

High-Speed Railways in China: An Update on Passenger Profiles

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Two Chinese high-speed rail (HSR) projects supported by World Bank loans - the Nanning-Guangzhou (Nanguang) and Guiyang-Guangzhou (Guiguang) - began operations in late December 2014. The services have connected the peripheral provinces of Guangxi and Guizhou to the economically advanced province of Guangdong. The travel time between Nanning and Guangzhou was reduced from 13 hours to three hours, 19 minutes and that between Guiyang and Guangzhou from 21 hours to four hours, nine minutes, thus making a step change to transport access.

The World Bank has conducted surveys on board the high speed and conventional trains in the Nanguang and Guiguang corridors to understand the profiles of the passengers and the extent to which the new services have influenced how they travel on those two routes. This has expanded our evidence base to cover the South China routes, building on the surveys we conducted previously between Changchun-Jilin in the North East, and between Tianjin and Jinan on the Beijing-Shanghai line.

INTRODUCTION

By the end of 2014, China Railway had built a network of over 16,000 route-km of high-speed railways (HSR)¹, connecting the fast-growing coastal centers and some inland cities. More lines, currently under construction or at the planning stage, will largely complete its coastal network and provide a step change in HSR access to the economically under-developed central and western regions (See HSR map.)

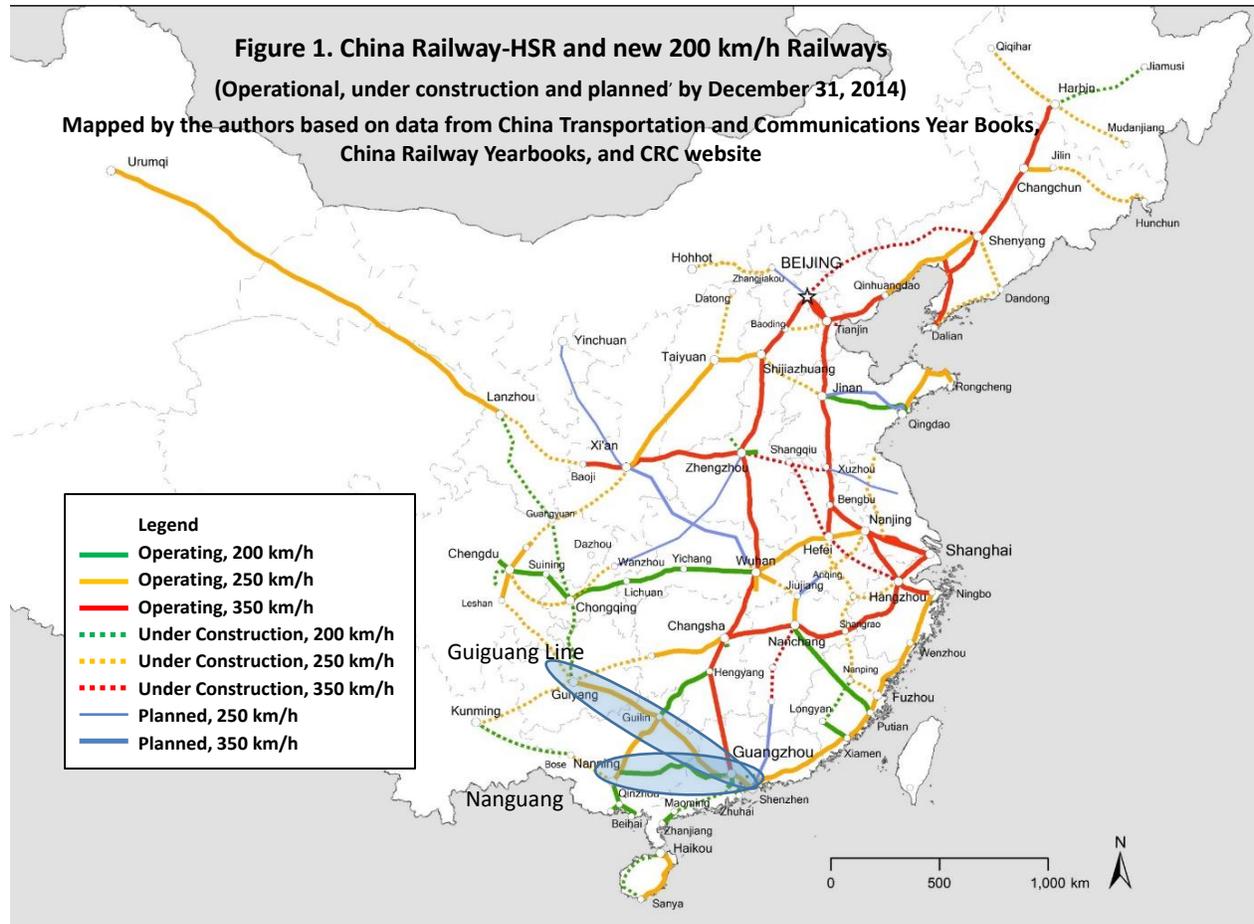
Two HSR projects, supported by World Bank loans, were completed and went into operation at the end of 2014: the Guiguang line between Guangzhou and Guiyang, a passenger-dedicated line with a top speed of 250 km/hr, and the Nanguang Railway between Guangzhou and

