Contrastive Analysis for Vehicle Toll Collection Burdens between Hainan Province and Other Provinces

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Abstract. For two collection ways, i.e., toll surcharge of vehicles in Hainan Province and post collection in other provinces, the actual toll burdens formed by minibuses, service coaches, service trucks and other different vehicle types are subject to quantitative comparison.

Vehicle Toll Collection Mode in Hainan Province

Unlike post collection in other provinces, Hainan Province is the sole province without highway toll station card, and the reform on “putting the pedal to the metal” is always deemed as the major achievement and one highlight of the reform on Hainan Special Economic Zone. From 1993, Hainan Province integrated road maintenance expense, road toll, bridge toll and highway transportation management fee into “four-in-one”, and uniformly collected the fuel surcharge. After national fuel tax reform in 2008, Hainan Province started to collect vehicle toll surcharge, and the collection mode was: the toll surcharge of gasoline vehicles is collected from the out-of-the-money gasoline sales section, the diesel vehicle toll surcharge is collected for the vehicle, with the charging tonnage metered according to the approved collection standards and collected according to the collection standards, which is remarkably reduced, compared with the original fuel surcharge standards. The prevailing motor vehicle toll surcharge collection standard in Hainan Province is CNY 1.05/L for gasoline, and CNY 220/t month approved laden mass for the diesel vehicle in accordance with the charging standard adjusted in April 2013.

The vehicle toll collection method of Hainan Province is completely different from those of other provinces, and the charging burdens formed actually by two charging methods are compared objectively: the advantages and disadvantages of different charging modes can be surveyed from multiple angles, and it is of certain referential significance for the reform direction and idea of the toll highway system.

Comparison Ideas of Toll Collection Burdens

Since Hainan Province is very different from the highway toll modes of other provinces, to compare the collection burdens, first it is necessary to convert into the same unit, and the following factors shall be considered comprehensively in conversion: 1. The toll surcharge of Hainan Province is different from the toll charging methods and ranges of other provinces: Hainan Province is to charge all gasoline and diesel vehicles, while other provinces are to charge the vehicles using the toll highway according to the mileage. 2. The toll surcharge charging methods of gasoline vehicles and diesel vehicles in Hainan Province are different: the gasoline vehicles are charged according to the oil consumption, and the diesel vehicles are charged according to the quota.

Therefore, comparative analysis for burdens needs to approximately merge different charging methods, and the indicators are converted into the same unit according to historical data for comparison. Overall consideration is given to the toll charging methods in and out of the province, and the contrast objects are divided into three classes:

(1) Station wagon: refers to small coach with 7 seats and below out of the province, and to all gasoline vehicles in the province.
(2) Service coach: refers to the bus with over 7 seats, including minibus and bus out of the province, and to all diesel buses in the province.

(3) Service truck: refers to all toll-by-weight trucks out of the province, including small trucks, medium trucks, large trucks, container vehicles, etc. and to all diesel trucks in the province.

Comparison is carried by two ways. 1. Annual average toll burden of single vehicle, i.e., annual average toll burden of single vehicle registered in Hainan Province, unit: CNY/year. 2. Unit mileage toll burden of single vehicle, i.e., toll burden of single vehicle per km converted by the vehicle running on toll highway in Hainan Province, unit: CNY/vehicle per km.

Comparison of Toll Burdens of Small Coaches

The small coach in Hainan Province is not charged according to the mileage on the toll highway, but according to the oil consumption of the small coach running on all roads. Therefore, the toll burden of small coach of unit mileage in Hainan Province calculated according to the oil consumption of unit mileage and oil price is incomparable to the small coach charge rate on expressways in other provinces.

In this report, the income from the non-vehicular gasoline toll surcharge in Hainan Province is deducted to approximately be the income from the small coach toll surcharge. Suppose Hainan Province implements the post collection mode, all the income is undertaken by the small coach running on toll highways of Hainan Province; the small coach toll rate is calculated according to the observation data of the actual traffic volume, and then compared with the actual small coach toll rate in other provinces.

\[
R1 = \frac{I1}{Q1 \times L \times 365/10000}
\]

\(R1\) - toll rate of small coach in Hainan Province, unit: CNY/vehicle km;
\(Q1\) - annual average daily traffic volume of mileage-weighted average small coach on toll highways in Hainan Province, unit: vehicle (natural number);
\(L\) -- mileage of toll highway in Hainan Province, unit: km.

Figure 1. Variation Trend of Small Coach Toll Rate in Hainan Province over the Years.

According to Fig. 2: the toll burden of small coach of unit mileage in Hainan Province is lower, and the charge rate is basically equal to that in Guangxi, lower than that in Fujian. It should be particularly pointed out that, taking the year of 2016 for example, the post collection rate calculated according to the actual traffic volume in Hainan Mode is averagely CNY 0.47/vehicle km, but if Hainan Province really adopts the post collection mode based on the rate of 0.47/vehicle km, the annual average daily traffic volume of small coach will be greatly reduced, and the income from collection of small coach toll will be also far less than the collection amount of the actual gasoline toll surcharge. It shows that, Hainan Mode guarantees effective raising of highway construction capital and urges small coaches to select expressway, consequently to improve the service efficiency of road network. Due to increased service efficiency of road network, the rate of small coach of unit mileage is kept at a lower level.
The service coach in Hainan Province is not charged according to the mileage on the toll highway, but subject to the quota collection according to the tonnage. In this report, the income from the toll surcharge of diesel coach in Hainan Province is approximate to the income from the toll of service coach. Assuming that if the post collection mode is adopted in Hainan Province, so
all such income shall be borne by the service coach running on toll highway in Hainan Province. Based on the actual traffic volume observation data, the toll rates of service coach are back-calculated and compared with the toll rates of service coach actually executed in other provinces.

