Study on Layout Planning and Design of Steel Logistics Park
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Abstract. In order to put forward in order to achieve high operational efficiency, the research is starts with the actual situation of steel logistics park, put forward the optimal layout scheme and designing the elements of traffic organization within the park. This paper is committed to shorten the flow distance of goods in the park under the conditions of permission, to minimize the cost of material handling; reduce the floor space of the park through a reasonable functional area layout, reduce the fixed cost; realize the principle of humanization. Plan system simulation model, enrich logistics park planning and design theory, improve current logistics park space utilization rate, reduce construction cost, enhance cooperation channels among enterprises in the park, and help to realize the scale benefits of steel logistics park.

Introduction
In recent years, with the advancement of supply-side reforms, steel prices have risen sharply, and the growth pattern of steel consumption has changed. The supply-side structural reform has set new targets for the steel industry. It is affected by the production and marketing model and the steel trade circulation mode. Steel logistics needs to realize supply chain integration services. At present, the concentration of China's steel industry is relatively low, making it difficult to coordinate the transportation of raw materials and the sales and transportation of steel products in the supply chain, resulting in waste of resources and increased logistics costs. As an important platform for the intensive development of the logistics industry, the logistics park is the key and breakthrough for the upgrading of the logistics industry. It plays a very important role in improving the local economic operation environment.

Taking the steel logistics park as an example, this paper is committed to shortening the flow distance of goods in the park under the permission conditions and minimizing the material handling cost; reducing the park floor area and reducing the fixed cost through reasonable functional area layout; realizing the principle of humanization. Plan system simulation model, enrich logistics park planning and design theory, improve current logistics park space utilization rate, reduce construction cost, enhance cooperation channels among enterprises in the park, and help to realize the scale benefits of steel logistics park.

Functional Area Layout Model
The functional characteristics of the integrated steel logistics park, the park uses a unequal area separation and multi-line layout model. The schematic diagram of the model is shown in Figure 1:
Construct a multi-objective function expression based on the model's target requirements:

$$\min F_j = w_1 F_1 + w_2 F_2$$

$$= w_1 \sum_{i=1}^{n} \sum_{j=1}^{n} f_{ij} c_{ij} d_{ij} + w_2 L \times \sum_{k}^{K} H_k$$  \hspace{1cm} (1)$$

In the formula:

- $F_1$ — Layout block total cost function
- $F_2$ — Total floor area
- $F_j$ — Minimum total cost of transportation and total floor space
- $W_1$ — Total cost of handling
- $W_2$ — Total land area weight, The actual situation is 0.5 and 0.5 respectively.
- $f_{ij}$ — Material flow between layout block i and layout block j
- $c_{ij}$ — Unit material handling cost from layout block i to layout block j
- $d_{ij}$ — The distance from the center of the layout block i to the center of the layout block j
- $L$ — The length of the total area of the layout block
- $W$ — Width of the total area of the layout block
- $H_k$ — The maximum height of the work unit placed on line k

Since the constraints are simple, simple quantitative penalties are used to deal with the constraints. The penalty function expression is:

$$p(x) = \lambda_{ik} P.$$  \hspace{1cm} (2)$$

In the formula:

- $\lambda_{ik}$ — Number of layout blocks in the kth chromosome that do not meet the constraint
- $P$ — Punishment amount of violation of the constraint

Combined with the penalty function term, the final objective function is:

$$\min F_j = w_1 F_1 + w_2 F_2$$

$$= w_1 \sum_{i=1}^{n} \sum_{j=i+1}^{n} f_{ij} c_{ij} d_{ij} + w_2 L \times \sum_{k}^{K} H_k + \lambda_{ik} P.$$  \hspace{1cm} (3)$$

According to the mathematical model built, the relationship between the operating units is reasonably arranged to minimize the handling cost and total floor space.
Steel Logistics Park Layout Simulation Model

After establishing the functional layout mathematical model, the genetic algorithm is used to find the optimal layout model.

The simulation model is established as follows:

Step1: Comprehensively consider the influence of various parameter sizes on the search results, and set the basic parameters of the simulation and the values of various parameters.

