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# THE SITE SELECTION AND OPTIMIZATION OF TANGSHAN PASSENGER WEST STATION

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**ABSTRACT**

In recent years, the proportion of Tangshan high-speed direct passenger in passenger transport is increasing. The existing bus terminal is still mainly dominated by ordinary road passenger. Bus terminal bit unreasonable station level is low, can not meet the requirements of the development of future high-speed passenger. The papers using principal component analysis to analyze the factors that affect passenger traffic, to determine the district's high-speed passenger traffic. Quantitative calculation and qualitative analysis method can produce a number of alternative sites. Finally, the establishment of maximum economic efficiency model, Compare the combined costs of various options, select the minimum cost solutions as the optimal site.

**Keywords**: *Express Bus Terminal, Site, Passenger Traffic, Optimization Model*

## 1. INTRODUCTION

Tangshan is a centuries-old coastal city of heavy industry. Tangshan transportation connections. Densely developed, a total mileage of 288 km highway, highway density reaches the level of developed countries, and countries as the main hub of the city, one of the National Highway 45.West Passenger Station existing operator class lines, high off P off duty line ratio is about 1:2[1]. West Passenger Station in Tangshan situation and future development of high-speed passenger point of view, the West Bus Station Reconstruction will become an inevitable trend. The current station location can not meet the future land needs of the development of the bus terminal alterations[2]. Therefore, the next bus terminal development is the key pointto solve the passenger terminal siting. The second part of the model introduced; The third part is the basis of data; fourth part is the steps Tangshan Bus Terminal site; final validation model is feasible.

## 2. RESEARCH METHOD

Consider the following uncertain discrete singular system Largest integrated economic efficiency model to calculate the current cost of the station site and the two alternative sites for the minimum integrated, lowest cost target, to select the optimal site.

Objective function[3-11]:

$$\min F_i = \sum_j a_{ji} S_{ji} + a_{ip} S_{ip}$$

Constraints: $D_i \in \{LD\}$

where $\sum_j a_{ji} = a_{ip}$

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$F_i$ - Station Location comprehensive cost in point I;

$a_{ji}$ -J to the average annual daily from departure passenger volume of passenger station i, passengers / day;

$a_{ip}$ -The amount of average annual daily travelers entering the highway from the bus terminal i p through toll stations, passengers / day;

$S_{ji}$ - The distance from to j to the bus terminal i ;

$D_i$ - The geographical location of the alternative bus terminal site i;

$\{LD\}$-The overall city layout planning optional set of land in the passenger terminal buildin.

## 3. HIGH-SPEED PPASSENGER VOLUME DETERMINED

(1) The statistics of Tangshan City, 2005-2011, as shown in Table 1.

Table data input SPSS software, its main component analysis, can eventually be each index in the share of passenger traffic weight coefficient: 1.254,1.634,7.994,0.675, 3..

*Table 1. 2005-2011 Statistic of Tangshan City*

| year | highway passenger volume (million) | GDP (billion) | the total population (Million) | Non-agricultural population (10,000) | Trunk highway Total mileage (100 kilometers) | Social consumer goods Total retail sales(Billion) |
|---|---|---|---|---|---|---|
| 2011 | 12900 | 5442.41 | 737.07 | 247.21 | 141.63 | 1334.8 |
| 2010 | 11348 | 4469.08 | 735 | 247.41 | 138.50 | 1119.45 |
| 2009 | 9868 | 3781.44 | 733.9 | 245.34 | 134.59 | 958.56 |
| 2008 | 5706 | 3561.19 | 729.41 | 244.39 | 132.15 | 809.76 |
| 2007 | 4566 | 2779.14 | 724.66 | 236.23 | 130.10 | 648.83 |
| 2006 | 4478 | 2361.68 | 719.12 | 229.3 | 124.55 | 544.28 |
| 2005 | 4477 | 2027.64 | 714.51 | 229.95 | 76.98 | 468.59 |

*Table 2. Tangshan Downtown District Statistics Ttable*

| are | Total output value(Billion) | Of the total population(Million) | Non-agricultural population(Million) | Trunk highway Total mileage(100 kilometers) | Social consumer goods Total retail sales(Billion) |
|---|---|---|---|---|---|
| Fen nan | 453.5543 | 54.4279 | 13.9760 | 12.37 | 93.2801 |
| Fen run | 447.3696 | 92.3822 | 27.7246 | 15.60 | 97.9963 |
| Lu nan | 64.6521 | 23.5912 | 20.1692 | 0.75 | 61.8764 |
| Lu bei | 76.1605 | 58.7335 | 58.7335 | 0.95 | 104.3471 |
| Gu ye | 142.0374 | 35.9567 | 26.7042 | 3.02 | 59.2513 |
| Kai pin | 136.7420 | 24.0755 | 13.5803 | 3.65 | 42.3056 |

