The Discussion of The Long-distance Maglev Transportation Organization Mode

(*)Song Denan, (**)Tang Wei

(*)Shanghai Maglucky Engineering Consultation Co., Ltd, No.2520 Longyang Rd, Pudong, Shanghai, China
8621-28907287 / 8621-38761022, song_dn@smec.net.cn,

(**)Shanghai Maglucky Engineering Consultation Co., Ltd, No.2520 Longyang Rd, Pudong, Shanghai, China
8621-28907294 / 8621-38761022, tang_w@smec.net.cn,

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Abstract
Maglev owns particular superiority. Under different circumstance, corresponding transportation organization mode shall be used. In this paper, we take the transportation organization mode in long-distance into consideration, which deducted from the high-speed railway and civil aviation.

1 Forword
Transportation Organization is the process of passenger transportation management for safety, rapid, nicety and convenient, which is based upon the principle of high convergence and uniform command, and it is allowed to adopt any reasonable measures for any status.

Now it is hard that we research the Transportation Organization of long-distance high-speed Maglev Transportation System from practical circs, for built Maglev transportation projects have not form network in the world, and they are short-haul projects. The construction of Shanghai Maglev Demonstration Operation Line has made an attempt to grope for Maglev Transportation operation management, but it is be designed only for “point-to-point” circular movement between two stations.

Treading on the heels of aviation, high-speed railway and freeway, high-speed Maglev Transportation comes to being the fourth high-speed transportation. There has been no theory system for high-speed Maglev Transportation, the speed of which is higher than high-speed railway and lower than aviation. So it is necessary to study reasonable and feasible mode of Transportation Organization, according to the character of our country’s passenger need and the technical features of maglev transport system.

Based on the construction and operation of Shanghai Maglev Demonstration Operation Line, National Maglev Transportation Engineering R&D Center and Shanghai Maglev Transportation Development Co., Ltd. have associated with domestic research organizations and universities to unfold investigations of the Transportation Organization of long-distance high-speed Maglev Transportation. The article is the personal understanding of the author in various investigative results.
2 The proper mode of Maglev Transportation Organization

Using for reference of other high-speed transportations’ Transportation Organization modes and integrating with the features of Maglev Transportation’s technology and economy, we will search out the proper mode of Maglev Transportation organization.

Source of data: Shanghai Maglev Transportation Development Co.,Ltd., applicability investigation of Maglev Transportation, the second fascicule—《Transport Organization and Traffic Capacity》

If high-speed Maglev Transportation adopts traditional Transportation Organization mode of railway, it will bring many disadvantageous aftereffects, such as reducing the travel speed of trunk line train, weakening discharge capacity of trunk line badly, affecting efficiency of the station evidently and so on. By accounting, under traditional Transportation Organization mode of railway , if 50% of all trains stop in the same station on positive line, there will be only 50% of academic discharge capacity to be used, the average of traveling speed is 283~338km/h, which obtain 60% of the highest running speed., So the character of the high-speed Maglev’s technology and economy will not be embodied adequately.

Maglev Transportation that is part of rapid transit system should borrow ideas from the transportation mode of junction eradiation of the aviation and container ocean shipping., as result of it, we put forward “eradiation of junction, separation of trunk and branch” as the Transportation Organization mode. Junction eradiation is a scientific, reasonable and effective mode of modern communications and transport industry. From the point of view with traffic network, this mode owns service function and potential economic interest, and it is also an optimized communications and transport organizing model. This mode will be fit for the transport requirements of high speed, high density and big volume of transport, which is an high-side transport mode that has been applied to aviation, ocean shipping and freeway.

If Maglev transport applies the mode of “eradiation of junction, separation of trunk and branch” (please see the figure), it will rapidly upgrade of dominances of Maglev Transport system, the cost
reduction of operation, and make moving trunk train not need operation of avoiding and overtaking. The mode of stop and turn-back on the feeder line makes layout of station track easier and reduces the number of switches.

