PROJECT TECHNICAL DESCRIPTION

1. The proposed project will have five main outputs intended to develop the new railway station into a major urban passenger transport hub, link the station to the existing city, and promote multimodal integration. The proposed project outputs are (i) 12.2 kilometer (km) bus rapid transit (BRT) system, (ii) an urban transport hub at the new Xiangpu Railway's Jiangxi Fuzhou Railway Station, (iii) river rehabilitation and “greenway” development from the existing city to the new station area, (iv) 10 km of station access roads, and (v) institutional strengthening and capacity building.

A. Output 1: Bus Rapid Transit (BRT)\(^1\)

2. The proposed BRT corridor will extend 12.2 km from the north of Fuzhou (Wenchang Road) to the south of the city (to the planned multimodal hub at the new railway terminal) via Gandong Road (see Figure 1). A total of 22 BRT stations have been proposed.

![Figure 1: Proposed BRT Corridor and Stations](source)

3. The southern section of Gandong and Zhangqian Roads will be newly constructed as part of the Station Access Road component of the project while the remaining BRT corridor will involve reconstructing existing road sections. Table 1 summarizes the list of two road sections for reconstruction and two other road sections included as part of the Station Access Roads component.

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Table 1: List of Road Sections for the Proposed BRT Corridor

<table>
<thead>
<tr>
<th>Name</th>
<th>Road Type</th>
<th>Length (km)</th>
<th>Width (m)</th>
<th>Nature of Civil Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wenchang Road</td>
<td>Urban trunk road</td>
<td>1.17</td>
<td>52</td>
<td>Reconstruction</td>
</tr>
<tr>
<td>Gandong Road (1)</td>
<td>Urban trunk road</td>
<td>8.87</td>
<td>33–55</td>
<td>Reconstruction</td>
</tr>
<tr>
<td>Gandong Road (2)</td>
<td>Urban trunk road</td>
<td>1.15</td>
<td>55</td>
<td>Construction</td>
</tr>
<tr>
<td>Zhangqian Road</td>
<td>Urban trunk road</td>
<td>1.05</td>
<td>70</td>
<td>Construction</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>12.24</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

km = kilometer, m = meter.

1. BRT Operation

4. A BRT trunk and feeder system and a flexible system (such as adopted in Guangzhou) were examined. Figure 2 shows a flexible system and a closed (trunk and feeder) system.

Figure 2: Flexible System and Closed (Trunk and Feeder) System

Source: Guangzhou Municipal Engineering Design and Research Institute and Institute for Transportation and Development Policy, Feasibility Study for Fuzhou BRT System, August 2011.

5. The trunk and feeder system would provide a substantially higher capacity, but the system was not adopted. Major disadvantages of the trunk and feeder system are:

(i) the system would require large-scale transfer terminals at both ends of the BRT corridor;
(ii) the construction period would be relatively long and requires land acquisition for the construction of terminals;
(iii) the majority of system users would need to change buses to reach their destinations;
(iv) the time savings benefit would be lower compared with a flexible route system; and
(v) feeder routes would need to be considered, which would require more vehicles.
6. Considering the relatively low and scattered passenger demand in Fuzhou, a flexible system was adopted.

7. Seven bus routes will be included in the BRT system. Table 2 shows these routes and the percentage of the section using the BRT corridor for each of the seven routes.

<table>
<thead>
<tr>
<th>No.</th>
<th>Route Number</th>
<th>Route Length (km)</th>
<th>Section Length along the BRT Corridor (km)</th>
<th>Percentage of Section within the BRT Corridor (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1</td>
<td>6.92</td>
<td>5.38</td>
<td>78</td>
</tr>
<tr>
<td>2.</td>
<td>2</td>
<td>12.34</td>
<td>3.26</td>
<td>26</td>
</tr>
<tr>
<td>3.</td>
<td>7</td>
<td>6.31</td>
<td>2.83</td>
<td>45</td>
</tr>
<tr>
<td>4.</td>
<td>10</td>
<td>6.90</td>
<td>1.73</td>
<td>25</td>
</tr>
<tr>
<td>5.</td>
<td>11</td>
<td>9.23</td>
<td>3.26</td>
<td>35</td>
</tr>
<tr>
<td>6.</td>
<td>13</td>
<td>7.13</td>
<td>1.88</td>
<td>26</td>
</tr>
<tr>
<td>7.</td>
<td>33</td>
<td>10.37</td>
<td>2.20</td>
<td>21</td>
</tr>
</tbody>
</table>

BRT = bus rapid transit, km = kilometer.
Source: Guangzhou Municipal Engineering Design and Research Institute and Institute for Transportation and Development Policy, Feasibility Study for Fuzhou BRT System, August 2011.

