TOLL DIVERSION RATES FOR PROPOSED CHINESE TOLL HIGHWAYS

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Abstract: The development of toll highway systems in China reflects the country's recent rapid economic growth. The core component of the major highway investment program is the National Trunk Highway System, a 35,000 km network of high-grade highways, due to be completed by 2015. However, it is noted that the actual traffic volume one or two years after opening to traffic was much lower than those forecast at appraisal. Data on the actual traffic volumes on the existing roads and the newly completed expressways were collected and observed diversion rates were then compared with those estimated in the feasibility study report. The relationship between the v/c ratio on the existing roads and the expected diversion rates was established. A new methodology of determining the expected diversion rates based on this relationship is proposed for application in Chinese feasibility studies.

Key Words: Toll highway, Transportation demand modeling, Highway network, Traffic assignment, Toll diversion

1. INTRODUCTION

China has historically under-invested in roads; its road network still ranks among the sparest in the world relative to its geographical area and population. China's road network today is about 1.3 million km, with some 12,000 km of expressways and some 20,000 km of other high-grade highways in operation. In recent years, governments at all levels have embarked on major highway investment programs. The core of this program is the National Trunk Highway System, a 35,000 km network of high-grade highways with an estimated cost of US$ 150 billion, connecting China's 100 major cities. The target completion date for this program is 2015. The first four corridors and three important road sections, totaling some 17,000 km will be completed by 2003 (World Bank (2000), China: Guangxi Highway Project, Project Appraisal Document).

Since 1985, the World Bank (Bank) has implemented or is implementing 24 highway projects, with 11 projects completed, 9 projects under implementation and 4 new projects under preparation. On some recently opened new toll highways, the actual traffic volume is substantially lower than expected. For instance, in one feasibility study it was estimated that about 78% of traffic on the existing road would divert to the new expressway once opened to traffic, but actually only 30% of the corridor traffic diverted to the expressway (World Bank (2000), China: Zhejiang Provincial Highway Project, Implementation Completion Report).

