



BRT in China: A brief review

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BRT in China

Kunming

Chongqing

Beijing

Xiamen

Hangzhou

Jinan

Changzhou

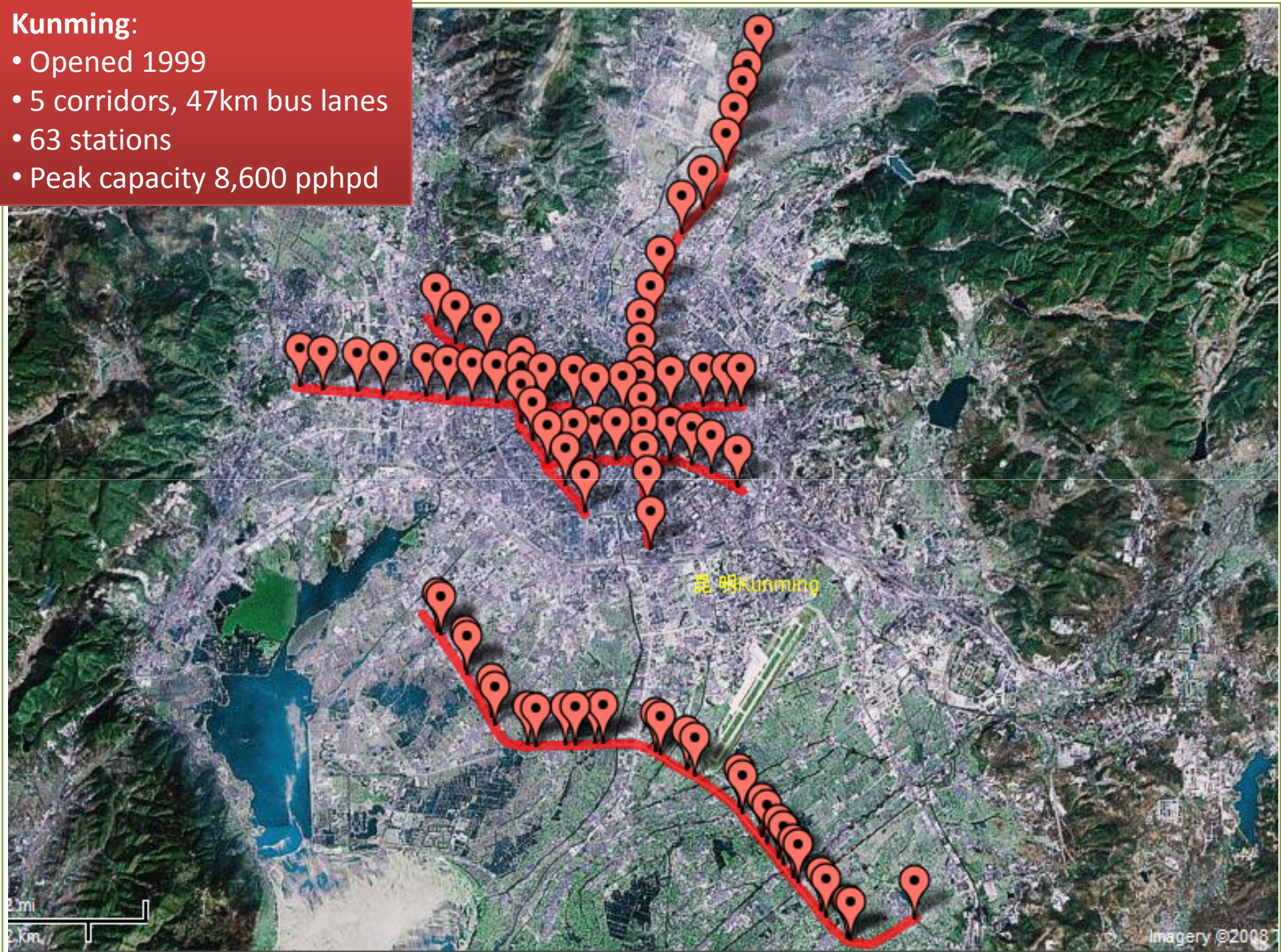
Guangzhou

Dalian

Conclusion

Kunming:

- Opened 1999
- 5 corridors, 47km bus lanes
- 63 stations
- Peak capacity 8,600 pphpd



Segregated busways or bus-only roadways	Year system commenced: 1999
High capacity BRT buses <i>new fleet of 18m, but most still 10-12m</i>	Number of existing trunk corridors: 5
Network of routes and corridors	Total length of dedicated busway (km): 46.7 <i>Incl. Guangfu Lu new corridor, 14.5km</i>
Enhanced station environment (more than just a bus shelter) <i>New corridors have wider, better stations</i>	Length including mixed traffic portions (km): 46.7
High city centre peak period operational speed (>20km/hr)	Number of stations: 63
Majority of bus passenger demand in the corridor met by BRT buses	Average distance between stations (m): 500 <i>Guangfu Lu corridor is 1km</i>
Net time saving for bus passengers in corridor	Location of busway lanes: Centre of roadway
Overtaking lanes at more than half of all stations	Location of bus doorways: Right side
Actual peak ridership over 10,000 passengers per hour per direction	Number of stations with passing lanes: 4
Passenger volume greater than a mixed traffic lane (~3000 pphpd)	Number of BRT terminals: 0 <i>Operational model does not require special BRT terminals</i>
Pre-board fare collection and fare verification	Number of BRT depots: 0 <i>Operational model does not require special BRT depots</i>
At-level boarding and alighting	System passenger-trips per day: 156,000 <i>not incl. Guangfu Lu</i>
Includes BRT-only tunnels or bridges	Peak ridership (passengers/hr/direction): 8,600 <i>Beijing Rd S-N PM, Mar-08</i>
Buses operating both inside and outside the busway corridor	City centre peak hour speed (km/hr): 11-14
Competitively bid operating contracts and concessions	Peak city centre buses/hr/direction: 140 <i>Beijing Rd S-N PM, Mar-08</i>
More than one BRT bus operator	Fleet of special BRT buses: ~20
No operational subsidy from government <i>no subsidy</i>	Fleet of integrated BRT feeder buses: 0 <i>Operational mode does not require feeder buses</i>
BRT buses paid for by operators rather than government budget	Median cash fare (yuan): 1
Low-emission vehicle technology (Euro III or higher) <i>18m BRT vehicles: yes. Fuel: no</i>	Total planning and design costs (million yuan): 0.5
Automated fare collection and fare verification system	Infrastructure cost per km (million yuan): 6
Weather protection on station platforms	BRT bus cost - public funds (million yuan): 0
System control centre	Number of doors in BRT buses: 4 <i>regular buses have 2 doors</i>
Real-time next bus information displays	BRT vehicle length: 18m <i>but most buses are 10-12m</i>
Distinctive marketing identity for system <i>New 18m buses marketed as BRT</i>	BRT vehicle fuel: diesel
Distinctive BRT buses <i>For the new 18m buses</i>	BRT bus manufacturer: Jinhua Neoplan
High-quality passenger information at stations	

Kunming median bus lanes map and station locations

System Aspect classification

See www.chinaBRT.org for latest figures



Karl Fjellstrom, ITDP

Kunming median bus lanes



Duan Xiaomei, GMTDC

Kunming. Many problems are concentrated at the intersection. But many intersections have been convert from 4 phase to 2 phase.



Daily experience in Kunming's busway corridors



Kunming: unsafe access to a mid-block bus station

BRT in China

Kunming

Chongqing

Beijing

Xiamen

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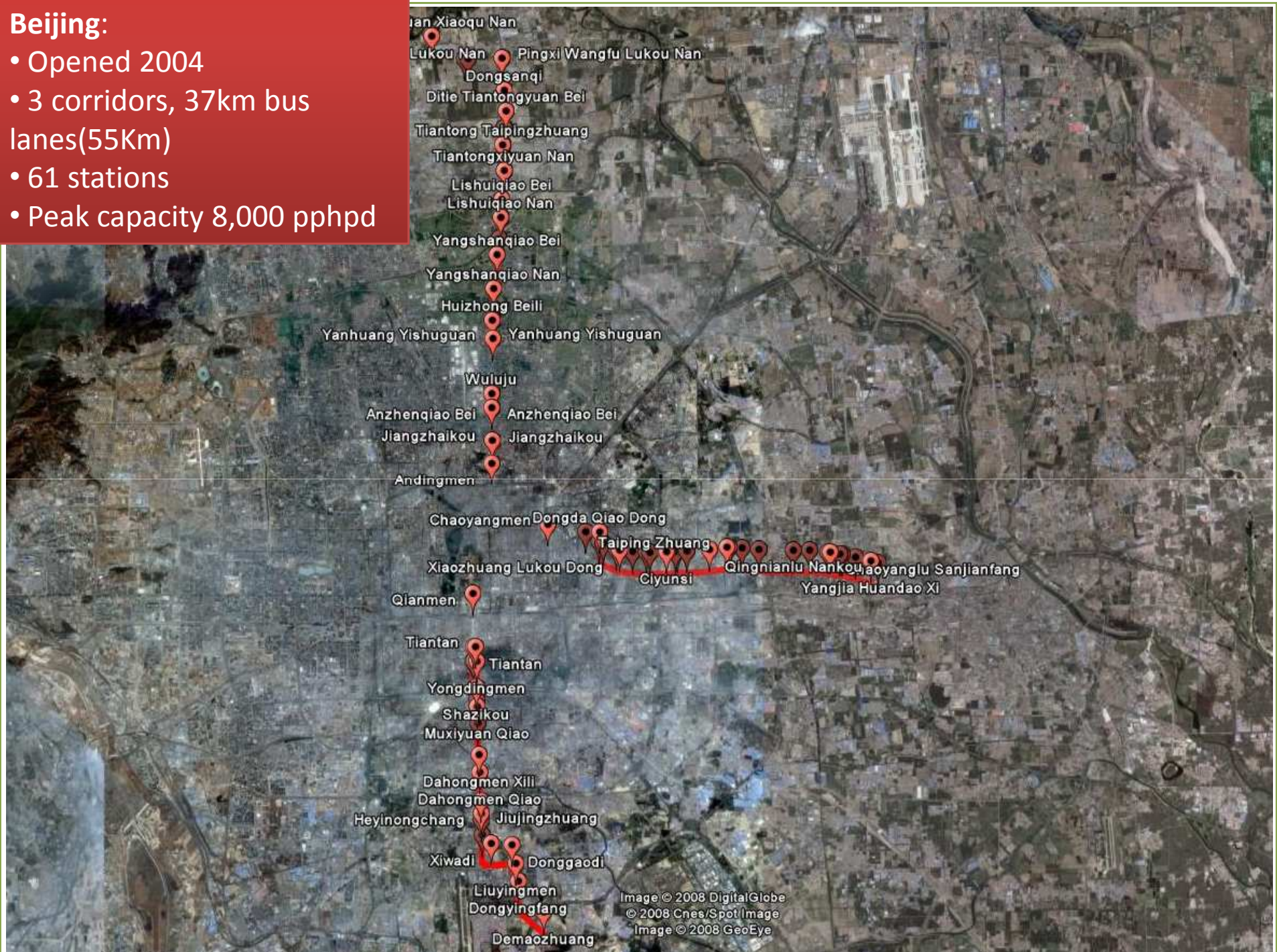
Guangzhou

Dalian

Conclusion

Beijing:

- Opened 2004
- 3 corridors, 37km bus lanes(55Km)
- 61 stations
- Peak capacity 8,000 pphpd