8. The locations of the existing seven bus routes to be included in the proposed BRT system are shown in the Figure 3. The BRT feasibility study assumes that an appropriate adjustment to these routes will be made by the time of a full operation. Potential route adjustments include: (i) an extension of Route 1 to the planned new railway station via planned access roads (Gandong Road and Zhangqian Road); and (ii) re-routing of some of Routes 2, 10, 11, and 13, will be required from Wenchang Bridge to the new Gandong Bridge now under construction.
2. BRT Corridor Construction

a. Cross-Sectional Design

9. Figures 4 to 9 present standard cross sections designed for road segments along the corridor (with and without a BRT station). The width of the dedicated BRT lane will be 3.5 meters (m). Stations require 5 m of right-of-way. Road widths of 40 m and less require reducing the amount of space for sidewalks and nonmotorized vehicle (NMV) lanes at station locations. The construction of NMV lanes is proposed throughout the BRT corridor. These NMV lanes (2–4.5 m) will be constructed next to the sidewalks and physically separated from vehicular traffic for safety.
Figure 4: Cross-Section Design of the BRT Corridor (1)

Source: Guangzhou Municipal Engineering Design and Research Institute and Institute for Transportation and Development Policy, Feasibility Study for Fuzhou BRT System, August 2011.

Figure 5: Cross-Section Design of the BRT Corridor (2)

Source: Guangzhou Municipal Engineering Design and Research Institute and Institute for Transportation and Development Policy, Feasibility Study for Fuzhou BRT System, August 2011.
Figure 6: Cross-Section Design of BRT Corridor (3)

Source: Guangzhou Municipal Engineering Design and Research Institute and Institute for Transportation and Development Policy, Feasibility Study for Fuzhou BRT System, August 2011.

Figure 7: Cross-Section Design of BRT Corridor (4)

Source: Guangzhou Municipal Engineering Design and Research Institute and Institute for Transportation and Development Policy, Feasibility Study for Fuzhou BRT System, August 2011.
Figure 8: Cross-Section Design of BRT Corridor (5)

Source: Guangzhou Municipal Engineering Design and Research Institute and Institute for Transportation and Development Policy, Feasibility Study for Fuzhou BRT System, August 2011.

Figure 9: Cross-Section Design of BRT Corridor (6)

Source: Guangzhou Municipal Engineering Design and Research Institute and Institute for Transportation and Development Policy, Feasibility Study for Fuzhou BRT System, August 2011.
b. Pavement Design

10. The pavement of the existing Gandong Road is in relatively good condition. Minimizing new pavement construction will save construction costs. For the road section to be newly constructed under this project, the BRT lane will follow the pavement design proposed for other new construction.

c. BRT Lane Separation and Safety

11. BRT lanes will, in general, be physically separated from regular traffic for reasons of enforcement and safety. The BRT scheme is designed so that buses can be used on special dedicated bus lanes, but also can divert onto the general road network. BRT vehicles operating in a dedicated lane operate faster, more reliably and more safely than buses in mixed flow lanes. Dedicated, concurrent flow BRT lanes operating in the centre of the roadway, as per the proposed Fuzhou BRT cross sections, provide road safety benefits due to the reduction in disturbance to the BRT flow from access to side roads and buildings. However, to maximize safety for pedestrians, provision of safe access to stops located in the middle of the road is required.

12. The method and materials for separation between the BRT bus lane and mixed traffic should be carefully selected. Deterioration of line markings and surface separators can lead to vehicles such as motorcycles and bicycles entering the bus lane. In general, in areas where bus lanes are not physically segregated, it is recommended that surface colorization be used to demarcate BRT lanes and that adequate enforcement be applied.

3. BRT Station

a. Platform Design

13. The BRT is expected to use only new buses with dual-side doors, which makes it possible to propose an island platform type of BRT station. An island platform uses less road space and entails a lower investment cost for the fare collection system compared to the Guangzhou-style two-sided platform. However, a disadvantage of the island platform is a requirement for new vehicles since the existing single-side door buses are not compatible with the station design.

14. Two types of standard station design are proposed for the road sections with and without a wide median (Figure 10 and Figure 11).