Step2: Enter the initial data, and complete the transfer amount from the table to the table (W_From_To_Chart), the distance from the table to the table (D_From_To_Chart), and the function area table (Activity Space). Create a Sequence Sequence Table (Machine Sequence).

Step3: The loading and leaving strategy is the control strategy when the material is moved. The parts list can count the total flow of the handling area at a certain point in time.

Step4: Sort the function areas in the order of 1-10. The sequence of functional areas is assigned to the workplace, the coordinates of each work place are generated, and then the distance between each functional area is calculated and filled in from the distance to the table. The modeling process is completed, and the results displayed after running are shown in Figure 2.

Step5: Calculate the flow rate from the table to the table and the amount of the flow from the table to the table. The genetic algorithm uses the object flow rate and the vertical distance of the layout as the fitness function value to generate the most functional area. Excellent sorting, regenerating the coordinates of each work place, and generating an optimal layout plan.

Steel Logistics Park Layout Optimization Plan

The optimization model uses the genetic algorithm tools GAWizard and GASequence in the logistics simulation software.

1) Define variable sequences and data types
   There are 10 units in 10 units, which are defined in the first column of each line from the 1st order.

2) Set Genetic Algorithm Wizard—Gawizard
   For the first time, when the genetic algorithm is executed, it is necessary to check whether the maximum number of generations is searched, and then whether the target value is ideal or the convergence of the objective function is considered, and whether the GA can be stopped can be considered.
   Each optimization result is exported to complete the switching sequence between the optimal sequence and the initial sequence.
3) Decoding
When the genetic algorithm generates the optimal order, the decoding needs to be completed, and the DNA sequence is interpreted as an individual trait, that is, the child is mapped to the phenotype, and the program line 40-70 in the Init method performs the decoding process.

Functional Area Layout Simulation Model Optimization Results
In the decoding of 190 different layout schemes, the minimum cost of the objective function is obtained as the optimal layout scheme, as shown in Figure 3.

![Figure 3. Optimization of the layout of the steel logistics park.](image)

Simulation Optimization of Traffic Organization in Steel Logistics Park
The article only simulates part of the routing, the steps are as follows:
Step1: Define the car generation table TableFile.
Step2: From the customer to the transport loading settings.
Step3: The vehicle automatically finds the path and the setting of the destination load.
Step4: Open the EventController and run the model.
The final running simulation results are shown in Figure 4.
In the background of the existing data of the steel logistics park, the paper draws the layout of the steel logistics park shown in Figure 5.

**Evaluation of Layout Scheme**

In terms of function: the north side of the steel logistics park is the cargo station, and the goods directly enter the storage area; there are 10 major functional areas such as processing area and business office area, which embodies the comprehensive functions of the logistics park, centralized storage, distribution processing functions, and multi-style 8 common functions such as intermodal functions.

In terms of layout method selection: due to the large volume of steel logistics parks, the steel logistics park chooses a multi-line layout design method, which divides the park into several blocks of different sizes, and each functional area is scattered in these blocks, improving the utilization rate of the park land and the traffic is smooth.

In the design: the principle of close distance is realized. When the conditions permit, and the distance of the goods flowing in the park is the shortest. The principle of layout optimization is realized, and the layout is arranged according to the volume of the material flow. The principle of humanization is realized, the cargo flow line is separated from the passenger flow line, avoiding the intersection of the flow of people and the goods, and the business hotel area. The principle of flexibility, after the design, the park still has a lot of open space.
Conclusion

This paper studies the layout of the steel logistics park, based on the purpose and principle of the campus layout design, with the goal of minimum transportation cost and minimum total footprint, establishes a multi-objective function model, and applies simulation software to sort the functional areas. The decoding program is called to generate a layout map, and then optimized by a genetic algorithm to obtain an optimal functional area layout scheme. Then, the transportation organization inside the park is designed, and then the logistics simulation software is used to simulate and optimize the internal roads of the park, and finally the layout plan of the logistics park is obtained. When conditions permit, the distance between the goods in the park is the shortest, and the transportation cost of material handling is minimized. The principle of layout optimization is realized, the principle of humanization is realized, and the principle of flexibility is realized.

References