Segregated busways or bus-only roadways	Year system commenced: 2004 <i>corridors 2 & 3 August 2008</i>
High capacity BRT buses	Peak ridership (passengers/hr/direction): 7,500 <i>22-Jan-09, northward AM, south of Tiantan. Corridors 2&3 around 2,000 in Sept. 2008</i>
Network of routes and corridors	City centre peak hour speed (km/hr): 21 <i>~17km/hr in corridor 2, ~14km/hr in corridor 3</i>
Enhanced station environment (more than just a bus shelter)	Number of existing trunk corridors: 3
High city centre peak period operational speed (>20km/hr) <i>Not in corridors 2 and 3</i>	Total length of dedicated busway (km): 34.5 <i>14/9.5/11km corridor 1/2/3; corridor 2 still under construction</i>
Majority of bus passenger demand in the corridor met by BRT buses	Length including mixed traffic portions (km): 54 <i>16km/15km/23km corridor 1/2/3</i>
Net time saving for bus passengers in corridor <i>Unlikely in corridor 1; not in corridors 2 or 3</i>	Number of stations: 60 <i>18/20/22 corridor 1/2/3</i>
Overtaking lanes at more than half of all stations	Average distance between stations (m): 940 <i>940m/790m/1000m corridor 1/2/3</i>
Actual peak ridership over 10,000 passengers per hour per direction	Peak city centre buses/hr/direction: 55 <i>~20 in corridors 2 and 3</i>
Actual peak ridership over 20,000 passengers per hour per direction	Number of bus routes operating both inside and outside the busway corridors: 0
Passenger volume greater than a mixed traffic lane (~3000 pphpd) <i>Yes in corridor 1, no in corridors 2 & 3</i>	Number of stations with passing lanes: 7
Pre-board fare collection and fare verification	Routes operating only in busway corridors: 4 <i>2/1/1 in corridors 1/2/3</i>
At-level boarding and alighting <i>level but sometimes large gap</i>	Location of busway lanes: Centre of roadway <i>Left of service lane in corridors 2 and 3</i>
Includes BRT-only tunnels or bridges	Location of bus doorways: Left side <i>Right side in corridors 2 and 3</i>
Buses operating both inside and outside the busway corridor	Number of BRT terminals: 4
Competitively bid operating contracts and concessions	Number of BRT depots: 2
More than one BRT bus operator	System passenger-trips per day: 120,000 <i>corridor 1 only (2 & 3 much less)</i>
No operational subsidy from government <i>subsidy needed</i>	Fleet of special BRT buses: 87 <i>corridor 1 only</i>
BRT buses paid for by operators rather than government budget	Fleet of integrated BRT feeder buses: 0
Low-emission vehicle technology (Euro III or higher)	Median cash fare (yuan): 1
Automated fare collection and fare verification system	Median smart card fare (yuan): 0.4 <i>0.2 for students</i>
Weather protection on station platforms <i>Many stations in corridors 2 & 3 are covered</i>	Total planning and design costs (million yuan): 6 <i>1st corridor only</i>
System control centre	Infrastructure cost per km (million yuan): 40 <i>1st corridor only</i>
Real-time next bus information displays	BRT bus cost - public funds (million yuan): 206 <i>Initial Iveco CNG buses cost \$350,000; later Neoplan diesel buses \$250,000</i>
Distinctive marketing identity for system <i>Beijing BRT</i>	Number of doors in BRT buses: 3 <i>4 in corridor 2 and 3</i>
	BRT vehicle length: 18.5m
	BRT vehicle fuel: diesel <i>Initial fleet CNG, newer buses diesel</i>
	BRT bus manufacturer: Jinhua Neopla

See www.chinaBRT.org for latest figures





Karl Fjellstrom, ITDP

A typical open-air corridor 1 station



Karl Ejlstrom, ITDP

Passengers wait for a non-BRT bus at a Beijing BRT station (this situation has since been greatly improved, and rarely do non-BRT buses now operate in the BRT corridor)



Karl Fjellstrom, ITDP

Runway degradation in corridor 1



Better stations in outer part of corridor 2; overtaking mixed traffic; right-side doors



Karl Fjellstrom, ITDP

Station in inner part of corridor 2, without shelter



Offset station in corridor 2



In all corridors the large majority of bus demand is outside the BRT, making an overall time saving benefit for bus passengers unlikely. Corr. 2&3 demand ~2,000 pphpd in BRT

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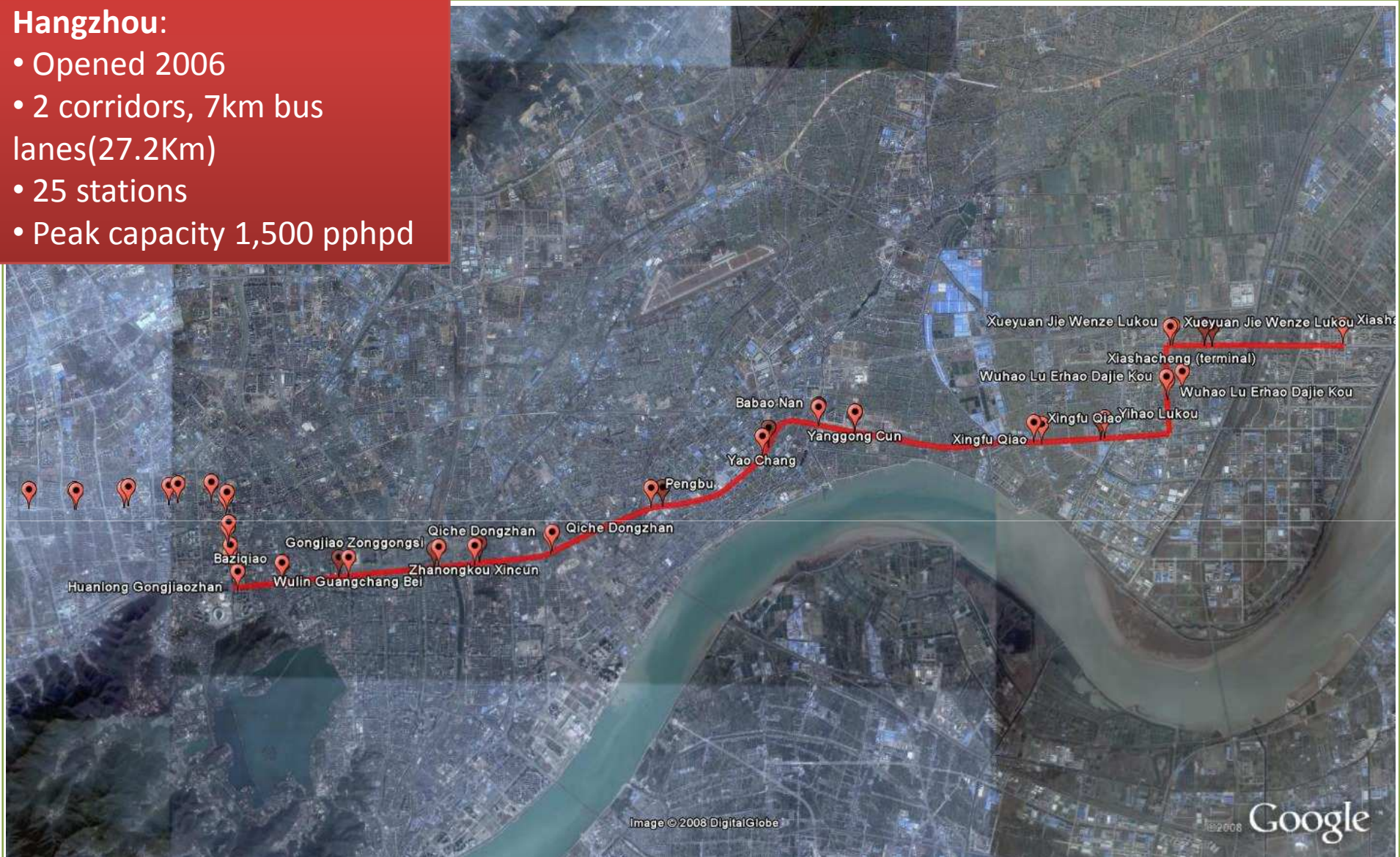
Guangzhou

Dalian

























Conclusion

Hangzhou:

- Opened 2006
- 2 corridors, 7km bus lanes(27.2Km)
- 25 stations
- Peak capacity 1,500 pphpd



7km dedicated bus lanes; 27.2km corridor, 2nd corridor recently opened

Segregated busways or bus-only roadways  <i>Some sections now open to mixed traffic</i>	Year system commenced: 2006
High capacity BRT buses 	Peak ridership (passengers/hr/direction): 1,500 6-Dec-07 Wulin Guangchang Bei to east
Network of routes and corridors 	City centre peak hour speed (km/hr): 15 25+ outside centre
Enhanced station environment (more than just a bus shelter) 	Number of existing trunk corridors: 1 2nd corridor under construction
High city centre peak period operational speed (>20km/hr) 	Total length of dedicated busway (km): 7
Majority of bus passenger demand in the corridor met by BRT buses 	Length including mixed traffic portions (km): 27.2
Net time saving for bus passengers in corridor 	Number of stations: 17
Overtaking lanes at more than half of all stations 	Average distance between stations (m): 1,700
Actual peak ridership over 10,000 passengers per hour per direction 	Peak city centre buses/hr/direction: 40 15 BRT buses, 25 smaller buses
Actual peak ridership over 20,000 passengers per hour per direction 	Number of bus routes operating both inside and outside the busway corridors: 4
Passenger volume greater than a mixed traffic lane (~3000 pphpd) 	Number of stations with passing lanes: 0
Pre-board fare collection and fare verification 	Routes operating only in busway corridors: 2
At-level boarding and alighting  <i>level but sometimes large gap</i>	Location of busway lanes: Midway between curb and centre 2nd corridor has curbside lanes
Includes BRT-only tunnels or bridges 	Location of bus doorways: Right side
Buses operating both inside and outside the busway corridor 	Number of BRT terminals: 2
Competitively bid operating contracts and concessions 	Number of BRT depots: 1
More than one BRT bus operator 	System passenger-trips per day: 40,000
No operational subsidy from government  <i>subsidy needed</i>	Fleet of special BRT buses: 48
BRT buses paid for by operators rather than government budget 	Median cash fare (yuan): 4
Low-emission vehicle technology (Euro III or higher) 	Median smart card fare (yuan): 2
Automated fare collection and fare verification system 	Total planning and design costs (million yuan): 2
Weather protection on station platforms 	BRT bus cost - public funds (million yuan): 96
System control centre 	Number of doors in BRT buses: 4
Real-time next bus information displays 	BRT vehicle length: 18.5m
Distinctive marketing identity for system  <i>Hangzhou BRT</i>	BRT vehicle fuel: diesel
Distinctive BRT buses 	BRT bus manufacturer: Jinhua Neoplan
High-quality passenger information at stations 	

Hangzhou BRT map and station locations

See www.chinaBRT.org for latest figures



Hangzhou station, with buses entering mixed traffic at the intersection



Karl Fjellstrom, ITDP

High quality station environment



More than 75% of public transport demand is outside BRT lane. Mixed traffic in the BRT lane in peak hours



Severe bus and mixed traffic congestion



Hangzhou's BRT is now open to 12m 'feeder' buses serving 4 routes in addition to the two trunk line 18m BRT bus routes. Flexible routing has been introduced to boost demand



Karl Fjellstrom, ITDP

Runway degradation



Where high volumes of bikes are forced onto the walkway, many instead use the BRT lane



Corridor 2: now operational; curbside bus bay-style stops and very poor results for buses, bicycles and pedestrians



