STUDY ON THE DEMAND FORECAST METHOD FOR THE INTER-URBAN PUBLIC TRANSPORT UNDER THE HIGH-SPEED RAILWAYS IN SHANGHAI-NANJING CORRIDOR

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Abstract: In the Eleventh Five-year Plan (2006--2010), the Ministry of Railways in China plans to build two high-speed railways in Hu-Ning corridor. Based on the detailed OD information in the railway database, this paper designs a comparatively low-cost method to forecast the passenger demand for the inter-urban public transport. Making Revealed Preference (RP) survey in this corridor, with the Logit model and the existing railway OD to estimate the inter-urban public transport OD; forecasting the trip-generations and traffic-distributions with the suitable models; making Stated Preference (SP) survey and using the combined RP/SP model to estimate the mode split on the new network. Then the travel demand can be forecasted. Additionally, the features of the inter-urban public transport on the new network are also analyzed in this paper.

BACKGROUND

Shanghai-Nanjing corridor with a length of 300km long is located in the connection of the Yangtze River Economic Belt and Coastal Economic Belt in China, covering six cities, Shanghai, Suzhou, Wuxi, Changzhou, Zhenjiang and Nanjing. This corridor has a powerful economy and high population density. In 2005, the overall Gross Domestic Product (GDP) of the six cities is 2054.5 billion which covers 11% shares of the whole country. The average personal GDP and population density is 56,530 Y/p and 1056 p/km2 respectively, which are 8.5 times and 4.1 times as the average level of the whole country. Meanwhile this corridor is also one of the busiest corridors in China. The inter-urban travel in this corridor is mainly on the railway and coach. Compared with the coach, railway is developing slowly and can’t satisfy the increasing travel demand. In the Eleventh Five-year Plan (2006--2010) the Ministry of Railways plans to build two high-speed railways in this corridor, one of which called Beijing-Shanghai Passenger Dedicated Line (PDL) with a speed of 300km/h, another is called Shanghai-Nanjing Inter-urban Railway (IUR) with a speed of 200km/h.The high speed railway is the completely new mode in this area, which will change the structure of the inter-urban public transport. The travel behaviors will also change when the two high-speed railways are being operated. Forecasting the inter-urban public transport demand can help to realize how the travel will be changed under the new network, which can also be used as reference for the government to make the transportation policies as well as the brace for the high-speed railways planning.

THE DEMAND FORECAST METHOD

In China, we generally forecast the passenger demand of the new built railway by 4-steps method, which is done through the trip-generation, traffic-distribution and mode-split models etc based on the particular OD information. The OD information, which is the basis of the traditional demand forecast method, is usually achieved by travel survey of the whole society. However, this method requires a long survey period and huge cost, as well as millions of data must be dealt. If no special investigation term is well organized to do this in a long term, the data can't be accurate enough for models. Especially in this promoting period of our country, as new high-speed road and railway network are continuously under construction, the people's travel behaviours are changing constantly. Therefore, if the OD information can't be updated in time, the data is also can't be used in the forecast models. Additionally, as the high-speed railway is a completely new mode in China, we usually use the Logit model based on the SP survey data to forecast the mode split. But the SP survey which is ground on the assumption may make the high-speed railway split over forecasted.

This paper tries to solve the problems mentioned above in the high-speed railway planning in our country. One is to find a low-cost way to get the OD information, the other is to forecast the mode split more accurately on the new network.

Because our country is a developing country, car is a luxury for the normal family, thus most demand for inter-urban travel is on the public transport. In order to forecast the inter-urban public transport demand when the two high-speed railways are being operated, three steps should be done. The first step is to know the inter-urban public transport OD information on the existing network; the second step is to forecast the inter-urban public transport OD in the future and the third step is to forecast the mode split under the new network.

