{eq}(h)_i = (\overline{L_{oE}})_i + 10\lg\left(\frac{N_i}{V_i T}\right) + 10\lg\left(\frac{7.5}{r}\right) + 10\lg\left(\frac{\psi_1 + \psi_2}{\pi}\right) + \Delta L - 16$$

(2) Prediction Results

According to the traffic forecast results, at night time, almost no bus will operate after 22:00. Therefore, the EIA only assess the day time impact. The prediction results are shown in table 5-9.

Table 5-9 Predicted Noise Level (unit: dB(A))

Road	Distance (meters)													
	20	30	40	50	60	70	80	90	100	120	140	160	180	200
Fenglin road	69	67	66	65	57	64	64	63	62	62	61	61	60	59
2nd ring road	69	67	65	64	64	63	62	62	61	61	60	59	59	58
Yulan road	69	65	64	63	62	61	60	60	59	59	58	57	57	56
Youyuan road	62	60	59	58	57	56	56	55	55	54	53	52	52	51
Yanhang road	64	62	60	59	58	58	57	56	56	55	54	53	53	52

It can be seen for the above table that all the road meet Class 4a standard ofGB3096-2008. Reference the class II limits of GB3096-2008, the standard reaching distance of each roads are: 160-180m for Fenglin road, 120-140m for 2nd ring road; 80-90m for Yulan road; 30-40m for Youyaun road, 40-50m for Yanhang road.

It is suggested that plant green belt along Fenglin road and 2nd ring road.

5.3.5 Operation Phase

(1) Noise Source

Noise source during operation include passenger and commercial area created noise, traffic noise and facilities in the transit hub including wind

engine, pump, buses, commercial shops, generator and traffic noise.

Noise from passengers and commercial building will not cause significant impact on the surrounding environment considering area has a higher background noise level. Noise level from facilities of the transit hub is listed in table 5-10.

Table 5-10 Noise source during operation

Location	Noise level[dB]	Note
Wind engine room	82	Hlb fan system
Pump station	83	Pump station
Bus	70	1489
Commercial shop	55-70	Social noise
Generator room	85	Reserved for power cut period

Noise muff will be installed for wind engine. Low noise level equipment will be selected to reduce noise from the source. At power transformer substation and pump station room, wall-facing will use noise-absorbing material. Power transformer substation has been designed away from hotel and office building. Greening will be designed to further reduce noise impact.

With the expanding of the bus station, traffic noise will be increased accordingly. Noise level of different type of cars at different travel condition is listed below.

Table 5-11 Traffic Noise level of vehicles

Source	**Travel Condition**	**Noise level（dB）**
Small car	idle	59~76
	normal	61~70
	horn	78~84
Medium car	idle	62~76
	normal	62~72
	horn	75~85
Heavy bus	idle	66~79
	normal	69~80
	horn	78~90

(2) Noise Prediction

(a) Noise impact of ITH: Following model was applied to predict the noise impact from the ITH on the noise sensitive sites.

$$L(r)=L(r_0)-20\lg(r/r_0)$$

The prediction results are shown in Table 5-12.

Table 5-12 ITH Noise Impact on Sensitive Sites

Sensitive sites	Background (dB）		Predicted（dB）	
	Day	Night	Day	Night
Guangxia Xinyuan	70.8	51.05	71.8	51.09
Wangxing Jingyuan	55.25	44.35	57.29	44.79
Chengxi Gongyu	55.25	44.35	56.28	44.69
Nanjiatang	57.6	41.05	59.6	41.89
Wangxin School	49.1	40.25	50.12	40.98

It can be seen from the above table that the noise level are within the standards at most of the sensitive sites, except that slighted exceeding at Guangxia Xinyuan and Nanjiatang where currently is mix area of residential and commercial with higher background noise level. Therefore, the impact is not significant.

(b) Noise impact of surrounding roads on sensitive sites

Following model is used in predicting noise impact of roads.

$$L_{eq}(h)_i = (\overline{L_{oE}})_i + 10\lg\left(\frac{N_i}{V_i T}\right) + 10\lg\left(\frac{7.5}{r}\right) + 10\lg\left(\frac{\psi_1 + \psi_2}{\pi}\right) + \Delta L - 16$$

The prediction results are shown in table 5-13

Table 5-13 Noise Prediction Results

Sensitive sites	Distance from road center (m)	Background (dB)	Predicted (dB)
Guangxia Xinyuan	75	52.05	53.95
Wangxing Jingyuan	70	48.35	50.16
Chengxi Gongyu	70	48.35	51.15

Nanjiatang	75	48.50	50.08
Wangxin School	95	47.50	48.80

It can be seen from the above table that noise level at all sensitive site can meet the standards.

(c) Roadside Traffic Noise Prediction

According to the traffic forecast results, at night time, almost no bus will operate after 22:00. Therefore, the EIA only assess the day time impact. The prediction results are shown in table 5-14.

Table 5-14 Predicted Noise Level (unit: dB(A)

Road	Distance (meters)													
	20	30	40	50	60	70	80	90	100	120	140	160	180	200
Fenglin road	66	66	65	64	61	60	60	58	58	57	56	55	55	54
2nd ring road	66	65	63	62	61	61	60	59	59	58	57	57	56	55
Yulan road	65	63	62	61	60	59	58	58	57	59	56	55	54	54
Youyuan road	63	60	59	58	57	56	56	55	55	54	53	52	52	51
Yanhang road	64	62	60	59	58	58	57	56	56	55	54	53	53	52

It can be seen for the above table that all the road meet Class 4a standard ofGB3096-2008. Reference the class II limits of GB3096-2008, the standard reaching distance of each roads are: 70-80m for Fenglin road, 70-80m for 2nd ring road; 40-50m for Yulan road; 30-40m for Youyaun road, 30-40m for Yanhang road.