Nanning, a mixed-traffic line for passenger services (top speed 200 km/hr), and freight trains (at speeds of up to 100 km/hr).

On-board passenger surveys were conducted on these two services about three months into their operations. The surveys provide a first picture of the passenger profiles and the findings are summarized here under three main headings: (i) socio-economic characteristics of the passengers and their purposes of travel; (ii) access to and from the stations; and (iii) impacts on travel patterns. We also compare the results with two similar surveys undertaken in 2013 on high-speed lines between Changchun and Jilin, and between Tianjin and Jinan².

¹ For the purpose of this note, the HSR includes both the dedicated new passenger lines with a design speed of 200 km per hour or above, and new passenger-freight lines with a maximum design speed of 200 km per hour.

² See China Transport Topic No.11 High-Speed Railways in China: A Look at Traffic



LINE DESCRIPTION

Guiguang HSR has 857km of double-track from Guiyang North Station to Guangzhou South via Guilin in Guangxi Province. This line crosses a mountainous area through a karst landscape. Over 23% of the line consists of bridges and viaducts, and about 54.5% is in tunnels. There are eight stations in Guizhou Province, eight in Guangxi and six in Guangdong. The line opened on December 26, 2014. There were on average 10 pairs of trains between Guiyang and Guangzhou every day, and 24 pairs between Guilin and Guangzhou from March 2015. Only one pair of non-stop trains travel between Guiyang and Guangzhou with the quickest travel time of 249 minutes. The others stop at three to

eight stations in between, with an average travel time of 322 minutes. The planned station for Yangshuo (which is one of the most popular tourist destinations in China) was not yet open when the survey was conducted. Neither were the smaller Wutong and GuilinXi Stations. Demand for January – March 2015, as estimated by the GuiGuang Rail Company, was an average of 53,000 passengers per day (which implies around 19 million p.a.). Most trains were completely full all the way and in many cases there were standing passengers for up to 10% of seating capacity.

The ticket fare between Guiyang and Guangzhou is RMB 321 for first class and 267.5 for second class. It used to take 17 hours by bus and 21

hours by conventional train (on a different, circuitous rail route) with similar levels of fares, compared with the travel time now by HSR train of 4-5.4 hours. Bus services between Guilin and the cities along the corridor have been reduced sharply, with most long distance services being canceled. Air fares have been discounted significantly, with the air fare now becoming lower than train tickets. Moreover, direct flights from Guiyang to Guilin (420km) have been canceled.³

Nanguang line runs from Nanning East Station to Guangzhou South Station, with a total length of 577 km. There are seven stations in Guangxi Province and seven in Guangdong. The section from Nanning to Wuzhou started operation on April 18, 2014, and the rest of the line opened on December 26, 2014. At the time the survey took place, Foshan West station was not open. The line service commenced with 18 pairs of trains but, in order to meet demand, three more pairs were added in January and a further 10 added in March 2015. Only one pair of non-stop trains operate between Nanning and Guangzhou per day with a travel time of 199 minutes. The others stop at three to five stations in between, with some trains continuing to Liuzhou and Beihai beyond Nanning. A daily through train was scheduled from Nanning to Shenzhen via Guangzhou south from March 2015, and more pairs of such services may be added subject to local demand. Demand for January – March 2015 was estimated by the Nanguang Rail Company as 46,000 per day on average (which implies around 17 million p.a.).