**Figure 10: BRT Station Design (Type A)**

Source: Guangzhou Municipal Engineering Design and Research Institute and Institute for Transportation and Development Policy, Feasibility Study for Fuzhou BRT System, August 2011.
15. Each station has two bus bays on each side, which is considered sufficient for the level of passenger demand in Fuzhou. The introduction of 18 m buses has been considered for routes with higher peak hour demand to effectively increase station capacity in terms of the number of passengers per hour.

16. Overtaking lanes have not been recommended at this stage since the traffic density is less than 80 buses per hour per direction though this decision will be revisited during detailed design. When demand increases in the future, however, the addition of 18 m buses will make it possible to handle the increased demand. The construction of overtaking lanes requires the reduction of sidewalk widths, NMV lanes, and carriageways, which should be avoided to secure smooth flow and safety of the remaining traffic. Overtaking lanes need to be built if express service is to be introduced along on the BRT corridor. Figure 12 presents an “image” of a BRT station.

Figure 12: Image of BRT Station (Type A) – Visually Attractive Design and Materials with Advanced Safety Consideration

Source: Guangzhou Municipal Engineering Design and Research Institute and Institute for Transportation and Development Policy, Feasibility Study for Fuzhou BRT System, August 2011.
b. Passenger Congestion on Platforms

17. When buses on both sides of a bus station arrive at the same time, the volume of boarding/alighting passengers in the same vicinity will increase, which can cause crowding and possible “overspill”. However, this is unlikely to be a concern in the case of the larger station design shown above, and the smaller station design includes a staggered arrangement. Depending on passenger demand, the length of the “stagger” could be marginally increased to avoid crowding in a small space.

18. Also, it is recommended that buses align at the same level as the bus station platform and dock close to the loading platform (e.g., with precision docking applications), which will reduce the risk of pedestrians tripping between the station and bus especially during fast boarding and alighting.

c. Security Door System

19. Each BRT station platform will be equipped with a security door system that synchronizes the opening/closing of bus doors. Such a system is usually operated by a remote control infrared system installed on the BRT buses. It can also be controlled through control systems at the platform level, as well as manually if necessary. In case of power failure, all security doors will be kept open, and the system will automatically be restarted when power is restored. This system has a history of reliable operation internationally as well as in the People’s Republic of China. The installation of a security door system will ensure the safe loading/unloading of passengers particularly during peak hours.

4. Vehicles

a. Selection of BRT Buses

20. Based on the level of passenger flow along the corridor, two types of buses were recommended by the feasibility study: (i) an 18 m bus (with a capacity of 150 passengers); and (ii) a 12 m bus (with a capacity of 75 passengers). Both types of buses would have doors on both sides since they will be used to load/unload passengers at the (island platform type) BRT stations and also outside of the BRT corridor.

21. High-floor buses (35 centimeters) were recommended for the following reasons:

   (i) a lower price compared to the price for low-floor buses;
   (ii) higher capacity for the same size;
   (iii) higher operational efficiency with a lower accident rate; and
   (iv) the possibility of installing wider doors on both sides.

22. The height of platform should be the same as the height of buses to ensure level boarding, which is faster and safer.

23. The feasibility study recommended that the buses meet Euro IV emission standards and use clean fuels (compressed natural gas or clean diesel). The proposed Global Environment Facility financed environmental improvement component will provide incremental financing to purchase low emission compressed natural gas buses for the BRT system.

24. In terms of BRT vehicle safety factors, driver assist technology can aid in the safer operation of a transit vehicle. This technology includes components such as cameras for
collision warning and prevention and voice and data communication with a central control center. Vehicle diagnostics systems help identify vehicle malfunctions as well as maintenance requirements, thereby increasing vehicle safety. Lane assist technology allows vehicles to operate at higher speeds in narrower lanes, and increases safety for passengers, improves functionality, and decreases the space required for buses.²

b. Fleet Requirement Issues

25. For calculation of the number of buses required for each route, the existing passenger demand and peak hour flow (a maximum of 4,500 passengers in both directions) was considered in the feasibility study. The results of the calculation are shown in Table 3.

Table 3: Type and Number of Buses in the Routes using the BRT Corridor

<table>
<thead>
<tr>
<th>Route</th>
<th>12 m Buses (75 passengers)</th>
<th>18 m Buses²</th>
<th>Total¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>4</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>10</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>13</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>4</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>16</td>
<td>51</td>
</tr>
</tbody>
</table>

m = meter.

Notes:  
(1) The numbers are calculated based on the current demand level of each route.
(2) 12 m buses may be sufficient during off-peak hours.
Source: BRT FS Report.