It is suggested that plant green belt along Fenglin road and 2nd ring road.
To reduce traffic noise, traffic flow has been designed to maximum shorten the travel distance and time. Meanwhile, vehicle speed will be limited when passing by Nanjiatang, Wangxing Jingyuan, Chengxi, Guangxia Xinyuan, Wangxin primary school and no horn. All of the vehicles will be checked properly maintained to meet noise standard. Tree belt will be planted at departure and arrival areas to reduce noise impact.

To reduce outside traffic noise impact on the hotel and office area, tree belt will be planted along the roads.

With the mitigation measures above, the noise level at the boundary of the transit hub can meet the Class IV Noise Emission Standard for Boundaries of Industries (GB12348-2008)

5.4 Solid Waste

5.4.1 Construction Phase

Construction workers will generate wastepaper, plastic bags, bottles, cigarette butts and other domestic wastes. It is estimated that the total volume of wastes produced will amount to 1800kg/day assuming that there will be around 1,500 people (including workers and management staff) every day in the peak construction period and 1.2kg solid wastes will be generated per person per day.

The excavated soil will back use and no borrow and spoil is needed .Construction wastes on the construction sites mainly refer to residual building materials such as aggregates, sand, lime, cement, steel materials, timber, precast components, etc. The total waste is estimated to amount to 15,000 tons. The aforesaid construction materials are procured on a scheduled way based on the construction progress.

If stockpiled in work sheds or in open air in a disorderly way, such materials may result in a visual pollution and a landscape obviously inconsistent with the surrounding environment. Permeation of lime or cement into the ground with water will result in soil hardening, higher pH value and ground water pollution and in the end the polluted land will lose productivity and the valuable land resources will be wasted.

In order to reduce and eliminate the environmental impacts of the aforesaid solid wastes, the construction plans and operating instructions will be followed to strictly control and minimize residual materials, which shall be stockpiled in an orderly and proper way and reused in rehabilitation of buildings in the neighborhood so as to mitigate the impacts of construction wastes on the environment. The left construction waste will be re-used for the designated construction site of Changsha Meixihu International Exhibition Center for road

construction and site leveling. Therefore, no spoil site is needed.

5.4.2 Operation Phase

During operation, the total amount of solid waste generated is about 670.3 tons per year, mainly domestic solid waste and solid waste from vehicle maintenance work shop.

(1) Domestic Solid Waste

Staff of the transit hub, drivers and passengers will generate wastepaper, plastic bags, bottles, cigarette butts and other domestic wastes.

If such domestic wastes are not properly treated, certain impacts will be produced on the surrounding natural environment. The bus company should strengthen their supervision over the pollution management of solid wastes and make sure that garbage bins are provided and the solid wastes are periodically removed and transported to the local solid wastes treatment facilities for centralized treatment. It is suggested that underground solid waste transfer station to be constructed at the southwest corner of the hub and cleaned at least twice in summer. All domestic waste will be transported to landfill.

(2) Solid Waste from Vehicle Maintenance Shop

Vehicle maintenance will generate waste tyre and other waste vehicle parts. The generation amount is estimated about 10 tons per year. There solid waste will be collected and recycled.

During vehicle maintenance, a certain amount of dangerous solid waste will be also generated such as waste oil paint, waste solvent barrel, totally amount to 0.38 tons per year. These solid wastes should be collected at special storage tank and transported to designated places for treatment by qualified company.

With the implementation of above mitigation measures, the solid wastes can be handled properly and will not cause significant impacts.

5.5 Ecology

The project is to re-construct the bus station at existing place. Impact on ecology environment is slight.

During rainy season, excavated area might cause soil erosion and affect the surrounded water environment.

Trees and grasses will be planted as designed. At detail design stage, further greening possibility should be developed to maximum the green rate as possible and to build the ITH an eco-transport facility.

During construction, mitigation measures to protect ecology environment and to avoid soil erosion include:

(i) Keep the topsoil for greening use;
(ii) Greening design should consider the function, style and feature of surrounded existing vegetation;
(iii) Timely and properly maintain the foundation water and runoff. Construct drainage ditch around the construction site and construction slop protection and retaining wall for slope area of construction sites;
(iv) Greening should be started as earlier as possible to reduce soil erosion;
(v) Timely hardening the road surface;
(vi) Avoid excavation and filling in rainy season;
(vii) Construction material should be properly stored to avoid runoff; construction waste should be dumped at designated places;

5.6 Risk Analysis of Gas Station Operation

Petrol is belongs to class I flammable liquid and diesel belongs to class II. The risk sources of a gas station include underground storage tank, vent hole of the tank, host, fuel hose, and gas filling machine. Since the gas ignition point is very low, there exists explosion risk during operation of a gas station.

5.6.1 Risk Possibility Analysis

According to the statistic of world 100 fatal accidents of petrochemical enterprises in the last 30 years, 16 times happened at tank area, accounting for 16%; 6 times happened at tank ship, accounting for 6%; 8 times related to CNG, accounting for 8%.

Accident investigation survey results of petrochemical enterprises showed that most of the accidents caused by oil leakage from equipment and pipeline, accounting for 52%; inappropriate operation caused accidents accounting for 21%; failure operation of environmental treatment system accidents accounts for 15% and the rest accounts for 12%.

According to the analysis report of accidents related to oil storage tank, the explosion possibility is less than once per 10,000 accidents, and with the development of fire fighting technology, the trend is decrease.

5.6.2 Risk Analysis of the Project Design

According to detail explanation of Specification on Design of Small Oil Deport and Gas Station (GB50156-1992) and Code for design and construction of automobile gasoline and gas filling station (GB50156-2002):

(1) For horizontal tank, due to the oil vapor concentration in the tank is below explosion point and with less oxygen, the fire only occurred at the manhole area.

(2) The pipelines are designed underground thus reducing the possibility of fire.