The price of tickets between Nanning and Guangzhou is RMB 169 and 202 for Second and

First class respectively. Rail fares are currently very competitive with, if not cheaper than, bus tickets. Long distance bus services within the corridor to and from Wuzhou and Guigang have been reduced sharply, typically by up to 50%, with few end-to-end passengers on long-distance trips other than those who could not obtain rail tickets. The flights between Nanning and Guangzhou dropped from nine per day to three.

THE ON-BOARD SURVEYS

During March 25-April 14, 2015 a sample of 971 interviews were conducted on 18 train services (including 10 pilot interviews on two trains) using students based in Guilin as interviewers. The survey forms were handed out at random to about every second or third row, alternately to the right and left of the aisle, with the aim of obtaining 60-65 completed survey forms per train on NG and 40-60 on GG.

Guiyang-Guangzhou

On the Guiguang line, 467 interviews were carried out on 12 trains: this includes the earliest train from Guangzhou on both weekend and weekday days, and on the return trains from Guiyang in the afternoon or evening. The same applied for Guiyang to Guangzhou services. Surveys were also conducted on the first and last trains from Guilin to Guangzhou.

Surveys were undertaken on Mondays and Fridays, together with another weekday. Interviews were also undertaken on Saturdays. The table below shows the 12 trains selected and interviews obtained on each train.

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<http://gz.people.com.cn/n/2014/1230/c194827-23389490.html>

Table 1. Selected trains for Guiguang Line and number of surveys collected on each train

	Train No.	Dep. Guilin	Dep. Guangzhou	Dep. Guiyang	Sample	Note
Saturday	D2804		730		38	To Guiyang
Tuesday	D2804	1033			34	Ex Guangzhou
Friday	D2808	1439			59	Ex Guangzhou
Monday	D2810		1325		34	To Guiyang
Saturday	D2844		2000		53	To Guilin
Monday	D2833	825			49	Starts Guilin
Wednesday	D2801(pilot)			731	4	
Thursday	D2809	1432			52	Ex Guiyang
Wednesday	D2813(pilot)			1320	6	
Tuesday	D2815			1549	35	To Guangzhou
Friday	G2905	1851			52	Guilin to Shenzhen
Friday	D2819			1738	51	To Guangzhou

Note: (1) Trains with odd numbers are running towards Guangzhou, and trains with even numbers are leaving from Guangzhou. (2) Ordered by departure time of the day by direction (leaving from or arriving at Guangzhou)

Nanning-Guangzhou

The trains on the Nanguang line were similarly selected, with four trains that left in the morning and noon from Nanning, returning in the afternoon and evening separately. The same pattern was used for trains from Guangzhou to Nanning. 504 samples were collected from these eight trains, two of which were on the weekend

and six on weekdays. The table below shows the trains surveyed on Nanguang line and the completed interviews on each train.

Table 2. Selected trains for NanGuang Line and number of surveys collected on each train

	Train No.	Dep. Nanning	Dep. Guangzhou	Sample	Note
Monday	D3601	700		65	
Tuesday	G2911	1130		60	To Shenzhen
Saturday	D3617	1450		59	
Friday	D3621	1700		70	
Friday	D3632		740	58	To Beihai
Saturday	D3606		940	67	

Monday	D3614		1315	60	
Tuesday	D3620		1735	65	

Note: Ordered by departure time of the day on one direction
(leaving from or arriving at Guangzhou)

SOCIO-ECONOMIC CHARACTERISTICS AND TRIP PURPOSE

The predominant group of passengers was between 19 and 40 year old, accounting for about 80 percent. This is similar, albeit slightly younger, to the passengers travelling on the Jilin-Changchun and Jinan-Tianjin HSR lines. Men accounted for approximately 64% of passengers and women 36%, similar to the Changji and Jinghu line.

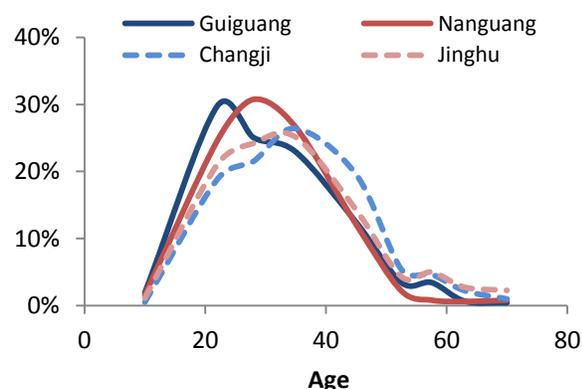


Figure 2. Age Distribution of Passengers

From the results of passenger survey, the female passengers tend to be younger and with lower income. Travelling for leisure accounts for a larger proportion for women’s trip purpose (59% on NG and 76% on GG) than men’s (49% on NG and 55% on GG).

The Guiguang line is famous for its attractive tourist destinations along the corridor, so it is not surprising that a large portion (61%) of passengers were travelling for tourism and leisure. Business trips thus only accounted for 36% on Guiguang HSR, substantially less than on the

Jinghu and Changji HSR (62% and 52%⁴ respectively). The Nanguang line had almost half of its trips for business, similar to the Changji corridor.

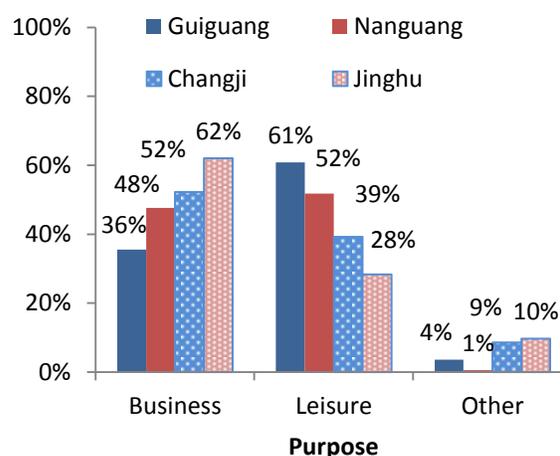


Figure 3. Trip Purpose

The survey results indicated that the high speed rail services were used by a broad range of income levels, with over 40% of travelers with an average monthly income of RMB 4000 or lower (Figure 4). On the Nanguang line, the average self-reported monthly personal income was around RMB 5500, and this was similar for Guiguang (RMB 5900). The equivalent values on the Tianjin-Jinan and Changchun-Jilin HSR were RMB 6700 and 4300 respectively in 2013. As expected, people in the 30-55 age group have the highest average income.

⁴ Revised from CTT 11 High-Speed Railways in China: A Look at Traffic, with small traders included.

Caution is of course required with the self-reported income figures, as richer individuals tend to understate their incomes to some extent in all countries⁵. In addition, the survey was taken before and after Tomb-sweeping Day, when migrant workers visit home according to Chinese tradition. Part of the success of HSR is that the HSR train ticket on Guiguang and Nanguang corridor is similar or cheaper compared to the alternative transport modes.

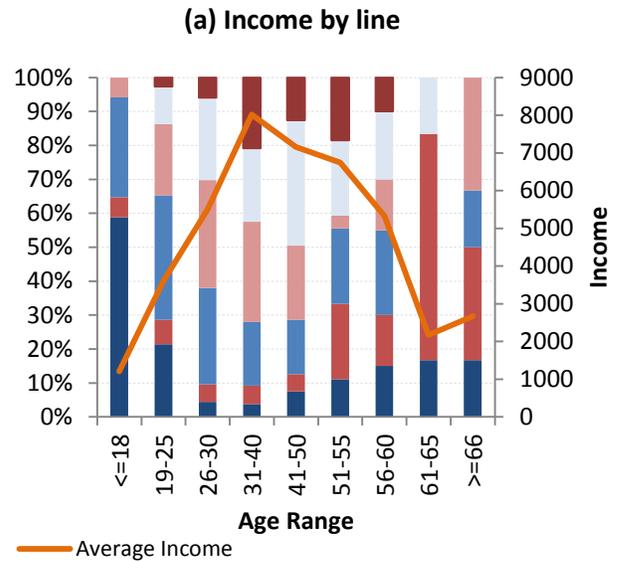
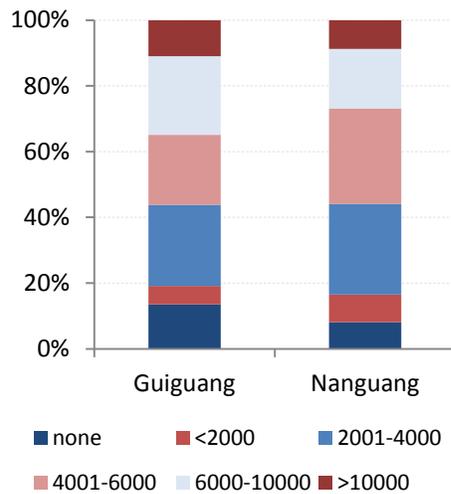


Figure 4. Monthly Income (RMB)

Many of the passengers are travelling between the main centers. On Guiguang, 41% of those interviewed were travelling all the way between Guiyang and Guangzhou, possibly influenced by the high proportion of tourists to Guiyang, the limited number of trains stopping at intermediate stations and the difficulty of obtaining tickets for impromptu travel. A similarly high proportion on the Nanguang line are from one end to another. In addition, 13% of the interviewed passengers travelled between Guangzhou and stations beyond Nanning, e.g. Beihai Railway, and some trips are thus longer than the Nanguang line itself. (Figure 5)

⁵ See, e.g. review by Chris Bramall (2011). The Quality of China’s Household Income Surveys. SOAS working paper. <http://eprints.soas.ac.uk/10693/1/QualityofChinasHouseholdIncomeSurveys.pdf>

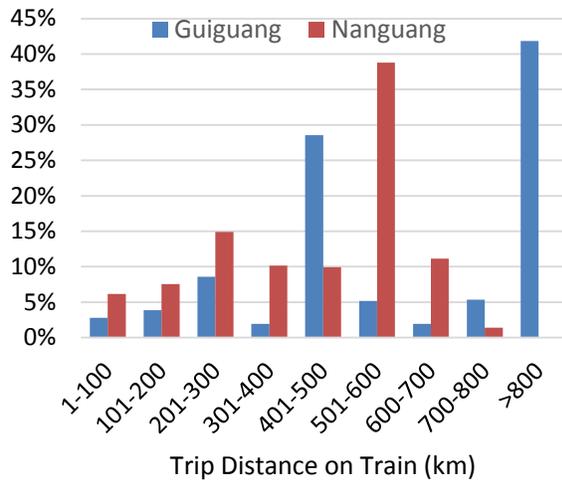
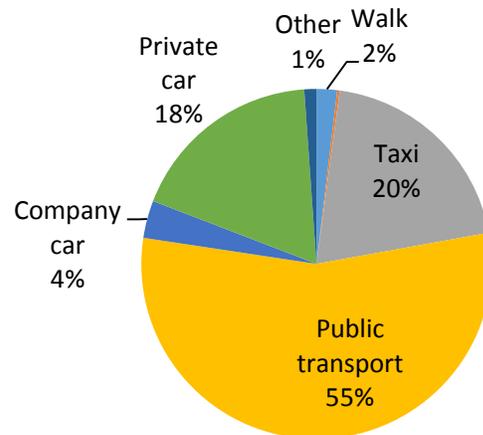


Figure 5. Travel Distance Distribution

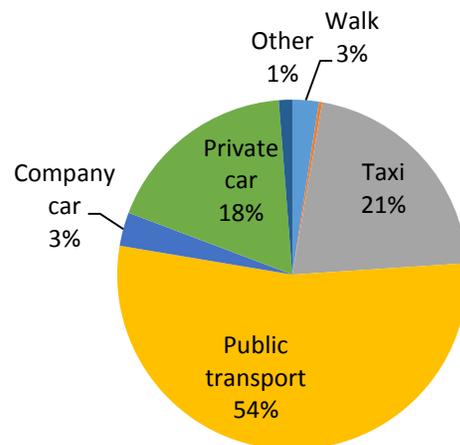
Access/Egress to Stations

The transport mode used to access HSR stations reflects the differences in where the stations are placed in the cities. Most stations on these lines are located several kilometers away from the current city centers. Some of the station squares and facilities are still under construction, and bus services were limited at the time of the surveys. For instance, passengers have to walk for a long distance at Yunfu between the station building and the parking lot/bus station; and for Guigang city, though the HSR station is located near city center, passengers have to climb many steep stairs from the parking lot to reach the station building without any ramp or elevator. Reflecting the inconveniences surrounding many of the HSR stations, only 27% of travelers chose public transport⁶ to/from railway stations, while 34% of them took taxis. This is similar to the pattern occurring on the Tianjin-Jinan corridor, where only 29% of passengers took public transport while 38% took a taxi. (Figure 6). In contrast, public transport was the predominant mode for

Guangzhou South Station (21% bus and 48% metro), accounting for 69% of interviewed travelers, followed by taxi (15%) and private car (11%) reflecting the good connectivity of the station.

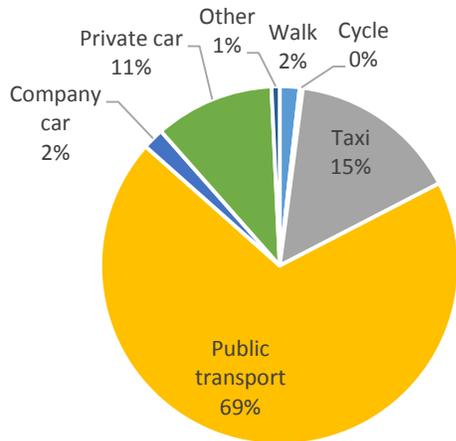


(a) Guiyang-Guangzhou

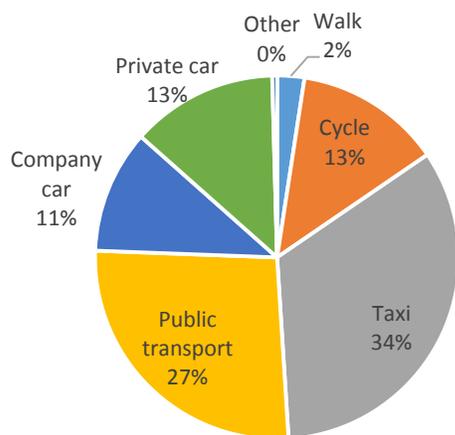


(b) Nanning-Guangzhou

⁶ public transport includes bus, coach, metro and tour bus provided by travel agencies



(c) Guangzhou South Station



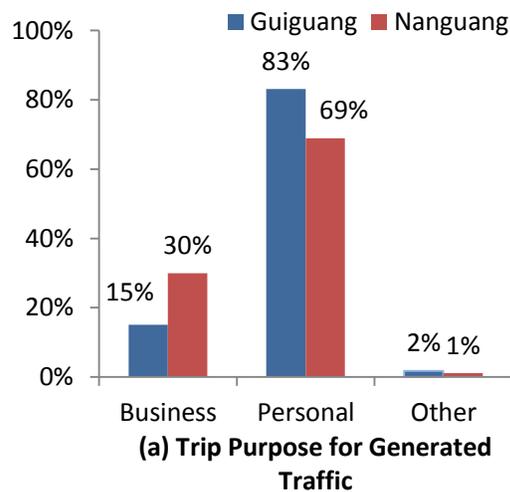
(d) Stations along NG&GG lines excluding Guangzhou South Station

Figure 6. Connecting Modes to Railway Stations

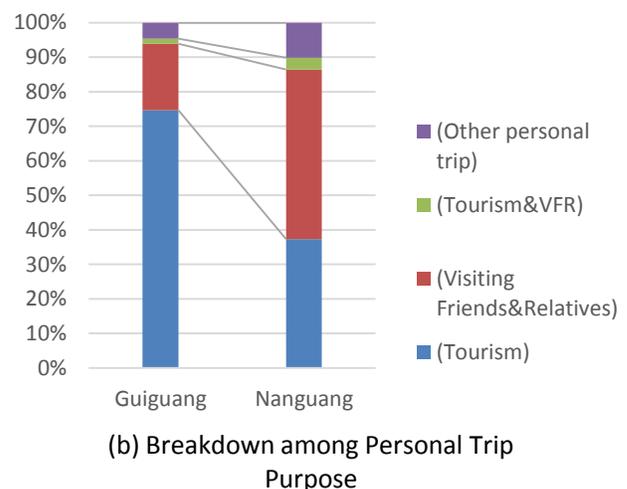
IMPACT ON TRAVEL PATTERNS

The survey asked passengers if they would still have undertaken the trip if the HSR service had not been there. About 36 percent of the passengers on Guiguang and 18 percent on Nanguang said that they would not have undertaken the trip. Most of these passengers were on personal travel, with tourism as the main trip purpose on Guiguang line (Figure 7). HSR also stimulated new business travel, in line with discussions with cities along the line. One reason business trips were low on the Guiguang line was the shortage of tickets. The travel agencies had to

book tickets well in advance, while businessman could not get tickets when they needed them.