26. The project will procure a total of 51 buses, including 16 units of 18 m, large-capacity, articulated buses and 35 units of 12 m, regular size buses. All buses will be required to have dual side doors.³

5. Traffic Management and Safety

27. The Fuzhou BRT proposal will create road safety benefits arising from a mode shift away from private vehicles and from reducing the distance travelled for some movements and reducing conflicts. The BRT proposal will help reduce accidents and improve the safety and personal security of passengers.

a. BRT-Priority Intersections

28. Restrictions on left turns will be introduced at BRT-priority intersections. Similarly, street crossings along the BRT corridor will be restricted for traffic in/out of minor streets. Eleven intersections along the BRT corridor (Figure 13) will be designated as BRT-priority intersections at which the movement of left-turning traffic will be restricted. This arrangement has been supported by the traffic police and is considered implementable. The detailed signs and markings required for traffic management at the relevant intersections will be designed at the preliminary design stage. The timing of the existing traffic signals will need to be redesigned to minimize delays at these intersections.

³ The market price of a 12 m bus with two-sided doors is about CNY 800,000 and that for an 18 m bus with two-sided doors is about CNY 1.6 million.
b. NMV Facilities along the Corridor

29. The proposed BRT corridor cross sections for Fuzhou include dedicated NMV lanes improving segregation with highway traffic that in turn should reduce conflicts and road traffic accidents. The NMV lanes with colored pavement and appropriate signs/m markings will be constructed along the entire BRT corridor. Figure 14 provides an example of these facilities.

Figure 13: Proposed Traffic Arrangement for Left-Turning Vehicles at BRT-Priority Intersection

Figure 14: Illustrative Nonmotorized Transport Facility Improvements along the BRT Corridor

Source: Guangzhou Municipal Engineering Design and Research Institute and Institute for Transportation and Development Policy, Feasibility Study for Fuzhou BRT System, August 2011.
c. Pedestrian Safety Issues

30. The feasibility study report notes the importance of pedestrian safety measures along the BRT corridor (e.g., introduction of pedestrian signals, safe street crossing arrangements for the NMV lanes). Detailed safety design considerations and a road safety audit will be conducted during the detailed design stage.

31. As some roads along the BRT route are very wide, consideration may be given to grade-separated methods of road crossing for pedestrians to access the BRT stations. However, currently this is not strongly recommended since traffic flows are not expected to be high and pedestrians would be unnecessarily inconvenienced. The current proposal is for pedestrian (zebra) crossing arrangements to access the bus stations. Although on one side pedestrians to cross the BRT lane in the path of arriving buses, bus driver awareness and decelerating bus vehicles would minimize safety risks to pedestrians. The other side of the station requires pedestrians to cross next to stationary buses that are loading passengers, which is acceptable as long as there is adequate visibility for pedestrians to view the approaching traffic passing the stationary buses. Adequate visibility will be provided so that waiting buses do not obstruct pedestrian vision of the road and approaching traffic.

d. Safety and Security

32. At BRT stations and terminals safety and security for passengers will be enhanced through adequate lighting and visibility, closed-circuit television (CCTV) systems, emergency “help” buttons, cleanliness, assistants, boarding platforms for level boarding, personnel training for emergency situations and station designs providing good sight lines. On-vehicle safety and security can be enhanced with on-board CCTV, driver customer care training and driver assist technologies such as rear- or side-view cameras.

6. Summary of Key Design Parameters

33. Table 4 summarizes key parameters of the proposed BRT system for Fuzhou.

<table>
<thead>
<tr>
<th>Table 4: Key Parameters of the Proposed Fuzhou BRT System</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Item</strong></td>
</tr>
<tr>
<td>Location</td>
</tr>
<tr>
<td>Route length</td>
</tr>
</tbody>
</table>
| Type of system | • Closed system with flexible routing  
| | • 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-sectional) | Center of the right-of-way |
| Pavement type | Asphalt concrete |
| Signalized intersections along the corridor | 16 intersections – introduction of coordinated traffic signals such as the SCATS system has been recommended (the SCATS control center is not included in the ADB component) |
| Number of bus routes to be included in the system (base year) | 7 routes (out of 13 routes considered) |