(3) For class II gas station, underground horizontal tank should be 50m away from important buildings; 12m, 15m and 20m away from class III, class IV anti-fire buildings. Only 6m between the tank and the class I and class II anti-fire buildings is required, because in most of the case, the fire can be extinguished within 1 hour that will not burn the class I and class II anti-fire buildings. The distance between tank and flame is required more than 25m. In case gas station install with vapor recovery system, the evaporated gas concentration will be greatly reduced and the distance can be reduced by

50%. Therefore, the project gas station can meet the requirement according to the distance requirement with flame.

(4) Explosion area of an outside gas filling machine is 4.5 m from the machine. Therefore, the distance between the filling machine and the station office should be more than 5 meters.

5.6.3 Prevention Measures

(1) Design Stage

During design stage, anti-fire, lightning protection, anti-static, anti-earthquake should be considered.

(i) The safety and fire prevention distance. Strictly follow the design requirements in the Code for design and construction of automobile gasoline and gas filling station (GB50156-2002). The safety and fire prevention distance between the facilities of gas station and surrounding construction building and facilities should be strictly follow the requirement of the Specification (GB50156-2002) and other regulations issued by fire fighting agencies, to ensure that during fire disaster, the surrounding buildings and environmental protection objectives is beyond the range of fire and explosion.

Table 5-15 Safety Distance with Surrounding Structures

Surrounding building and others	Distance between oil tank, gas filling machine, vent and outside buildings and others (m)				
	Underground tank			Vent	Filling machine
	Class I station	Class II station	Class III station		
Important public building	50	50	50	50	50

Surrounding building and others		Distance between oil tank, gas filling machine, vent and outside buildings and others (m)				
		Underground tank			Vent	Filling machine
		Class I station	Class II station	Class III station		
Flame		30	25	18	18	18
Residential building	Class I	25	20	16	16	16
	Class II	20	16	12	12	12
	Class III	16	12	10	10	10
Factory building of Class A and Class B products; Class A and Class B liquids storage tank		25	22	18	18	18
Factory building and storehouse of other products; Class C liquid storage tank; and underground Class A and Class B liquid storage tank with volume less than $50m^3$.		18	16	15	15	15
Outside transformer station		25	22	18	18	18
Railway		22	22	22	22	22
Urban road	Trunk roads, BRT	10	8	8	8	6
	Minor trunk roads, and brunch roads	8	6	6	6	5
Elevated power line		1.5 times of pole height	Pole height	No crossing	No crossing	

Note: see GB50156-2002 and related guidelines for detail definition

(ii) Fire fighting and annunciator: According to Building Design Specification for Fire Fighting (GBJ140-90), fire fighting facilities should be designed together with Alarm devices.

(iii) Anti-explosion design: Anti-explosion design should follow the requirements for Class A dangerous places. Explosion-proof electric accessory and equipments, lamp should be used. No flame is allowed in the station.

(iv) Lightning Protection and electrostatic prevention: Lightning protection and electrostatic prevention should be designed. Lightning belt and rod should be used to avoid directly lightning strike, induction lighting protector should be designed for distribution bus. Static electricity grounding device with electric resistance less than 100 ohm should be designed for oil unloading field.

(v) **Earthquake-resistance.** The design should follow the antiseismic design requirements of Changsha government.

In addition to the S Code for design and construction of automobile gasoline and gas filling station (GB50156-2002), other design code and specifications should also be followed including but not limited to:

(i) Code of Design on Building Fire Protection and Prevention (GB50016-2006)
(ii) Code of Design on Building Lightning Prevention (GB50057-1994)（revised in 2000）
(iii) Code for seismic design of buildings (GB50011-2001)（revised in 2008）
(iv) Electrical installations design code for explosive atmospheres and fire hazard (GB50058-1992)
(v) Code for design of electric power supply systems, (GB50052-1995)
(vi) Code for design of heating ventilation and air conditioning (GB50019-2003)
(vii) Code for the design of combustible gas and toxic gas detection and alarm for petrochemical industry (GB50493-2009)

(2) Construction Phase

Contractors should strictly follow the requirements of the above mentioned standards, specifications and codes, especially the (GB50156-2002), as well as the requirements in the civil work contract and detail design.

Construction Supervision Company should designate special person to supervise the oil tank, pipeline construction, and equipment installation.

(3) Operation Phase

The operation of the gas station should strictly follow requirements under *Safety Code for Operation at Gas Stations*（AQ3010-2007）.

The project owner should establish safety management system, including fire

prevention, explosion prevention. Periodical training should be provided to the gas station staff on fire fighting, safety production and management.

This safety code is very detail. The project clients and the staff of the gas station should learn it very carefully and get the certification before operation. Establish safety supervision and safety performance assessment mechanism to promote safety production.

Pre-job training will be given to the operators. Safety operation rules should be established and strictly complied with. Safety equipments should be regularly checked and maintained.

The project owner should develop emergency plan with responsibilities designated to special person. The gas station should be equipped with fire fighting facilities, water supply system and ventilation system. In case of accident, the project owner should instantly organize manpower and material resources to fight the fire and to deal with the emergence. Oil leakage source, fire source should be cut as quickly as possible to avoid accident expanding and inform the local fire fighting agency.

Due to the project is still at the preliminary design stage, the gas station design has not commenced, it is suggest that the design should strictly follow the requirement of Code for design and construction of automobile gasoline and gas filling station (GB50156-2002). Conduct safety assessment for the gas station.

5.7 Vehicle Maintenance Workshop

During vehicle maintaining operation, incorrect operation may hurt the peoples nearby, such as knock injury, crush injury, splash injury, scald injury, cut injury and etc. Improper operation may also damage the equipment, vehicle or cause fire accidents. Therefore, unsafe operation is the key reason of accidents.

Before operation, the project owner should establish safety supervision and inspection system, develop safety operation rules, strengthen safety education, develop emergency plan.

