# PROJECT TECHNICAL DESCRIPTION

## A. Background

1. The Ji'an Municipal Government has proposed the following key components under the Jiangxi Ji'an Sustainable Urban Transport Project: (i) a 6.9-kilometer (km) bus rapid transit (BRT) system and public transport hub, (ii) river rehabilitation and "greenway" development, (iii) traffic management system and 19.3 km of urban roads, and (iv) institutional strengthening and capacity building. Additional financing from the Global Environment Facility is being sought for the environmental improvement presented in Supplemental Linked Document 17 of the RRP. The proposed project will contribute to inclusive growth and environmentally sustainable development in Jiangxi Ji'an by improving the efficiency and sustainability of urban transport.

## B. Urban Planning Context

2. The project area is situated in the new western development area as shown in Figure 1. The western development area is currently a rural area on the western edge of Ji'an urban area. It is dominated by low-lying agricultural land, with villages, woods and ponds etc. The area is planned to accommodate a population of 276,000 by 2030. In conjunction with the proposed Chang-Ji-Gan high-speed passenger rail development aligning at the west edge, the area will serve as the gateway to the old urban area for the new railway station and surrounding developments. The Ji'an urban development plan has identified the main axes linking the activities centers together, as presented in Figure 1.

**Figure 1: Overview of Urban Planned Area, 2020**


Source: Detailed Plan for Western City New Development Area, JMG.

3. A more comprehensive public transport system will be established in the new development areas, the old city, and at the existing railway station and vicinity, all being linked with higher quality public transport services and safe and sustainable urban roads. This will bring accessibility, and connectivity benefits, as well as travel time savings, congestion relief and improved safety and nonmotorized transport (NMT) provision. With the implementation of the Yudai River improvement and greenway development, the city will be less vulnerable to flooding. The greenway will provide a new dedicated corridor for NMT between the western development area and the existing city.

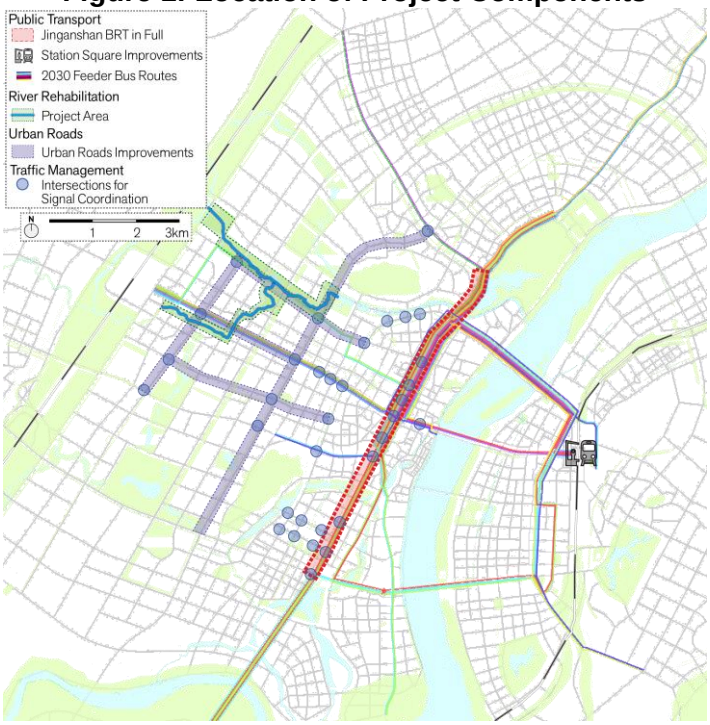
## C. Project Components

4. The three physical project components are as follows:

(i) Public transport (BRT and station square improvement)
(ii) River rehabilitation and greenway
(iii) Urban roads and traffic management

5. Figure 1 shows the location of the project components in the Ji'an Urban Area.

**Figure 1: Location of Project Components**




Source: ADB.

### 1. Public Transport Component

6. The public transport component under consideration consists of the development of a new BRT system and an intermodal hub at the existing Ji'an Railway Station in Qingyuan District.

