

# **The Science Development of Chinese Railways**

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**Abstract:** This paper is based on the science and technology development plan of Chinese railways, it has briefly described the big breakthrough achieved during the “ Ninth Five Year Plan ” and has presented the outstanding symbol of science and technology level of Chinese railways by the year of 2000.

**Key Words:** Railway Science & Technology Development

## **1. Generals:**

Railway is the big artery of national economy in China, and it is the backbone of the comprehensive transportation system. It plays a very important role in realizing the great target of national economy and social development. From 1996 to 2010, it is the key period of national economy and social development in China and it is also the very important stage of changing from short of capacity to meet the reform of railway. In order to practise the strategy of making the railways prosperous by science education and implementing the idea of the first productive force is to apply science and technology, in all around the way, the Ministry of Railways had worked out 《 The Plan of Railway Science Development in the Ninth Five Year Plan & the Long Term Plan of 2010 》 in October, 1995. It is comply with the domestic high - tech to push the railway modernization in China by actively relying on progress of science and technology, expanding the capacity of railway network, improving the level of technical equipment, raising the comprehensive transportation capacity, following the development trend of international advanced technology, and, speeding up the progress of Chinese railway technology.

The principle of railway technology development in China is to raise the transportation capacity as the center, to ensure the transportation safety as the pre condition, to raise the transportation quality 、 efficiency 、 and profit from time to time.

In order to turn the new technology into productive force as earlier as possible, a suitable economic policy will be worked out and the management system will be reformed as well, positively in introducing advanced technology both at home and abroad, paying attention to combine the various technology together based on the different transportation demands and the level of the economic development. The technology and equipment at deferent stage will be used to form a system and to make

the best use of the system.

The railway development in China will be shifted onto the track of modern technology、equipment and management by introducing the strategy of making the railway prosperous by science education, relying on the progress of science technology and improving the quality of the workers.

The general target of railway technical development in China are as follows: Realizing electrification and combustion in haulage power and heavy duty rolling stocks, modern management on traffic operation, automation and semi automation on main transportation process, heavy rail for rail-structure, mechanization for maintenance、construction、loading and unloading and repairing, modern technology for railway construction, decision making based on science for railway, to lay equal stress on both high-tech and suitable advanced technology step by step, to coexist the technology and equipment at deferent stage, to take account of weight、density and speed, set up an adaptable and completed railway technical system with Chinese characteristics, which is with a great comprehensive capacity、good quality、high efficiency、low cost and profit.

“ Safety First ” is the principal of railway transportation in China, set a perfect safety protection system by introducing new technology and equipment, developing a complete set of railway safety facilities, raising the reliability of transportation facilities and strengthening management.

## **2.Four Big Technical Project:**

According to the policy and target of railway development based on making railway prosperous by science and education, the key tasks of development plan of railway science and technology including the following big technical project.

(1).Tackle key project of trans-century and take the following 5 fields as the key points, namely, high speed、heavy load、safety、information and soft science. To carry out the long term research and apply it step by step and lay the technical foundation for the development of major project of Chinese railways, such as research on the targeted speed 300KM/hour high speed technology for passenger transportation; 25 ton axle heavy load for freight transportation; electronic computer and modern telecommunication technology of railway information and the macron decision making based on science for railway and the railway soft science for modern management and operation

(2).Key Technical Development Project

According to the demands of economical development of socialist market, Chinese railway will take the hot and hard nuts which are urgently to be solved as the key points of the technical development, concentrate all the efforts to tackle the problem and establish the complete system and positively convert them to raise the capacity、efficiency、profit and etc. They are mainly including 10 key technologies as follows:

- (a) Raise the speed technology of passenger trains.
  - (b) Raise the weight technology of freight trains.
  - (c) The safety technology of ensuring traffic and staffs.
  - (d) Raise the technology of service quality of passenger transportation.
  - (e) Raise the quality technology of freight transportation.
  - (f) The new technology of management for railway operation.
  - (g) The new technology of railway permanent way and engineering.
  - (h) The new technology of telecommunication and signal.
  - (i) The new technology of locomotive and rolling stock.
  - (j) The new technology of maintenance and reform the regulation of rail facilities.
- (3) Strengthen the foundation technology of engineering.