Corridor 2: now operational; curbside stops and very poor results

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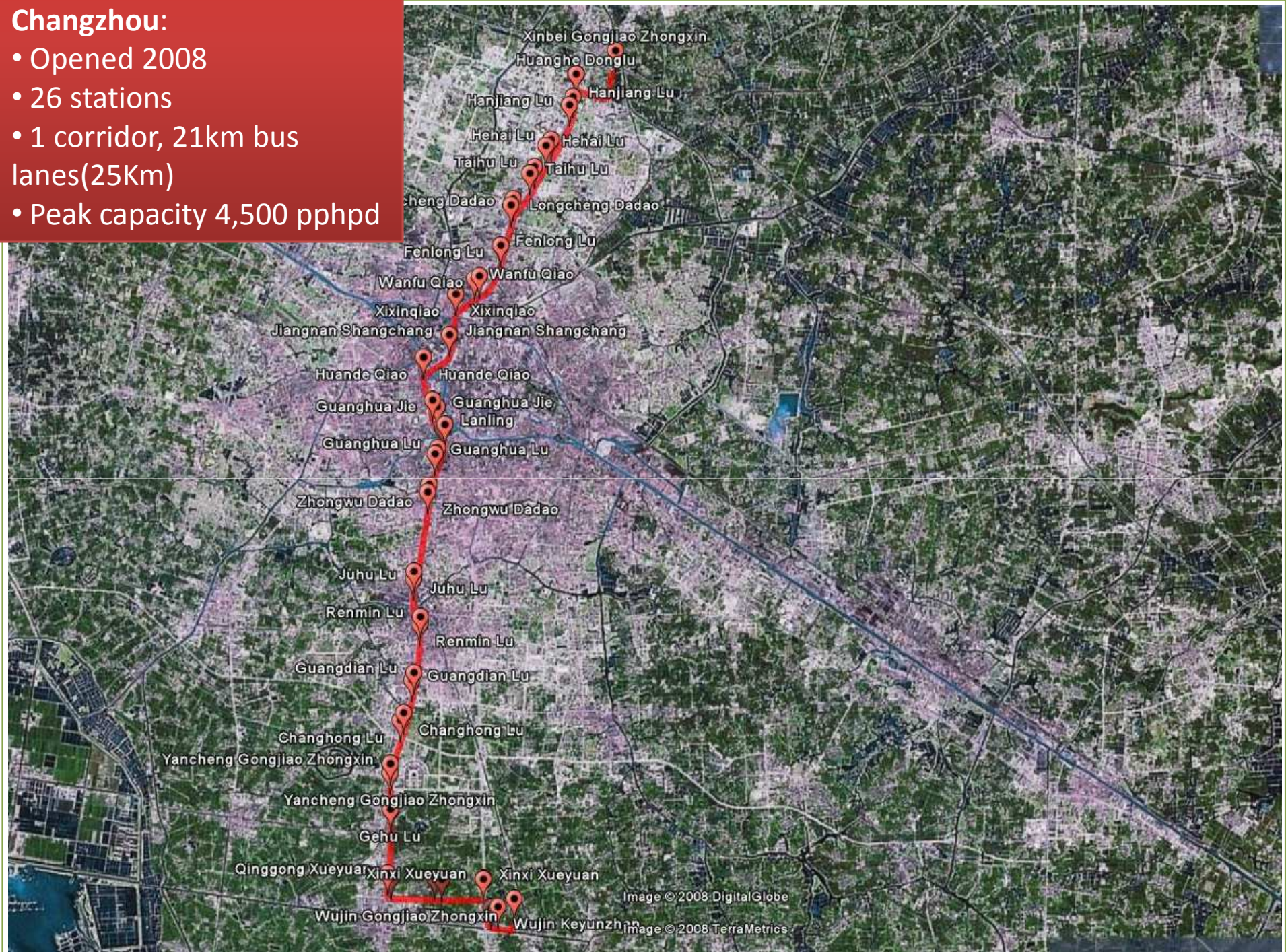
Guangzhou

Dalian

Conclusion

Changzhou:

- Opened 2008
- 26 stations
- 1 corridor, 21km bus lanes(25Km)
- Peak capacity 4,500 pphpd



Segregated busways or bus-only roadways	Year system commenced: 2008 <i>Jan-08 1st 12.5km, full corridor 18-Apr-08</i>
High capacity BRT buses	Number of existing trunk corridors: 1
Network of routes and corridors	Total length of dedicated busway (km): 21.2
Enhanced station environment (more than just a bus shelter)	Length including mixed traffic portions (km): 24.6
High city centre peak period operational speed (>20km/hr)	Number of stations: 26
Majority of bus passenger demand in the corridor met by BRT buses <i>Possibly yes in a few segments</i>	Average distance between stations (m): 984
Net time saving for bus passengers in corridor <i>Possible but unlikely</i>	Number of bus routes operating both inside and outside the busway corridors: 2 <i>B12 & B13, B11 planned</i>
Overtaking lanes at more than half of all stations	Routes operating only in busway corridors: 1
Actual peak ridership over 10,000 passengers per hour per direction	Location of busway lanes: Centre of roadway
Passenger volume greater than a mixed traffic lane (~3000 pphpd)	Location of bus doorways: Right side
Pre-board fare collection and fare verification	Number of stations with passing lanes: 0
At-level boarding and alighting <i>level but sometimes large gap</i>	Number of BRT terminals: 2
Includes BRT-only tunnels or bridges	Number of BRT depots: 1 <i>under construction</i>
Buses operating both inside and outside the busway corridor	Peak ridership (passengers/hr/direction): 4,500 <i>Xixinqiao PM southbound</i>
Competitively bid operating contracts and concessions	City centre peak hour speed (km/hr): 18
More than one BRT bus operator	Peak city centre buses/hr/direction: 55 <i>Xixinqiao PM southbound</i>
No operational subsidy from government <i>subsidy needed</i>	Fleet of special BRT buses: 60
BRT buses paid for by operators rather than government budget	Median cash fare (yuan): 1
Independently operated and managed fare collection system	Median smart card fare (yuan): 0.6
Quality control oversight from an independent entity / agency	Infrastructure cost per km (million yuan): 30
Low-emission vehicle technology (Euro III or higher)	BRT bus cost - public funds (million yuan): 120
Automated fare collection and fare verification system	Number of doors in BRT buses: 4
Weather protection on station platforms	BRT vehicle length: 18m
System control centre	BRT vehicle fuel: diesel
Real-time next bus information displays	BRT bus manufacturer: MAN / Huanghai (25); Scania (35)
Distinctive marketing identity for system	
Distinctive BRT buses	

Changzhou BRT map and station locations

See www.chinaBRT.org for latest figures



Most stations are offset across intersections. Some are facing



Even with current low demand, some stations are already experiencing overcrowding



In city centre, critical 500m section of BRT corridor is open to mixed traffic and is congested during peak periods



Karl Fjellstrom, ITDP

Significant time savings are possible in the city centre, though BRT peak hour city centre speeds are low



Stations located at the intersection already sometimes result in queues blocking the intersection and the pedestrian crossing, even with current relatively low bus volumes



None of the BRT systems so far have incorporated bike parking into any of the BRT designs, despite very high bicycle volumes in Beijing, Changzhou, Kunming and Hangzhou