The project owner should strengthen safety management. Workers should receive pre- job training and gain qualification certification before engaged. Watch men should be on duty 24 hours and regularly inspect the site. During key equipment especially the paint-spay equipment operation, the user should not leave the site. In case accident, extinguish the fire instantly.

In addition, vehicle maintenance operation has some uncertain factors which might cause accidents; some of them cannot be mitigated through technology or equipment. Therefore, personal protection facilities should be provided to the workers, such as protective glass, protective mask, tight fatigue clothes, protective oral-nasal mask, and earplug. These articles of labor protection should be regularly provided to the workers and special person should be designated to supervise their utilization.

5.8 Community Disturbance

Before the demolition of existing passenger building is undertaken, the temporary passenger building will be built on the collective land to be required for the project for transition of passenger transportation. The south end of Jinxing Road will be temporarily used as parking lot for passenger vehicles. When construction of the new passenger building is completed, the temporary passenger building will be demolished for construction of garage and gas-station. During the transitional period of passenger vehicles moving in and out of the temporary passenger building with limited capacity, some shift of passenger vehicles will be readjusted to other bus stations located in south, north and east Changsha. The schedule of bus shift readjustment has been publicly informed by media of television, broadcast and newspaper since November 3, 2010. The bus operation will be relocated to the bus parking and maintenance building which has been completed, so there will have no impact on the bus operation.

During the construction, temporary measures such as traffic divergence and detour can cause inconvenience to residents alongside of the road. Consultation has been conducted with the affected residents and traffic police station. Detail traffic management plan has been developed in the temporary transitional field design report.

To reduce the disturbance to public, following mitigation measures will be taken:

1) Traffic arrangement plan should be developed based on the Specification of Traffic Organization for urban road work following the principle of (a) spatially and temporally balance traffic flow distribution; (b) enhance traffic capacity of vicinal roads; (c) give priority to pedestrian, non-motor vehicles and public buses; (d) mainly consider divert measures and supplemented with mandate control.
2) Traffic arrangement plan should: (a) meet the basic transportation need of the nearby residents and units; (b) temporary access road is preferable to road/lane closure; (c) Road left for traffic should be meet the minimum width for traffic safety; (d) appropriately adjust public bus travel route and stations location to ensure safely pickup and drop off passengers; (e) develop emergency response plan to reduce possible traffic jam in case of traffic accidents or other unexpected incidents.
3) Further public consultations with local residents should be conducted to inform them about project activities and obtain comments. Temporary access roads should be constructed before block the construction roads.
4) Consult the local government and traffic police regarding construction materials transportation on the existing roads to avoid traffic jam, especially reduce the transportation though the villages.
5) Construction notice should be posted on the bulletin board of townships along the alignment, introducing the project activities, resettlement policies to the local people.
6) Erect billboard at each construction site, listing contractor and Construction Supervision Engineer contract names and telephone numbers, construction period and other brief construction information for public notice. Also list the local EPB hotline or contract number for public complaints.
7) For the construction activities close to the sensitive sites stated above, construction should be fenced with warning sign.

5.9 Health and Safety

5.9.1 Health

Health risks are primarily related to increased transit population during construction (construction workers) and operation in the regions. The increased mobile population could potentially bring and spread infectious diseases in the Project area.

Measures on for protecting occupational and community health include:

(i) Provide disease prevention and control training to construction workers, particular epidemic diseases prior to start of the construction. Leaflets, education seminars will be organized, in association with the local government and communities, to increase the awareness and knowledge on the epidemic diseases.

(ii) Posters will be placed in and around the construction sites for disease control, for not only construction workers but also local residents and others in the areas.

(iii) Adequate protective gear such as condoms will be provided to workers at the construction camps;

(iv) Periodical health check will be provided to construction workers to ensure their health and well being.

(v) At and near construction site, traffic signs will be set. Traffic safety education will be given to the contractors' staffs as well as nearby local people.

5.9.2 Safety

The gas station is located at 95m south of the station located Nanjiatang residential area. The distance is bigger than the requested limited 45 meters distance between gas station and residential buildings set in the Code for design and construction of automobile gasoline and gas filling station (GB50156-2002) revised in 2006. However, during operation, there is still potential risk of oil leakage, air pollution and safety issue. In that case, it might

affect the residents in case of accident. Therefore, it is suggested conduct additional safety assessment and report should be prepared. During operation, the IA should strictly follow the suggestions proposed in the safety assessment report which will include safety management, gas station facilities design, gas station processing. Details might include:

(i) Safety management responsibilities,
(ii) Safety management system,
(iii) Safety management organization,
(iv) Qualified working staff,
(v) Safety management operation specification,
(vi) Emergency plan,
(vii) Project layout design,
(viii) Heating and ventilation system design,
(ix) Greening design,
(x) Fire prevention facilities
(xi) Drainage design,
(xii) Safety labeling,
(xiii) Oil tank selection and installation,
(xiv) Oil/gas leakages prevention
(xv) Power supply and lightning protection and anti-static electricity design

The other safety risk is primarily in the construction phase with the local residents, particularly children who have little awareness of construction site safety and traffic safety. In a linear construction site there will be hardly full control of the site and the construction areas will be mostly open with no control from public access. The curious students may hang around the sites after the school causing safety risks.

To reduce the safety risk, following measures should be taken on construction staff and public:

(i) The contractor will provide safe and convenient passages for the public
(ii) Provide construction workers sufficient personal protection

equipment such as hard hats, earpiece, safety shoes, and others

(iii) Seminar on safety issues will be provided to local public, particularly school students;

(iv) Where the potential dangers are present, warning signed will be installed;

(v) There will be construction staff on duty on or near heavy movement of construction vehicles, or heavy construction vehicle traffic through the residential area to ensure safety

(vi) Regular safety walks involving qualified representatives will be organized throughout the construction in order to ensure the implementation of safety measures and to identify areas of concerns for improvement.