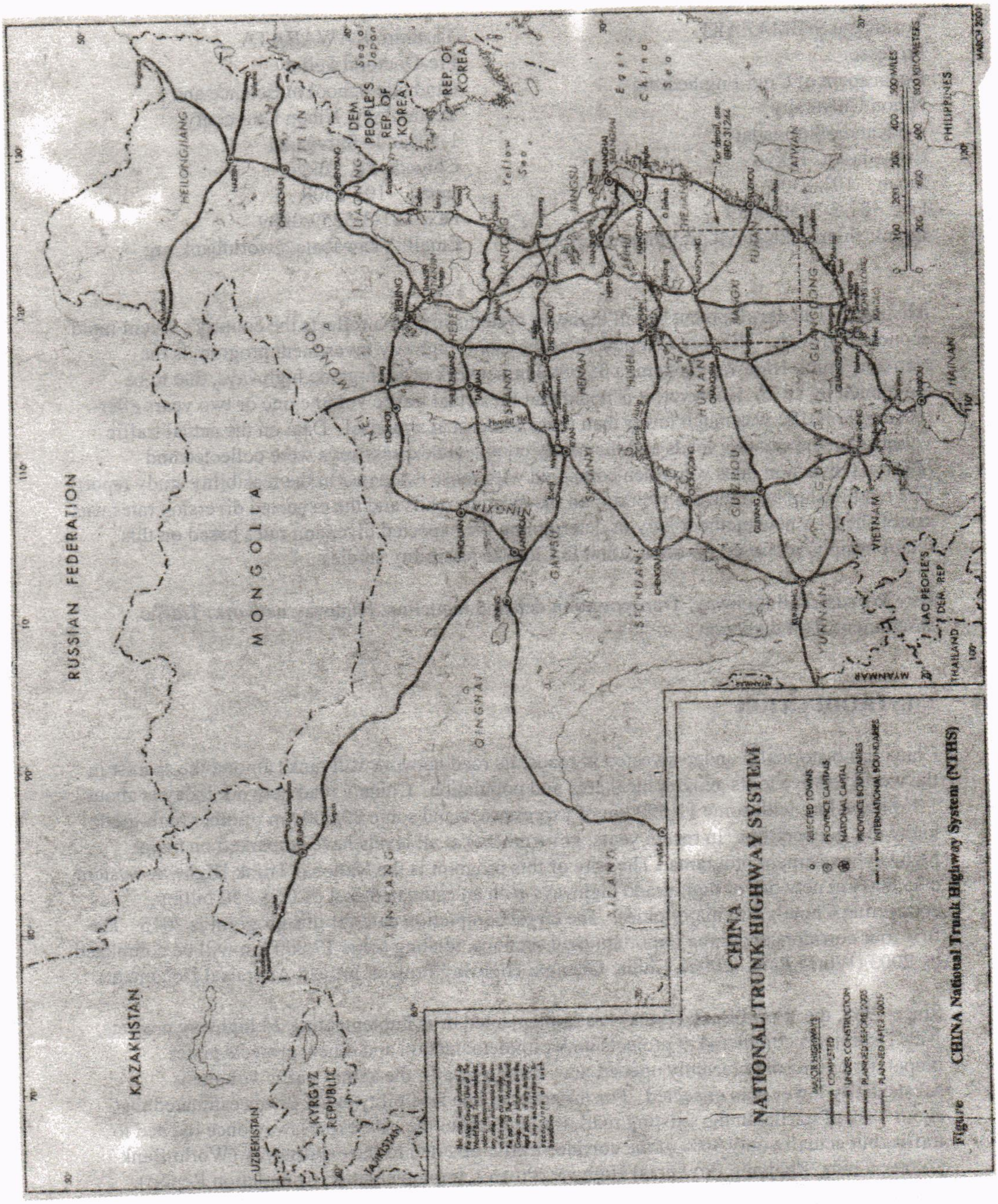

Figure CHINA National Trunk Highway System (NTHS)

Current Chinese policy regarding development of toll roads is that if a new highway is being financed by loans, then tolls should be collected from users. The existing procedure for the determination of toll rates begins with calculation of the toll rate, which would fully recover all capital, interest, and operating costs of the highway given the traffic projections. This rate is very high and unrealistic to implement. An alternative method which is frequently used is to determine the toll rate based on a value equal to 30 – 50% of vehicle operating benefits of road users. As far as the highway projects with the foreign loan are concerned, the purpose of toll is to repay the bank loan (about 40% of the project cost), instead of maximizing the financial rate of return on the investment. The proposed toll rates evaluated by the Provincial Communications Departments (PCDs) are submitted to the Provincial Price Bureau. The Price Bureau can then accept or reject the suggested toll rates or establish another rates. The Price Bureau has full final authority on the establishment of toll rates.

Based on the experience of recently completed toll highways, it is clear that an appropriate level of toll rate under varying traffic conditions and perception of potential users needs to be urgently established.

Deficiency in the current evaluation of a toll highway in Chinese feasibility studies is that the impact of the level of tolls on the traffic forecasts is not given full and proper consideration. There appears to be an overly-optimistic expectation on the diversion of traffic from the existing roads to the proposed toll highways. Generally, in a feasibility study, it is simply assumed without the detailed analysis that about 60-80% of traffic on the existing roads diverts once the proposed toll highway is open to traffic. However, actually much lower traffic than expected diverts to the toll highway. The sensitivity of traffic demand to the application of alternative levels of toll charges needs to be addressed more seriously. A recommended approach to determine the toll road traffic diversion in a feasibility study is discussed hereinafter.