### a. BRT System

7. **BRT Corridor.** The proposed BRT corridor is 6.9 km along Jingganshan Road between the northern road intersection (Jizhou District) and Junshan Road intersection (Ji'an County). A total of 15 BRT stations are proposed. The BRT corridor stretches from the north of Ji'an City (Northern Avenue Intersection) to the south of the city (Yingbin Road Intersection) via Jingganshan Avenue. The width of the BRT corridor will be 7 m, with two lanes (both directions) for general traffic having a lane width of approximately 3.5 m. Center lanes and will be reserved for the BRT corridor to improve BRT operation and passenger safety, reduce conflicts with general traffic and minimize weaving among BRT buses.

8. **BRT Operations.** Considering the relatively dispersed passenger OD patterns, a flexible system was adopted for Ji'an where BRT buses can enter and exit the corridor without forcing transfers at terminal stations. However, it should be noted that the flexible system could be converted to a trunk and feeder system in the future. There are nine bus routes to be included in the BRT system. The routes have been selected that have a high level traffic demand and route consistency with the proposed BRT corridor.

9. **BRT Stations.** An island type platform is proposed for the Ji'an BRT system with lengths of 55 and 110 meters (m) with widths of 5 and 6 m. A total of 15 stations are planned along the proposed corridor with an average distance between stations of slightly less than 500 m. The preliminary BRT station and platform design is shown in Figure 2.

10. Each station will have several bus bays on each side, depending on the number and frequency of the bus routes to be integrated into the Ji'an BRT system. Overtaking lanes have been recommended to secure sufficient capacity for the growth of demand along the corridor. Security doors and various types of intelligent transport system (ITS) elements for improving convenience of bus users and overall operational efficiency will be installed.

**Figure 2: Proposed Ji'an BRT Station Design**

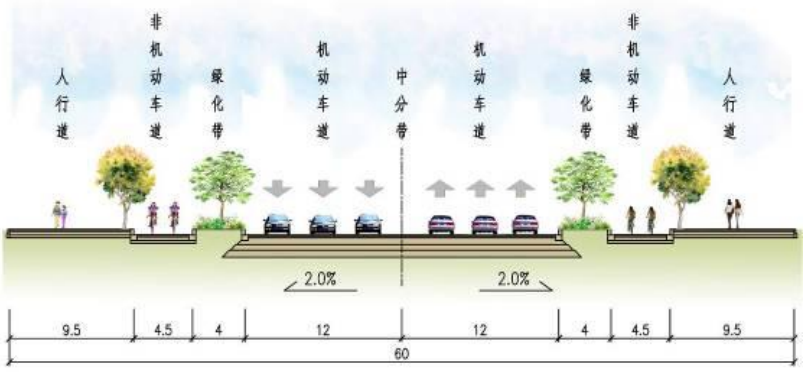

Source: GMEDRI, Feasibility Study for Ji'an BRT System, November 2013.

**Figure 3: Image of BRT Station – Visually Attractive Design and Materials with Advanced Safety Considerations**

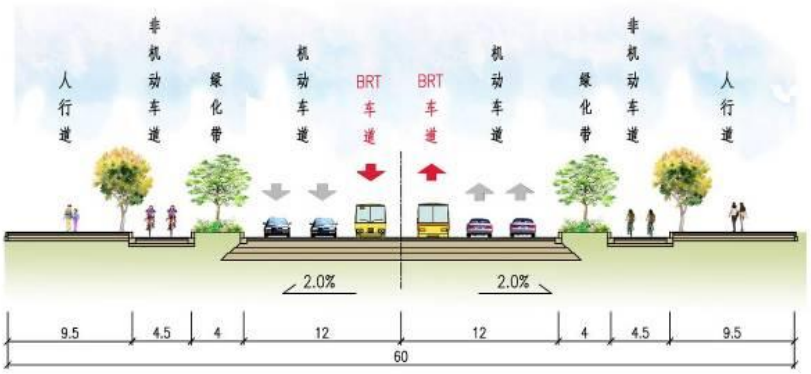
Source: GMEDRI, Feasibility Study for Ji'an BRT System, November 2013.