\[
R_2 = I_2 / (Q_2 \times L \times 365/10000)
\]

- \(R_2\) - Conversion toll rate of service coach in Hainan Province, unit: CNY/vehicle km;
- \(I_2\) - Income from diesel toll surcharge of service coach, unit: CNY 10,000/year;
- \(Q_2\) - Annual average daily traffic volume of mileage-weighted average service coach on toll highway in Hainan Province, unit: vehicle (natural number);

As can be seen in the chart, the unit mileage toll burden of service coach in Hainan Province is much smaller than that in other provinces. Taking 2016 as an example, it accounts for 11.4%, 12.7% and 10.1% of the toll burden in Guangdong, Guangxi and Fujian respectively.

**Toll Burden of Service Truck**

The toll surcharge of service truck in Hainan Province is subject to the quota collection according to the tonnage. In this report, the income from the toll surcharge of diesel truck in Hainan Province is approximate to the income from the toll of service truck. Assuming that if the post collection mode is adopted in Hainan Province, so all such income shall be borne by the service truck running on toll highway in Hainan Province. Based on the actual traffic volume observation data, the toll rates of service truck are back-calculated and compared with the toll rates of service truck actually executed in other provinces.

\[
R_3 = I_3 / (Q_3 \times L \times 365/10000)
\]

- \(R_3\) - Conversion toll rate of service truck in Hainan Province, unit: CNY/vehicle km;
- \(I_3\) - Income from toll diesel service truck in Hainan Province, unit: CNY 10,000/year;
- \(Q_3\) - Annual average daily traffic volume of mileage-weighted average service truck on toll highway in Hainan Province, unit: vehicle (natural number);

The unit toll burden of truck shall be converted into CNY/ton kilometer according to Formula (10).

\[
R_4 = R_3 / (I_3 / (12 \times r))
\]

- \(R_4\) - Conversion toll rate of service truck in Hainan Province, unit: CNY/ton km;
- \(r\) - Rate of toll surcharge of the service truck in Hainan Province, unit: CNY/ton month, taking CNY 210/ton month from 2011 to 2012, and taking CNY 220/ton month from 2013 to 2016.

![Figure 5. Variation Trend of Rate of Ton Kilometer Toll of Service Truck in Hainan Province over the Years.](image)

The trucks in Guangxi, Guangdong and Fujian implement the method of toll-by-weight, and the charging and billing standards are more complicated and are simply indicated as follows.
As can be seen in the Table, the unit tonnage mileage toll burden of service truck in Hainan Province is much smaller than that in other provinces, and its rate level is about 1/10 of the benchmark rate in other provinces. Even considering that the rate in other provinces decreases with the increase of tonnage, the rate of converted service truck in Hainan Province is also below 15% of that in other provinces.

Table 1. Rate of Toll-by-weight of Trucks in Other Provinces.

<table>
<thead>
<tr>
<th>Tonnage</th>
<th>Guangdong</th>
<th>Guangxi</th>
<th>Fujian</th>
</tr>
</thead>
<tbody>
<tr>
<td>5t</td>
<td>0.09</td>
<td>0.08</td>
<td>0.09</td>
</tr>
<tr>
<td>5t~10t</td>
<td>0.1125</td>
<td>0.08~0.04</td>
<td>0.09~0.045</td>
</tr>
<tr>
<td>10t~20t</td>
<td>0.075~0.099</td>
<td>0.04</td>
<td>&gt;40t</td>
</tr>
<tr>
<td>20t~40t</td>
<td>0.06~0.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;40t</td>
<td>0.06</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 6. Comparison of Rate of Average Ton Kilometer Toll of Truck in Four Provinces.

Summary

As can be seen from the comparison of the user burdens above, according to the actual gas toll income in Hainan and the traffic calculation of small coach on expressway, the unit mileage rate of small coach in Hainan Province in 2016 was CNY 0.47/vehicle·km based on the post collection, which is basically the same as that of Guangdong and Guangxi, and lower than the rate level of Fujian Province. According to the income from actual toll of diesel coach in Hainan Province and the calculation of traffic volume of coach on expressway, the rate of unit mileage of service coach based on the post collection in Hainan Province in 2016 is much lower than that of post collection mode in other provinces, accounting for only 11.4%, 12.7%, and 10.1% of the toll burden of coach in Guangdong, Guangxi, and Fujian provinces, which undoubtedly significantly reduces the transportation costs of Hainan tourism and plays a positive role in promoting the development of tourism.

According to the income form actual toll of diesel truck in Hainan Province and the calculation of traffic volume of truck on expressway, the rate level of unit tonnage mileage of service truck based on the post collection in Hainan Province in 2016 is also about 1/10 of the benchmark rate of other provinces. Even considering that the rate in other provinces decreases with the increase of tonnage, the rate of converted truck in Hainan Province is also below 15% of that in other provinces.
Therefore, it has played a positive role in reducing transportation costs in the logistics industry in Hainan Province.

References


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