In addition, this mode embodies applicability of Maglev Transport system. In the aspect of layout of line, it is feasible that both trunk line and branch line are along existent or planning traffic corridor, especially because it is made the most of freeway corridor’s landform and physiognomy character, it makes for selecting of high-speed Maglev Transportation line. In the aspect of operational control system, it contains :inner operation of trunk line and branch line, conjoining operation of trunk-branch, conjoining operation of trunk-trunk, they will be apply three modes, such as supervising of trunk line, connecting of intersection and connecting of conjoining zone. In the aspect of propulsion and power supply system(PPS), this mode supply PPS with cost reduction space.

3 Eradiation of Junction
3.1 Eradiation of junction in exterior of Maglev Transportation

After the volume and speed of traffic vehicle obtained marked development, it gave birth to new-style mode of “eradiation of junction, separation of trunk and branch” in industry of aviation, freeway and ocean shipping. Both aviation and ocean shipping apply different vehicle between trunk line and branch line, thereinto trunk and branch line architecture of freeway is built upon different speed gradation. In allusion to track traffic, the speed of the Maglev is more than one multiple of wheel-rail’s, so the need of high-speed traffic among junction-terminals, which is based upon the Maglev trunk line. Suburb railway network, urban mass transit network and highway network make up of eradiation network of trunk junction, which is the precondition of the situation of “win-win” and benign competition between Maglev transport and other traffic.

3.2 Eradiation of junction in inner of Maglev Transportation

What is “eradiation of junction”? It means that “point-to-point” trunk nonstop trains move among pivotal cities, the trunks will structure skeleton lines of the high-speed Maglev Transportation, the function of convergence and dispersal between he pivotal city and its circumference is realized through branch lines, finally, they make up of the “junction-eradiation”. In initial stages and seedtime of Maglev Transport network, “point-to-point” nonstop trains move on trunk among junctions. If discharge capacity of trunk line is sufficient, the “eradiation of junction” will coming to being by moving “point-to-point” nonstop trains which span trunk and branch of the urban inner. Going with development of the Maglev Transport, intercity line will extend or link with another Maglev intercity line, and they so much as form long-distance line or trunk network. On part of lines which come into city, the Transportation Organization will apply scheme of branch line.

4 Separation of trunk and branch

The mode of “separation of trunk and branch” was brought forward for fulfilling eradiation of junction, which assures that the nonstop train of 400~450 km/h traveling speed will move, but it doesn’t reduce speed when it passes station. At the same time, the moving mode of trunk line is also different from
branch line for assuring high density moving of trunk train. So substantially, “separation of trunk and branch” is the idiographic mode that carries out “eradi ation of junction”, which realized the aim of high density, large traffic and high-speed nonstop among junctions of high-speed Maglev.

From view of configuration, “separation of trunk and branch” layout of “eradi ation of junction”. The line that link junction with the city that is out of trunk is called branch line. But generally, the line that parallels trunk and is distanced from trunk is also called branch line, such as the ling that link station with trunk. From view of operational performance, “separation of trunk and branch” is for the sake of improving efficiency of operation and reducing loss of transportation capacity.

Based on “eradi ation of junction”, we put forward some measures about the mode of “separation of trunk and branch”, for example:

4.1 “Separation of trunk and branch about line”

“Separation of trunk and branch about line” means that lines are classified by line grade, it contains trunk line and branch line, they will be equipped with different propulsion module. Going with development of the Maglev network, after network is formed finally, In allusion to Maglev intercity line, the long-distance Maglev line is called trunk. In allusion to Maglev urban inner line, the Maglev intercity line is called trunk. That some intercity lines link with each other will form a long-distance line. In allusion to long-distance line and intercity line, The line round of the urban is called branch line, whose length will be confirmed by the urban’s character. The branch line not only takes on the centralizing and dispersing of passenger for trunk line, but also accomplishes the task of passenger transport for itself.