The estimate of inter-urban public transport OD

This paper introduces a method to estimate the inter-urban public transport OD with the Logit model. In China, all the railways belong to the same department, which has an integrated information management system sharing a powerful database. With the tickets information in this data base, we can get the detail railway OD information. But the coach companies with no integrated information system, so the inter-urban coach OD information can't be received. At present, the inter-urban public OD estimation problem transforms to this, how to get the whole inter-urban OD when knowing partly of the OD information. To solve this problem, we should know the railway and coach mode split, which can just be dealt with by Logit model. There are two methods to survey the passengers' travel, one is the RP survey and the other is the SP survey. The former one is based on observations of actual choices and allows to characterize current travel behavior, while the latter provides information about travellers' preferences for new alternatives.

Based on the RP survey and travel features analysis in Hu-Ning corridor, this paper built the travel utility functions to calculate the mode split on the existing network. Then the whole inter-urban public transport OD can be estimated on the detail railway OD data.

Forecasting the inter-urban public transport OD in the future

With the analysis of the social and economic features in different cities, the inter-urban public transport OD can be forecasted with the trip-generation and traffic-distribution models.

The mode split under the new network

In order to take advantages of the RP and SP data, the combined data models are researched （Ben-Akiva and Morikawa,1990; Hensher and Bradley,1993; Bradley and Daly, 1997; Louviere et al,2000）.The combined models allow to exploit their respective advantages and to overcome their specific limitation. In this paper, we also made the SP survey in Hu-Ning corridor. Combing with the RP data, different inter-urban public transport splits are forecasted.

Through this three steps forecast method, the inter-urban travel demand can be forecasted.

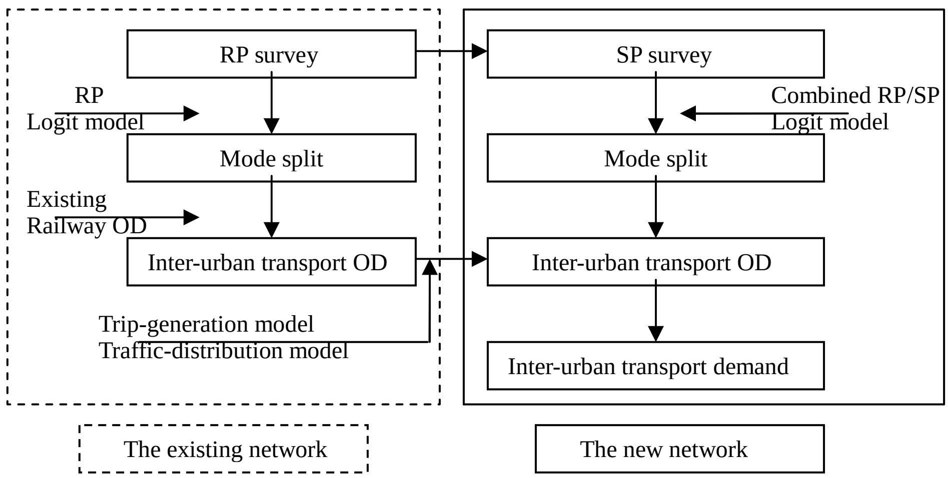

Figure 1: The designed travel demand forecast method.

Because the trip-generation and traffic-distribution models are very common, this paper doesn't specify how to build these models. In the next section, the methods for the estimation of the inter-urban public transport OD on the existing network with the RP data and the mode split with the RP+SP data on the new network are explained.

THE MAIN FORECASTING MODELS

In the transportation research field methods of discrete choice analysis have been developed for the analysis of travel demand and applied to various aspects of travel behavior. This method is with an idea of there are two sets of attributes, observed and unobserved, associated with each alternative to the choice outcome. In linking the two sets, it is generally accepted practice that individuals act as if they are maximizing utility. The solution to the utility maximization problem is an indirect utility expression for each alternative which is a function of the observed and unobserved attributes of alternatives. The behavioral framework outlined is applicable for both RP and SP data. The definition of the observed and unobserved influences on the choice outcome however varies. First, the observed levels of the attributes of alternatives typically obtained in an RP study are sought directly from the decision maker. By contrast, the attribute levels associated with an SP study are fixed by the analyst. Second, the choice outcome in the RP study is the known outcome, whereas for the SP study it is the potential outcome or the outcome with the highest likelihood of occurrence given the combination of attribute levels offered in an experimental replication. So the RP data can reflect the actual behavior on the existing network but can't forecast the preference for the new transport mode. While, the SP data can deal with the preference on the new network, but has a weakness that people who declare their choices in hypothetical conditions may act differently in real ones.

