

Research on the origin and evolution of technical management regulations for railway

Lei Tian

*Transport and Economics Research Institute,
China Academy of Railway Sciences Corporation Limited, Beijing, China*

Yuming Sun

*Department of Science, Technology and Information Technology,
China State Railway Group Co., Ltd., Beijing, China, and*

Yonggang Jia

*Transport and Economics Research Institute,
China Academy of Railway Sciences Corporation Limited, Beijing, China*

779

Received 12 August 2024
Revised 2 September 2024
Accepted 2 September 2024

Abstract

Purpose – To facilitate technical managers and field workers to master and understand the provisions of Technical Management Regulations for Railway more accurately, so as to better serve the comprehensive revision of the Regulations, this paper carries out the research on the traceability and evolution of the provisions of the Regulations.

Design/methodology/approach – This paper studies and analyzes the evolution of the 11th edition of the Regulations by analyzing the relevance of clauses and summarizes the historical background of the development of calendar editions of the Regulations. The basic research on the traceability and evolution of the Regulations is carried out from four aspects: the continuity of the development of the Regulations, the authority of contents, the relevance of clauses and the richness of historical materials.

Findings – From the first edition of the Regulations issued by the former Ministry of Railways in 1950 to the 11th edition, there have been ten comprehensive revisions. There is a strong correlation and continuity between the calendar editions of the Regulations in terms of chapter structure and clauses. Studying the context of the terms of the Regulations is an important way to understand and master the current clauses of the Regulations.

Originality/value – Through the research on the traceability and evolution of the clauses of the Regulations, one is to explore the context of the development of railway technical equipment in China, the other is to clarify the historical background when the provisions were formulated and the third is to trace the development and evolution of the provisions. The revision of the Regulations is based on an accurate grasp of the context of the provisions, which can effectively judge the possible security risks caused by the revision of the provisions and avoid the possible risks in field implementation from the source.

Keywords Technical management regulations for railway, Origin and evolution, Revision, Technical regulation, Organization of train operation

Paper type Research paper

1. Introduction

“Technical Management Regulations for Railway” is the basic technical regulation in the system of railway technical regulations in China, and it is the most important basis of railway

© Lei Tian, Yuming Sun and Yonggang Jia. Published in *Railway Sciences*. Published by Emerald Publishing Limited. This article is published under the Creative Commons Attribution (CC BY 4.0) licence. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this licence may be seen at <http://creativecommons.org/licences/by/4.0/legalcode>

This project is funded by Revision and Key Technical Research on Railway Technical Management Regulation (P2023B001).



technical operation (Jia, Bao, Yang, Sun, & Wang, 2018). In the past 60 years, from the first edition of Regulations which the former Ministry of Railways issued in 1950 (Ministry of Railways of the People's Republic of China, 1950) to the 11th edition of Regulations which was issued in 2014, the Regulations have undergone ten comprehensive revisions (China Railway, 2014), with an average revision interval of six to seven years. The current Regulations of China Railway have been implemented for nearly 10 years since 2014 (Jia, 2019). During this period, it was partially revised twice in 2017 and 2023, respectively. With the upgrading of railway technical equipment and the optimization of transportation organization, new requirements have been put forward for field operation. Some provisions of the Regulations have restricted the improvement of field operation, and some subordinate technical regulations have broken through the provisions of the Regulations. With the development of heavy haul railway and intercity railway technology and the application of new technical equipment such as power concentrated EMUs, new demands are put forward for the provisions of the Regulations.

In order to meet the needs of the development of railway technology management in the new era, China Railway has organized a comprehensive revision of the Technical Regulations in 2023. The revision of the Regulations is a systematic project. In order to meet the need for the revision, it is necessary to clarify the ins and outs of the provisions of the Regulations. Previously, relevant experts have studied the evolution and development of the last three editions of the Regulations (Jia & Sun, 2020), but some clauses of the Regulations can be traced back to the first edition of the Technical Regulations. In order to grasp the ins and outs of the provisions of the Regulations more accurately, it is necessary to carry out research on the traceability and evolution of the provisions of the Regulations in different editions, so as to provide strong support for the revision of the Regulations of China Railway.