5.10 Resettlement

Since the project is to reconstruct the West Bus Station at the existing place, only a small amount of land taken and house removal. The impact is not significant. According to the feasibility study, the land area to be permanently required is of 175 mu (11.67 ha.), of which 18 mu of collective land among and 157 mu of state-owned construction land, the temporary occupied land is of 7.5 mu of state-owned construction land.

The houses to be demolished by the project will have an area of 89,033 square meters. No people will be affected by land, while people affected by house demolition will be 1408.

Cash compensation will be paid to displaced people by residential housing on collective land or state-owned land, and source of security housing will be provide by the government for the displace people who can buy the house of suitable size for themselves. The living standards of these affected household will not decrease but increase instead.

The households living on the state-owned land will be paid at the evaluated price, and choose the replacement measure of buying security housing by government or cash subsidy. The living condition will be improved.

The only enterprise to be affected by the project is Changsha West Bus

Station (CWBS) under Hunan Longxiang Transport Group Co, which is one of four stakeholders of CITC. Before the demolition of existing passenger building is undertaken, the temporary passenger building will be built on the collective land to be required for the project for transition of passenger transportation，the south end of Jinxing Road will be temporarily used as parking lot for passenger vehicles. When construction of the new passenger building is completed, the temporary passenger building will be demolished for construction of garage and gas-station. During the transitional period of passenger vehicles moving in and out of the temporary passenger building with limited capacity, some shift of passenger vehicles will be readjusted to other bus stations located in south, north and east Changsha. The schedule of bus shift readjustment has been publicly informed by media of television, broadcast and newspaper since November 3, 2010. The bus operation will be relocated to the bus parking and maintenance building which has been completed, so there will have no impact on the bus operation.

The compensation for the affected shop will be paid to its owner. In addition to the lump sum of moving allowance, subsidy for 3 months operation lost will be also paid to the shop owner. After completion of the ITH, these affected shop owners will have priority to rent new shops in the ITH. Therefore, the shop owners will not be affected.

In a word, the resettlement plan guaranteed the living standards of affected people will be improved.

5.11 Possible Change of Project Scope or Design

In case of a possible change in project scope and design, the following measures will be taken. For a minor deviation, the environmental management consultant will propose mitigation measures and incorporate these into the detailed design. In case of a major deviation that may cause significant environmental impacts or affect additional people, the Longxiang Transportation Group will conduct additional environmental assessments, including public consultations. The revised EIA will be submitted to Changsha EPB for review and approval, following government procedures.

As one of the basic industry of national economy, transport must be the economic modernization of the "advance guard", invigorate the circulation, boom the market economy, and increase the "bridge" and "link" of social and economic benefits. Transportation is an important socio-economic component, and also an important basic condition to speed up the economic and social development. Changsha Western Changsha Terminal (Changsha Wangchengpo Bust Station) is in the "immediate needs, long-term for the overall planning, phased implementation" provide passengers with food, housing, transportation, travel, and shopping. Quick, Convenience, comfort and coordination as construction principles, to adapt the urban economic and social development goals.

5.12 Positive Impacts

5.12.1 Social Benefits

(1) Increase national and local tax revenue. The completion of the project is to contribute to the annual national and local tax revenue. The project will accelerate the development of passenger transport industry to form a new economic growth point.

(2) Promote urban construction

a) speed up the process of urban construction in Changsha, beautify the city, improve the urban taste, promote the expansion of Changsha Quality Improvement.

b) improve urban infrastructure in Changsha, optimize investment environment.

c) improve the traffic situation in Changsha, facilitate passengers, reduce congestion, promote urban civilization

(3) Speed up transport development

a) create conditions for urban transportation market rapid development.

b) strengthen the road transport management, establish normal motor transport market order, protect the legitimate rights and interests of transport .

c) facilitate urban planning, ease the traffic pressure, reverse the

current chaotic situation of passenger transport market, achieve the goal of integrated rural and urban passenger transport.

(4) Increase employment opportunities. Implementation of this project can provide the community with a lot of employment to contribute to social stability and development.

(5) Promote local tertiary industry development

The project will promote local tertiary industry development, increase employment, promote economic growth, form a public service area which integrates new non-polluting with social services, business services.

In summary, this project is a public good transportation infrastructure projects.

5.12.2 Environmental Benefits

(1) Improve Air Quality

The existing bus station lacks of reasonable planning. Disordered ravel routes always cause traffic jam that expands the loading and unloading time, and accordingly increase vehicle emission. After construction of the ITH, travels routes will be separated spatially which can rapidly divert the bus enter or exit the hub, reducing the waiting and travel time, thus reducing the vehicle emission as well. Moreover, vehicle emission from the garage will be exhausted at places with better dispersion condition to reduce adverse impact on the local environment.

Due to lack of management, some of the restaurants near the existing bus station have no smoke treatment system. Smoke from these restaurants is directly exhausted to the air causing serious air pollution. During operation of the ITH, the restaurant will be arranged at the podium building. Restaurant smoke will be collected and pre-treated, and then pipe to the top of south tall building exhausted at high level where easy to disperse, and reducing the pollution accordingly.

(2) Improve Water Quality

The existing west passenger bus station has no wastewater pre-treatment facilities. Waste water was directly discharge into the urban sewer network thus increased the load of Yuelu Waste Water Treatment Plan. The newly build ITH will construct various waste water pre-treatment facilities including oil filter, septic tank, sedimentation tank thus improve the discharging water quality.

(3) Improve Ecology Environment

Almost all of the ground area in the existing bus station is concrete paved surface with very little green area. After completion of the ITH, green rate will be increased to 18.9%. These green areas will improve the ecology environment; assist in noise reduction and absorbing vehicle emission.

(4) Institutional Strengthening and Capacity Building

During implementation of the project, special environmental person from the EA, the IA, contractors and supervision firms will be designated for the environmental management and implementation of EMP. These people will be trained with environmental laws, regulations, environmental technology and environmental management. After the project, the environmental management capacity will be greatly promoted.