Based on the features of each data set, the paper uses the RP Logit model to analyze the mode split on the existing network while using the combined RP/SP Logit model to forecast the mode split on the new network in the future.

There are many influences for the traveler when choosing the inter-urban public transport, including the mode features such as the ticket cost, speed, frequency etc. as well as the connections of the terminal with the city transport system, also the waiting time for the vehicle. Additionally the sensitivities to these features vary with the travel distance. In order to reflect the travel behavior more precisely, it separates the whole travel into four parts: access to the station, waiting at the station, riding on the road and egress from the station based on the RP and SP survey. Then dividing the samples into three small samples as of the travel distance less than 100km，between 100 and 200km, and between 200 and 300km. For each small sample, a RP and SP utility function is setup separately. Because the model building method is the same for the three small samples, so this paper will further explain how to build the model for some one as the example.

For each type data, the utility function is as follows:

$$U_i^{RP} = \alpha_i^{RP} + \beta^{RP} outt_i^{RP} + \chi^{RP} wt_i^{RP} + \delta^{RP} invt_i^{RP} + \gamma^{RP} c_i^{RP} + \varepsilon_i^{RP} \quad \forall i \in C^{RP}$$
$$U_j^{SP} = \alpha_j^{SP} + \beta^{SP} outt_j^{SP} + \chi^{SP} wt_j^{SP} + \delta^{SP} invt_j^{SP} + \gamma^{SP} c_j^{SP} + \varepsilon_j^{SP} \quad \forall j \in C^{SP}$$

Where, i,j is an alternative in choice sets C^{RP}, C^{SP} respectively, C^{RP} ={i,i=1 existing railway, i=2 coach } , C^{SP} ={j,j=1 PDL, j=2 IUR, j=3 existing railway, j=4 coach} $outt_i^{RP}$ $outt_j^{SP}$; wt_i^{RP} wt_j^{SP} ; $invt_i^{RP}$ $invt_j^{SP}$; c_i^{RP} c_j^{SP} are respectively the access/egress time, waiting time, in vehicle time and total cost. β^{RP} β^{SP} ; χ^{RP} χ^{SP} ; δ^{RP} δ^{SP} ; γ^{RP} γ^{SP} are the parameters in RP and SP utility functions. α_i^{RP} α_j^{SP} are the alternative specific constants (ASCs) in the two data sets. ε_i^{RP} ε_j^{SP} are the unobserved effects associated with the RP and SP data configuration and assuming these random terms have the independent and identical distribution (IID) Gumbel property.

The mode split on the existing network

Based on the RP data and Logit model, we can get the probability of the alternative i chosen by traveler n. that is:

$$p_{in}^{RP} = \frac{\exp(V_{in}^{RP})}{\sum_{i=1}^{2} \exp(V_{in}^{RP})}$$

Where, V_i^{RP} is the observed part of the RP utility.

Then, the log likelihood of RP data can be got: $\ln L^{RP}\left(\hat{\alpha}_i^{RP},\hat{\beta},\hat{\chi},\hat{\delta},\hat{\gamma}\right)=\sum_{n\in RP}\sum_{i\in C_n^{RP}} y_{(RP)in}\ln p_{in}^{RP}$

Where, $y_{(RP)in}=1$ if traveller n chooses alternative i, and =0 otherwise.

When the mode split got on the existing network, the inter-urban public OD can be estimated on the detail existing railway OD.