2. EXISTING TOLL RATES AND TRAFFIC USAGE

2. 1 Existing Toll Rates

The financial objectives of the toll highway operator, and the economic objectives of the government are often in conflict, with respect to the imposition of tolls. The higher the toll rate is, the higher the financial results of the project, up to the point of revenue maximization. However, the economic results are often reduced, as benefits are attributed to less traffic using the toll highway. Traffic congestion on the existing road usually will increase with a higher toll rate. Thus, it is essential to determine the level of toll rates, which would maintain traffic volumes at a level sufficient to generate an acceptable economic rate of return, and yet provide an adequate financial result.

A wide range of toll rates is used on the Chinese highways. Some examples of toll rates now in effect are shown in Table 1.

Table 1. Toll Rates on Expressways in China

Location of Toll Road	Toll Rate (RMB/km) as of May 1999	GNP per Capita (RMB) in 1999
Hebei Province		4,338
Shijiazhuang - Anyang: 216 km	0.28	
Henan Province		3,224
Anyang – Xinxiang: 124 km	0.28	
Shaanxi Province		2,781
Weinandong – Huayin: 53 km	0.47	
Huayin – Baijia: 30 km	0.50	
Shanghai City		16,821
Songjiang – Fengjing: 28 km	0.60	
Xinjiang Region		4,723
Turpan – Urumqi: 176 km	0.24	
Zhejiang Province		7,910
Fengjing – Hangzhou: 102 km	0.45	
Hangzhou – Ningbo: 138 km	0.45	

Source: World Bank's internal reports
Note: 1RMB = US $ 0.12

Toll rates for a small car range from RMB 0.24/km to RMB 0.6/km. The highest toll rate is found in the Songjiang – Fenjing section (in Shanghai) of the Shanghai – Hangzhou Expressway, while the lowest in the Turpan – Urumqi Highway in Xinjiang. The average toll rate for a small car for selected roads is about Chinese RMB 0.41 per vehicle-kilometer, which is equivalent to about US$ 0.05 per vehicle-kilometer. The toll rate for the Dulles Greenway in Virginia, USA is also about US$ 0.05 per vehicle-kilometer (in 1999). Considering the difference in GNP per capita (1999) in the two countries, US$ 30,600 in the United States compared with US$ 780 in China, it is difficult for the Chinese road users to bear a same rate of toll as the United States.

Table 1 indicates the economic status of each province (in terms of GNP per capita), one indicator of the income elasticity of demand. Even though the economic power in Zhejiang is about 3 times greater that that of Shaanxi, the level of tolls charged to small cars in Zhejiang is slightly lower than those in Shaanxi. Shanghai's economic power is larger than Shaanxi by six times, but the toll rate for small cars in Shanghai is only about 20 % higher than that in Shaanxi. The current toll rates in China do not reflect the price/income elasticity of demand in each province. An appropriate level of toll tariff under varying traffic conditions and perception of potential users need to be urgently established.

2.2 Traffic Usage

Statistics show that traffic volumes (corridor total) during the first year of operation of seven selected expressways have so far fallen below projections (average by about 23%), varying between minus 57% for the Turpan-Urumqi Highway and plus 7% for the Hangzhou – Ningbo Highway for individual expressway section (see Table 2).