11. **Cross Section Design.** An example cross section of proposed BRT corridor (existing compared with proposed) is shown in Figure 4. Vehicle carriageways for general traffic will be reduced from three lanes to two lanes. Greenway separation between the vehicle carriageway and NMT lanes near BRT stations will be removed to accommodate the construction of BRT stations and passing lanes.

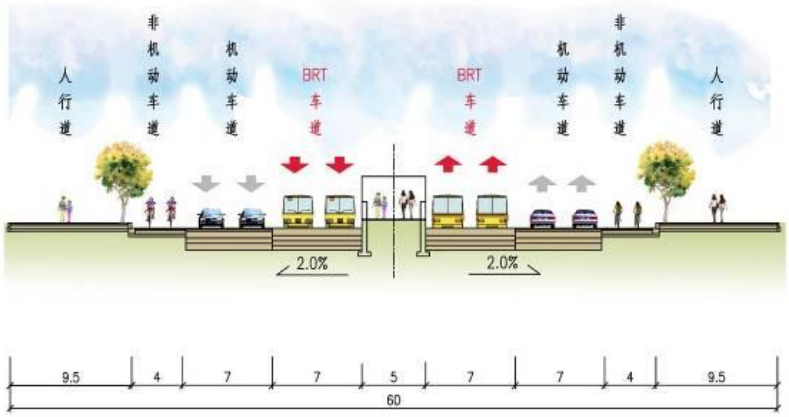
**Figure 4: Proposed Cross Sections for the BRT Corridor between Jizhou Road and Yangming Road (K1+180~K3+370)**




**Existing Cross Section**




**Proposed Cross Section with Central BRT Lanes**




**Proposed Cross Section with BRT Station**

Source: GMEDRI, Feasibility Study for Ji'an BRT System, November 2013.

12. **Vehicle Specifications.** Based on the demand and future growth patterns in Ji'an, 12 m regular buses are recommended for the short term, and 18 m high-capacity buses for the medium to long term for the BRT system. All buses using the BRT corridor need to have doors on both sides as the buses will operate in the BRT corridor as well as on non-BRT roads. Medium-height-floor buses (38 cm) instead of low-floor buses are recommended for Ji'an BRT system.

13. **Key Characteristics of the Ji'an BRT System.** Key characteristics of the Ji'an BRT system are summarized in Table 1.

**Table 1: Key Characteristics of the Proposed Ji'an BRT System**

| Item | Design Parameter |
|---|---|
| Location | From the north of Ji'an City (Northern Avenue Intersection) to the south of the city (Yingbin Road Intersection) via Jingganshan Avenue |
| Route length (initial route) | 6.94 km |
| Type of system | • Open system<br>• Several bus routes share part of their service in the BRT corridor |
| Width of BRT lane (single-lane width) | 3.5 m (3.2 m at critical locations) |
| Location of the BRT lanes (cross- | Center of the right-of-way |

| Item | Design Parameter |
|---|---|
| sectional) | |
| Pavement type | Asphalt concrete |
| Signalized intersections along the corridor | Coordinated traffic signals system will be implemented as part of the project |
| Number of bus routes to be included in the system (base year) | 9 routes (out of 31routes considered) |
| Fare payment system | • Along the BRT corridor: pay at the entrance of the station<br>• Outside the BRT corridor: pay on board |
| Assumed fare level | CNY 2.00 (flat fare system with no transfer charges among BRT buses) with usual discounts |
| Mode of payment | Smartcard (or cash) |
| Number of BRT stations along the corridor | 15 stations and average distance of 600 meters between stations |
| Type of BRT station | Island platform type at the center of lanes with the security doors installed |
| Dimension of BRT stations | Type A: 55 m x 5 m (standard)<br>Type B: 55 m x 6 m<br>Type C: 110 m x 5 m |
| Average distance between the stations | Approximately 460 meters |
| Vehicle type | • Length: Type A: 12 m (carrying capacity 60–80 passengers); Type B: 18 m (120–170 passengers)<br>• Both types of vehicles have doors on both sides<br>• Fuel type to be determined: clean diesel or CNG fueled<br>• Medium-height-floor type buses (38 cm) |
| Type and Number of vehicles to be operated on the BRT corridor | • 12 m buses with doors both sides.<br>• Total 84 vehicles |
| Operating speed on the corridor | Average 26 km per hour was assumed based on international and domestic experience (existing speed 16 km per hour) |
| Vehicle operation parameters | • Vehicle dwell time at stations: 5–10 seconds<br>• Acceleration and deceleration time: 13 seconds<br>• Vehicle door opening/closing time: 2.5 seconds |
| Operator | Ji'an Public Transport Company (new operating unit to be established under the bus company) |
| Maintenance Arrangement | Corridor: by Construction Bureau, Ji'an Municipality<br>Station Facilities: Ji'an Public Transport Company<br>Buses: Ji'an Public Transport company |
| Frequency of service along the BRT corridor during peak hours | (varies by route) |
| Intermodal considerations | • Bicycle parking at the BRT stations<br>• Sidewalk improvements near the BRT stations<br>• NMV lanes along the corridor |