6. PUBLIC CONSULTATION

The public consultation and information disclosure was conducted in accordance with Chinese EIA laws and the World Bank OP4.01 Environmental Assessment.

The implementation of the Project will definitely have negative or positive impacts to the environment, affect directly or indirectly the public interests in the neighborhood. With their interests in mind, the public is likely having various opinions about the project. The public involvement is aimed at public opinion examination and expert consultation to understand the different attitudes, opinions, and suggestions to the Project, the various social, economic, and environmental impacts of the Project, so that the difficulties and troubles caused by one-sided approach could be reduced.

Two rounds of public participation were completed. The first round of public consultation was initiated in October 2010. It included a survey based on a questionnaire and stakeholder's workshop. The second round of public consultation was held in January 2011.

6.1 Scope of Investigation and Survey

According to geographical location of the project and possible environmental impacts, public participation in this evaluation is mainly targeted to the residents of Wangxing Jiangyuan, Chengxi Appartment, Nan Jiatang and Wangxin Primary School; they come from all walks of life, with a certain representation.

6.2 Public Participation Method

In the preliminary stage of EIA, the project construction side Changsha Transportation Hub Construction Investment Co., Ltd commissioned the Environmental Impact Assessment Center of Hunan University released the public announcement of the local environmental impact assessment in Changsha Bus West Station in October 2010, meanwhile issued public notice of environmental impact assessment in China EIA Network (www.eiacn.com). A simplified draft EIA was made publicly available to inform the public project data, potential impacts and proposed mitigation measures to solicit wider

public opinions and comments. The full draft EIA was also disclosed at above websites, local transportation bureau and environmental protection bureaus. On-site photos as shown in Figure 6-1, online publicity photos as shown in Figure 6-2. 。（http://www.eiafans.com/viewthread.php?tid=160534&extra=）

Figure 6-1 First notice to public on website

Figure 6-2 Second round notice to public on website

Figure 6-3 Notice Board at Sensitive Area

The construction unit also conducted a survey to do a two-way communication, extensively collect and listen to public views on specific projects and requirements, the statistics and analysis, are on the basis of public comments. Public participation carried out by questionnaire. Project staff introduced project overview, type, and truthfully explained to the public the potential environmental impact during the project construction and operation and control measures. Public opinion survey sample as shown below.

Table 6-1 Changsha Western Changsha Terminal Project Environmental Impact Public Participation Questionnaire

Name		**Gender**		**Age**		**Profession**		**Position**	
Address							**Education**		
Project Overview	The project is located in the core area of modern service industry inside Changsha Great Hexi Pilot District, east of West 2nd Ring Road, north of Fenglin Road, west of Yulin Road, south of Yanhang Road and Youyuan East Road which divide this area into south section and north section. The project is to replan and reconstruct a transport hub which integrates passenger transport, rail transport, urban public transport, other transport modes, south section is to be used as bus depot area.								

	Proposed project location is in Changsha Bus West Station with a total investment 1.64 billion RMB., total land area 65341m2, , total construction area is 279292m2, north section takes 257727m2, the construction area of station house is 108168m2, commercial is 149559m2, the construction area of south section is 17643m2. Ramp and bridge is 19993m2, road reconstruction is 8256m2.
Select the best answer from the following (tick A, B, C, D) and give brief reasons.	
1	Do you know Changsha Western Changsha Terminal Project?
	Yes B. No
2	Are you satisfied with the curren environment quality of the proposed location? (please specify the reason if you not satisfied):
	A. very satisfactory B. quite satisfactory C. not satisfactory D. very disappointed
	What do you think cause the environmental problems?
	Large population B. weak awareness C. lack of environmental protection facilities
3	Are you satisfied with the location of the proposed project? (Please specify the reason if not satisfied)
	A. very satisfactory B. quite satisfactory C. not satisfactory D. very disappointed
4	What do you think is the biggest problem brought by the project implementation?
	A. impact on traffic B. negative impact on the environment C, no impact
5	What do you think is the impact on environment brought by the project implementation?
	A. water pollution B. air pollution C. waste pollution D. noise pollution E. no impact
6	Do you think the project can solve the traffic problem?
	A. Yes B. No C. Not sure
7	What do you think is the impact on environment during operation?
	solid waste pollution B. water pollution C. noise pollution D. air pollution
8	Are you in favor of the project?
	A. Yes B. No C. Indifferent
9	Do you have any suggestions on reducing the negative effects of project construction on the environment?

Public participation will be informed on December 28, 2010 to January 9, 2011 to the public in the form of notice, meanwhile published on Chinese EIA website (www.eiacn.com), didn't receive any environmental consults, telephone complaints, letters or e-mail related to the project within 15 days.

200 questionnaires were distributed, 200 copies were returned, 100%

recovery rate, the result can basically represent residents' attitude to the project.

6.3 Public Consultation Results

According to the statistics of the survey sample table, the results are as follows:

(i) The proportion of male and female investigated: male 110, female 90;

(ii) Do you know Changsha Western Changsha Terminal Project? 179 persons don't know, 21 persons know.

(iii) Are you satisfied with the current environment quality of the proposed location? 182 persons are very satisfactory, 18 persons are quite satisfactory.

(iv) Are you satisfied with the location of the proposed project? 115 persons are very satisfactory, 55 persons are quite satisfactory, 30 persons are not sure.

(v) What do you think is the biggest problem brought by the project implementation? 79 persons think it's the. impact on traffic, 61 persons think it's the negative impact on the environment, 60 persons think there's no impact.

(vi) What do you think is the impact on environment during construction? 60 persons think it's air pollution, 95 persons think it's noise pollution, 24 persons think it's water pollution, 21 persons think there's no pollution.

(vii) Do you think the project can solve the traffic problem? 190 persons thinks it can, 10 persons are not sure.

