Optimization study of jinghu highspeed railway train operation diagram

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Abstract. This article is based on familiarization with the technical methods of the standardized highspeed train operation diagram. Investigated the existing problems of the train working diagram of highspeed train between Beijing and Shanghai. In the process of train operation diagram compilation, analyze the difficulties based on the normalized. The operating diagrams which optimized from the various processes have been prepared from organization. The optimization plan of the normalized train operation diagram on the Jinghu highspeed train was proposed as well.

1. Introduction
In this paper, highspeed train operation diagram adopts the operation diagram of "standardization" because the operation diagram of periodicity is consistent with the passenger demand. China has huge passenger travel demand at present, especially in the long-distance transport routes, has put forward higher requirements for China's transport organization and operation chart compilation. To increase the passenger transport capacity as much as possible put forward new requirements for the line-lyeing under certain infrastructure conditions.

At the same time, high speed railway brings new problems, and puts forward higher requirements for operation diagram. With the increase of running speed, the requirements for the response are getting higher and higher, requiring adjustment speed to keep up with the speed of passenger flow demand changing.

Based on the above analysis background, this paper adopts the "normalized" operation diagram to meet the current high requirements on passenger convenience, providing theoretical support for the application of "normalized" Jinghu highspeed train operation diagram. At the same time, the optimization theory is studied to compile the operation diagram of standard highspeed train between Beijing and Shanghai, meeting the requirements of fast train travel speed and convenient and fast passenger with large transportation capacity.

2. Literature review
The establishment of "standardized" operation map must be combined with China's national conditions, that is, the current characteristics of the compilation line. At the present stage, in our country "standardization" will be applied to the reality of most of the subway map shop painting and intercity railway scope. In this paper, "standardized" operation diagram technology is applied to the Beijing-Shanghai high-speed railway with a long and large capacity, which needs further research.

Literature [1] proposed for the first time to apply the periodic time planning problem model to the computer compilation operation diagram.
Literature [2] used branch and bound method in PESP model to optimize the operation scheme and operation diagram preparation.

Literature [3] introduced new cut generation algorithm in PESP model to improve the adaptability of periodic train operation diagram solving model.

Literature [4], fundamental cycle basis algorithm was added into the PESP model to simplify the process of compiling the periodic running schedule of trains.

Literature [5], by virtue of the principle of secondary distribution, designs a model for compiling periodic train operation diagram.

At present, China's standard operation chart technology is applied to urban rail transit and intercity railway, which has produced operational advantages and achieved good economic and social benefits.

3. Problem description and Solving

The deficiency and problems of current transport organization on Beijing-Shanghai highspeed railway:

(1) uneven on train speed difference leads to the low capacity of current transport organization and passenger flow capacity failure. Affected by short-distance cross-line trains, the quantity of long-distance direct trains is not enough to meet the huge demand of passengers leads to inefficient organization management, limited equipment capacity, incomplete standard requirements of technical design.

(2) there is no obvious rule on the passing time of the train at the station, so it is inconvenient for passengers to remember and miss the boarding time; At the same time, there is no routine in working hours of technicians, which is threat to security.

(3) operation diagram cannot adapt to the requirements of passenger flow changes.

(4) the running time of the whole train is too long, and the delayed train has a great impact on the railway line transport.

Figure 1. The number of direct trains issued by Beijing south railway station is compared with the number of passenger traffic in the whole road from 6:00 to 21:00
In the future, normalization Jinghu highspeed train operation diagram will face problems as follows:

(1) high requirements for the stability of passenger flow within the line range and weak adaptability to real-time changing passenger flow;

(2) passenger flow needs to be stable and large in number. due to high capacity for standardized line-laying, if the demand is not stable, diagram-painting which is according to the cycle will create a useless motor walk.

(3) China's railway situation, with more types of vehicles, complicated railway stations and interlaced road network, is complex. It is necessary to analyze the characteristics in combination with the specific problem, which makes it difficult to compile the stereotyped operation diagram.

(4) the line connects Beijing and Shanghai is long, and the cycle time should be controlled within a reasonable range of units. It adds difficulties to the line-laying process.

(5) to solve the problem of trains at different speed mix in transition processing on the existing line, the restriction should be strengthened on the whole.
Figure 3. The number of map of direct trains departing from Beijing south railway station every hour from 6:00 to 17:00 is compared with the standard operating chart

4. Conclusion
The laying of the main line is determined first, in this way, the situation that the method can not find the optimal solution during the laying process can be reduced. The importance of sequencing is reflected when dealing with normalization in contradiction cases of actual life.

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