Source: GMEDRI, BRT Feasibility Study for Ji'an, November 2013.

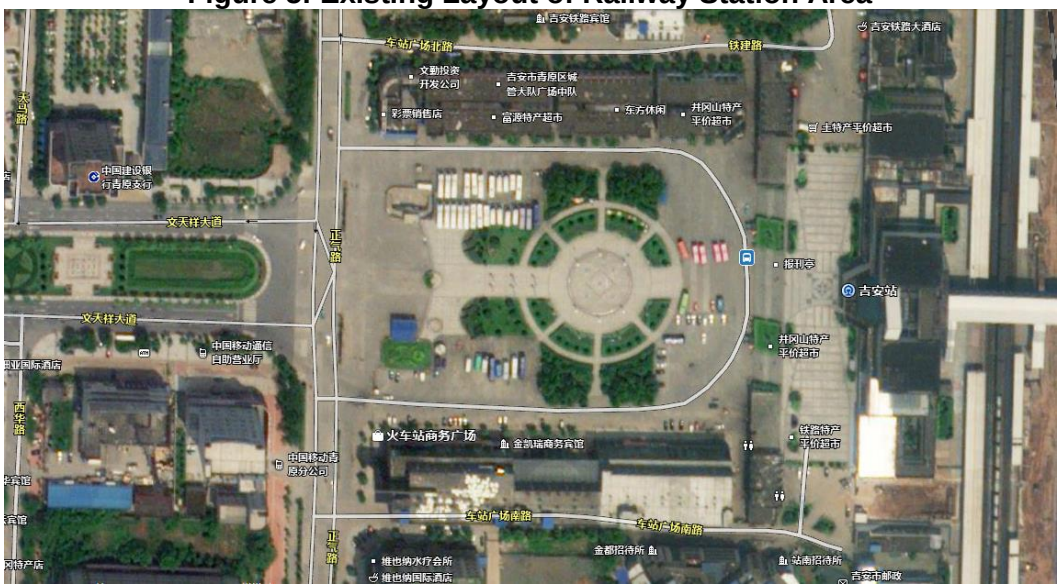
### b. Railway Station Square: Multi-Modal Hub

14. **Existing Situation and Issues.** The number of railway passenger arrivals and departures at Ji'an Railway Station has been steadily increasing in recent years. Between 2005

and 2012, passenger and freight traffic (arrivals and departures) increased to 5.45 million passengers and 3.8 million tons, with an annual increase of 14.3% and 9.4% respectively. Currently, 98 passenger trains per day in each direction (Beijing and Kowloon) stop at the Ji'an Railway Station.

15. The existing station building is owned by the Ji'an Railway Construction Office, and has been recently renovated to improve passenger comfort. The station square is located in front of Ji'an Railway Station. The station square level is owned by Qingyuan District. The station square itself is currently serving many purposes, but not effectively serving passengers transferring from one mode to another. In addition, the monument and park area are not being effectively utilized.

**Figure 5: Existing Layout of Railway Station Area**




Source: Google Maps.