The railway foundation technology is an important part of the work in railway science and technology and is also a necessary condition of progress on railway science and technology. The Chinese railway will emphasize the strength to research and apply the following 8 foundation technology, namely:

- (a) Strengthen the research on practicable foundation to provide the theory base of development of railway technology.
  - (b) Pay much attention to construction infrastructure facilities and establish a group of key laboratory and big and middle test bases.
  - (c) Strengthen the work of information on railway science and technology and get the service function of information on railway science and technology into full play.
  - (d) Strengthen the standard of rail design and construction and the regulation for working out and revising the technical standard to meet the demands of progress on science and technology.
  - (e) Use the international standard in all round the way, improve the railway standardization and measuring system.
  - (f) Strengthen the supervision of rail technology to ensure the product quality.
  - (g) Seriously implement the national policy of energy saving and positively carry out the activities of energy saving.
  - (h) Strengthen the environment concept and pay attention to the protection of railway environment.
- (4) Convert the success of science and technology into productive force.

Converting the success of science and technology into real productive force is the key link of combining science and technology with economy, and is also the key point of realizing the railway modernization. According to the characteristics of Chinese railway, the main carrier of the progress on science and technology are based on rail transportation、 infrastructure engineering and industrial products, the administrative methods must be taken and the function of market system must be brought into full use. Positively organize and disseminate the available mature technology and practicable the success of science and technology to increase the capacity of transportation、 protect traffic safety、 raise the quality of products and increase profit.

According to the actual demands of railway development in China, the following major mature complete technology must be disseminated and converted into real productive force in a fast pace.

(a) On the aspect of railway transportation.

Raise the weight of freight train and increase the transportation capacity; Raise the speed of passenger train and reduce the travelling time; Develop safety technology and protect traffic safety; Use the new type of equipment for passenger transportation to improve the service quality of passenger transportation; Use the modern means to raise the service quality of freight transportation; Use the advanced technology to disseminate the management modernization of transportation; Use the high-tech to speed up the modernization of telecommunication and signal.

(b) On aspect of railway engineering and permanent way.

Use the new technology to improve the engineering quality of tracks; Use new method to raise the construction speed and quality of bridge and tunnels; Use new measures to raise the quality and speed of survey and design; Use advanced equipment to raise the level of modernization for the permanent way maintenance, disseminating the new products and new structure of permanent way and engineering.

(c) On aspect of railway industry.

The series products of locomotives and rolling stocks must meet the demands of heavy loading and speed raising; The designing and manufacturing technology must be modernized; Use new technology and material to upgrade the equipment and technical renovation positively.

### **3. Big breakthrough on six aspects.**

(a) The big breakthrough of technical equipment for transportation safety. The priority will be given to realize the modernization of technical equipment for transportation safety during the construction of railway modernization in China. Strengthen the efforts to research the safety technology to prevent mishandling、over run in、over run out、over speed、rail breakage、axle breakage、derailment、escaping、loading deviation、overloading and heavy disaster. Taking the safety of passenger train as the key point, improve the protection of over speed at deferent stages and supervision of train operation and technical equipment. Research new type of points and switch device. Raise the comprehensive automation of power supply system and the reliability and mechanical strength of main spares of pantograph. The technical research must be conducted to forecast、prevention and controlling the land sliding、debris flow、geological disasters and flood calamity to improve and upgrade the safety facilities and basically establish the protective technical system of transportation safety.

(b) The big breakthrough of speed raising on busy main lines.

To be involved in market competition, it is very important to raise the speed of

passenger trains on the existed busy main lines and improve the quality of passenger transportation. Develop the complete technology which is suitable for speed raising on busy main lines in China including locomotive 、 rolling stock 、 track 、 signal and transportation organization. The speed of passenger trains from Beijing - Guangzhou 、 Beijing - Shanghai and Beijing - Harbin on busy main lines will be raised to 140 - 160/km/h and the speed of passenger train on other main lines will also be relatively raised. To develop heavy load transportation and raise haulage is an important channel to increase the capacity and profit of freight transportation. The 5000 ton train will be run on busy main lines step by step and the haulage of freight train will be comprehensively raised in nationwide.

Speed up the research and development of high speed railway and try to establish a comprehensive test section during the period of “ Ninth Five Year Plan ” .

(c) The big breakthrough of technical equipment for passenger and freight transportation service.

Positively use new type of technical equipment of passenger transportation, disseminate the ticket booking by computer and establish the control center of ticket office and the ticket booking and reserving system by computer in nationwide and develop big size passenger station with multiple modernization. Develop double deck passenger coach for middle and long trip 、 air conditioned trains and luxurious tourist trains to make passenger more comfortable. Research and develop information system of passenger trains and upgrade the facilities of dinning car and improve the service. Research the reform plan of freight transportation, the standard and measures of business concentration of freight transportation. Establish a freight transportation center and develop complete technology for container transportation. Develop information management system of container transportation and the electronic account set system of transportation business of international container. Use all types of special wagons to realize the containerization of freight transportation step by step and the refrigeration of transportation for live and perishable goods and realize mechanization of loading and unloading for bulk goods and big size of goods. Establish the business system of door to door transportation service for all the destination by developing multiple model transportation and organizing express trains.