(viii) What do you think is the impact on environment during operation? 30 persons think it's air pollution, 95 persons think it's noise pollution, 24 persons think it's water pollution, 50 persons think there's no pollution.

(ix) Are you in favor of the project? 195 persons are, 5 persons are indifferent.

(x) Do you have any suggestions on reducing the negative effects of project construction on the environment? The public expressed the

hope that efforts should be done to strengthen environmental supervision during construction, the project should serve the surrounding residents.

Public Participation Suggestions include:

(i) In the design phase, construction phase, operation phase, environmental protection measures will be implemented step by step respectively.
(ii) Environmental management agencies should be set to implement environmental management and monitoring plan, supervise the environmental protection work conducted by construction side and management side in the operation phase to protect the local environment
(iii) The planning and design work of recycling of various pollutants should be settled down as soon as possible and environmental impact assessment should be conduct
(iv) Arrange construction time rationally to guarantee the normal life of residents living around

According to the findings of public participation, opinions adoption is shown in Table 6-2.

Table 6-2 Opinions of Public Participation Adoption

Opinions	Adoption
Prohibiting large-scale machinery constructing before six o'clock am, after ten o'clock pm, and during the lunch break	adopted
Setting sprinklers where is to prone to dust at the construction site to reduce dust	adopted
Setting routes of construction waste transport in reason to reduce the environmental impacts	adopted
Cleaning transport vehicles before exiting the construction site to reduce pollution along	adopted
Avoiding school time when constructing	adopted

near WangXin Primary School	

6.4 Public Consultation during RAP Preparation

During the stage of RAP preparation, great efforts are made on public participation and consultation for the formulation of resettlement policies and options, and in the stage of RAP implementation, the public will be also encouraged to monitor the activities of resettlement. In the phase of the project preliminary design, consultation with local governments and local people has been made by the owner and the designer on the enlargement of the project and the related issues. During the preparation of RAP, consultation were made on the compensation standards and resettlement options

(1) During the period of June 2009-September 2010 when designing the project, consultation were made by the project owner and designer with locals on the options, especially the expert's suggestions, of project design, and the survey physical indicators of project impact and socio-economic data was assisted by the local government

(2) Several meetings participated by local people were held during July-September 2010 for the necessity of the project construction and the compensation standards and resettlement to be used for the project, and public opinions on resettlement were recorded.

(3) In July 2009, a survey of random selected 2,000 passengers in CWBS, assisted by 20 volunteers of students from Hunan Commercial College, was carried out by the owner with designed questionnaire. Of the collected 1,807 effective questionnaire, 92.2% interviewed shown their great support to the construction of new terminal.

(4) In July, 2010, Changsha Land Survey Institute made DMS of land to be acquired and house to be removed on the project affected area. The DMS was assisted by YDLRB, YDREB and WCPRO. The DMS data of land was confirmed by the representative of the community, and of house confirmed by the owner of house.

For the preparation of RAP, two meeting were held by the project owner with

WCPRO on November 9 and 11, 2010, to disclose the resettlement policy including compensation standards, to hear the opinions from the displaced people. All participants prefer cash compensation for the house removal and buy residential house in the source provided by the government of security residential house.

For the use and distribution of land compensation, the participants prefer to distribute the compensation funds among the displaced people.

Prior to the commencement of project construction, all the information will be made available by media of television, newspaper, internet, etc for the public to understand the purpose, schedule, and policy of the project, especially that related to land acquisition and resettlement.

On September 10, 2010, the Pre-land Acquisition Announcement was posted in the Jiangongshan Community for the displaced people to know the issues of land area, house affected, compensation and resettlement policy, etc.

During the RAP implementation, information of house size, population of displaced people, and compensation funds will be posted in the community by YDREB/WCPRO for public supervision. After publicity period expired, compensation agreement will be made between the displaced household and related agency.

7. ENVIRONMENTAL MANAGEMENT PLAN

7.1 Objectives

The objectives of an EMP are to propose appropriate mitigation measures and to recommend establishment of institutions or mechanisms to monitor and ensure compliance with environmental regulations and implementation of proposed mitigation measures. Such institutions and mechanisms will also seek to ensure continuously improving environmental protection activities during pre-construction, construction, and operation phases to prevent, reduce, or eliminate adverse impacts.

7.2 Mitigation Measures

Mitigation measures are defined in the previous chapters of the EIA and summarized in a standalone document. The EMP will be reviewed and updated at the end of the detailed design for consistency with the final detailed design.

In addition to the project-specific mitigation measures included in the EIA and EMP, project design and construction of the ITH are also subject to a wide range of domestic laws, regulation, technical guidelines and codes of practice in China, which by default are legal requirement for project design and construction management. These include (i) Hunan Provincial Environmental Protection Regulations for Construction Projects; (ii) Changsha Environmental Sanitation Management Regulation; (iii) Changsha Dust Pollution Control and Management Regulation; (iv) Code for the Design and Construction of Automobile Gasoline and Gas Filling Station (v) Environment and Hygiene Standards for Construction Site (JGJ146-2004), Management Regulations for Construction Sites, Safety Rules for Construction Projects, Technical Specifications for Environmental Protection Check & Acceptance Inspection for Project Completion.

7.3 Management and Supervision Organizations

There will be two levels of organizations which will be responsible for environmental performance of the Project. The first is environmental management organizations including the Environmental Office of the MOT, the HPDOT, the Project Management Office (PMO) which is the Project proponent; the Changsha Integrated Transport Terminal Construction and Investment Co. Ltd. (CITTC) will be responsible for the expressway operation and various technical groups for environmental design,

monitoring and supervision. The other level is the environmental supervisory organizations which include Environmental Protection Bureaus of different levels of government.

7.4 Environmental Monitoring

Comprehensive environmental monitoring programs have been designed for both construction and operation phases. Monitoring includes water quality, noise, , construction dust as well as soil erosion and vegetation restoration. The Project Office will entrust environmental monitoring stations to carry out these plans. During operation, environmental monitoring will be carried out by provincial or municipal environmental protection bureaus.