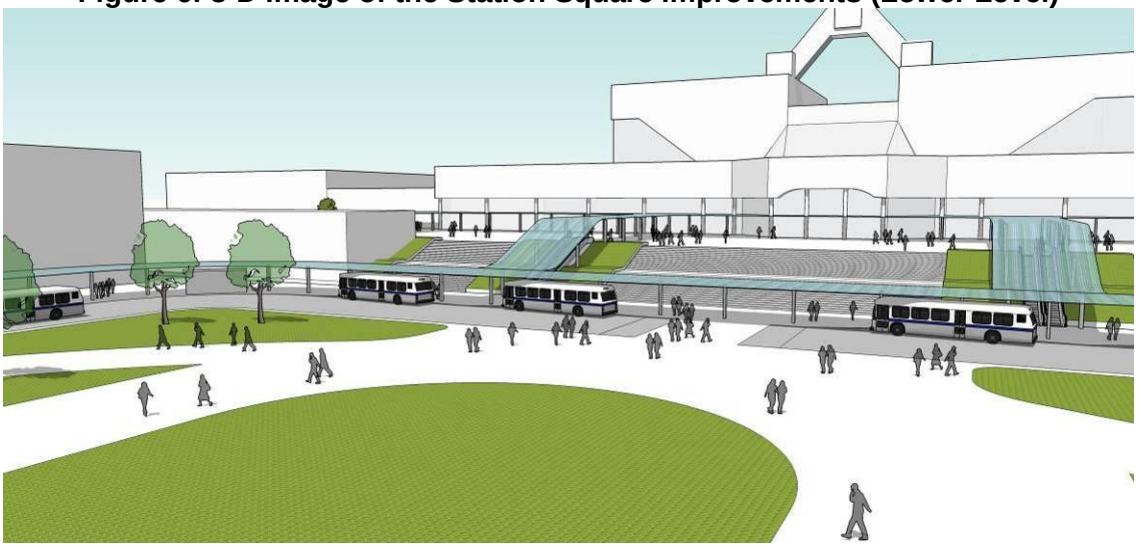
16. Buses and taxis (including motorcycle taxis) wait at the lower part of the square, and passengers especially the elderly, disabled or those with heavy luggage face a number of accessibility difficulties. An overhaul of the traffic flow and pedestrian access between the railway and public transport and taxis is needed.

17. **Design Concepts.** Achieving multi-modal connectivity at the rail station is critical for the development of public transport in Ji'an. The following key concepts informed the initial design for the station square improvement:

(i) The improvement project could include a remodeled station plaza, involving redesigned public space, facilities for weather protection, the integration of bus and long-haul coach transfers, proper signing for guiding direction and information, and the rearrangement of different transport modes.
(ii) The usage of the two access roads to the upper plaza (Station Plaza North and South Roads) should be utilized for taxi pick-up and drop-off.
(iii) Introduction of ramps or escalators linking the lower and upper plaza areas.

18. Figure 6 and Figure 7 shows 3-D images of the selected option.

**Figure 6: 3-D Image of the Station Square Improvements (Lower Level)**



Source: OTC.

**Figure 7: 3-D Image of the Station Square Improvements (Upper Level)**

Source: OTC.

19. Main features of the proposed design include rebuilding the access road and separation of transport modes, the installation of weather protection shelters along the major pedestrian areas and the escalators linking upper and lower levels of the square. A total of four escalators (two sets of going up and down escalators) are proposed. A weather protection canopy protects passengers from extreme weather conditions at bus/taxi waiting areas, escalators and along major pedestrian paths.

### 2. River Rehabilitation and Greenway Component

20. The Yudai River runs through the main part of the western new development area. It is currently used as a source of water for rice cultivation and is integrated into the agricultural areas near it. The farmland on both sides of the river floods frequently. Following the overall city planning scheme and expansion trends in the urbanized area, the new town development is taking place along the Yudai River. For this reason, the river needs to be improved to ensure

that the new development area will not be flooded. There will be a greenway and river promenade landscaped for recreation and NMT. The length of the river is 5.871 km, covering an area of 1,898.89 mu, including a land area of 1634.28 mu and a water area of 264.61 mu. A number of options were considered, and the current scheme as shown in Figure 8 was selected.

**Figure 8: Layout of River and Landscape Design**

Source: Shanghai Urban Construction Design and Research Institute, Yudai River Landscape Design, October 2013.

21. The scope of project includes flood control and landscaping works. The flood protection works consist of river channel dredging, river bank renovation and slope protection, in full consideration of the watershed program and new area development plan. The landscaping works are designed to respect the natural environment and water courses by incorporating the elements of woodland, lawns, pedestrian paths, bicycle trails, and associated facilities e.g. lighting, service areas for leisure activities, street furniture, parking, etc. The component will play an important role in relieving frequent flooding risks, and optimize the ecological environment and improve the environmental quality of the region. Furthermore, the improved water system is expected to create a more pleasant environment and improve people's living standards.

22. Examples of concept design are shown in Figure 9.

**Figure 9: Concept Rendering of Waterfront Pedestrian Path**

Source: Shanghai Urban Construction Design and Research Institute, Yudai River Landscape Design, October 2013.

23. The project seeks to accommodate sustainable modes of transport within the greenway. Auto transport is restricted and car parks will be provided only at the entrance. Electric bikes, bicycles, boat and walking will be the main modes of transport within the park area. As shown in Figure 10, three levels of road/path are proposed. The main paths (red) would be 4 to 6 m wide. The network would be completed by secondary (blue) and minor paths (purple) again for NMT users. Several piers for boats would be set up around the area.

**Figure 10: River Rehabilitation Project Promenade/NMT Network**

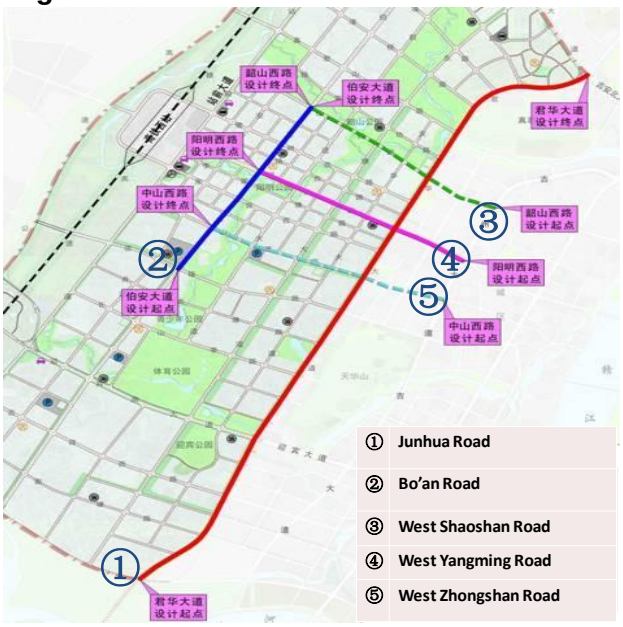

Source: Shanghai Urban Construction Design and Research Institute, Yudai River Landscape Design, October 2013.

## 3. Urban Roads and Traffic Management

### a. Urban Road Development

24. Five urban roads are to be financed by ADB. As shown in Figure 11, the five road sections are all major urban trunk/secondary roads.

**Figure 11: Location of Urban Road Sections**




Source: ADB.

25. Shaoshan West Road, Yangming West Road and Zhongshan West Road are the extension of existing primary urban roads connecting to the planned new high speed railway station area. Junhua Road and Bo'an Road are the major south-north trunk lines in the network. The planning and design standards that were applied to the five road sections are presented in Table 2.

