TRANSPORT

Developing Sustainable Transportation with the Guangzhou Bus Rapid Transit System and Multi-Modal Transport Network

CHINA

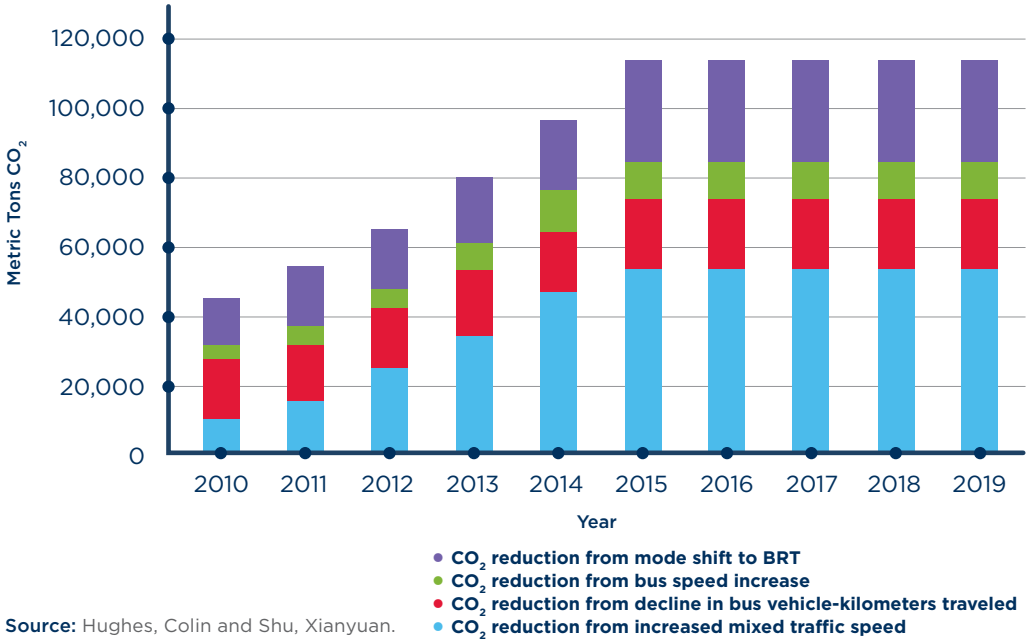
SEEKING A SOLUTION TO GRIDLOCK

Bus rapid transit in China boosts ridership, cuts emissions

The Guangzhou Bus Rapid Transit system, which won the Institute for Transportation and Development Policy's 2011 Sustainable Transport Award, is at the forefront of sustainable transport and integrated urban planning. The system, which contributes significantly to local and national sustainable development goals, with an overall reduction in government subsidies, provides a model that other Asian countries could follow.

China's fast-growing economy, population and vehicle use, combined with rapid urbanization, is placing enormous strain on transportation in cities. Besides having negative local impacts, the situation is substantially increasing oil consumption in the country, which already has the world's highest total greenhouse gas emissions.[1] China's Twelfth Five-Year Plan, for 2011 through 2015, sets goals for reducing the carbon and energy intensity of the country's economy. Those national targets are distributed among provinces and cities, and the National Development and Reform Commission has launched low-carbon demonstration projects in certain provinces, including Guangdong.[2]

Figure 1: Guangzhou BRT Yearly Projected CO_2 Reductions by Source



Source: Hughes, Colin and Shu, Xianyuan.

Guangzhou is the capital of Guangdong province and the third-largest city in China, with a population of more than 6 million in the city and nearly 12 million in the metropolitan area.[3] Before the Guangzhou Bus Rapid Transit (GZ-BRT) was introduced in February 2010, Guangzhou suffered crippling traffic congestion and gridlock on Zhongshan Avenue, a central trunk road, and the public bus system was slow and overcrowded. A Bus Rapid Transit system was determined to be cheaper and faster than building a metro system, which would entail huge capital cost and time delay. Authorities, however, had to overcome a legacy of incremental and disjointed urban transport planning, as well as negative perceptions of public transport.[4]

SYSTEM COMBINES EASY ACCESS, LOW FARES AND "GREENWAYS"

Guangzhou created an innovative Bus Rapid Transit system as the centerpiece of a multimodal transport network with integrated urban design elements. Among the key features of the GZ-BRT system:[5]

- The system consists of a 22.5-kilometer corridor of fully segregated rapid bus lanes with more than three times the capacity of any other Bus Rapid Transit system in Asia. It has the world's highest Bus Rapid Transit bus volumes (350 per hour in a single direction, or roughly one bus every 10 seconds), direct access to metro-rail stations and bus station bridges connecting directly to adjacent buildings, and station size is based on passenger demand.
- The system is located in a very high-density region with high transit demand and intensive adjacent land use, giving it access to many people and places.
- Bike parking and public bike sharing are available at every station and in adjacent neighborhoods, and a "greenway" on either side of the bus rapid transit corridor combines dedicated bike lanes and walkways with parks, plazas and children's play areas.
- Flat-rate bus fares and discounted smart cards for frequent users, which are part of a subsidized citywide low-fare program, are reported to have nearly halved the average cost of a bus trip.

The Guangzhou Municipal Engineering Design and Research Institute (GMEDRI) developed the first phase of the system, with preliminary scoping in 2003; detailed design, planning and analysis between 2005 and 2008; and infrastructure construction, establishment of regulatory and operational systems, vehicle procurement and public outreach in 2009. Work continues for future expansion of the system. The Institute for Transportation and Development Policy collected and monitored data, producing a report analyzing the system's first year of operation in May 2011.[6]

BENEFITS FOR RIDERS, INVESTORS AND THE ENVIRONMENT

The Institute for Transportation and Development Policy report showed that the GZ-BRT has exceeded expectations, reducing traffic congestion and travel times, improving efficiency of the city's bus system, increasing use of public transport and alleviating overcrowding, while producing other benefits and a competitive return on investment:

1. **Passenger volumes and traffic speed.** The system's 805,000 daily boardings give it the largest ridership of any bus corridor in Asia. It carries more passengers per hour than any metro line in mainland China outside of Beijing.[7] The new system has increased the speed of buses and mixed traffic in the corridor by 29 percent

and 20 percent, respectively, resulting in a time savings of 52 million hours for travelers in 2010, with an estimated annual value of USD 24 million.[8] Bicycle trips in the corridor increased by an average of 45 percent between 2009 and 2010. Surveys showed a substantial increase in bus service satisfaction (from 29 percent to 65 percent) and civic pride after the GZ-BRT began operating. Changes to the fare structure resulted in USD 103 million in total consumer savings on trip costs in 2010.[9]

2. **Environmental and public health benefits.** The Institute for Transportation and Development Policy estimates that the GZ-BRT will reduce CO_2 emissions by an average of 86,000 metric tons annually during its first 10 years—amounting to higher CO_2 emission reductions per kilometer than other bus rapid-transit systems. It is also expected to reduce particulates that cause respiratory illness by an average of four tons a year—a relatively low figure because Guangzhou's buses and taxis already run on liquefied petroleum gas—because of lower fuel consumption and pollution in the corridor. In its first year of operation, the Guangzhou BRT is estimated to have reduced CO_2 emissions by 45,000 metric tons, based on observed changes in the system's share of ridership, bus speed, mixed traffic speed and vehicle kilometers traveled by the buses.[10]

3. **Capital and operating costs and return on investment.** Total capital cost for the GZ-BRT was USD 146 million, and its per-kilometer cost was a fraction of recent metro projects in Asia. Because it has a higher capacity than most metros, it is a more cost-efficient investment. Despite deliberately low, subsidized bus fares, the city government reports annual operating cost savings of USD 14 million since the system began operating, likely due mainly to fuel savings. This translates into an estimated 79 percent return on the capital costs within 10 years, which could rise to 131 percent if local and global benefits, excluding health impacts, are considered.[11] Preliminary data also suggest that property values adjacent to the BRT corridor could increase.

The GZ-BRT is transforming the city of Guangzhou and benefiting residents in a number of ways. It is a leading example of cost-effective, sustainable transportation planning that other cities with high transit demand could emulate.

Figure 2: Achievements of Guangzhou's Multi-Modal Transport Network

ACHIEVEMENTS OF GUANGZHOU'S MULTI-MODAL TRANSPORT NETWORK
• Largest ridership of any bus corridor in Asia (805,000 daily boardings)
• World's highest BRT bus volume (350 per hour in a single direction, or roughly one bus every 10 seconds)
• Increased average bus speed along the bus corridor by 29%
• Increased average mixed traffic speed along the bus corridor by 20%
• Time savings of 52 million hours for travelers in 2010
• Estimated traveling cost savings of USD 24 million in 2010
• Increased bicycle trips in the corridor by an average of 45% from 2009 to 2010
• Increased satisfaction in bus service by 36% (based on surveys)
• Consumer savings of USD 103 million in trip costs in 2010 (due to changes in fare structure)
• Expected GHG emissions reductions of 86,000 metric tons CO_2 annually
• Expected reductions in particulate matter of 4 metric tons annually
• Annual operating cost savings of USD 14 million (due mainly to fuel savings)

Source: Hughes, Colin and Xianyuan Shu.

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ENDNOTES

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4 Asian Development Bank, 2012, *op cit.*

5 Hughes, Colin and Xianyuan Shu, 2012, *op cit.*

6 *Ibid.*

7 *Ibid.*

8 *Ibid.*

9 *Ibid.*

10 *Ibid.*

11 *Ibid.*

Figure References

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Hughes, Colin and Xianyuan Shu. May 2012. "Guangzhou, China Bus Rapid Transit: Emissions Impact Analysis." Institute for Transportation and Development Policy. Web. July 2012. <http://www.itdp.org/documents/20110810-ITDP-GZBRTImpacts.pdf>

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