The mode split on the new network

When building the combined data model, there is a fundamental assumption that the trade-offs relationship among major attributes is common to both RP and SP, which reflected to the utilities functions is that the common attributes have the same parameters in both data sources, i.e., $\beta^{RP}=\beta^{SP}=\beta$, $\chi^{RP}=\chi^{SP}=\varphi$, $\delta^{RP}=\delta^{SP}=\delta$, $\gamma^{RP}=\gamma^{SP}=\gamma$.However, since the effect of unobserved factors may well be different between RP and SP data, there is no reason for assuming that ε_i^{RP} and ε_j^{SP} have an identical distribution, or more specifically, have the same variance. Here we introduce a scale parameter to build the relationship, let $U^{SP'}=\theta U^{SP}$, θ represents the ratio of standard deviations of ε_i^{RP} and ε_j^{SP}. Then, we can get:

$$\theta^2=\frac{\mathrm{var}(\varepsilon_i^{RP})}{\mathrm{var}(\varepsilon_J^{SP})}$$

Basing on the Nested Logit (NL) model to estimate the parameters, which was proposed by Bradley an Daly (1992) and Hensher and Bradely (1993), we can get the artificial tree structure:

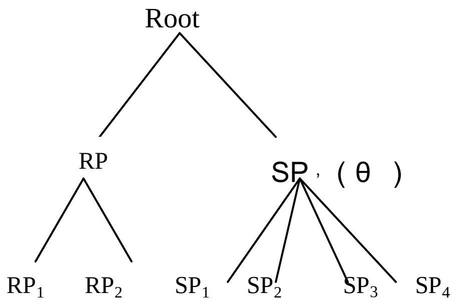

Figure 2: The artificial tree structure

The joint estimation of a choice situation using two types of data involves a choice outcome associated with the RP data and a number of choice outcomes associated with the SP data. This is not a typical discrete choice application where there is only one choice outcome in either an MNL or NL configuration. To allow for this multiple response we "stack" the observations in such a way that for each RP observation there is a null choice set for the SP observation, and for each SP observation there is a null choice set for the equivalent RP observation.

The probability of the alternative i chosen by traveler n in RP data is:

$$p_{in}^{RP} = \frac{\exp(V_{in}^{RP})}{\sum_{i=1}^{2} \exp(V_{in}^{RP})}$$

The probability of the alternative j chosen by traveler n in SP data is:

$$p_{jn}^{SP} = p_{(j|SP')n}^{SP} p_{(SP')n}^{SP} = \frac{\exp(\theta V_{jn}^{SP})}{\sum_{j=1}^{4} \exp(\theta V_{jn}^{SP})}$$

Where, V^{RP}, V^{SP} is respectively the observed part of the RP and SP utility.

Assuming the two data sources come form independent samples, the log likelihood of the combined data is simply the sum of the multinomial log likelihoods of the RP and SP data:

$$\ln L^{RP+SP}\left(\hat{\alpha}_i^{RP}, \hat{\alpha}_j^{SP}, \hat{\beta}, \hat{\chi}, \hat{\delta}, \hat{\gamma}, \theta\right) = \ln L^{RP}\left(\hat{\alpha}_i^{RP}, \hat{\beta}, \hat{\chi}, \hat{\delta}, \hat{\gamma}\right) + \ln L^{SP}\left(\hat{\alpha}_j^{SP}, \hat{\beta}, \hat{\chi}, \hat{\delta}, \hat{\gamma}, \theta\right)$$

where ,

$$\ln L^{RP}\left(\hat{\alpha}_i^{RP}, \hat{\beta}, \hat{\chi}, \hat{\delta}, \hat{\gamma}\right) = \sum_{n \in RP} \sum_{i \in C_n^{RP}} y_{(RP)in} \ln p_{in}^{RP}$$

$$\ln L^{SP}\left(\hat{\alpha}_j^{SP}, \hat{\beta}, \hat{\chi}, \hat{\delta}, \hat{\gamma}, \theta\right) = \sum_{n \in SP} \sum_{j \in C_n^{SP}} y_{(SP)jn} \ln p_{jn}^{SP}$$

Where, $y_{(RP)in} = 1$, $y_{(SP)jn} = 1$ if traveller n chooses alternative i and j, and $y_{(RP)in} = 0$ $y_{(SP)jn} = 0$ otherwise.