<table>
<thead>
<tr>
<th>Item</th>
<th>Design Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fare payment system</td>
<td>• Along the BRT corridor: pay at the entrance of the station&lt;br&gt;• Outside the BRT corridor: pay on board</td>
</tr>
<tr>
<td>Assumed fare level</td>
<td>2 CNY (single fare system with no transfer charges among BRT buses) with usual discounts</td>
</tr>
<tr>
<td>Mode of payment</td>
<td>Smartcard (and cash)</td>
</tr>
<tr>
<td>Number of BRT stations along the corridor</td>
<td>22 stations</td>
</tr>
<tr>
<td>Type of BRT station</td>
<td>Island platform type at the center of lanes with the security doors installed</td>
</tr>
<tr>
<td>Dimension of BRT stations</td>
<td>Type A: 56 m x 5 m (standard)&lt;br&gt;Type B: 47 m x 13 m (for the section with wide median)</td>
</tr>
<tr>
<td>Average distance between the stations</td>
<td>550 m</td>
</tr>
<tr>
<td>Vehicle type</td>
<td>• Length: Type A: 18 m (carrying capacity 60–80 passengers); Type B: 12 m (120–170 passengers)&lt;br&gt;• Both types of vehicles have doors on both sides&lt;br&gt;• Fuel type to be determined: clean diesel or CNG fueled</td>
</tr>
<tr>
<td>Number of vehicles to be operated on the BRT corridor</td>
<td>• Type A: 18 m (16 vehicles)&lt;br&gt;• Type B: 12 m (35 vehicles)&lt;br&gt;• Total 51 vehicles</td>
</tr>
<tr>
<td>Operating speed on the corridor</td>
<td>Average 26 km per hour was assumed based on international and domestic experience (existing speed 11 km per hour)</td>
</tr>
<tr>
<td>Vehicle operation parameters</td>
<td>• Vehicle dwell time at stations: 5–10 seconds&lt;br&gt;• Acceleration and deceleration time: 13 seconds&lt;br&gt;• Vehicle door opening/closing time: 2.5 seconds</td>
</tr>
<tr>
<td>Number of operators</td>
<td>Single operator (new operating unit to be established under the bus company)</td>
</tr>
<tr>
<td>Frequency of service along the BRT corridor</td>
<td>Not known (varies by route)</td>
</tr>
<tr>
<td>Maximum BRT traffic demand along the BRT corridor</td>
<td>4,500 passengers per hour (both directions)&lt;br&gt;180 vehicles per hour (both directions)</td>
</tr>
<tr>
<td>Intermodal considerations</td>
<td>• Bicycle parking at the BRT stations&lt;br&gt;• Sidewalk improvements near the BRT stations&lt;br&gt;• NMV lanes along the corridor</td>
</tr>
</tbody>
</table>

ADB = Asian Development Bank, BRT = bus rapid transit; CNG = compressed natural gas; CNY = Chinese yuan; km = kilometer, m = meter, NMV = nonmotorized vehicle, SACTS = Sydney Coordinated Adaptive Traffic System.

Source: This PPTA based on the BRT Feasibility Study report, August 2011.

B. **Output 2: Urban Transport Hub**

34. The Urban Transport Hub will be built on two land lots covering an area of 70,140 square meters ($m^2$), located on the northwestern side of the railway station plaza. This area will accommodate the bus terminal and car park, the BRT terminal, and the municipal bus company headquarters as shown in Figure 15.
1. BRT Bus Access to the BRT Station

35. The BRT station within the new railway station area was designed to ease the access of the BRT buses to/from Zhangqian Road.
2. Access to Bus Terminal Area

36. Figure 17 shows the movement of local buses and those entering the maintenance and storage facility.

Source: Guangzhou Municipal Engineering Design and Research Institute and Institute for Transportation and Development Policy, Feasibility Study for Fuzhou BRT System, August 2011.
3. Safety and Security

37. In addition to safe pedestrian access to and from the Urban Transport Hub and between the interchange points for the various modes, there are a variety of safety factors that will be built into the Urban Transport Hub design particularly for pedestrians. Urban Transport Hub station and terminal safety and security for passengers will be enhanced through adequate lighting and visibility, CCTV systems, emergency “help” buttons, cleanliness, station assistants, boarding platforms for level boarding, personnel training for emergency situations and station designs providing good sight lines. All these factors will help increase public transport usage in a safer, more attractive environment.

4. Bus Terminal and Control/Dispatch Center Building

38. Fuzhou Municipal Bus Company is currently located on Fubei East Road. It covers an area of 14,000 m², 11,300 m² of which is for bus parking, while office floor area only consumes 1,600 m². The office space is insufficient to meet the demand for current daily operations, and office and maintenance facilities urgently need to be modernized. Especially after introducing the BRT system, public transport operations and maintenance facilities must be improved. In addition, the bus company faces constraints on further expansion due to the limited supply of land in the old urban area. With the construction of the new railway station, the new bus company headquarters and bus terminal will be consolidated at the new railway multimodal hub.