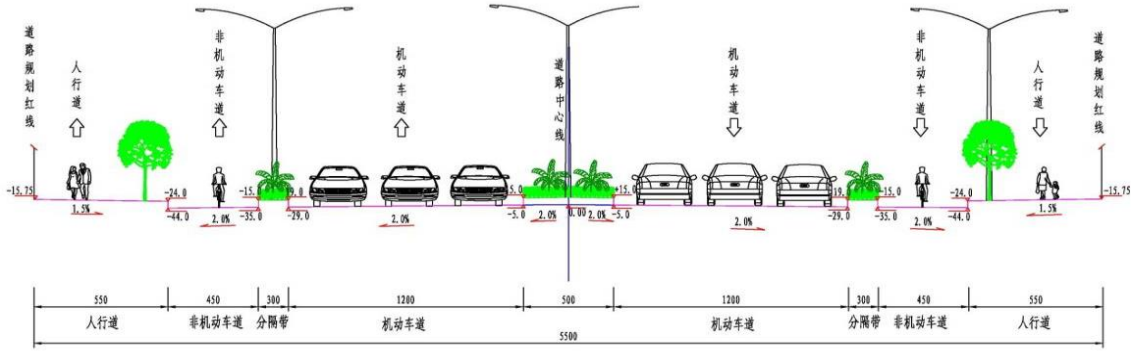
**Table 2: Proposed Road Sections**

| No. | Road | Section | Length (km) | Width (m) | No. of MV Lanes | Road Classification |
|---|---|---|---|---|---|---|
| 1. | Yangming West Road | Jizhou Road–Bo'an Road | 2.05 | 55 | Dual 3 | Trunk |
| 2. | Junhua Road | Ji'an South Road–Ji'an North Road | 7.80 | 55 | Dual 3 | Trunk |
| 3. | Bo'an Road | Jifu Road–Shaoshan Road | 3.15 | 40 | Dual 2 | Secondary |
| 4. | Zhongshan West Road | Jizhou Road–Bo'an Road | 3.34 | 40 | Dual 2 | Secondary |
| 5. | Shaoshan West Road | Jizhou Road–Bo'an Road | 2.99 | 40 | Dual 2 | Secondary |
| | **Total** | | **19.33** | | | |

Source: ADB.

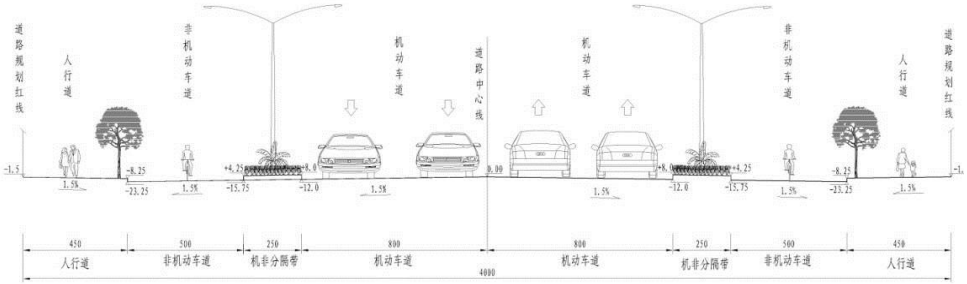
26. Roadway cross sections were designed according to road functions, traffic volumes and consistency with the rest of the built road network. The following drawings represent the recommended cross sections from the feasibility study which will be finalized during the detailed design phase.

**Figure 12: Proposed Cross Section for 55m Width (Recommended)**




Source: Shanghai Urban Construction Design and Research Institute.

**Figure 13: Proposed Cross Section for 40m Width (Recommended)**




Source: Shanghai Urban Construction Design and Research Institute.

### b. Traffic Management System

27. In Ji'an, traffic signals are installed at 105 intersections. All of these signals are controlled by YA-B-44L type controllers and are operating independently at each intersection on manually adjusted predetermined phasing. In the view of the rapid growth of traffic demand and the implementation of the BRT project, it is necessary to upgrade the traffic signal system along the major corridors in Ji'an.

28. There are 300 CCTV cameras installed and monitored at the Traffic Control Center within the Police HQ. Several officers continuously monitor traffic irregularities and violations such as crashes, stopping at intersections, speeding etc, and inform field police officers on duty. The CCTV video information also provides the degree of traffic congestion, which is passed to radio stations for broadcasting. There are currently no variable traffic signs for indicating locations of traffic congestion information. All of these operations, however, are done manually and no automated control system currently exists.