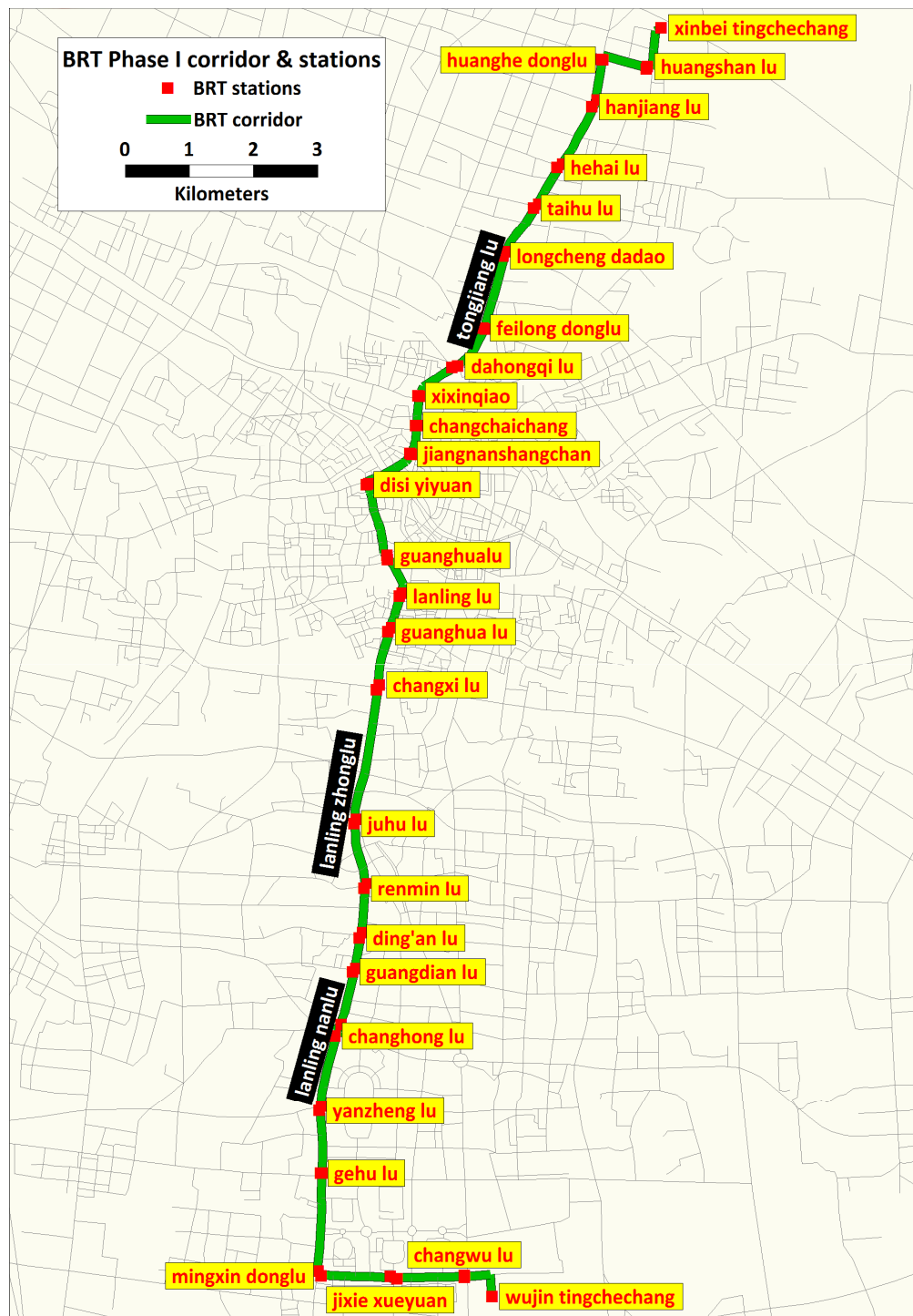


Changzhou's BRT stations are too narrow



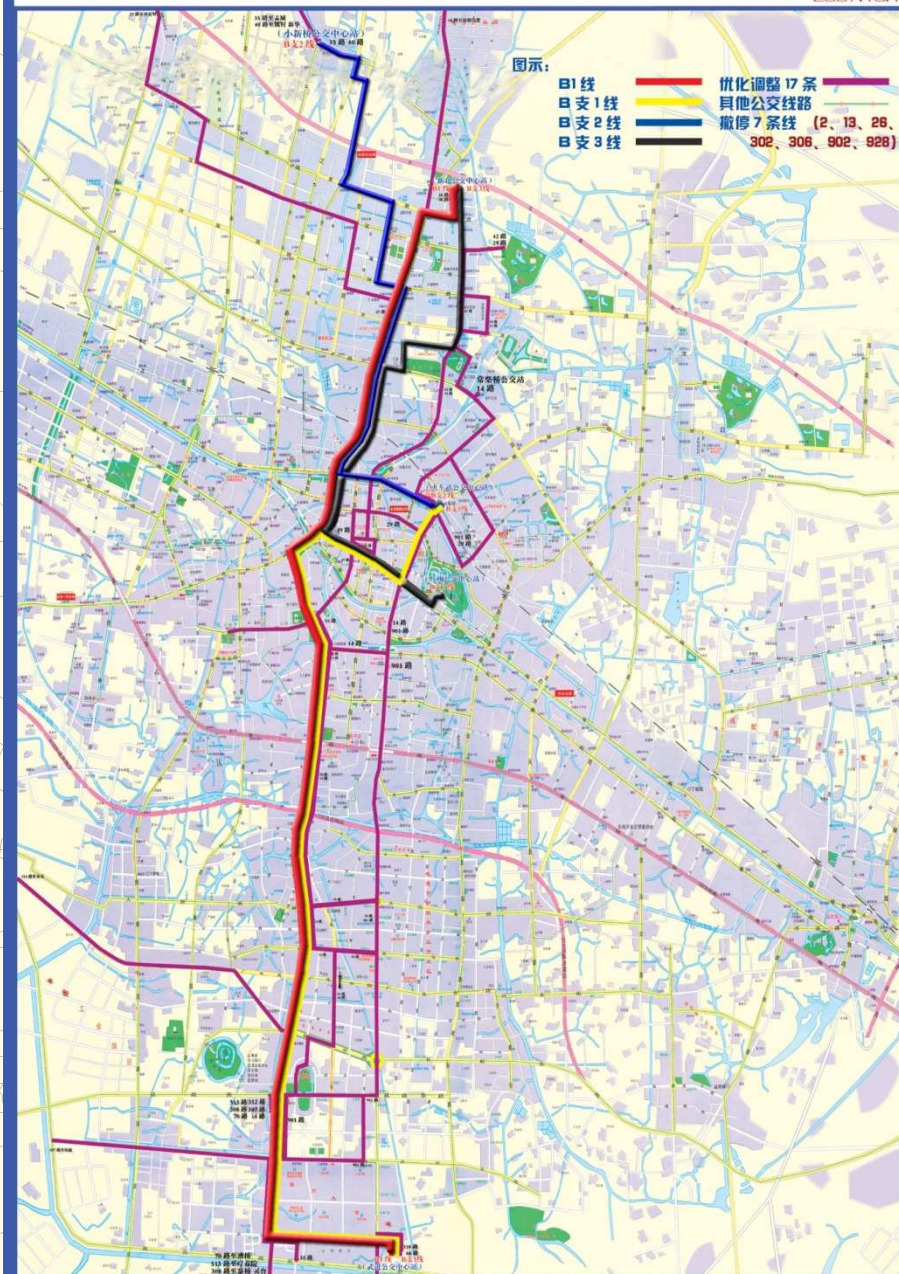
Karl Fjellstrom, ITDP

Narrow stations mean that just a few people reading the information board is enough to block passage



2008 年常州公交线路优化调整方案示意图

2007.10.1



BRT in China

Kunming

Chongqing

Beijing

Xiamen

Hangzhou

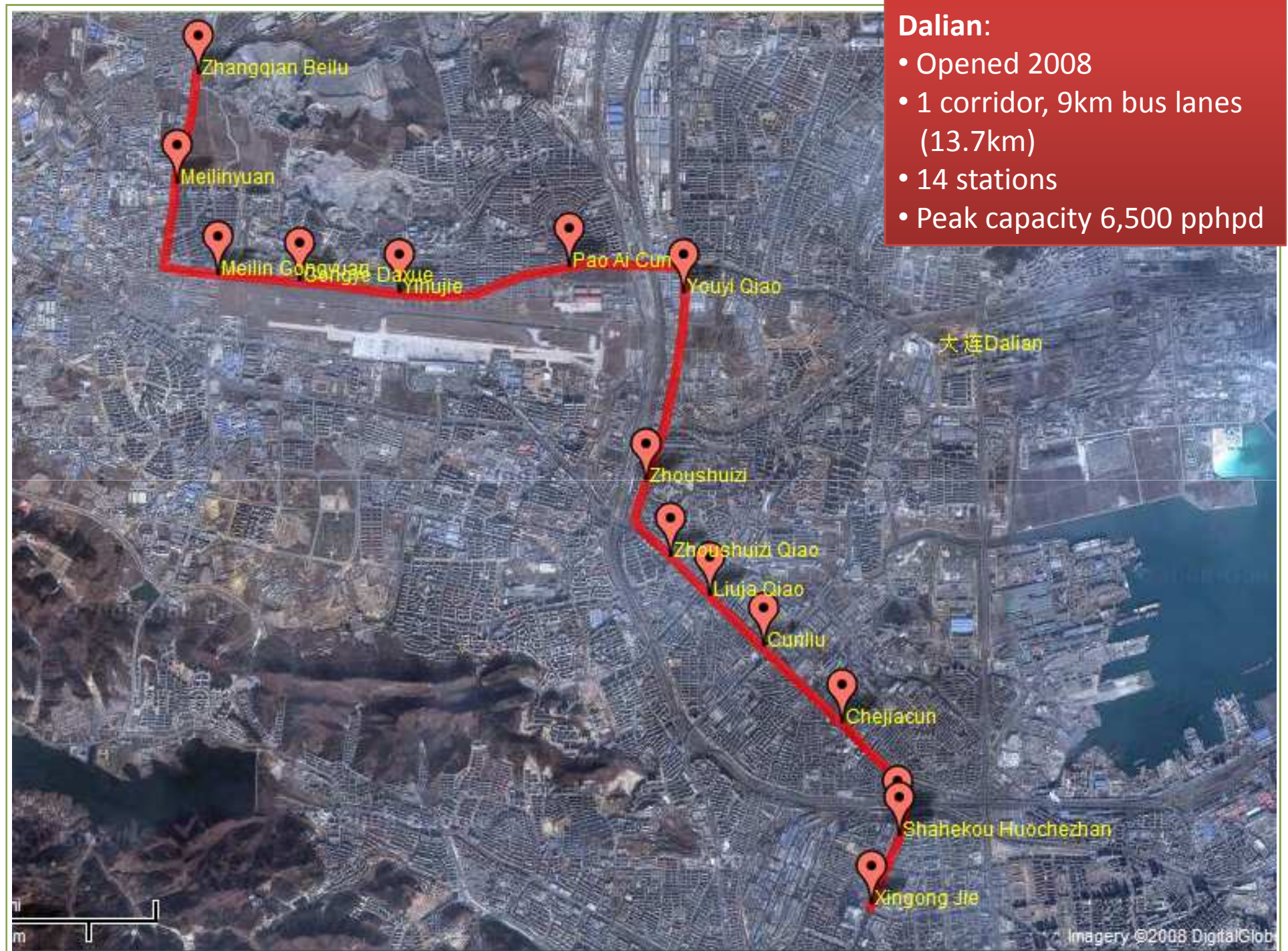
Jinan

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Conclusion



Segregated busways or bus-only roadways	✓	<i>though around 4.5km is not segregated</i>
High capacity BRT buses	✓	<i>Also a fleet of 12m BRT buses</i>
Network of routes and corridors	✓	
Enhanced station environment (more than just a bus shelter)	✓	
High city centre peak period operational speed (>20km/hr)	✓	
Majority of bus passenger demand in the corridor met by BRT buses	✗	<i>Around 1/4 to 1/3 of demand is in BRT</i>
Net time saving for bus passengers in corridor	●	<i>Possible but unlikely</i>
Overtaking lanes at more than half of all stations	✗	
Actual peak ridership over 10,000 passengers per hour per direction	✗	
Passenger volume greater than a mixed traffic lane (~3000 pphpd)	✓	
Pre-board fare collection and fare verification	✓	
At-level boarding and alighting	✓	<i>level but sometimes large gap</i>
Includes BRT-only tunnels or bridges	✗	
Buses operating both inside and outside the busway corridor	✓	
More than one BRT bus operator	✓	
No operational subsidy from government	✗	<i>subsidy needed</i>
BRT buses paid for by operators rather than government budget	✗	
Low-emission vehicle technology (Euro III or higher)	✓	
Automated fare collection and fare verification system	✓	
Weather protection on station platforms	●	
Real-time next bus information displays	✗	<i>displays present but not functioning</i>
Distinctive marketing identity for system	✓	
Distinctive BRT buses	✓	
High-quality passenger information at stations	✓	
High-quality passenger information on buses	✓	
Bicycle parking at stations	✗	

Year system commenced: 2008	<i>Opened 15 January</i>
Number of existing trunk corridors: 1	
Total length of dedicated busway (km): 9	
Length including mixed traffic portions (km): 13.7	
Number of stations: 14	
Average distance between stations (m): 940	
Number of bus routes operating both inside and outside the busway corridors: 3	<i>also, route 405 has several variations</i>
Routes operating only in busway corridors: 1	<i>both 18m and 12m BRT buses</i>
Location of busway lanes: Varies; mainly centre of roadway	
Location of bus doorways: Right side	
Number of stations with passing lanes: 1	<i>Xingongjie terminus</i>
Number of BRT terminals: 1	
Number of BRT depots: 0	<i>major new depot planned for 2008</i>
Peak ridership (passengers/hr/direction): 6,500	<i>PM around 5,700</i>
City centre peak hour speed (km/hr): 24	
Peak city centre buses/hr/direction: 80	
Fleet of special BRT buses: 64	<i>half 12m, half 18m buses</i>
Median cash fare (yuan): 1	
Median smart card fare (yuan): 0.95	
Infrastructure cost per km (million yuan): 19.5	
BRT bus cost - public funds (million yuan): 94.4	<i>1.8mill for 18m bus, 1.15mill for 12m bus</i>
Number of doors in BRT buses: 4	<i>the 12m buses have 3 doors</i>
BRT vehicle length: 12m, 18m	
BRT vehicle fuel: diesel	
BRT bus manufacturer: MAN / Huanghai	

Dalian BRT map and station locations

See www.chinaBRT.org for latest figures



Median aligned busway; minimal cover at stations; low demand along the corridor



3 door 12m BRT buses



4 door 18m BRT buses



Flexible routing



Route 405 is a feeder (non-BRT) buses, a large fleet, frequency roughly the same as the two BRT routes (12m blue and 18m red) combined