39. The bus terminal and its controlling and dispatching center building will be located northwest of the station yard of the multimodal hub on about 44,827 m² (67.24 mu). The entrance and exit of the bus terminal will be on Waihuan road. The bus terminal area will be divided into three subareas: the control building will be in the southern part of the site and will incorporate the functions of dispatching and controlling buses, staff dining room, administration, and rest area; the duty area will be in the western part of the site and will include a repair and maintenance workshop, a bus washing station, and depot; the bus departing area will be in the eastern part of the site; the north-south arranged dispatching room, and public toilets will be in the middle of the site; a greenbelt will separate the parking area and departing area, to prevent conflicts between the two areas (See Figure 15).

40. The construction of the bus terminal and controlling and dispatching building must satisfy the needs of existing operations, while also allowing for future development and expansion. Table 5 presents the facilities of construction in the proposed bus terminal area.

Table 5: Facilities in the Proposed Bus Terminal

<table>
<thead>
<tr>
<th>No.</th>
<th>Facility</th>
<th>Area (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Controlling and dispatching building</td>
<td>7,966</td>
</tr>
<tr>
<td>2</td>
<td>Duty house</td>
<td>463</td>
</tr>
<tr>
<td>3</td>
<td>Operation control room</td>
<td>120</td>
</tr>
<tr>
<td>4</td>
<td>Public toilet</td>
<td>120</td>
</tr>
<tr>
<td>5</td>
<td>Bus repair workshop</td>
<td>2,755</td>
</tr>
<tr>
<td>6</td>
<td>Gas station</td>
<td>393</td>
</tr>
<tr>
<td>7</td>
<td>Roads</td>
<td>4,483</td>
</tr>
<tr>
<td>8</td>
<td>Departing and depot areas</td>
<td>24,000</td>
</tr>
<tr>
<td>9</td>
<td>Automatic spraying bus washing rack</td>
<td>800</td>
</tr>
</tbody>
</table>

m² = square meter.
Source: Feasibility Study Report.
a. **Control/Dispatch Center Building**

41. **Building Layout:** The layout of the control and dispatch building will be rectangular, with various functional zones connected by hallways, staircases, and elevators. The building will be well-lighted by large windows and have a good ventilation system. A waiting hall for passenger departures will be on the first floor (Figure 18), with offices on the second to fourth floors, the control/dispatch center and office space on the fifth floor, and a conference room and lounge on the sixth floor.

![Figure 18: Layout of the Control/Dispatch Building (First Floor)](source)

42. **Figure 19 presents a front view of the control/dispatch building.**

![Figure 19: Front View of the Control/Dispatch Building](source)
43. Barrier-free Design: Barrier-free facilities will be provided on the entire site and in the interior of the building. A wheelchair ramp will be provided at the entrance of the waiting hall. Public toilets will be designed for easy access for wheelchair users and designated facilities for the handicapped.

b. Maintenance Workshop

44. The maintenance workshop will be a “long-stretch” rectangular shape and fully equipped to handle the new BRT bus fleet. There will be two floors, with the first floor accommodating maintenance workshops and the second floor for duty offices and a lounge.

C. Output 3: Fenggang River Improvement

45. Fenggang River is an inland river running through the main part of the West Bank Area of the Fuzhou urban district. The river is winding and the drainage is poor. When flood season arrives, the farmland on both sides of the river is often flooded. Following the overall city planning scheme and expansion trends in the urbanized area, new town development is taking place along two sides of the Fenggang River. For this reason, the river needs to be improved to ensure that the new developments will not be flooded. Phase I of the Fenggang River Improvement Project has already been completed; it improved not only the flood control capacity of the inner urban area at the river reach, but also provides a significant amount of green space for residents of Fuzhou City.

46. The flood control projects of the city of Fuzhou take the Fu River as a boundary, and are divided mainly into Fu River East Embankment, Fu River West Embankment, and Fenggang River Improvement projects. Pursuant to existing urban planning, the city area will be developed along the Fu River, i.e., the East Bank Area and the West Bank Area. The East Bank, which is protected by the East Embankment, was formerly the old town of Fuzhou City, protected by the flood-proof wall east of the bridge and the Zhongzhou Embankment, to ensure that the area will not be inundated by floods exceeding the design standard. The West Bank Area, which includes the Fuzhou City downtown area, is protected by the Yaoping Embankment.