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*Table 3. The Tangshan City Ddistrict Aaverage Ddaily Aamount of Rroad Ppassenger and Hhigh-speed Ppassenger Ttraffic*

| Area | Average daily the highway passenger traffic (person / day) | The average daily amountof high-speed passenger (person / day |
|---|---|---|
| Fennan | 3289 | 1096 |
| Fenrun | 3851 | 1283 |
| Lunan | 1452 | 484 |
| Lubei | 3031 | 1010 |
| Gguye | 1960 | 653 |
| Kaipin | 1396 | 465 |

(2) The 2010 Tangshan downtown district passenger traffic impact factor statistics in Table 2 [1] shows. Corresponding multiplying weight coefficients in Table3 above indicators in the share of passenger traffic, passenger traffic on each partition can get. Calculate the ratio of the total passenger traffic in each partition passenger traffic Tangshan,: 0.164,0.193,0.073,0.152,0.098,0.070.

(3) The district's average daily high-speed passenger traffic results, as shown in Table 3.

## 4. THE CONTROLLER DETERMINATION OF THE SITE

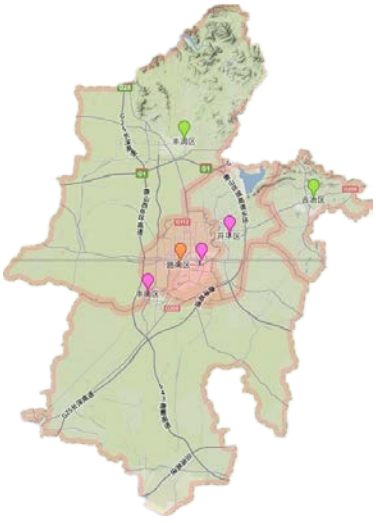

*Figure 2.Tangshan Downtown Figure*

The interception by Google Maps website Tangshan downtown Figure, image processing, the Tangshan downtown map. Shown in Figure 2.

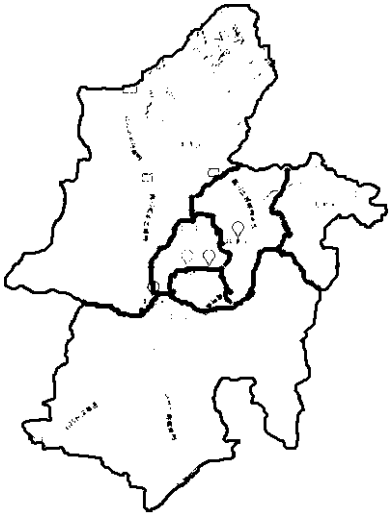

*Figure 3. Tangshan District Schematic*

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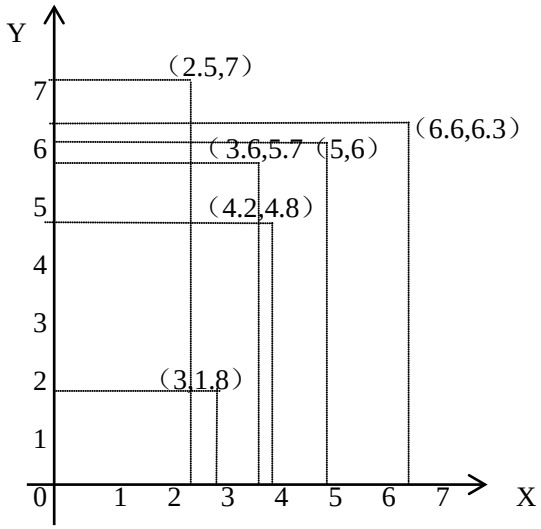


*Figure 4.The Geometric Center Of The District Of Tangshan Downtown*

Image processing, District of Tangshan diagram is shown in Figure3.

Image perspective of the relative position of the geometric center of the District of Tangshan downtown is shown in Figure 4.

Center of gravity method Terminal site model is as follows:

$$X = \frac{\sum V_i X_i}{\sum V_i} \qquad Y = \frac{\sum V_i Y_i}{\sum V_i}$$

Where:

$(X_i, Y_i)$ -Known supply point and demand point coordinates, the coordinates of the center of the District

$(X, Y)$- Be the coordinates of the location in the passenger terminal

Center of gravity method, each partition of the data, as shown in Table 4.

*Table 4. The Partition Coordinate And The Average Daily Amount Of High-Speed Passenger*

| area | fennan | fenrun | lunan | lubei | guye | kaipin |
|---|---|---|---|---|---|---|
| X | 3 | 2.5 | 4.2 | 3.6 | 6.6 | 5 |
| Y | 1.8 | 7 | 4.8 | 5.7 | 6.3 | 6 |
| $V_i$ | 1096 | 1283 | 484 | 1010 | 465 | 653 |

Calculation Terminal coordinates (X, Y) are as follows:

$$X = \frac{3\times1096 + 2.5\times1283 + 4.2\times484 + 3.6\times1010 + 5\times653 + 6.6\times465}{1096+1283+484+1010+653+465} = 3.7$$

$$Y = \frac{1.8\times1096 + 7\times1283 + 4.8\times484 + 5.7\times1010 + 6\times653 + 6.3\times465}{1096+1283+484+1010+653+465} = 5.2$$

Corresponds to the actual location, Changning Road and Dali Road intersection near the bus terminal about. That position belongs to the critical areas of urban and suburban, city traffic will not cause interference, and ample land resources, will not have a huge amount of demolition. In this position, however, far from the existing bus terminus and railway station in Tangshan City, and relatively few bus lines is not very convenient for passengers to reach the station Transferring.

## 5. VERIFY

District average daily high-speed passenger traffic data as shown in Table 5-1.

From j to the bus terminal i distance data as shown in Table 6.

*Table 6 From The Bus Terminal Distance Table*

| $S_{ji}$ i | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | 23.3 | 20.0 | 6.9 | 3.9 | 29.0 | 14.6 |
| 2 | 27.2 | 17.2 | 8.5 | 2.5 | 25.7 | 11.1 |
| 3 | 23.4 | 19.7 | 7.1 | 3.7 | 28.9 | 14.4 |

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The calculation process is as follows:

if i=1

$$\sum a_{j1}S_{j1} = 1069\times 23.3 + 1284\times 20.0 + 484\times 6.9 + 1010\times 3.9 + 653\times 29.0 + 465\times 14.6 = 84238.54$$

if

i=2

$$\sum a_{j2}S_{j2} = 1069\times 27.2 + 1284\times 17.2 + 484\times 8.5 + 1010\times 2.5 + 653\times 25.7 + 465\times 11.1 = 80496.47$$

if

i=3

$$\sum a_{j3}S_{j3} = 1069\times 23.4 + 1284\times 19.7 + 484\times 7.1 + 1010\times 3.7 + 653\times 28.9 + 465\times 14.4 = 83699.47$$

Bus terminal i to the highway at the entrance to the distance data as shown in Table 7.

*Table 7 Bus Terminal To The Distance Of The Highway At The Entrance*

| $S_{ip}$ i / p (km) | 1 | 2 | 3 |
|---|---|---|---|
| 1 | 12.6 | 24.1 | 12.2 |
| 2 | 20.7 | 17.4 | 20.3 |

The calculation process is as follows:

$$a_{ip} = 1069 + 1284 + 484 + 1010 + 653 + 465 = 4993$$

If i=1

$$\sum a_{1p}S_{1p} = 4993\times(12.6 + 20.7) = 166266.9$$

If i=2

$$\sum a_{2p}S_{2p} = 4993\times(24.1+17.4) = 2072095$$

If i=3

$$\sum a_{3p}S_{3p} = 4993\times(12.2 + 20.3) = 162272.5$$

Calculated for each site, calculated as follows from the above datas.-

$$F_1 = \sum_j a_{j1}S_{j1} + a_{1p}S_{1p} = 84238.54 + 166266.9 = 250505.4$$

$$F_2 = \sum_j a_{j2}S_{j2} + a_{2p}S_{2p} = 80496.47 + 207209.5 = 287706$$

$$F_3 = \sum_j a_{j3}S_{j3} + a_{3p}S_{3p} = 83699.47 + 162272.5 = 245972$$

Compare available

$$\min F_i = \min\{F_1, F_2, F_3\} = 245972$$

The above calculation concluded for the use of the method to determine the sites for optimal site.

*Table 5District average daily high-speed passenger Scale*

| Partition number, $j$ | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| The average daily high-speed Passenger traffic(Passengers / day) | 1096 | 1284 | 484 | 1010 | 653 | 465 |

## 6. CONCLUSION

In comparison with the existing bus terminal address, the new site from the bus terminus in the city of Tangshan City train station a little far, but are not interested in the transit of passengers transfer and arrive convenience to have a huge impact. The new site is located in the northern section of two-way in front of the station at ten-lane road capacity is greatly enhanced, and here the traffic flow has been reduced a lot.

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Therefore, even if the new station site and existing passenger West Station and the distance of the high-speed inlet and does not vary a lot, but it brings the effect is significant. Avoided Station Road, a narrow four-lane sections, away from the city's high-density traffic, passenger vehicles pulled out of the new station to enter the high-speed driving. Rough calculation, if the passenger vehicles outbound route at the entrance from the bus terminal to Jinghagaosu Tangshan assume that sailed out of the new station's speed up to 60km/h, by the new station into the high speed of only 20.3 minutes, the same time, the existing bus terminal vehicle just traveling to Chen Chuang near the bus station. From the point of view of land use, compared with the existing stations, new site development land is relatively abundant, and due to the deviation from the center, the smaller amount of demolition, land prices low, the bus terminal Jianzhan costs relatively low cost.

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