(d) The big breakthrough of modernization of operation management.

Operation management is the foundation to fulfill the transportation task and ensure the transportation quality, and it is also the key link to raise the efficiency and profit of railway.

Develop information technology and computer technology and its application of railway operation management. Develop and establish the comprehensive information management system based on locomotive 、 rolling stock 、 train 、 container 、 station 、 waybill 、 confirmed report and dispatching, the calculating system for wagons loading and unloading 、 the existed wagons and wagon current and the

computer network system. Develop the central processing system of train management information system ( TMIS ) and dispatching management information system ( DMIS ) .In telecommunication engineering system, realize working out the train diagram by computer, establishing the dispatching center of Ministry of Railways with relative high modernization. Research and develop passenger current 、 goods current and organization of wagon current and its tracing of modernization 、 decision making and the new technology of controlling. Research the modernization of organization and management technology for railway goods movement under the economical condition of socialist market. Taking up the transportation quality as the core, set up a target system of railway transportation.

**(e) The big breakthrough of product quality and grade of railway industry.**

Taking the momentum of progress on science and technology, increase the types and technology of railway industrial products and raise the quality and grade of industrial products greatly. Positively develop the new products of locomotive and rolling stock, which must meet the demands of heavy loading 、 high speed and speed raise on the busy main lines. Research and develop the high speed test train for passenger transportation and the alternative current transmission locomotive and the new type of passenger coach with high quality to meet the demands at deferent levels. Research and manufacture more powerful locomotive, big size of wagon and upgrade the braking device, disseminating the synthetic brake shoes with high friction, the 120 type control valve for wagon and new type of electric vacant brake and the disk brake for passenger coach. Research and develop the complete technology for 25 ton axle wagon raising the reliability and duration of products of locomotive and rolling stock, further extending the cycle for maintenance and decrease the rate of breakdown. To raise the level of manufacturing technology and workmanship of combustion and electric locomotive and passenger coach, upgrade the railway telecommunication and signal, and the special facilities for permanent way and engineering and the production technology of instruments. Develop new product raising its quality and the level of comprehensive technology of industrial production in all round the way and reduce the cost, further exploring and expand the rail market as well as international market.

**(f) The big breakthrough of engineering technology of railway construction.**

The railway construction in China has launched a new tide in southwest, made much efforts on coal transportation, speeded up the construction and expanded the railway network. After 5 years construction, the capacity of the southwest corridor will be doubled, the capacity of the transportation for coal out from Shanxi, Shaanxi and west of inner Mongolia will be increased by 100 million ton. The special line for fast speed of passenger transportation from Qin Huang Dao to Shenyang will be built and the earth braking of Beijing - Shanghai high speed railway will be commenced , and the operation mileage will be over 70 thousand km. To fulfill the railway construction task with high speed 、 high quality and high efficiency must rely on the progress of science and technology.

Widely use computer technology 、 aerial survey 、 remote sensor and comprehensive exploring combining survey with design intelligently and raising design quality comprehensively. Positively use new technology 、 new equipment and have a better management of construction organization, raise engineering quality, shorten construction time , reduce construction cost and raise economic efficiency.

#### **4. Ten Outstanding Symbols**

After “ Ninth Five Year Plan ” development of science and technology, Chinese railway will make big achievements on the whole and the level of science and technology will be obviously raised. The following 10 big projects will be the outstanding symbols of Chinese railway science and technology in 2000 years.

- (1) To be successful in researching and manufacturing the test train of high speed for passenger transportation, establish a test section for high speed railway of maximum 300/km/h;
- (2) Establish the train management information system ( TMIS ) and the dispatching center of Ministry of Railways with part of railway administration, realizing the modernization of transportation dispatching;
- (3) Preliminarily establish the protection technology system for railway safety;
- (4) Build a railway bridge with a big span of 400 meter and a long tunnel of 18 km. for single track;
- (5) The function and reliability of the products of locomotive and rolling stock will reach or close to the international level in 1980, and the AC DC AC locomotive will be put into production in a small group;
- (6) The big size wagon with 25 ton axle will be put into production in batch;
- (7) Preliminarily establish a digit telecommunication network and the coverage rate of telephone will be 50%;
- (8) The coverage rate of mechanization for permanent way maintenance is 50%;
- (9) Set up a ticket booking and reserving system in nationwide;
- (10) The comprehensive automation of all the marshalling yard within railway network will be realized.

After realization of all the targets above mentioned, Chinese railway will be one of the best in the railway field in the world with its own Chinese characteristics of big capacity 、 high speed and efficiency 、 good service 、 safe and reliable and with the international trend as well, and will make its obligatory contribution to turn China into middle level developed country in the middle of the next century.