4.2 “Separation of trunk and branch about vehicle”

“Separation of trunk and branch about vehicle” means that lines are classified by train grade, it contains trunk train and branch train, what their difference is the tracing interval. On the long-distance line, most of moving trains are trunk trains, but a little of trains are trunk trains from intercity lines. On the intercity line, most of moving trains are trunk trains (it contains part of trains from the long-distance lines and trunk trains moving on the intercity line) and a little trains are the branch trains from urban inner lines. On the urban inner lines, all moving trains are branch trains. Except special circs, branch trains from urban inner lines moving on the long-distance lines will be not arranged. In the same way, the trains from the long-distance line moving on the urban inner lines will not be planned. The aim of division of standard grades is to the character of each line’s transportation organization, to lighten influence on high-speed moving by the trains of different grade (different tracing interval time) moving on the same line, and to predigest Transportation Organization.

4.3 “Separation of trunk and branch about operation”

“Separation of trunk and branch about operation ” means that when the moving train comes into different lines, its number will not change, but its moving principle will be adjusted to the lines (it chiefly means that the moving speed and tracing interval will be changed). As a result, it forms a character that the transportation organization will apply the mode of the same speed nonstop as possible on the trunk, and it will apply the mode of the same speed stop on the branch. For example, some trains from branch will move on the trunk whose capacity is redundant, so their moving mode must keep to the mode of the same speed nonstop on the trunk, however their moving mode must keep to the mode of the same speed stop on
the branch. Going with development of the Maglev network, the transportation organization mode of some branch line or network will have not be adapted to the new circs, so according to the need of development, the mode must be staged for adjusting to the trunk.

4.4 “Separation of trunk and branch about station setting”

The setting format of the Maglev station is divided into setting station on the trunk and setting station on the branch. And the format of setting station on the branch primarily contains the run-through form and the herringbone form. In a run-through station, there are positive lines and layout lines. The train will stop on the layout line, at the same time other trains can pass at high speed. In a herringbone station (or a station set by paralleling positive line), there are no positive lines, but layout lines and switches by which the train can move from one line to another line. The aim of setting station on the branch line is to reduce disturbance caused by moving from one line to another line. In principle, if long-distance line is planned to build, the station will be set on the branch line. When the passenger traffic is not high, some intermediate station will be allowed to set on the positive line, but as well as the hinge station will be set on the branch line generally. Considering the factor of traffic increase, the intermediate station must be provided with the condition of setting station on branch line.

Otherwise, the lines of the herringbone station could be extended, which will become an urban inner line or intercity line. If the station is set on the branch line, it will be considered that the formats contain overhead station and ground station, thereinto the latter will reduce the investment scale of the station. The imagination that overhead structure is applied to the line of space interval and ground setting mode is applied to station roots in the technical character of Maglev system. Because of power dispersing that is applied to Maglev train, its gradeability is more stronger than wheeltrack railway, and that Maglev train’s speed will have been reduced, which is lower than 200km/h, whose noise influence is not evident, so it will meet with the standard of urban environment. But the precondition of setting station on the ground is that the setting will not affect the lay-out of the ground traffic. Of course, integrating with the city lay-out and the function of compositive traffic hinge about Maglev station, whether ground setting or overhead setting will be chosen must be considered cautiously about the setting format of Maglev station.

![Diagram](image-url)

*Figure: separation of trunk and branch layout*
5 Conclusion

The task about Maglev transportation business operation is always one of topics all circles pay attention to. To make full use of the capacity of Maglev system, transportation organization must be provided with overall situation and far-sight, which harmonizes one subsystem with another subsystem in the Maglev transportation system. Based on the experience of Shanghai Maglev Demonstration Operation Line and cooperative effort of domestic institutions, we will deepen the knowledge of the Maglev transportation and the investigation of the application of Maglev transportation system to long-distance line, at the same time we will make great efforts for popularizing Maglev transportation in China.

Reference:


