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Study of optimizing the transportation distribution of coal

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ABSTRACT

According to the present situation of the influence on the environment from the transportation system of coal, it's necessary to study the construction and optimization of the transportation system of coal and design an operating mechanism of green transportation system of coal in order to achieve the transformation from traditional transportation to green transportation. The present paper has supplied an optimized scheme: in order to minimize the pollution and green transportation, the shortest path and the best distribution can be achieved through the method of multimodal transport, considering both road and rail.First of all, considering both road and rail, a network chart of road and rail transportation has been plotted. Based on the algorithm of War shall-Floyd, the shortest path between supply place and marketing place can be obtained. Secondly, according to table dispatching method, the best distribution scheme can be plotted.Then you can get the minimum freight.

KEYWORDS

Method of multimodal transport;
Shortest path;
Table dispatching method;
War shall-floyd algorithm.

INTRODUCTION

The transportation of coal, as a key link of coal industry, is a bridge and link between the production and consumption of coal. However, coal industry, as one of the largest flow of social material resources, will inevitably have a negative influence on the environment. At the same time, the irrational distribution scheme of coal will cause more serious pollution.

Based on the optimization theory, according to the present situation of the influence on the environment from the transportation system of coal, it's necessary to study the construction and optimization of the transportation system of coal and design an operating mechanism of green transportation system of coal.

QUESTION ANALYSES

According to the present situation of the influence on the environment from the transportation system of coal, in order to study the construction and optimization of the transportation system of coal and design an operating mechanism of green transportation and achieve the transformation from traditional transportation to green transportation, the present paper covers two questions:

Question 1

Considering the transportation method and route. Therefore the key to the question is how to make sure of the shortest route from the various routes quickly

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and efficiently.

Question 2

Obtaining the best distribution scheme, based on the shortest route, under the balance between supply and demand.

SYMBOL DESCRIPTIONS

A_i : the i-th place of production (i={1,2,3})

E_j : the j-th place of demand (j={1,2,3,4})

a_i : the output of the i-th place

b_j : the sales volume of the j-th place

c_{ij} : freight (the sum of all the sections of freight on the shortest path)

x_{ij} : the cargo volume from the i-th place of production to the j-th place of demand

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Z : cost of transporting coal

d_{ij} : the shortest distance between vertex A_i to E_j

W_{ij} : the weight of vertex A_i to E_j

CONSTRUCTIONS OF MODELS AND SOLUTIONS

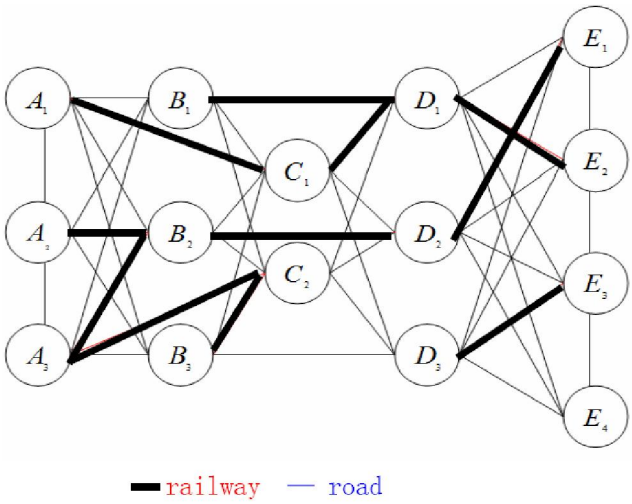
Assume that the freight per ton per kilometer is the same with the same mode of transportation.The freight volume will not change in the process of transportation, namely, assume that the goods will not be damaged or lost. There is no time limits of transportation.Assume the production balances with marketing.

Question 1

The construction of model of shortest path

(1) The connected graph of network of coal transportation

(2) According to the network of routes, the adjacency matrix of freight per volume between two cities



about graph 1 can be obtained.

$$M=\begin{pmatrix}
0 & 19 & \infty & 19 & 24 & 28 & 30 & \infty & \infty & \infty & \infty & \infty & \infty & \infty & \infty \\
19 & 0 & 24 & 23 & 15 & 20 & \infty & \infty & \infty & \infty & \infty & \infty & \infty & \infty & \infty \\
\infty & 24 & 0 & 29 & 17 & 15 & \infty & 27 & \infty & \infty & \infty & \infty & \infty & \infty & \infty \\
19 & 23 & 29 & 0 & \infty & \infty & 16 & 17 & 23 & \infty & \infty & \infty & \infty & \infty & \infty \\
24 & 25 & 17 & \infty & 0 & \infty & 12 & 13 & \infty & 21 & \infty & \infty & \infty & \infty & \infty \\
28 & 20 & 15 & \infty & \infty & 0 & 27 & 13 & \infty & \infty & \infty & \infty & \infty & \infty & \infty \\
30 & \infty & \infty & 16 & 12 & 27 & 0 & \infty & 9 & 15 & 3 & \infty & \infty & \infty & \infty \\
\infty & \infty & 27 & 17 & 13 & 13 & \infty & 0 & 26 & 18 & 13 & \infty & \infty & \infty & \infty \\
\infty & \infty & \infty & 23 & \infty & \infty & 9 & 26 & 0 & \infty & \infty & 26 & 14 & 21 & 28 \\
\infty & \infty & \infty & \infty & 21 & \infty & 15 & 18 & \infty & 0 & \infty & 24 & 24 & 12 & 7 \\
\infty & \infty & \infty & \infty & \infty & \infty & 23 & 13 & \infty & \infty & 0 & 29 & 19 & 16 & 10 \\
\infty & \infty & \infty & \infty & \infty & \infty & \infty & \infty & 26 & 24 & 29 & 0 & 20 & \infty & \infty \\
\infty & \infty & \infty & \infty & \infty & \infty & \infty & \infty & 14 & 14 & 19 & 20 & 0 & 13 & \infty \\
\infty & \infty & \infty & \infty & \infty & \infty & \infty & \infty & 21 & 12 & 16 & \infty & 13 & 0 & 18 \\
\infty & \infty & \infty & \infty & \infty & \infty & \infty & \infty & 28 & 17 & 10 & \infty & \infty & 18 & 0
\end{pmatrix}$$

The solution of the model of shortest path

Let be d_{ij} is the shortest distance between vertex A_i and E_j; and W_{ij} is the weight of vertex A_i to E_j

According to graph theory, the shortest route to each city can be obtained through War shall-Floyd algorithm

A_1 to E_1: A_1-C_1-D_1-E_1; A_1 to E_2: A_1-C_1-D_1-E_2; A_1 to E_3: A_1-C_1-D_2-E_3; A_1 to E_4: A_1-B_3-D_3-E_4; A_2 to E_1: A_2-B_2-C_1-D_1-E_1; A_2 to E_2: A_2-B_2-D_2-E_2; A_2 to E_3: A_2-B_2-D_2-E_3; A_2 to E_4: A_2-B_3-D_3-E_4; A_3 to E_1: A_3-C_2-D_2-E_1; A_3 to E_2: A_3-B_2-D_2-E_2; A_3 to E_3: A_3-B_3-D_3-E_3; A_3 to E_4: A_3-B_3-D_3-E_4;

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Question 2

The construction of the model of allocation of transportation

Cities demand coal of 4,200,000 tons, 3,500,000 tons, 5,100,000 Cities E_1, E_2, E_3, E_4 demand coal of 4,200,000 tons, 3,500,000 tons, 5,100,000 tons, 3,800,000 tons respectively every year, which is supplies by coal mines A_1 A_2 A_3. The output of A_1 is 5,200,000 tons; A_2 is 7,000,000 tons; A_3 is 4,400,000 tons. Seek the minimal freight.

Let x_{ij} be the quantity of the goods transported from the place of production A_i to the place of marketing E_j (i=1,2,3,...,m;j=1,2,3,...,n).

The mathematical model of transportation is:

$$\min Z = \sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij}x_{ij}$$

$$\text{s.t.}\begin{cases}\sum_{j=1}^{n} x_{ij} = a_i, i = 1,2,3,...,m\\ \sum_{i=1}^{m} x_{ij} = b_i, j = 1,2,3,...,n\\ x_{ij} >= 0\end{cases}$$

Balance between production and marketing: $\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j$

According to the known information, the mathematical model of this question can be obtained:

$$\min Z = 65x_{11}+53x_{12}+57x_{13}+59x_{14}+60x_{21}+42x_{22}+46x_{23}+57x_{24}+62x_{31}+44x_{32}+48x_{33}+50x_{34}$$

$$\begin{cases}x_{11}+x_{12}+x_{13}+x_{14}=520\\ x_{21}+x_{22}+x_{23}+x_{24}=700\\ x_{31}+x_{32}+x_{33}+x_{34}=440\\ x_{11}+x_{21}+x_{31}=420\\ x_{12}+x_{22}+x_{32}=350\\ x_{13}+x_{23}+x_{33}=510\\ x_{14}+x_{24}+x_{34}=380\\ x_{ij}>=0, i=1,2,3, j=1,2,3,4\end{cases}$$

The solution of the model of allocation of transportation

Step ①: according to the question on the shortest path, the comprehensive freight from the three coal mines to the four cities can be obtained.

Freight to each city (yuan/ton)

marketing supply	E_1	E_2	E_3	E_4
A_1	65	53	57	59
A_2	60	42	46	57
A_3	62	44	48	50

Step ②: based on the freight obtained from Step 1, obtain the best distribution scheme through table dispatching method.

The volume of each city (million tons)

marketing supply	E_1	E_2	E_3	E_4	output
A_1	4.20			1.00	5.20
A_2		3.50	3.50		7.00
A_3			1.60	2.80	4.40
marketing	4.20	3.50	5.10	3.80	16.60

The best distribution scheme can be obtained based the above chart:From the coal mine A, coal of 4.2 million tons is transported through the route $A_1 - E_1$; coal of 1.0 million tons is transported through the route $A_1 - E_4$.From the coal mine B, coal of 3.5 million tons is transported through the route $A_2 - E_2$; coal of 3.5 million tons is transported through the route $A_2 - E_3$.From the coal mine C, coal of 1.6 million tons is transported through the route $A_3 - E_3$; coal of 2.8 million tons is transported through the route $A_3 - E_4$.According to this scheme, the total freight is 856,80 million yuan.

REFERENCES

[1] Dexun Xi; The Base of Discrete Mathematics Ap-

plication. Science Press, **(2009)**.

[2] Song Dong-Ping, Dong, Jing-Xin; Effectiveness of anempty container repositioning policy with flexibledestination ports. Transport Policy, **(2011)**.

[3] Xun Yuan, Congquan Yan, Hui Liu; A Network Algorithm for Solving the Transportation Problem[J]. Operations Research and Management Science, **1**, **(2005)**.

[4] Haiying Wang, Qiang Huang, Chuantao Li, Baozeng Chu; Graph-theoretical Algorithm and Mat Lab Implementation. Beijing: Bei Hang University Press.

[5] Zhonglin Huang, Jing Huang; The MATLAB Implementation of Basic Science Algorithm. National Defence Industry Press, **(2011)**.

[6] Guangting Chen, Zheyong Qiu; Mathematical Modeling. Higher Education Press, **(2011)**.

[7] Youdeng Hu; Study on Transportation and National Economics. Changsha: Changsha University of Science and Technology Press, **(2006)**.

[8] C.C.Chou, R.H.Gou, C.Tsai et al; Application of amixed fuzzy decision making and optimizationprogramming model to the empty container allocation. Applied Soft Computing, **(2010)**.

[9] Xinsheng Yuan, Dahong Shao, Shilian Yu; Application of LINGO and Excel in Mathematical Modeling. Science Press, **(2007)**.

[10] T.Yamada, B.F.Russ, J.Castro; Taniguchi E.Designingmultimodal freight transport networks:A heuristic approach andapplications. Transportation Science, **(2009)**.

[11] Walid Klibi, Alain Martel, Adel Guitouni; The design of robust value-creating supply chain networks:A critical review. European Journal ofOperational Research, **(2010)**.

[12] Yafeng Yin, Siriphong Lawphongpanich, Yingyan Lou; Estimating investment requirement for maintaining and improving highway systems. Transportation Research, **(2008)**.