(a) Trip Purpose for Generated Traffic



(b) Breakdown among Personal Trip Purpose

Figure 7. Trip Purpose for Generated Traffic

Women are more likely to be a new travelers than men. On Nanguang Railway survey, 21% of female interviewees are new travelers, while only 16% males are new travelers who would not travel without the Nanguang railway. On Guiguang, 45% of women and 30% of men are new travelers.

Though in general, men account for approximately 64% of passengers and women 36% of this survey, the gender difference is less for generated traffic, with 55% men and 45% women.

For all transferred business travelers who would travel by another mode if there were no HSR, men are the dominant group (about 73%).

The results also shows that men tend to take longer trips (Figure 8).

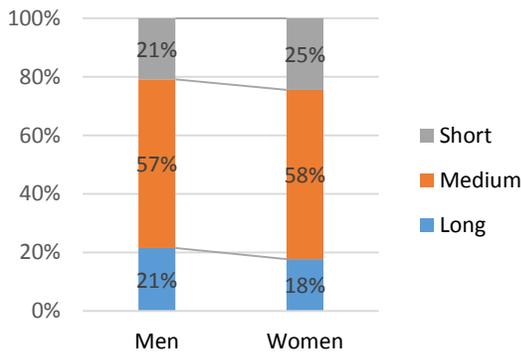


Figure 8. Trip Distance by Gender

If HSR did not exist, 64% of the passengers on Guiguang and 82% on Nanguang would still have travelled. On the Nanning-Guangzhou Corridor, almost half of the passengers would have chosen coach or bus, 20% air and 18% other trains. On the Guiyang-Guangzhou corridor, over 70% of short-distance passengers would use bus with 19% choosing private car with air as the main alternative mode for medium and long distance trips. The share of passengers that would select bus or non-HSR train as the alternative mode reduces with increasing travel distance, as expected, similar to the Beijing-Shanghai corridor.

The survey also asked if the passenger had increased their travel frequency with HSR service by comparing travel frequencies on the route in 2014 with the planned trip frequency in 2015. Over three-quarters (76%) of passengers reported more such trips will be taken in 2015 with an overall increase of 40-50%. Whilst such statements of future intent are often unreliable, the responses indicate that the large increase in

overall trip-making that has accompanied many HSR services is due to a combination of existing travelers making trips more frequently as well as completely new travelers.

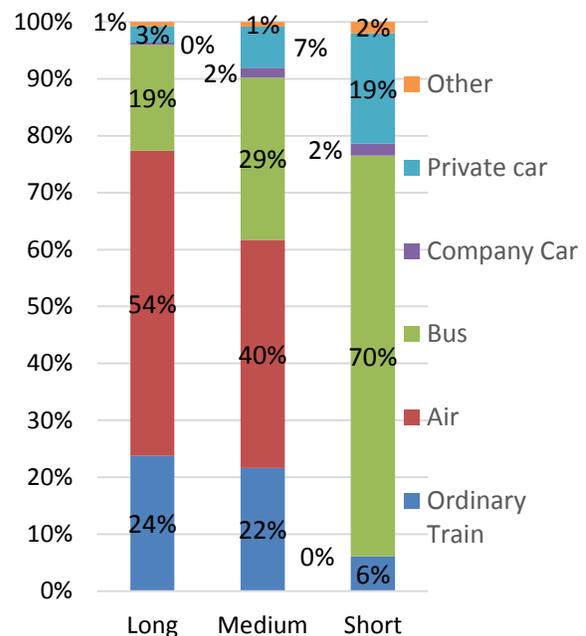
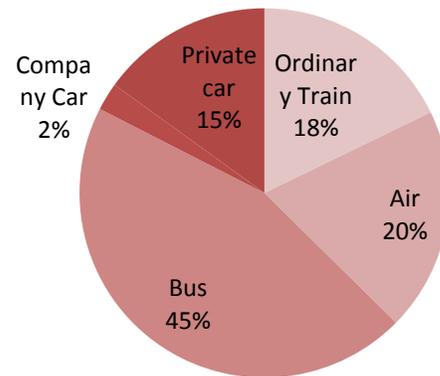


Figure 9. Alternative Modes If the HSR Services Were to Stop Running for Nanning Guangzhou (top chart) and Guiyang Guangzhou (bottom)

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This note is part of the China Transport Note Series to share experience about the transformation of the Chinese transport sector. For comments, please contact Nanyan Zhou (nzhou1@worldbank.org) or Gerald Ollivier (gollivier@worldbank.org).

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