To scale the variance of the unobserved effects in the SP component relative to the RP component, we can use a sequential or a simultaneous scaling approach. Because simultaneous estimation of the "nested" structure using the method of full-information maximum likelihood (FIML) is the most efficient approach (Hensher and Bradely, 1993), in this paper, we estimated the parameters with the simultaneous estimation.

With this combined data method, we can exploit the two data’s respective advantages and to overcome their specific limitation to forecast the mode split more correctly on the new network in the further.

The survey and data analysis in Hu-Ning corridor

Survey time: 11~21 Sept.2006. Survey places; the railway and coach terminals in the main cities in Hu-Ning corridor. Survey object: the people who have the inter-urban travel in this corridor. Survey method: random sample. At last, we get: RP 853 observations and SP 853 observations.

Apart these samples into three small samples as the travel distance which are less than 100km，between 100 and 200km ,200 and 300km. Then deal with the data with the NLOGIT software. The results are as below.

Table 1: Estimation results (t-statistics in parentheses)

Distance	<100km		100-200km		200-300km	
	RP	RP+SP	RP	RP+SP	RP	RP+SP
Access/Aggress time	-0.00581 (-3.212)	-0.00625 (-2.213)	-0.00706 (-1.331)	-0.00926 (-1.843)	-0.0093 (-1.632)	-0.00873 (-1.201)
Waiting time	-0.00673 (-4.150)	-0.00713 (-3.140)	-0.01031 (2.216)	-0.01393 (1.765)	-0.01916 (-2.864)	-0.01742 (-0.745)
In-vehicle time	-0.00489 (2.126)	-0.0054 (-1.763)	-0.00908 (-1.556)	-0.01197 (-6.556)	-0.0164 (6.994)	-0.02013 (-11.216)
Total travel cost	-0.00973 (-1.993)	-0.00993 (-2.129)	-0.01535 (-5.639)	-0.02083 (-6.667)	-0.02669 (-3.013)	-0.02586 (-6.001)
ASCs						
Existing Railway RP	-0.2387 (-3.306)	-0.2816 (-1.270)	-0.039 (-3.667)	-0.188 (-3.287)	0.3391 (-2.392)	-0.0279 (1.949)
Existing Railway SP		-0.10368 (-1.027)		-1.748 (-2.131)		-0.1179 (-1.022)
IUR SP		-0.2996 (-1.999)		-0.3252 (1.433)		-03979 (-2.331)
PDL SP		-0.3117 (2.011)		-0.5117 (-1.992)		-0.638 (2.194)
Scale Parameter		0.876		0.92		0.931
Goodness-of-fit						
Log-likelihood at convergence	-338.924	-986.17	-170.63	-817.31	-297.6	-723.6
McFaddens rho-squared	0.208	0.374	0.279	0.3111	0.269	0.331
Value of access/egress time（￥/h）	35.82	37.76	27.59	26.67	20.9	20.25
Value of waiting time（￥/h）	41.5	43.08	40.29	40.12	43.07	40.41
Value of in-vehicle time（￥/h）	30.15	32.62	35.49	34.47	36.86	46.7

THE DEMAND FORECAST IN HU-NING CORRIDOR

In section 3, the main models were explained. Basing on these analyses as well as the detail existing railway OD got from the ticket information in the powerful data base, we forecast the inter-urban public transport demand as the method designed in section2.

The estimation of the inter-urban public transport OD on the existing network

Analyzing the RP data, we can conclude the average travel information when traveling by railway and coach on the existing network.

Table 2: The travel information.

Distance	<100km		100km—200km		200km—300m	
mode	Existing railway	coach	Existing railway	coach	Existing railway	coach
Access time (min)	36.32	30.84	37.6	30.75	47.61	31.28
Access cost (￥)	6.56	6.11	6.32	5.9	7.86	6.32
Waiting time (min)	40.8	20.19	55.8	25.2	63.7	36.4
Egress time (min)	31.6	23.65	36.26	32.29	34.91	27.82
Egress cost（￥）	6.13	5.8	6.51	6.3	6.9	5.9

The ticket cost and travel time can be got from the railway and coach operation information. Then bring this information as well as the travel information in table 2 into the utility functions of the RP data, with the Logit model to forecast the mode split on the existing network. Then, the inter-urban public transport OD are estimated.

Table 3: The railway share on the existing network (%)

	Nanjing	Zhenjiang	Changzhou	Wuxi	Suzhou	Shanghai
Nanjing		40.49	44.24	43.89	51.06	53.26
Zhenjiang	40.49		40.96	44.09	45.35	49.82
Changzhou	44.24	40.96		40.96	41.05	45.33
Wuxi	43.89	44.09	40.96		41.68	46.72
Suzhou	51.06	45.35	41.05	41.68		41.91
Shanghai	53.26	49.82	45.33	46.72	41.91	

Table 4: The inter-urban public transport OD on the existing network（million）

	Nanjing	Zhenjiang	Changzhou	Wuxi	Suzhou	Shanghai	P_i
Nanjing		241.46	262.13	240.86	259.92	566.67	1571.03
Zhenjiang	221.31		116.13	77.39	108.19	165.14	688.16
Changzhou	244.26	111.23		167.18	245.92	398.83	1167.43
Wuxi	222.67	73.99	179.03		395.38	720.57	1591.64
Suzhou	279.82	103.34	240.82	405.10		1667.86	2696.94
Shanghai	619.51	174.98	409.56	726.11	1703.19		3633.33
A_j	1587.57	704.99	1207.68	1616.63	2712.60	3519.07	11348.53

Trip-generation forecasting

Compared with several trip-generation models, we found the regression model with the GDP and population is the fitness one for forecasting the traffic of production and absorption. The models are as below:

$$P_i = 952.576 - 1.386x_i + 0.519y_i \qquad R^2 = 0.958$$
$$A_i = 1032.795 - 1.503x_i + 0.516y_i \qquad R^2 = 0.936$$

Where, Pi, Ai, xi and yi means the producing traffic, absorbing traffic, populations (million) and GDP (0.1 billion ￥) respectively of the city i.

Traffic-distribution forecasting

A gravity model, with producing and absorbing trips as the attraction factors and average generalized cost as the impeding factors, was used to forecast the traffic-distribution.

$$q_{ij} = K_i K_j \frac{P_i A_j}{R_{ij}^r}$$
$$K_i = (\sum_j K_j A_j R_{ij}^{-r})^{-1} \qquad \text{(i=1,}\cdots\text{,n)}$$
$$K_j = (\sum_i K_i P_i R_{ij}^{-r})^{-1} \qquad \text{(j=1,}\cdots\text{,n)}$$

Where, q_{ij} is the traffic from i to j, P_i is the producing traffic in i, A_j is the absorbing traffic in j, K_i, K_j is respectively the restrictive parameter, R_{ij} is the average generalized cost from i to j, r is the parameter that should be calculated.

$$R_{ij} = \sum_k P_{ijk} R_{ijk}$$
$$R_{ijk} = c_{ijk} + vot^{out} t_{ijk}^{out} + vot^{wt} t_{ijk}^{wt} + vot^{invt} t_{ijk}^{invt}$$

Where, R_{ijk} is the generalized cost from i to j when choosing the mode k; P_{ijk} is the probability of choosing mode k; c_{ijk} is the whole trip cost of choosing mode k; $t_{ijk}^{out}, t_{ijk}^{wt}, t_{ijk}^{invt}$ is respectively the access time, waiting time and egress time of choosing mode k; $vot^{out}, vot^{wt}, vot^{invt}$ is respectively the value of access/egress time, waiting time and in-vehicle time. When calculating the parameters of the gravity model with the actual traffic-distribution, put the various value of time got from the RP utility function into the average generalized cost model. While when forecasting the traffic-distribution in the future, put the various value of time got from the combined RP/SP utility function into the average generalized cost model.

The gravity model calculated with the actual OD is:

$$q_{ij} = K_i K_j \frac{P_i A_j}{R_{ij}^{1.1}}$$

K_i=0.03811, 0.02372, 0.02111, 0.02018, 0.02121, 0.03963
K_j=1.40685, 0.87699, 0.77722, 0.74295, 0.77762, 1.48031

From the planning of the two high-speed railways, they will be operated in 2015. So, we will forecast the trip-distribution of Hu-Ning corridor in 2015. Bring the forecast GDP and population of these six cities into the gravity model, then the traffic-distribution is as below.

Table 5: The inter-urban public transport OD in 2015

	Nanjing	Zhenjiang	Changzhou	Wuxi	Suzhou	Shanghai	P_i
Nanjing	0	518.2	336.5	478.5	469.7	2158	3960.9
Zhenjiang	508.5	0	187.3	216.3	209.1	925.7	2046.9
Changzhou	333.3	189	0	371.8	352.7	1336.9	2583.7
Wuxi	480.6	221.4	377	0	740.4	2631	4450.4
Suzhou	474.5	215.3	359.8	744.7	0	4177.9	5972.2
Shanghai	2180	953.2	1363.6	2646.1	4177.5	0	11320.4
A_j	3976.9	2097.1	2624.2	4457.4	5949.4	11229.5	30334.5

The mode-split forecasting

The combined RP/SP Logit model was used to forecast the mode split on the new network. From the travel information in table 2, we can see the frequencies and the connection with the city traffic system of the coach are better than the existing railway, reflected as the traveller's access/egress time and the waiting time are less than the railway's. As the PDL and IUR are the high grade railways, when forecasting the mode split on the new network, supposing the frequencies and the connections are between the existing railway and coach, that is the access/egress time and the waiting time of the two high-speed railways are the average value of the existing railway and coach. Thinking about the coach speed is obviously slow down when it drives into the city, suppose it's average speed is 85km/h in the future. And the existing railway is mainly for the small station's requirement along the line, put this influence factor into the future environment. The ticket cost and the travel time of the PDL and the IUR are from the designed papers, "the ratio ticket cost of the PDL is 0.5￥/pkm, and the speed is 300km/h", "the ratio ticket cost of the IUR is 0.4￥/pkm, and the speed is 200km/h". And also supposing the station sustaining time of the two high-speed railways are 2 minutes.

Table 6: The PDL shares on the new network（%）

	Nanjing	Zhenjiang	Changzhou	Wuxi	Suzhou	Shanghai
Nanjing		24.78	24.72	23.74	29.95	29.76
Zhenjiang	24.78		24.26	24.33	24.47	27.09
Changzhou	24.72	24.26		25.05	24.95	21.16
Wuxi	23.74	24.33	25.05		25.01	21.90
Suzhou	29.95	24.47	24.95	25.01		24.17
Shanghai	29.76	27.09	21.16	21.90	24.17	

Table 7: The IUR shares on the new network（%）

	Nanjing	Zhenjiang	Changzhou	Wuxi	Suzhou	Shanghai
Nanjing		25.74	33.45	33.61	43.73	45.05
Zhenjiang	25.74		25.40	32.78	34.29	40.01
Changzhou	33.45	25.40		25.93	26.35	29.69
Wuxi	33.61	32.78	25.93		25.83	29.36
Suzhou	43.73	34.29	26.35	25.83		25.33
Shanghai	45.05	40.01	29.69	29.36	25.33	

Table 8: The existing railway shares on the new network（%）

	Nanjing	Zhenjiang	Changzhou	Wuxi	Suzhou	Shanghai
Nanjing		19.52	14.53	14.85	8.50	7.99
Zhenjiang	19.52		20.10	15.40	15.05	10.73
Changzhou	14.53	20.10		19.57	18.72	18.18
Wuxi	14.85	15.40	19.57		20.03	19.10
Suzhou	8.50	15.05	18.72	20.03		20.64
Shanghai	7.99	10.73	18.18	19.10	20.64	

Table 9: The coach shares on the new network（%）

	Nanjing	Zhenjiang	Changzhou	Wuxi	Suzhou	Shanghai
Nanjing		29.96	27.30	27.80	17.82	17.20
Zhenjiang	29.96		30.24	27.50	26.19	22.17
Changzho	27.30	30.24		29.45	29.98	30.97
Wuxi	27.80	27.50	29.45		29.13	29.63
Suzhou	17.82	26.19	29.98	29.13		29.85
Shangha	17.20	22.17	30.97	29.63	29.85	

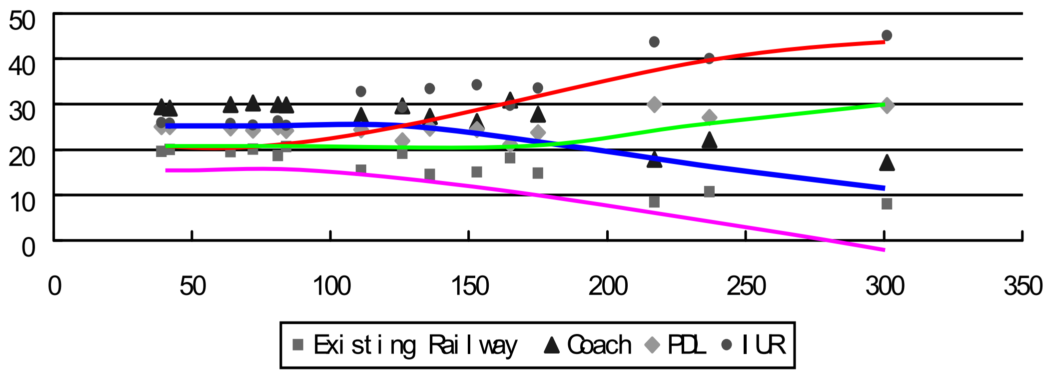

Figure 3: The mode share with the travel distance

From the fig3 mode share with the travel distance, we can see clearly, in the short distance travel (<100km), the travel time of all the inter-urban public transports are less than 1 hour. The in-vehicle time is not the key factor that influences the choice outcome. People have a more preference for a mode that has a better connection with the city transport system and high density frequencies. The coach covering the biggest share within this travel distance reflects this phenomenon.

Along with increasing of the travel distance, people put more and more preference on the inter-urban mode speed. So, the advantages of the high speed rail-ways begin to turn up. The value of the in-vehicle time increasing with the travel distance just reflects that. Especially the IUR, plus a proper ticket cost, will cover the biggest share. However, the share of the coach and existing railway is descending with the travel distance increasing. Especially the existing railway, when the travel distance up to 300km, the share is down to 8%, which shows that most people turn to the high-speed railways.

CONCLUSION

Recently, for the high-speed railway demand forecast, our country mostly uses the 4-steps method. But the OD information is achieved by travel survey of the whole society, which cost huge and hard to be updated. Based on the railways database, this paper designs a comparatively low-cost method to forecast the travel demand. Making RP survey in this corridor, with the Logit model and the existing railway OD to estimate the inter-urban public transport OD; forecasting the trip-generations and traffic-distributions with the suitable models; making SP survey and using the combined RP/SP model to estimate the mode split on the new network. Then the travel demand can be forecast. The analysis in section 4 proves the demand method designed in this paper is feasible and gives us some travel features in this corridor, which are in the short travel distance people prefer to choose an inter-urban transport that has a better connection with the city transport system and high density frequencies, while with the travel distance increasing, more preference turns to the transport speed and the high-speed railways begin to turn up.

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