47. The Fenggang River greenway will connect the Fenggang River in the existing New Administration Area to the extension of Jin’ni Road in the New Railway Station Area. The total length of the river in the greenway project will be 4.117 km. The total area of the land used is 1,800 mu, including 800 mu of water area and 1,000 mu of green and landscape areas. The designed normal water level is 36.3 m (Yellow Sea Altitude).

1. Content of Construction Works

48. Construction works for the park development will include sculptures, parks, plazas, and towers. The river improvement works will include dredging, slope protection, and remodelling of the site topography (see Figure 20 and Figure 21).

There will be dozens of buildings constructed in the park. Because the project site is close to lakes and other bodies of water, the general principle is that buildings should integrate harmoniously with natural scenes to reflect the southern park style of the People’s Republic of China. Figure 22 shows the design of the park development subcomponent and the location of proposed monuments and buildings.
2. Transport Facilities within the Park

50. Major modes of transportation within the park will be ecologically friendly (e.g., electric or e-vehicles, bicycles, boats, and walking). Parking space (a total of about 8,000 m²) will be constructed for private cars and bicycles (including rent-a-cycles) at several entrances of the park. At the main entrance of the park, i.e., the west gate, there will be space for bus parking. In total there will be 12 parking lots (15–20% of the area will be for bicycle parking or rent-a-cycles). Three boat piers will be constructed along the lake, close to each entrance or areas with a large number of visitors. Figure 23 displays examples of transport facilities within the park.
51. Four types of roads are planned in the park:

(i) Type I roads will pass through and connect main scenic areas. The width of Type I roads will be 6 m and they will be used by e-vehicles and bicycles.

(ii) Type II roads connect scenic spots within each scenic area; the width of the road will be 4 m, to serve a combination of visitors and electric vehicles or visitors and bicycles.

(iii) Type III roads will be used by pedestrians. The width of this type of road will be 2 m and the width of the path will be 2.5 m, while the total length is 3,800 m.

(iv) Type IV roads include garden roads and footpaths for mountaineering and other recreational uses. The width of roads of this type will be 1.0–2.0 m.

D. Output 4: Station Access Roads

52. The proposed road network in the new railway station area calls for the construction of 27 road sections. The rights-of-way for these roads range from 16 m to 70 m depending on the functional classification of the road. The key principle behind the planning of these roads was to develop a network that interconnects all transport facilities with regional significance, including the new railway terminal, the ring road, and major corridors in the existing urban area. The four road sections under the ADB-financed project are all major urban trunk roads in the road network, as shown in Figure 24. These sections are the extension of existing primary urban roads connecting to the new terminal, which is particularly important because the new rail service will provide regional high speed rail access to Fuzhou for the first time, and has the potential to transform Fuzhou into a satellite city of Nanchang. Without the proposed road network, the new station will have limited accessibility to/from the rest of the city due to its distance from the existing urban center.
53. The feasibility study report was based on key planning documents underlying the Fuzhou Urban Master Plan (2008–2020) and the Fuzhou Railway Station New Area Detailed Plan. The planning and design standards were applied to the four road sections as presented in the Table 6. The proposed road network meets the planning and design criteria set out for the new area.

### Table 6: Proposed Road Sections to be Financed by ADB

<table>
<thead>
<tr>
<th>Road</th>
<th>Section</th>
<th>Length (km)</th>
<th>Width of RoW (m)</th>
<th>No. of MV Lanes</th>
<th>Road Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.Gandong Road</td>
<td>Anshi Road – Jinni Road</td>
<td>2.93</td>
<td>55</td>
<td>Dual 3</td>
<td>Trunk</td>
</tr>
<tr>
<td>2.Jichao Road</td>
<td>Anshi Road – Jinni Road</td>
<td>2.06</td>
<td>50</td>
<td>Dual 2</td>
<td>Trunk</td>
</tr>
<tr>
<td>3.Zhangqian Road</td>
<td>Waihuan Road – Gandong Road</td>
<td>1.05</td>
<td>70</td>
<td>Dual 4</td>
<td>Trunk</td>
</tr>
<tr>
<td></td>
<td>Gandong Road – Jinni Road</td>
<td>1.14</td>
<td>55</td>
<td>Dual 3</td>
<td></td>
</tr>
<tr>
<td>4.Waihuan Road</td>
<td>Anshi Road – Chonggang Road</td>
<td>3.06</td>
<td>55</td>
<td>Dual 3</td>
<td>Trunk</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>10.24</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

km = kilometer, m = meter, MV = motorized vehicle, ROW = right-of-way.
Note: The width of 70 m for Gandong Road has not been agreed by ADB.
Source: ADB.