Regular buses in the BRT corridor outnumber BRT buses by roughly 3:1



Morning peak into the city: bus demand outside far exceeds inside the corridor

BRT in China

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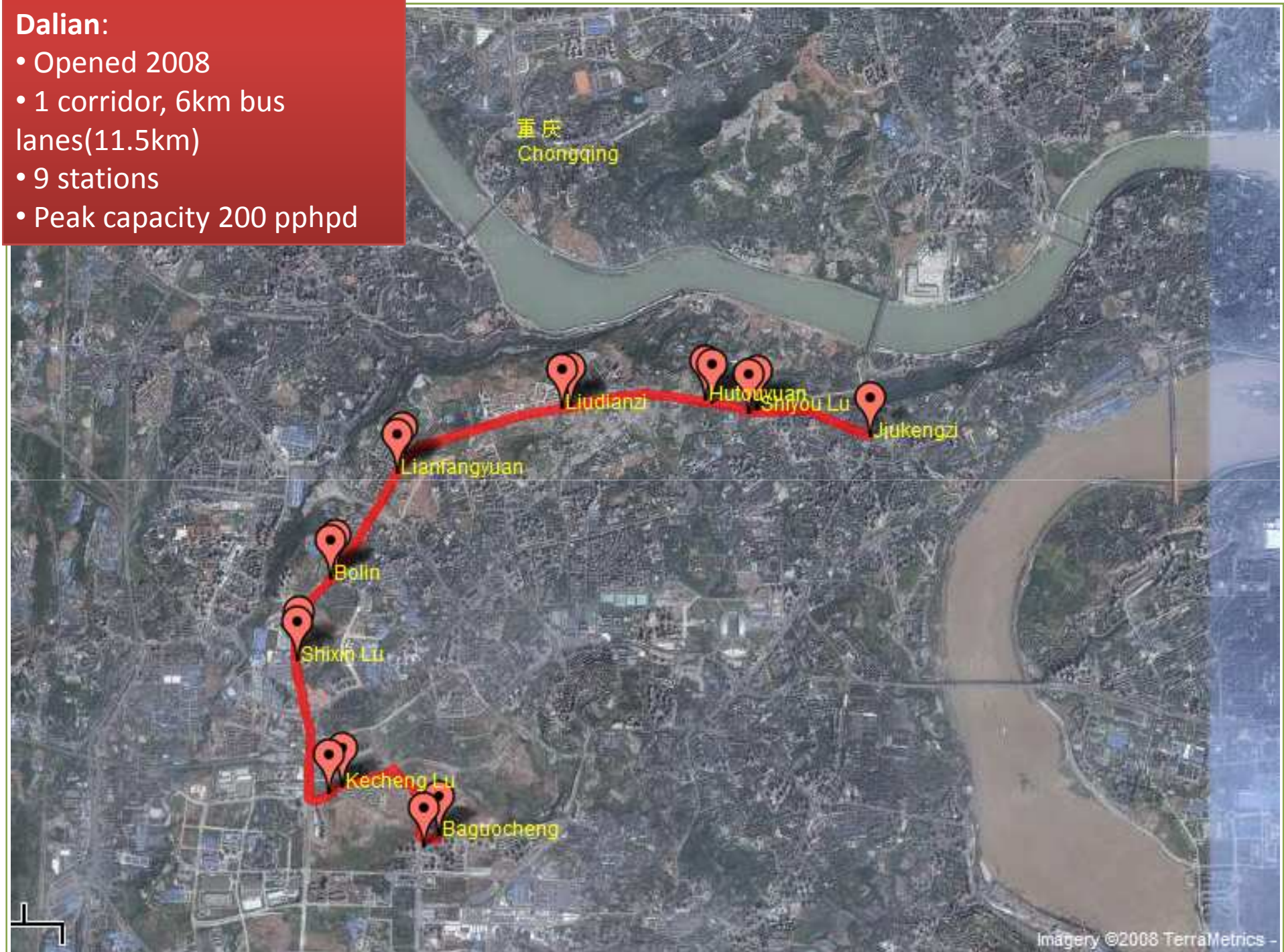
Guangzhou

Dalian

Conclusion

Dalian:

- Opened 2008
- 1 corridor, 6km bus lanes(11.5km)
- 9 stations
- Peak capacity 200 pphpd



Segregated busways or bus-only roadways	✓	<i>though only 3.5km fully segregated</i>
High capacity BRT buses	✗	
Network of routes and corridors	✗	
Enhanced station environment (more than just a bus shelter)	✓	
High city centre peak period operational speed (>20km/hr)	✓	
Majority of bus passenger demand in the corridor met by BRT buses	✗	
Net time saving for bus passengers in corridor	✗	
Overtaking lanes at more than half of all stations	✗	
Actual peak ridership over 10,000 passengers per hour per direction	✗	
Passenger volume greater than a mixed traffic lane (~3000 pphpd)	✗	
Pre-board fare collection and fare verification	✗	<i>plan 4 stations buy in bus, but Mar-08 all in bus</i>
At-level boarding and alighting	✗	<i>bus has steps</i>
Includes BRT-only tunnels or bridges	✗	
Buses operating both inside and outside the busway corridor	✗	
Competitively bid operating contracts and concessions	✗	
More than one BRT bus operator	✗	
No operational subsidy from government	✗	<i>subsidy needed</i>
BRT buses paid for by operators rather than government budget	✗	
Independently operated and managed fare collection system	✗	
Low-emission vehicle technology (Euro III or higher)	✓	
Automated fare collection and fare verification system	●	<i>Equipment there but doesn't yet function</i>
Weather protection on station platforms	✓	
Real-time next bus information displays	●	<i>Provided at some stations</i>
Distinctive marketing identity for system	✓	

Year system commenced: 2008	<i>Opened 1 January</i>
Number of existing trunk corridors:	1
Total length of dedicated busway (km):	6
Length including mixed traffic portions (km):	11.5
Number of stations:	9
Average distance between stations (m):	1,440
Number of bus routes operating both inside and outside the busway corridors:	0
Routes operating only in busway corridors:	1
Location of busway lanes:	Mainly centre of roadway
Location of bus doorways:	Right side
Number of stations with passing lanes:	1
Number of BRT terminals:	1
Number of BRT depots:	1
System passenger-trips per day:	2,000 <i>approximate estimate</i>
Peak ridership (passengers/hr/direction):	200
City centre peak hour speed (km/hr):	32
Peak city centre buses/hr/direction:	4
Fleet of special BRT buses:	10
Fleet of integrated BRT feeder buses:	0
Median cash fare (yuan):	1
Median smart card fare (yuan):	1
BRT bus cost - public funds (million yuan):	10 <i>~1m for each of 10 buses</i>
Number of doors in BRT buses:	2
BRT vehicle length:	12.7m
BRT vehicle fuel:	CNG
BRT bus manufacturer:	Hengtong

Chongqing BRT map and station locations

See www.chinaBRT.org for latest figures



BRT bus exiting the central bus lanes



Access at the Jiu Keng Zi terminal station at Daping



Passengers alight at the BRT terminal



As well as the step to enter the bus, passengers have one additional step in bus doorway



Best thing you can say about Chongqing BRT is that for 1 RMB can get shoe polished outside the downtown terminal station



Produce from an adjacent field adorns a damaged BRT station sign on a pedestrian bridge



The corridor is only a 21 minute trip, but the Chongqing BRT bus has been designed like an intercity coach, with 39 large padded seats and little standing room

BRT in China

Kunming

Chongqing

Beijing

Xiamen

Hangzhou

Jinan

Changzhou

Guangzhou

Dalian

Conclusion

Xiamen:

- Opened 2008
- 2 corridors, 38km bus lanes
- 30 stations
- Peak capacity 3,600 pphpd



Segregated busways or bus-only roadways	Year system commenced: 2008 <i>Opened 1 September</i>
High capacity BRT buses	Number of existing trunk corridors: 2
Network of routes and corridors	Total length of dedicated busway (km): 38.2 <i>line 1 26km (feeder 2.2km), line 2 10km</i>
Enhanced station environment (more than just a bus shelter)	Length including mixed traffic portions (km): 40.2
High city centre peak period operational speed (>20km/hr)	Number of stations: 30 <i>line 1 20 (feeder 2), line 2 8</i>
Majority of bus passenger demand in the corridor met by BRT buses	Average distance between stations (m): 1,300 <i>915m in e-w section</i>
Net time saving for bus passengers in corridor	Number of bus routes operating both inside and outside the busway corridors: 0
Overtaking lanes at more than half of all stations	Routes operating only in busway corridors: 3
Actual peak ridership over 10,000 passengers per hour per direction	Location of busway lanes: Elevated busway <i>bus-only elevated road; some at-grade median aligned</i>
Passenger volume greater than a mixed traffic lane (~3000 pphpd)	Location of bus doorways: Right side
Pre-board fare collection and fare verification	Number of stations with passing lanes: 2
At-level boarding and alighting	Number of BRT terminals: 2 <i>Jichang and Diyimatou</i>
Includes BRT-only tunnels or bridges <i>Including a tunnel and very long bridge</i>	Number of BRT depots: 4 <i>One at the end of each corridor</i>
Buses operating both inside and outside the busway corridor	Peak ridership (passengers/hr/direction): 3,600 <i>Railway Station to east, PM</i>
Competitively bid operating contracts and concessions	City centre peak hour speed (km/hr): 29
More than one BRT bus operator	Peak city centre buses/hr/direction: 50 <i>Railway Station to east, PM</i>
No operational subsidy from government <i>subsidy needed</i>	Median cash fare (yuan): ~1 <i>distance based; 1 yuan for a 10km trip</i>
BRT buses paid for by operators rather than government budget	Median smart card fare (yuan): ~1 <i>distance based; 1 yuan for a 10km trip</i>
Automated fare collection and fare verification system	Number of doors in BRT buses: 2
Weather protection on station platforms	BRT vehicle length: 10, 12m <i>12m trunk, 10m feeder</i>
System control centre	BRT vehicle fuel: diesel
Real-time next bus information displays	BRT bus manufacturer: Kinglong
Distinctive marketing identity for system	
Distinctive BRT buses	
High-quality passenger information at stations	
High-quality passenger information on buses	
Bicycle parking at stations	

Xiamen BRT map and station locations

See www.chinaBRT.org for latest figures



Karl Fjellstrom, ITDP





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BRT feeder route map

BRT

文

灶

站

厦门快速公交线路图



BRT一号线多记线路图





Most demand below the elevated busway; shortage of access ramps



Karl Fjellstrom, ITDP

Severe overcrowding, even during off peak, has led to consideration of using 18m buses



Queuing for exit fare validation scanning (for distance-based fare application) delays station exit at busy stations by several minutes



Karl Fjellstrom, ITDP

Narrow station access combined with the exit fare verification and few turnstiles further limits system capacity



Karl Fjellstrom, ITDP



Karl Fjellstrom, ITDP

Queuing at the Railway Station BRT station



Bicycles are banned along Xiahe Lu, Xiamen's main BRT corridor



Lots of stairs



On street parking

BRT in China

Kunming

Chongqing

Beijing

Xiamen

Hangzhou

Jinan

Changzhou

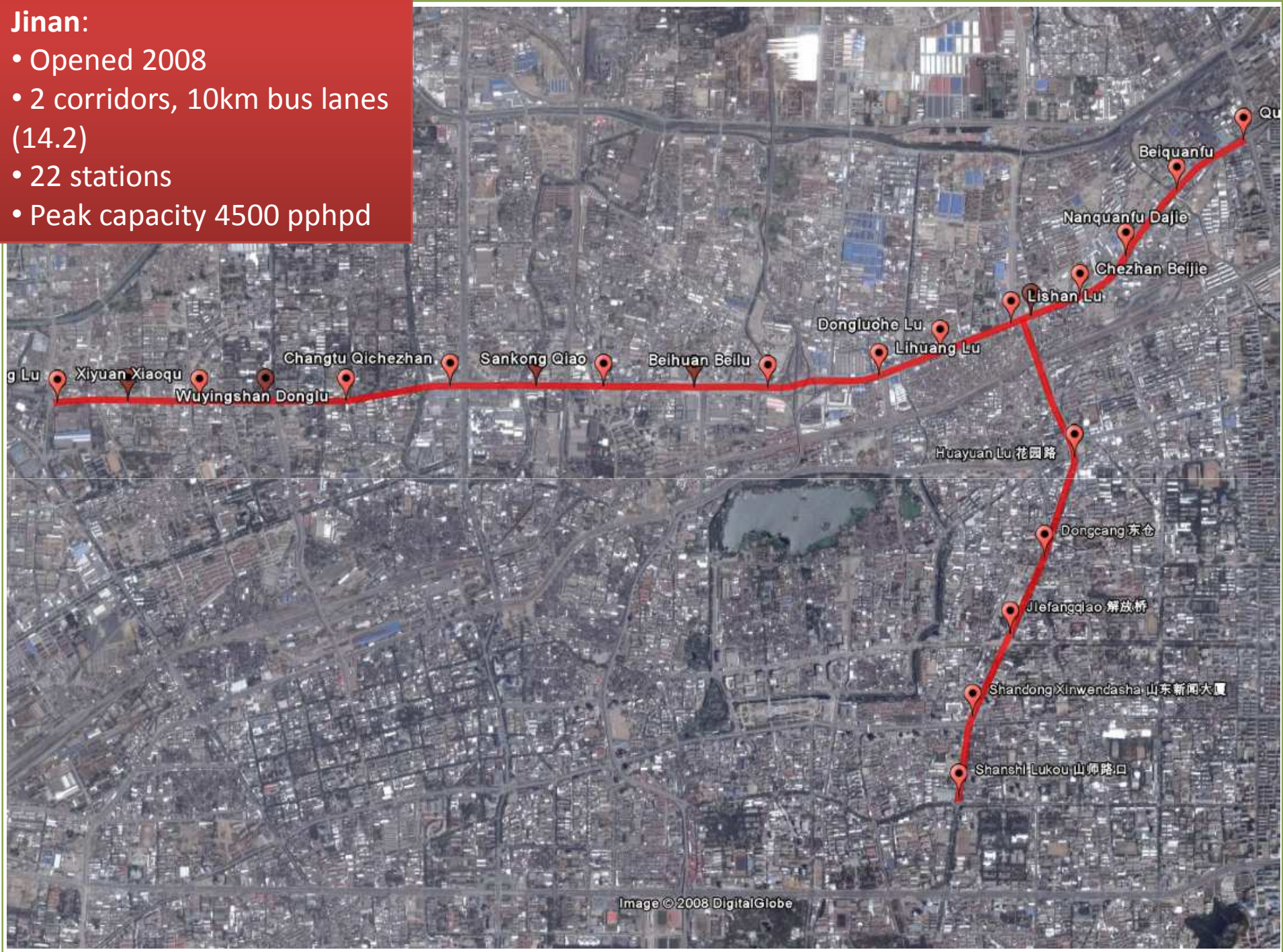
Guangzhou

Dalian

Conclusion

Jinan:

- Opened 2008
- 2 corridors, 10km bus lanes (14.2)
- 22 stations
- Peak capacity 4500 pphpd



Segregated busways or bus-only roadways	✓
High capacity BRT buses	✓ <i>Also a fleet of 12m BRT buses</i>
Network of routes and corridors	✓
Enhanced station environment (more than just a bus shelter)	✓
Overtaking lanes at more than half of all stations	✗
Actual peak ridership over 10,000 passengers per hour per direction	✗
Actual peak ridership over 20,000 passengers per hour per direction	✗
Passenger volume greater than a mixed traffic lane (~3000 pphpd)	✓ <i>but not in north-south section</i>
Pre-board fare collection and fare verification	✓
At-level boarding and alighting	✓ <i>level but sometimes large gap</i>
Includes BRT-only tunnels or bridges	✗
Buses operating both inside and outside the busway corridor	✓
Competitively bid operating contracts and concessions	✗
No operational subsidy from government	✗ <i>subsidy needed</i>
BRT buses paid for by operators rather than government budget	✗
Low-emission vehicle technology (Euro III or higher)	✓ <i>Euro III buses; but fuel?</i>
Automated fare collection and fare verification system	✓
Weather protection on station platforms	✓
Real-time next bus information displays	✓
Distinctive marketing identity for system	✓ <i>Jinan BRT</i>
Distinctive BRT buses	✓
High-quality passenger information at stations	✓
High-quality passenger information on buses	✓
Bicycle parking at stations	✗
Segregated bike lanes along main corridor(s)	✓

Year system commenced: 2008	22 April 2008
Peak ridership (passengers/hr/direction): 4,500	8-Jan-09, west of Lishan Lu station (north-south section 2,500, south of Huayuan Rd station, 9-Jan-09)
City centre peak hour speed (km/hr): 20	e-w section. n-s (mixed) section <10km/hr
Number of existing trunk corridors: 2	
Total length of dedicated busway (km): 10.0	east-west corridor under viaduct
Length including mixed traffic portions (km): 14.2	includes 4.2km n-s section
Number of stations: 22	17 in e-w section, 5 n-s section
Average distance between stations (m): 675	
Peak city centre buses/hr/direction: 40	
Number of bus routes operating both inside and outside the busway corridors: 0	not including north-south section
Number of stations with passing lanes: 2	
Location of busway lanes: Centre of roadway	under an elevated road in east-west section
Location of bus doorways: Both sides	
Fleet of special BRT buses: 15	18m LCK6180G buses (10-Nov-08: a further 40 have been ordered)
Fleet of integrated BRT feeder buses: 40	Neoplan BRT 12m buses (JNP6120G-3)
Median cash fare (yuan): 1	
Median smart card fare (yuan): 0.9	A 50 yuan monthly pass for urban non-a/c buses can also be used in the BRT
BRT bus cost - public funds (million yuan): 54.5	1.5mill for 18m bus, 0.8mill for 12m bus
Number of doors in BRT buses: 3	2 in both sides of 12m buses
BRT vehicle length: 12m, 18.5m	
BRT vehicle fuel: diesel	
BRT bus manufacturer: Zhongtong, Neoplan	Zhongtong 18m, Neoplan 12m

Jinan BRT map and station locations



BRT under a massive elevated road: dead at birth?



Wide stations and ample turnstiles, but extremely low passenger demand



Karl Fjellstrom, ITDP

Oppressive environment, but generally good pedestrian and bicycle facilities and access, elevated road minimizes development potential



Spacious, well-protected stations



Flexible 18m buses; 3 doors in both sides



Karl Fjellstrom, ITDP

Doors in both sides



BRT in China

Kunming

Chongqing

Beijing

Xiamen

Hangzhou

Jinan

Changzhou

Guangzhou

Dalian

Conclusion

Steps in the Guangzhou BRT planning process

- 2003-2004 preliminary BRT planning
- ITDP MOU with Construction Commission of Guangzhou , Apr. 2005
- GMTDC / GMEDRI work with ITDP since that time

2005: Conceptual plan, demand analysis & corridor comparison

2006: Phase II planning; further traffic, operational and design planning & demand analysis for phase I

2007-2008: Implementation planning & design. Final station & operational design, BRT authority, architecture, engineering design, metro integration, NMT integration, demand analysis

Late 2009: BRT operation



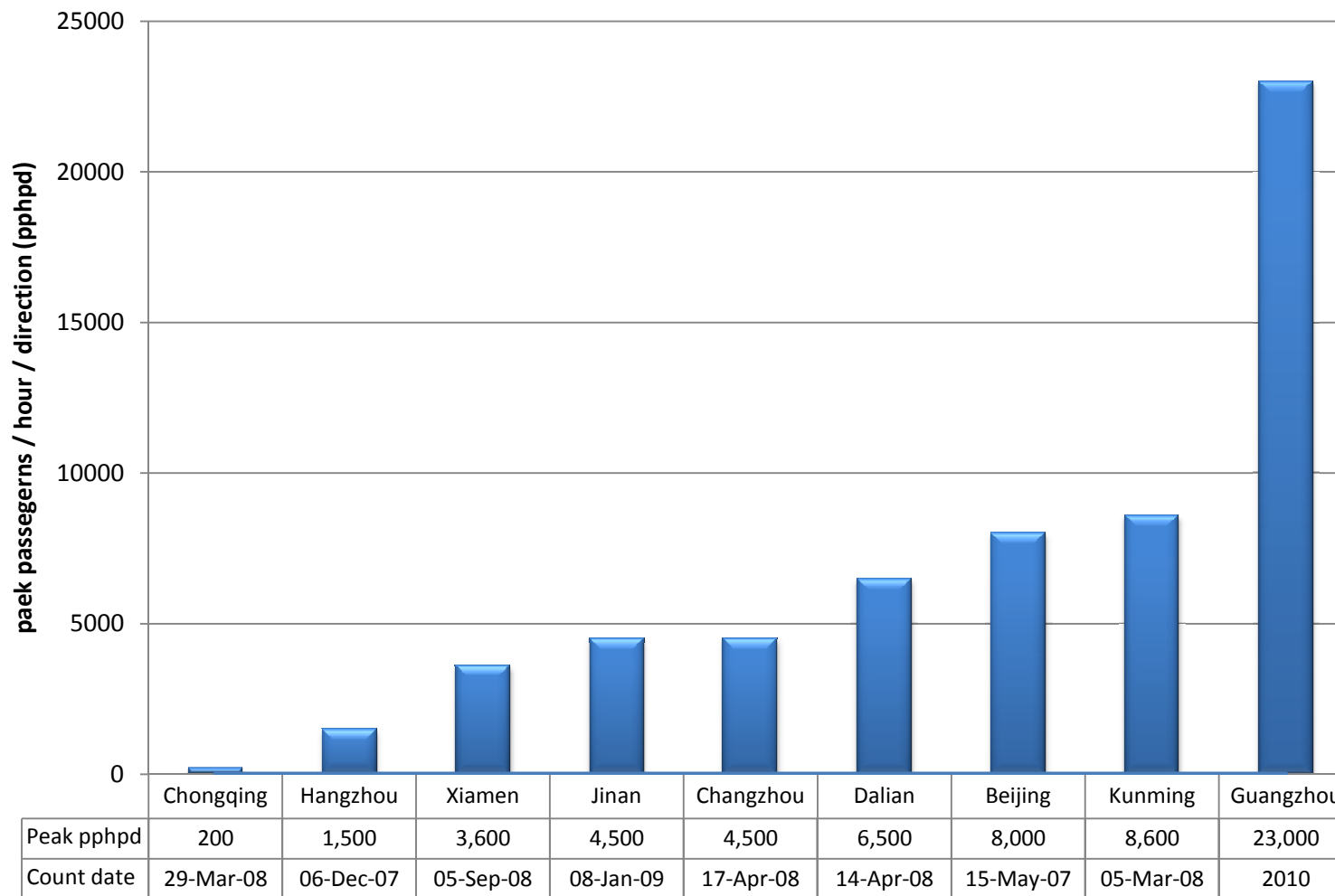
Ceremony to launch BRT construction in Guangzhou

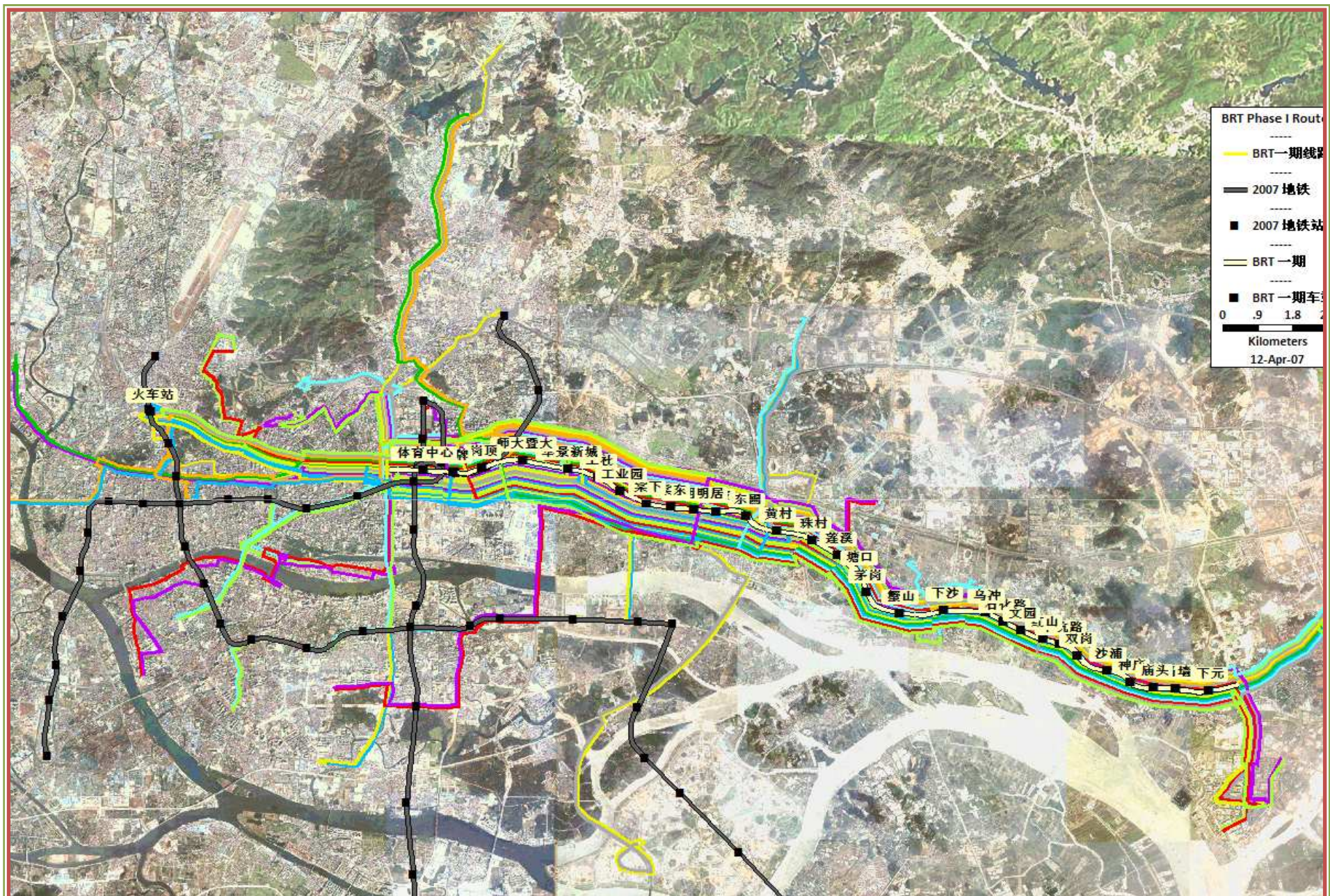


News coverage of start of construction, 30-Nov-08

China BRT systems peak passenger flows

(actual ridership except Guangzhou, projected)





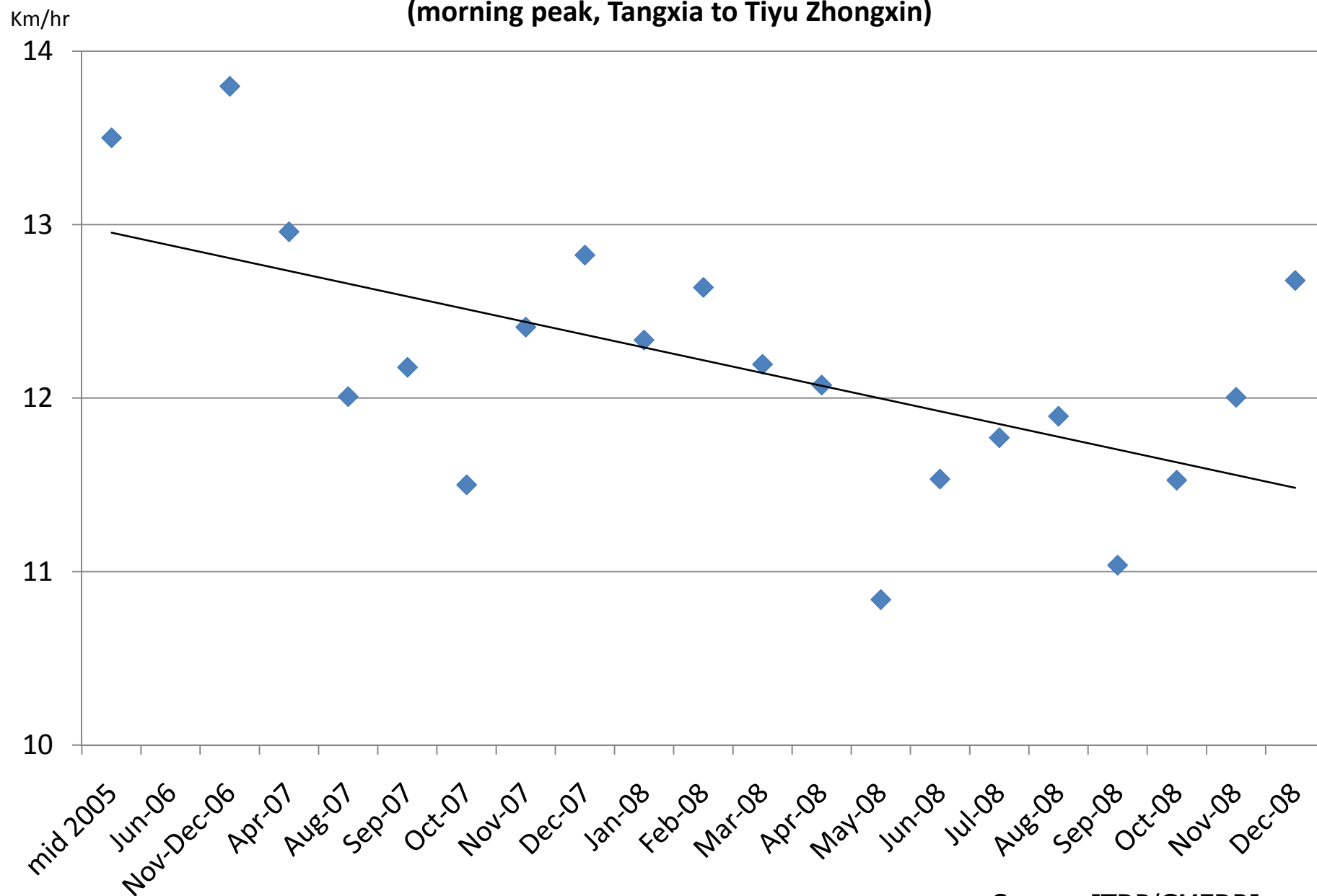
23 Phase I BRT routes

8号站——棠下
9号站——棠东
10号站——天朗明居



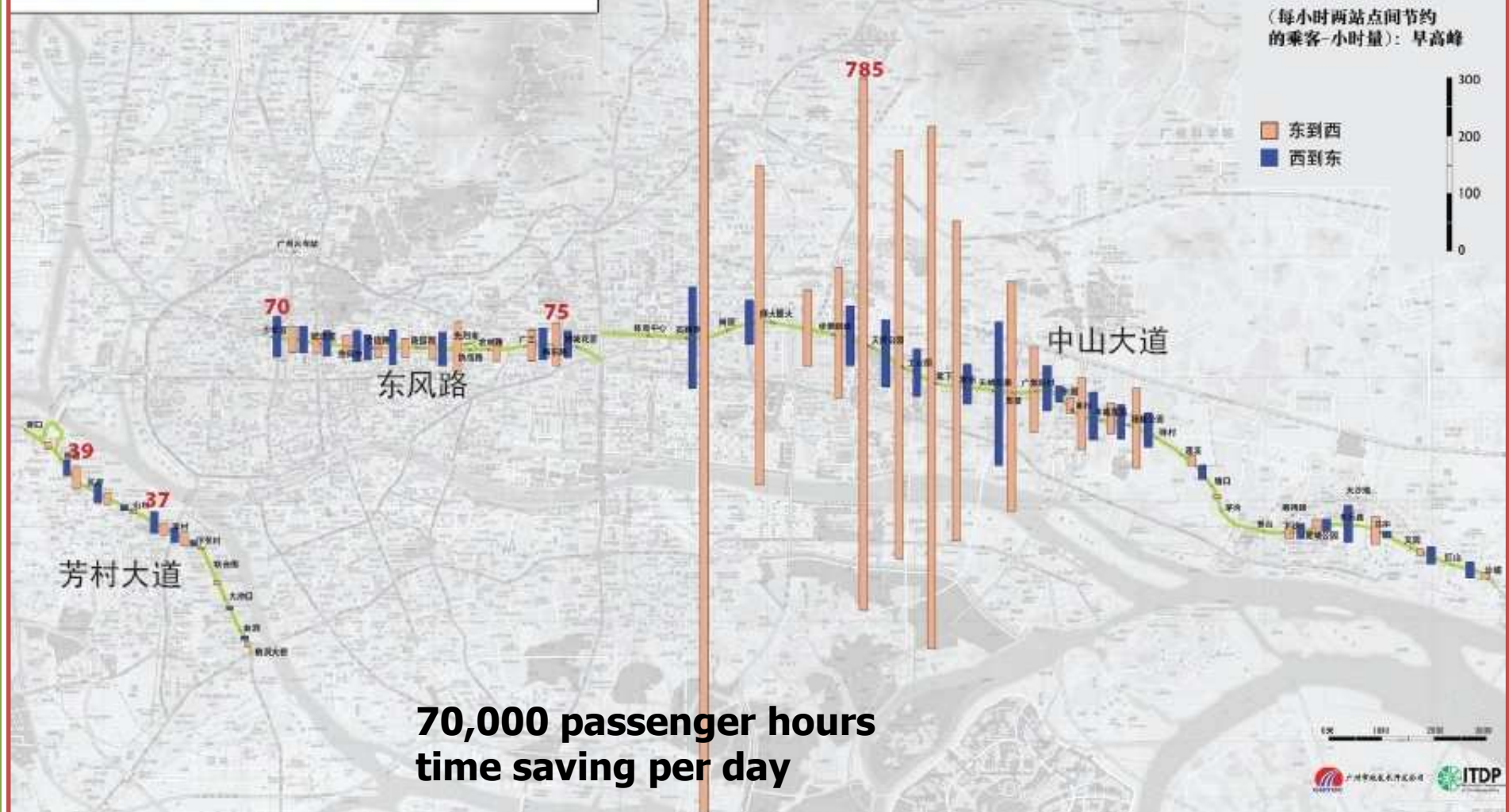
Zhongshan Avenue bus speeds

(morning peak, Tangxia to Tiyu Zhongxin)



Source: ITDP/GMEDRI surveys

5: 早高峰时段各站点之间由于BRT系带来的每小时公交车上乘客时间节约



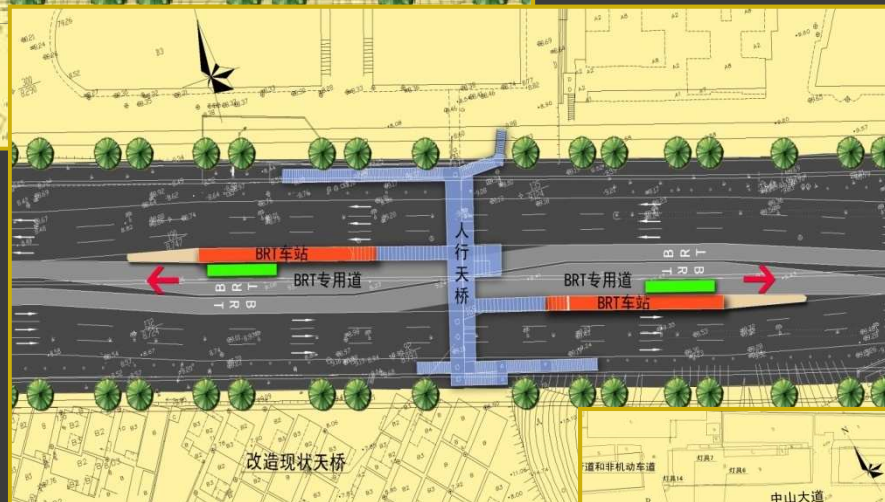
Passenger-hours saved per hour with BRT (east to west, morning peak), between BRT stations. Comparison between the alternative BRT corridors shows greatest time savings on Zhongshan Avenue – this analysis convinced the city to choose Zhongshan Avenue

BRT Station layout

One of the 1-module configurations
(offset, at grade)



One of the 1-module configurations
(offset, footbridge)



One of the 2-module configurations
(facing, at grade crossing)











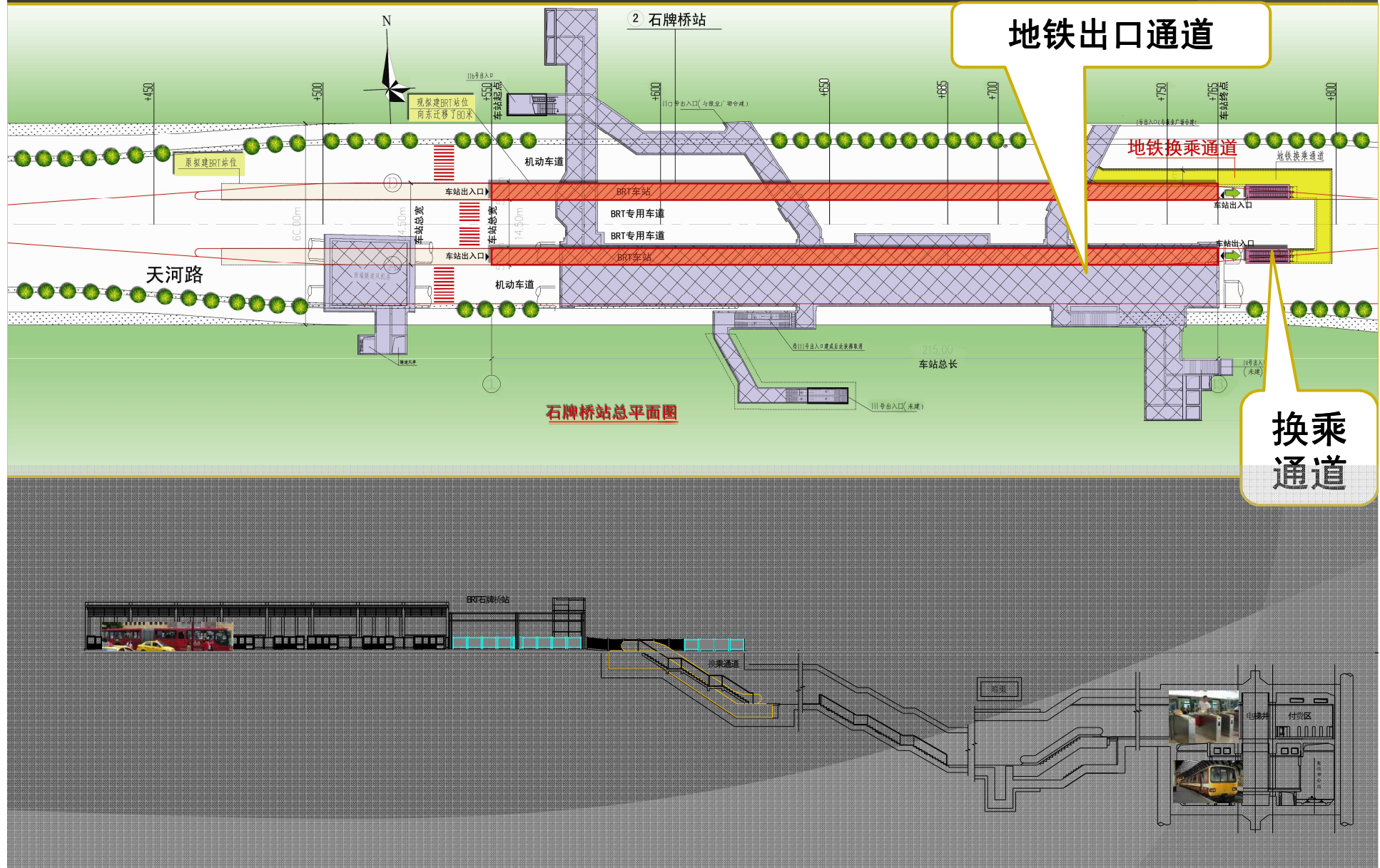
编号	尺寸及容量	选址建议
Pb1	60m*50m 可停靠2152辆自行车	改造体育中心内部机动车停车场
Pb2	60m*3.3m 可停靠96辆自行车	利用路侧绿化带,新建自行车停车设施
Pb3	60m*3.3m 可停靠96辆自行车	利用路侧绿化带,新建自行车停车设施
Pb4	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb5	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb6	30m*3.3m 可停靠48辆自行车	利用人行道绿化新建自行车停车设施
Pb7	30m*3.3m 可停靠48辆自行车	利用人行道绿化新建自行车停车设施
Pb8	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb9	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb10	30m*10.2m 可停靠192辆自行车	利用天河公园门前空地新建自行车停车设施
Pb11	30m*3.3m 可停靠48辆自行车	利用人行道绿化新建自行车停车设施
Pb12	30m*3.3m 可停靠48辆自行车	利用人行道绿化新建自行车停车设施
Pb13	4*30m*3.3m 可停靠192辆自行车	利用人行道绿化新建自行车停车设施
Pb14	60m*3.3m 可停靠96辆自行车	利用人行道绿化新建自行车停车设施
Pb15	30m*3.3m 可停靠48辆自行车	利用人行道绿化新建自行车停车设施
Pb16	30m*3.3m 可停靠48辆自行车	利用人行道绿化新建自行车停车设施
Pb17	30m*3.3m 可停靠48辆自行车	利用天河广场门前空地及人行道绿化,新建自行车停车设施
Pb18	15m*5.1m 可停靠48辆自行车	利用东圃广场门前空地新建自行车停车设施
Pb19	60m*3.3m 可停靠96辆自行车	占用路侧绿化带,新建自行车停车设施
Pb20	30m*3.3m 可停靠48辆自行车	占用路侧绿化带,新建自行车停车设施
Pb21	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb22	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb23	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb24	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb25	30m*3.3m 可停靠48辆自行车	占用部分人行道空间,新建自行车停车设施
Pb26	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施

编号	尺寸及容量	选址建议
Pb27	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb28	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb29	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb30	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb31	30m*3.3m 可停靠48辆自行车	占用绿化带及部分人行道空间,新建自行车停车设施
Pb32	30m*3.3m 可停靠48辆自行车	占用绿化带及部分人行道空间,新建自行车停车设施
Pb33	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb34	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb35	30m*3.3m 可停靠48辆自行车	占用部分人行道空间,新建自行车停车设施
Pb36	30m*3.3m 可停靠48辆自行车	占用部分人行道空间,新建自行车停车设施
Pb37	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb38	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb39	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb40	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb41	15m*3.3m 可停靠24辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb42	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb43	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb44	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb45	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb46	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb47	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb48	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb49	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施
Pb50	30m*3.3m 可停靠48辆自行车	利用天桥楼梯下空间,新建自行车停车设施

4840辆



Integration with the Guangzhou metro



BRT in China

Kunming

Chongqing

Beijing

Xiamen

Hangzhou

Jinan

Changzhou

Guangzhou

Dalian

Conclusion



Karl Fjellstrom, ITDP

Hefei BRT, under construction



Hefei BRT, under construction

	Beijing	Bogota	Brisbane	Changzhou	Chongqing	Dalian	Hangzhou	Jinan	Kunming	Quito	Seoul	Xiamen
Segregated busways or bus-only roadways	🟡	🟢	🟢	🟢	🟢	🟢	🟡	🟢	🟢	🟢	🟢	🟢
High capacity BRT buses	🟢	🟢	🔴	🟢	🔴	🟢	🟢	🟢	🟡	🟢	🔴	🔴
Network of routes and corridors	🔴	🟢	🟢	🟢	🔴	🟢	🟡	🟢	🟢	🟢	🟢	🟢
Enhanced station environment (more than just a bus shelter)	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🟢
High city centre peak period operational speed (>20km/hr)	🟢	🟢	🟢	🔴	🟢	🟢	🔴	🔴	🔴	🟢	🔴	🟢
Majority of bus passenger demand in the corridor met by BRT buses	🔴	🟢	🟢	🔴	🔴	🔴	🔴	🔴	🟢	🟢	🟢	🔴
Net time saving for bus passengers in corridor	🔴	🟢	🟢	🟡	🔴	🟡	🔴	🟡	🟢	🟢	🟢	🟢
Overtaking lanes at more than half of all stations	🔴	🟢	🟢	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🔴
Actual peak ridership over 10,000 passengers per hour per direction	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🟢	🔴
Actual peak ridership over 20,000 passengers per hour per direction	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🔴
Passenger volume greater than a mixed traffic lane (~3000 pphpd)	🟢	🟢	🟢	🟢	🔴	🟢	🔴	🔴	🟢	🟢	🟢	🟢
Pre-board fare collection and fare verification	🟢	🟢	🔴	🟢	🔴	🟢	🟢	🟢	🔴	🟢	🔴	🟢
At-level boarding and alighting	🟢	🟢	🔴	🟢	🔴	🟢	🟢	🟢	🔴	🟢	🔴	🟢
Includes BRT-only tunnels or bridges	🔴	🟢	🟢	🔴	🔴	🔴	🔴	🔴	🔴	🟢	🔴	🟢
Buses operating both inside and outside the busway corridor	🔴	🟡	🟢	🟢	🔴	🟢	🟢	🔴	🟢	🟡	🟢	🔴
Competitively bid operating contracts and concessions	🔴	🟢		🔴	🔴		🔴	🔴	🟢		🔴	🔴
More than one BRT bus operator	🔴	🟢		🔴	🔴	🟢	🔴		🟢		🟢	🔴
No operational subsidy from government	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴	🟢		🔴	🔴
BRT buses paid for by operators rather than government budget	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴	🟢		🔴	🔴
Independently operated and managed fare collection system		🟢	🔴	🔴	🔴						🟢	
Quality control oversight from an independent entity / agency		🟢	🟢	🔴								
Low-emission vehicle technology (Euro III or higher)	🟢	🔴	🟡	🟢	🟢	🟢	🟢	🟢	🔴	🔴	🟢	
Automated fare collection and fare verification system	🟢	🟢	🔴	🟢	🟡	🟢	🟢	🟢	🟢	🟢	🟢	🟢

	Beijing	Bogota	Brisbane	Changzhou	Chongqing	Dalian	Hangzhou	Jinan	Kunming	Quito	Seoul	Xiamen
Weather protection on station platforms	🟡	✅	✅	✅	✅	🟡	✅	✅	✅	✅	🟡	✅
System control centre	✅	✅	✅	✅			❌		🟡		✅	✅
Real-time next bus information displays	✅	🟡	✅	✅	🟡	❌	✅	✅	❌	🟡	❌	✅
Distinctive marketing identity for system	✅	✅	✅	✅	✅	✅	✅	✅	🟡	✅	❌	✅
Distinctive BRT buses	✅	✅	❌	✅	✅	✅	✅	✅	✅	✅	❌	✅
High-quality passenger information at stations	✅	✅	✅	✅	🟡	✅	✅	✅	❌	🟡	✅	✅
High-quality passenger information on buses	✅	❌	❌	✅	✅	✅	❌	✅	✅	✅	❌	✅
Bicycle parking at stations	❌	🟡	🟡	❌	❌	❌	❌	❌	❌	❌	❌	❌
Segregated bike lanes along main corridor(s)	✅	🟡	✅	✅	❌	❌	✅	✅	✅	❌	❌	❌
Disabled access to stations			✅									
BRT authority responsible for planning and control of the system	✅	✅	❌	❌					❌		❌	



Concluding remarks

- All have low capacity station design, limiting capacity and expansion
- Most do not provide an overall time saving benefit for bus passengers or mixed traffic in the corridor
- All tend to design stations of the same size, regardless of passenger demand
- All have only one operator
- There is a trend toward 'flexible' operation modes rather than 'closed' systems
- Hefei BRT, under construction, seems to have a higher capacity design
- Guangzhou BRT is projected to be Asia's first high capacity BRT, with more than double the one-direction capacity of any other BRT system in China. The system will also feature tunnels connecting metro and BRT at 3 stations, bike parking at BRT stations, a high quality enclosed station design, and good pedestrian access
- Several key issues, however, remain to be resolved during 2009

- www.itdp-china.org (all photos)
- www.chinaBRT.org (BRT data)
- www.gzbrt.org (Guangzhou BRT