Table 2 Estimated and Actual Diversion Rates in the First Opreational Year

Expressway	Section	Estimated Traffic Volume veh./day Existing Road	Estimated Traffic Volume veh./day Expressway	Estimated Diversion Rate (%)	Actual Traffic Volume veh./day Existing Road	Actual Traffic Volume veh./day Expressway	Actual Diversion Rate (%)	Difference Traffic Volume (Corridor Total)	Remarks
Shijiazhuang – Xinxiang (Hebei)	Shijiazhuang – Yuanshi	9,050 pcu	25,260	74	17,400	8,400	33	less 25 %	Opening 1997,1998 Data
	Yuanshi – Xingtai	9,540	22,260	70	17,400	7,300	30	less 22 %	
	Xingtai – Matou	10,740	23,350	68	17,400	8,000	31	less 25 %	
	Matou – Border	7,790	21,300	73	17,400	5,700	25	less 21 %	
Shijiazhuang -Xinxiang (Henan)	Hebei Border – Tangyin 55.0km	9,600 pcu	26,000	73	14,000	6,800	33	less 42 %	Opening 1997,1998 Data
	Tangyin – Xinxiang 67.0km	8,100	24,850	75	15,000	5,900	28	less 37 %	
Weinan-Tongguan (Shaanxi)	Chengjia – Huayin 47.8km	2,840 mte	6,350	69	1,270	6,750	84	less 13 %	Opening 10/1/99 10/1999 – 4/2000 Data
	Huayin – Baijia 36.7km	2,270	4,600	67	1,000	4,920	83	less 14 %	
Turpan-Urumqi (Xinjiang)	Turpan – Begining Mountainous Section 66.4km	1,900 mte	4,400	70	2,400	1,400	37	less 40 %	Opening 8/20/98 1999 Data
	Mountainous Section 28.0km	3,700	6,000	62	NA	NA	NA	NA	
	End of Mountainous Sec.–Fertilizer Plant 62.4km	3,700	6,000	62	2,700	1,600	37	less 56 %	
	Fertilizer Plant – Wulapo 19.5km	3,800	12,000	76	3,800	3,000	44	less 57 %	
Shanghai-Hangzhou (Shanghai)	Fengjing – Songjiang 27.0km	24,100 pcu	27,000	53	27,900	16,100	37	less 14 %	Opening 12/1998 1999 Data
Shanghai-Hangzhou (Zhejiang)	Yuhan – Fengjing 85.0km	27,500 pcu	23,100	46	27,500	26,500	49	plus 7 %	Opening 12/1998 1999 Data
Hangzhou-Ningbo (Zhejiang)	Xiaoshan – Shaoxing 35.3km	10,400 pcu	25,800	71	20,400	17,900	47	plus 6 %	Opening 12/1995 1997 Data
	Shaoxing – Shangyu 29.4km	9,100	24,000	73	15,400	13,900	47	less 11 %	
	Shangyu – Yuyao – Ningbo 72.3km	4,600	16,400	78	14,500	6,300	30	plus 1 %	
Average				***68.1***			***42.2***	***less 22.7%***	

Source: World Bank's Staff Appraisal Reports listed in references and internal documents.
Note: Diversion Rate = Traffic volume on expressway/that along the corridor (Existing road + Expressway)

Except for a few expressway sections, the traffic volume on the expressway was much lower than forecast at the project preparation stage (feasibility study stage). For example, for the Shanghai - Hangzhou Expressway, projected volumes in 1999 for the Fengjing - Songjing section and the Yuhang – Fengjing section were 27,000 and 23,100 vehicles per day, respectively. However, actual volumes in these two sections amounted to only 16,100 and 18,900 vehicles per day. These results indicate that in the opening year, only 60 % and 82 % of the projected traffic was materialized for the Fengjing – Songjing section and for the Yuhang – Fengjing section, respectively.

3. TOLL DIVERSION MODEL ESTABLISHED

In current toll road feasibility studies in China, the sensitivity of traffic demand to the application of toll charges is not properly assessed. It is well known that road user's negative perceptions of toll rates deter him from using toll roads and this results in lower traffic volumes than those evaluated in the economic evaluation (with no tolls). Experience in other countries indicates that traffic diversion impact from tolls varies by type of road, depending on numerous factors, including the following:

- Standard and quality of the existing road(s)
- Existing and future traffic volumes and degree of congestion
- Length of new project, and location of interchange access points along the project (i.e. affecting accessibility to the project road)
- Travel distance of road users

In order to estimate the traffic/toll rate sensitivity, it is important to understand the limit of acceptability of toll rates, from the perspective of road users. A logit-based toll traffic diversion model was developed based on an extensive survey of driver route choice behavior on the recently completed toll roads in China. An established diversion model is used to estimate the distribution of traffic between the toll road and other existing roads where a toll road is being modeled. The probability of diversion to the toll road is estimated by the following model: (PPK et al, 1998)

$$\% \text{ Diversion} = \frac{1}{1+e^{(a+b(T_{toll}-T_{free})+cxC_{Toll})}} \tag{1}$$

where:

T_{Toll} = the travel time on the toll road (project road);
T_{Free} = the travel time on the other road;
C_{Toll} = the average toll on the toll road; and
a = - 1.2477
b = 0.09991
c = 0.02079

Note: The a, b, and c parameters were calibrated using data obtained from field surveys conducted in Hebei and Henan provinces in China.

This diversion model can apply to an *aggregate* vehicle fleet in a specific province and it can be thus adequate as an initial guide for transport planning purposes. (PPK et al, 1995) However, specific models need to be further developed for different classes of vehicles, type of commodities transported or trip purposes, taking local characteristics into account.

It is very difficult for the Chinese planners to apply the newly developed diversion probability model in an actual feasibility study work because of the following reasons:

1. The developed model is only applicable to the hourly traffic condition, while in a feasibility study, an analysis is made on the daily traffic volume basis;
2. The Speed-Flow curves currently available in China are shown as a function of free-flow speed (km/hr) and degree of saturation (traffic volume divided by capacity); and
3. Reliable important information on the traffic characteristics (i.e. peak-hour factor, directional split rate, composition of vehicle fleet, and highway capacity of each road section) is not easily available. This information is required to convert the hourly traffic volume to the daily traffic volume and to undertake the diversion analysis on the daily traffic flow basis.

4. DIVERSION RATES ON THE SELECTED EXPRESSWAYS

In China, diversion rates to be used for the traffic forecasting and economic analysis are assumed without the detailed analysis. The diversion rates used for the feasibility analysis were collected from the World Bank's Staff Appraisal Reports for each of the selected highway projects (see Table 2). The average assumed diversion rate (for the first operational year) of the selected expressways was about 68% ranging between 46% and 78%, while the corresponding actual diversion rate was about 42% ranging between 25% and 84%. These results clearly indicate that the diversion to the newly completed expressways did not take place as anticipated, thus resulting in reduced economic benefits of new road construction. There are several reasons for these low diversion rates. The most critical one is that the toll rate itself is too high, which is on the same level as those in the United States. With diversion of some traffic to a toll highway, traffic volume on the existing roads was reduced and resulted in less congestion on the existing road. Also, a number of institutional problems generally discourage vehicles from travelling via a toll expressway. These includes: i) traffic control and penalties on the toll road are perceived as overly severe; and ii) buses and trucks cannot pick up and unload passengers or load and unload their freight on the expressways.

Consequently, while a vehicle can travel on the existing road with a reasonably comfortable speed, drivers tend to remain on the existing roads without paying tolls. It is noted that most drivers are still much more sensitive to the out-of-pocket toll charges than any perceived benefits in terms of savings in travel time and operating costs.

5. RELATIONSHIP BETWEEN DIVERSION RATE AND CONGESTION

As discussed above, it is noted that in China the income elasticity of demand is not necessarily the only factor related to the diversion rates of traffic from the existing road to a toll highway.

Another factor, congestion on the existing road was analyzed how it is related to the diversion of traffic from the existing road to a toll highway.

It is essential that more studies be undertaken in a society where toll highways are a new phenomenon, which would estimate the level of toll rate, which is deemed to be "acceptable" by road users. In China, road users still feel uncomfortable or unwilling for paying a toll for the benefits enjoyed. Thus, while drivers can travel with a reasonable speed on the existing road, they tend to stay on the existing road.

Prediction of diversion rates resulting from an increase in congestion degree on the existing roads needs to be studied for traffic planning and feasibility studies. Congestion degree on the existing road is a function of speed and thus it can indirectly represent the relationship between the travel time saving and the probability of diversion. The relationship between the diversion rate and congestion (degree of saturation) on the existing road was analyzed and developed as follows:

- analysis on the highway capacity of each class of roads (design daily capacity), see Table 3. (Swedish National Road Consulting AB et al, 1999)

- calculation of the degree of saturation (DS), defined as the ratio of flow to capacity, using the pre-determined capacities of each road class and the actual daily traffic volume observed on the existing road

- analysis of diversion rates as a function of saturation degree on the existing road, see Table 4.