54. The roadway will be classified as urban trunk road Grade II with a design speed of 40 kilometer per hour (kph) (Waihuan road 50 kph). Major design criteria were as listed below:
(i) Road standard: Urban Trunk road Grade II  
(ii) Design speed: 40 kph  
(iii) Right of way width: 50–70 m  
(iv) Pavement design load: BZZ-100KN  
(v) Design life: 20 years

55. The first section of Zhangqian Road (Waihuan Road–Yuming Road) is already being built with a width of 70 m. The EA/IA are planning that the Zhangqian Road, between Yuming Road and Gandong Road, be built with a width of 70 m wide to maintain consistency of the street layout on the BRT corridor. After the BRT turns onto Gandong Road, Zhangqian Road will narrow to 55 m.

1. Roads

56. Figures 25 to 32 show the proposed cross sections for the access roads. The lane configurations will need to be elaborated during the detailed design stage taking into consideration the options for median belt separation.

Figure 25: Proposed Cross Section for Gandong Road – Recommended

Source: Jiangxi Provincial Planning and Design Institute (JPPDI).

Figure 26: Proposed Cross Section for Gandong Road (with BRT Station)

Source: JPPDI.
Figure 27: Proposed Cross Section for Zhangqian Road (Waihuan Road to Gandong Road) – Recommended

Source: JPPDI.

Figure 28: Proposed Cross Section for Zhangqian Road with BRT Station

Source: JPPDI.

Figure 29: Proposed Cross Section for Zhangqian Road (Gandong Road to Jinni Road – Recommended)

Source: JPPDI.
57. **Drainage.** Storm water runoff will be collected via road surface gullies set at intervals of around 25–50 m, and directed to the underground drainage system.

58. Most land along the proposed road is used for rural farming at present. Temporary ditches will be built along both sides of the road embankment to collect storm water runoff and
direct it into stream, river, or low-lying area nearby. Over the long term, the whole area will be the subject of urban development. Storm water runoff will need to be integrated into a holistic municipal drainage system. In addition, blind (closed) drainage ditches will be laid in the greenbelt to direct runoff into the main drains, in order to prevent the road pavement and subgrade from water infiltration.

59. A box culvert is proposed where Waihuan Road passes under Zhangqian Road in front of the railway terminal. However, this junction has great significance given the complexity of multimodal traffic approaching the new terminal. The traffic characteristics should be studied further and alternatives such as a bridge crossing Waihuan Road explored and compared with the box culvert in terms of costs and traffic impact. Gravity-retaining walls are proposed for the underpass section of Waihuan Road. The retaining wall would be made of cement-mortar mason. A detailed structural design will need to be undertaken during the detailed design phase.

2. Traffic Management and Safety

60. **Intersection Channelization.** For all the road sections, at-grade intersections instead of grade separations are proposed in consideration of the function of the urban roads serving all road users and to ensure easy access for pedestrian and cyclists. Signalization will be provided when a primary road intersects another primary road. As shown in Figure 33 and Figure 34, pedestrians and cyclists have been channelized, and traffic islands are proposed in order to increase intersection capacity. The right-of-way for intersections will be widened by adding an auxiliary lane to accommodate turning movements. The movements of road users will be controlled, e.g., by yield signs, stop signs, and traffic signals. These will help organize traffic and decrease potential conflicts.

61. Noting the issues around wide roads and crossing distances, pedestrian crossings will include a refuge area or be integrated with the medians, so that pedestrians can cross the road in two stages. It is also recommended that a dedicated pedestrian phase be provided as part of the signalization with the junction signal times optimized with pedestrian push buttons and potentially vehicle detector loops in the junction signal designs. The pedestrian refuge could include a staggered pedestrian refuge arrangement with the advantage that pedestrians would face the oncoming traffic direction before crossing, which would be safer.

62. Sufficient width for rights-of-way will be provided for pedestrians including both sidewalks and crosswalks helping to reduce conflicts and encourage more walking trips by providing a safer and more pleasant pedestrian environment.
Figure 33: Traffic Arrangement for the Intersection of Gandong Road and Zhangqian Road

Source: JPPDI.

Figure 34: Traffic Arrangement for the Intersection of Jinchao Road and Zhangqian Road

Source: JPPDI.