All personnel of the Project Office Environment Protection Section and construction workers will receive environmental training at least one time before commencement of construction. Key environmental administrative and monitoring personnel will also go through technical training provided by the project.

7.5 Environmental Supervision

During construction, environmental supervision shall be carried out by qualified supervision unit reporting to the Project Office of the IA. Each Supervision Engineer company will be required by contract to assign at least one Environmental Supervision Engineer. The Environmental Supervision Engineers will:

(i) Review and assess on behalf of the Project Office whether the construction design meets the requirements of the mitigation and management measures of the EIA and EMP,
(ii) Supervise site environmental management system of contractors including their performance, experience and handling of site environmental issues, and provide corrective instructions;
(iii) Review the EMP implementation by the contractors and subcontractors, verify and confirm environmental supervision procedures, parameters, monitoring locations, equipment and results;
(iv) Report EMP implementation status to Project Office and prepare the environmental supervision statement during the construction period; and
(v) Approve invoices or payments.

7.6 Independent Environmental Consultant (IEC)

The IA will recruit an Independent Environmental Consultant (IEC) to conduct independent supervision on implementation of EMP. The lead IEC shall be a person who can independently and professionally examine records, procedures and processes. He/she may require a small team to assist him/her with checking the site (i.e. the IEC team). The IEC shall have extensive knowledge and experience in environmental monitoring and auditing to provide independent, objective and professional advice on the environmental performance of the project (at least 5 years experience is required). The IEC shall familiarize himself/herself with the project works through review of the reports, including the project EMP. In particular, the IEC is expected to perform the following duties:

(i) Review and audit in an independent, objective and professional manner in all aspects of the EMP;
(ii) Validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations, monitoring procedures and locations of sensitive receivers;
(iii) Conduct random site inspections;
(iv) Audit the EIA recommendations and requirement against the status of implementation of environmental protection measures;
(v) Review the effectiveness of environmental mitigation measures and project environmental performance;
(vi) On a need basis, verify and certify the environmental acceptability of the construction methodology (both temporary and permanent works), relevant design plans and submissions. Where necessary, the IEC shall seek the least impact alternative in consultation with the designer, the Contractor(s), and Project Office;
(vii) Verify the investigation results of any non-compliance of the environmental
(viii) Quality performance and the effectiveness of corrective measures;
(ix) Feedback audit results to Project Office and Environmental Supervision Engineers (ESE) according to EMP procedures of non-compliance in the EMP, and provide Supervision Engineer suggests on actions of penalty, suspension or other punishment;
(x) Provide environmental training to the Contractors, ESE and the Project Office staff prior to and during construction; and

(xi) Prepare semi-annual progress report to the IA, EA, the World Bank and GEF.

The results of these environmental supervision and monitoring activities will be used for assessing the (i) extent and severity of the environmental impacts against the predicted impacts, (ii) performance or effectiveness of the environmental protection measures or compliance with pertinent rules and regulations, (iii) trends in impacts, (iv) overall effectiveness.

With the assistant of the IEC, the IA will prepare and submit to Hunan EPB and World Bank semi-annual reports on environmental performance based on the monitoring and audits. No later than 6 months before completion of the construction work, the department will prepare and submit to World Bank a construction mitigation completion report based on the information collected from all contractors, supervision company and IA. The report will indicate the timing, extent, and effectiveness of completed mitigation measures and of maintenance, as well as detail needs for further mitigation measures and monitoring during operation.

7.7 Correction and Improvement of Mitigation Measures

Based on the inspection and monitoring reports, the IA and the Hunan EPB will decide whether (i) further mitigation measures are required as corrective actions, or (ii) some improvements are required regarding environmental management practices. If it is found, during inspection, that there is substantial deviation from the EMP or changes are made to the Project that may cause substantial adverse environmental impacts or increase the number of affected peoples, then the IA should consult with World Bank and Hunan EPB immediately and form an EIA team to conduct additional environmental assessments and, if necessary, further public consultations. The revised EIA reports should be submitted to Hunan EPB for final approval

8. CONCLUSION AND RECOMMENDATIONS

The Project will provide a significant benefit to Changsha and nearby cities. The project will promote local tertiary industry development, increase employment, promote economic growth, and form a public service area which integrates new non-polluting with social services, business services

The proposed Western Changsha Terminal (Changsha Wangchengpo Bus Station) fits into the legal framework. It is in the "immediate needs, long-term for the overall planning, phased implementation" provide passengers with food, housing, transportation, travel, and shopping; quick, convenience, comfort and coordination as construction principles, to adapt the urban economic and social development goals. It is consistence with the local land use plan, transportation development planning of Changsha City.. Environmental considerations dominate the site selection and feasibility study.

The construction and operation of the transit hub will result in a number of adverse impacts to the physical and socio-economic environment in the Project area. These impacts include permanent occupation of land, increased soil erosion, increased noise and air emissions, community severance, health and safety of local residents, water quality, and resettlement and relocations. These impacts are not serious.

For those identified adverse impacts, mitigation measures are proposed in EIA has been proposed and their implementation arrangement including the budget has been prescribed in the EMP. With the mitigation measures designed specifically for the adverse impacts, the impacts will be prevented, reduced, minimized or otherwise compensated. Furthermore, an environmental management systems involving environmental management and supervision organizations, environmental monitoring, institutional strengthening and personnel training will be established to ensure the environmental performance of the Project. To ensure successful implementation of these measures, the EMP covers all the relevant aspects such as institutional arrangement for environmental management and supervision, environmental monitoring and training. Implementation of the mitigation measures, as well as the environmental management systems, the

adverse impacts will be reduced to acceptable levels. The Project is environmentally acceptable and feasible when mitigation measures and EMP are implemented