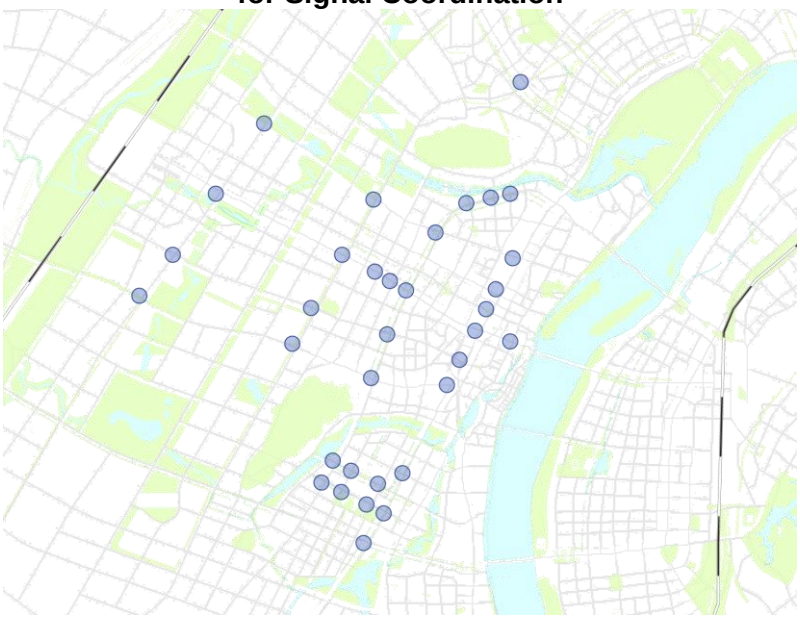
29. The traffic management component proposed by Traffic Police Department includes three sub-components: (i) coordinated signal system, (ii) central control system, and (iii) traffic information collection system. Each is discussed in turn below.

30. **Coordinated Signal System.** The essential functions of centrally controlled coordinated signal systems are:

(i) Real-time-traffic-signal timing with coordination between signals in order to improve traffic flow within the road network, minimizing vehicle stops, delays, and emissions as well as improving the operational characteristics of the proposed BRT routes (see Box 1 for concept of coordinated traffic signals).
(ii) Indicate and register alarms and/or incidents automatically and identify the police units nearest to the site so as to minimize response time.
(iii) Traffic information displays – variable message signs to provide real time traffic situations to road users.

31. The proposed traffic signals for co-ordination at over 30 intersections are shown in Figure 14. Priorities will be given to the traffic flows of Jingganshan Road and Yangmin Road, and the southern and western new development areas. Existing signal equipment will be utilized as much as possible, but controllers will be replaced with the ones that are compatible with a centralized control system.

**Figure 14: Location of Proposed Intersections for Signal Coordination**



Source: ADB.

32. The signals at these intersections will be centrally controlled and coordinated based on real time traffic data to minimize delays. Control data will be transmitted to each controller through the optical data communication systems along Jingganshan Road, which already exist for operating the CCTV monitoring system.

33. **Central Control System.** A central control system will be installed at the traffic control center at the Police HQ. The proposed system consists of several servers, switching systems, and relevant application software. The central computer will give various control orders, timing orders, parameters and program. The traffic signal controllers will upload traffic volume information, any faults and current working status, signal timing plans and other data. Communication between the center and the traffic signal controllers will use the RS232 interface

and standard RJ45 Ethernet port for full-duplex data transmission using the standard Data Communication Protocol between the traffic signal controllers and the higher-level PC (GB20999-2007) at the center.

34. The system will categorize the traffic status of the road network in five levels according to real-time traffic levels: smooth, relatively smooth, slight congestion, moderate congestion and severe congestion, and the status can be viewed at the control center. At the central control center, a database system will be developed and utilized for various traffic management decisions.

35. **Traffic Information Collection System.** The proposed data collection system mainly consists of microwave or loop vehicle detectors that constantly monitor traffic movements on site, and send the real-time traffic information to the central control system through the optical communication systems. At five strategic locations, real-time traffic information will be provided to road users on LED message display devises. Variable message signs are distributed on Jinggangshan Road and aim to divert traffic from the major congested roads to less congested ones improving network efficiency and safety.