- establishment of a relationship between the diversion rate and the saturation degree on the existing road, see Figure 1.

Given this information as well as other assumptions, the diversion – saturation degree relationship was established using the actually observed data on the selected highway sections. Due to unique reasons for some highways, a clear relationship between the diversion rate and the degree of saturation (DS), which can be expressed by a mathematical equation was not confirmed. However, the following observations are made:

i) Once the expressway is open to traffic, at least 25% of the corridor traffic diverts to a new expressway;

ii) Regardless the degree of saturation (DS), the diversion rate to the expressway ranges between 30 and 50% with an average rate of about 40%. Since expressways were newly opened (with one to two years operation) both an existing road and an expressway have sufficient capacity to accommodate traffic volume, even with a small percentage of diverted traffic to an expressways; and

iii) Even though the diversion continues to take place, at least 15% of traffic still remains on the existing road.

Table 3 Estimated Standard Unit Road Capacity by Road Class and by terrain

Road Class/Terrain	Design Speed (km/h)	Lane Width (m)	Shoulder Width (m)	Hourly Capacity (MTE/Hour/Lane)(1)	Daily Capacity (MTE/Day)(2)	Design Daily Capacity (MTE/Day)(3)
Expressway (4-lane)						
Flat/Rolling	120/100	3.75	3.25/3.00	1,000	41,700	31,200
Hilly/Mountainous	80/60	3.75/3.50	2.75/2.50	950	39,600	29,700
Class I Hwy (4-lane)						
Flat/Rolling	100	3.75	3.00	810	33,750	25,300
Mountainous	60	3.50	2.50	720	30,000	22,500
Class II Hwy						
Flat/Rolling	80	4.50	1.50	1,300	16,250	12,450
Mountainous	40	3.50	0.75	1,050	13,120	10,200
Class III Hwy						
Flat/Rolling	60	3.50	0.75	1,100	13,750	10,500
Mountainous	30	3.00	0.75	960	12,000	9,200

(1) For class II, and III roads, this is the directional capacity.
(2) K=8%, D=60%.
(3) Design Daily Capacity was estimated taking into account the service level (0.75).

Note: Flat/rolling terrain assumed to comprise average gradients up to 2%. Hilly/mountainous terrain roads assumed to have average gradients of over 2%.

Table 4 Diversion Rates in relation to D/S

Expressway	Section	Actual Corridor Traffic Volume (in MTE)	Diversion Rate (%)	D/S Existing Roads (%)	Type of Existing Roads
Shijiazhuang – Xinxiang (Hebei)	Shijiazhuang – Yuanshi	12,900	33	34	Class I
	Yuanshi – Xingtai	12,350	30	34	
	Xingtai – Matou	12,700	31	34	
	Matou – Border	11,550	25	34	
Shijiazhuang [1)]–Xinxiang (Henan)	Hebei Border – Tangyin	10,400	33	56	Class II
	Tangyin – Xinxiang	10,450	28	60	Class II
Weinan –Tongguan (Shaanxi)	Chengjia – Huayin	8,020	84	10	Class II
	Huayin – Baijia	5,550	83	8	Class II
Turpan – Urumqi (Xinjiang)	Turpan – Begining Mountainous Section	3,800	37	19	Class II
	Mountainous Section	NA	NA	NA	Class III
	End of Mountainous Sec.–Fertilizer Plant	4,300	37	22	Class II
	Fertilizer Plant – Wulapo	6,800	44	30	Class II
Shanghai –Hangzhou (Shanghai)	Fengjing – Songjiang	22,000	37	55	Class I
Shanghai –Hangzhou (Zhejiang)	Yuhan – Fengjing	27,000	49	81	Class I
Hangzhou –Ningbo (Zhejiang)	Xiaoshan – Shaoxing	19,150	47	40	Class II
	Shaoxing – Shangyu	14,650	47	62	Class II
	Shangyu – Yuyao – Ningbo	10,400	30	58	Class II

Note: Diversion Rate = Traffic volume on expressway/ that along the corridor (Existing road + Expressway)

D/S = Degree of saturation

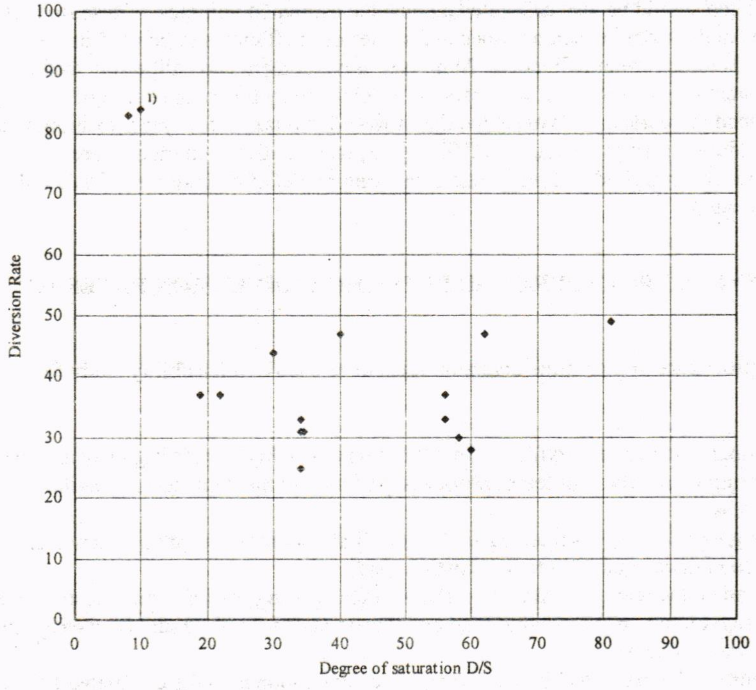

Figure 1 Diversion Rate as a Function of D/S on Existing Road

Note: These two high diversion rates were observed on the Weinan-Tongguan Expressway in Shaanxi Province. It is reported that high diversion was caused by strict enforcement of traffic regulations on the existing roads by traffic police and highway administrators, right after the expressway was opened to traffic. Thus, this should be considered as an exceptional case.

6. DIVERSION RATES CURRENTLY USED IN CHAINESE FEASIBILITY STUDIES

In a feasibility analysis in China, the following procedure is currently used in assigning the traffic volume. Firstly, the total traffic volume along the proposed corridor (both expressway and existing roads) is estimated. Secondly, some certain percentage (60 – 80%) of corridor traffic is assigned to a new expressway without detailed analysis on the impact of toll charges. The assumed diversion rate is high from the first operational year, and adjustment of diversion rates for future years is seldom done.

There are some analytical techniques available, which can be used in China, which enables to quantify the effect of a toll rate on the volume of traffic projected for a new expressway. However, it is still not clear how these can best apply to each province in China. In order to develop more practical diversion models, more surveys on driver's route choice behaviors need to be undertaken. The results of the actual behavior of drivers on the corridor when a toll highway was completed should be also calibrated against the estimated volumes. These surveys and works should be undertaken in each province and values of coefficients to be used in the diversion model needs to be further calibrated. Moreover, development and calibration technique need to be disseminated to each province, and training for planners, who are in charge of highway planning need to be done. It is expected that it would still take a few years to strengthen relevant institutes and train staff in charge. Until the more practical diversion models are developed, the following simplified and pragmatic estimating model of diversion rates to a toll highway is recommended.

7. A RECOMMNENDED PROCEDURE FOR DETERMING DIVERSION RATES TO BE USED.

The recommended procedure to determine diversion rates to be used in a feasibility study for China is as follows:

1. Estimate the corridor traffic volume (both on a new high-grade highway and the existing roads) through the network assignment and the demand forecasting process.
2. Assign 30% of the corridor traffic (for the first operational year) to a new high-grade highway and 70% to the existing road.
3. Calculate the degree of saturation (DS) on the existing road(s) using the assigned traffic volume on the existing road and the estimated standard unit road capacity (refer to Table 3).
4. Compute the expected diversion rate, which corresponds to the calculated DS on Figure 1 – Diversion Rate as a Function of D/S on Existing Road. (For example, when DS is 40%, the expected diversion rate to the proposed high-grade highway would be about 35%.)
5. Assign the corridor traffic to the high-grade highway and the existing road by using the expected diversion rate (the rate estimated in the above Step 4).
6. Repeat steps 3 and 4 above, and confirm that the estimated diversion rate is more or less the same as the estimated diversion rate. In principle, the diversion rate for the first operational year should not be more than 50 %.
7. Estimate future diversion rates by applying the estimated traffic growth rates for the corridor (increase diversion rates taking into account the traffic growth). However, the maximum allowable diversion rate should not be more than 80%.

The recommended procedure could be applied only to the intercity highway links, for which surveys on driver choice behavior have not been conducted.

8. CONCLUSION

The recommended procedure to determine diversion rates should be used until a logit-based toll diversion model is developed in China. Toll highways, which were selected for studies, were opened to traffic in 1997-1999, and thus have only a few-year operation experience. With an additional few-year operation experience, a logit-based toll diversion model could be developed using the accumulated traffic data along the corridor for each province. Further studies should also be done on driver choice behavior on the corridors where both a toll road and an existing parallel road exist in each province. Each toll road has different toll rates charged and thus impact of alternative levels of toll charges to traffic demand can be also analyzed. Furthermore, concept of value of time will gradually change as the Chinese economy grows, and soon the diversion models developed in industrial countries could be applied in China without major modification on the models.

REFERENCES

1) PPK *et al*, (1995), **Draft Final Report for the Study of Prioritization of Highway Investment and Improving Feasibility Study Methodologies**, World Bank, Washington, D.C.

2) PPK *et al*, (1998), **Draft Final Report for the National Highway Investment Study**, World Bank, Washington, D.C.

3) Swedish National Road Consulting AB *et al*, (1999), **Final Report for the Highway Capacity Study**, Hebei and Henan Provincial Communications Departments, Shijiazhuang/Zhengzhou, China

4) World Bank, (1992), **China: Zhejiang Provincial Highway Project, Staff Appraisal Report #10335-CHA**, China and Mongolia Department, East Asia and Pacific Region, World Bank, Washington, D.C.

5) World Bank, (1994), **China: National Highway Project, Staff Appraisal Report #12552-CHA**, Country Department II, East Asia and Pacific Region, World Bank, Washington, D.C.

6) World Bank, (1994), **China: Xinjiang Highway Project, Staff Appraisal Report #12833-CHA**, Country Department II, East Asia and Pacific Region, World Bank, Washington, D.C.

7) World Bank, (1995), **China: Shanghai-Zhejaing Highway Project, Staff Appraisal Report #14034-CHA**, China and Mongolian Department, World Bank, Washington, D.C.

8) World Bank, (1996), **China: Second Shaanxi Highway Project, Staff Appraisal Report #15160-CHA**, China and Mongolian Department, World Bank, Washington, D.C.

9) World Bank, (2000), **China: Zhejiang Provincial Highway Project, Implementation Completion Report #20921**, Transport Sector Unit, East Asia and Pacific Region, World Bank, Washington, D.C.

10) World Bank, (2000), **China: Guangxi Highway Project, Project Appraisal Document #19971-CHA**, Transport Sector Unit, East Asia and Pacific Region, World Bank, Washington, D.C.