2. The evolution of the historical edition of technical regulations

2.1 The 1st edition of the regulations

In the early days of New China, the types of railway technical equipment in China were complicated and different; some locomotives and vehicles could not be used universally, and even some types of locomotives could only run on specific lines. At that time, because divided by the lines, the management requirements among railway bureaus were quite different, which had a great impact on the cross-line operation of railways and then affected the production efficiency of railways. Therefore, it was the primary task of the railway industry at that time to build the centralized leadership and unified management of national railways, and it is imperative to formulate unified technical management regulations. The Northeast Railway General Administration, established in 1946, comprehensively studied the Soviet Union's experience in technical management, compiled and implemented the Northeast Railway Technical Management Regulations with the Soviet Union's Railway Management Regulations as a template and accumulated rich railway management experience in the application process. Under such a historical background, the former Ministry of Railways organized and compiled the first edition of the Regulations based on the Technical Management Regulations of Northeast Railways, which came into effect in 1950.

2.2 The 2nd edition of the regulations

From 1950 to 1954, the first route relay and electrical centralized interlocking independently designed, assembled and constructed were put into use. The use of new technologies and equipment put forward new requirements for on-site technical management and organization of train operations. With the beginning of the first five-year plan, the development of railways

has also entered a period of planned large-scale construction. The Tianlan section of Chengdu–Chongqing Railway and Longhai Railway and Laimu section of Xianggui Railway have been built successively, achieving a “zero” breakthrough in southwest and northwest railways. Under the background of railway technology and construction development, the former Ministry of Railways revised and issued the second edition of the Regulations in 1954 ([Ministry of Railways of the People’s Republic of China, 1954](#)). This revision defined the Regulations as the basic railway regulations for the first time, which establishes the important position of the Regulations in railways.

2.3 The 3rd edition of the regulations

From 1955 to 1956, the former Ministry of Railways proposed the principle of combining high traffic density and heavy train weight, which needs to transform the existing railways and buildings to improve transportation capacity and complete technical transformation in order to complete the increasing transportation tasks, thus starting a new round of rapid development of railway lines and technical equipment. After investigation and scientific computing, the former Ministry of Railways decided to raise the traction weight of freight trains from 2,250 tons to 2,400 tons while keeping the interval operation time unchanged in six main lines, such as Shenshan and Jingshan Railway. Nine railway administrations, such as Harbin and Shenyang, fully implemented the improvement, which puts forward new requirements for railway transportation organization and technical equipment management of rolling stock. According to the changes in technical management and the feedback during the implementation of the second edition of the Regulations, the former Ministry of Railways revised and issued the third edition of the Regulations in 1956 ([Ministry of Railways of the People’s Republic of China, 1956](#)).

2.4 The 4th edition of the regulations

From 1957 to 1960, the national railway completed the transportation index and construction index of the first five-year plan about one year ahead of schedule. It was time to summarize the advanced technical management requirements and organization measures of train operation. For example, Fengtai Station used plain lead tracks to start peaks on the ground, used the potential energy of freight cars on hump for rolling to shunt and replaced hand brakes with iron shoes, which significantly improved shunting efficiency and promoted the construction of simple hump. At this stage, the former Ministry of Railways carried out the reform of rules and regulations and abolished 1,196 rules and regulations in three batches. In December 1958, the former Ministry of Railways abolished the Railway Sub-bureau and concentrated the dispatching work on the Railway Administration. With the adjustment of organization, new requirements are put forward for the organization management of train operations. In addition, the level of railway technical equipment had also improved significantly, such as the increase of double-track railway, the proportion of laying 43kg/m rails and the types and quantities of locomotives and rolling stock, the corresponding increase of the allowable speed of some lines and the development of communication and signal equipment, such as semi-automatic blocks. According to the above development, the former Ministry of Railways revised and issued the 4th edition of the Regulations in 1960 ([Ministry of Railways of the People’s Republic of China, 1960](#)). This revision incorporated the main provisions of Signal Processing Rules and Railway Train Operation Rules for the first time.

2.5 The 5th edition of the regulations

From 1961 to 1964, the former Ministry of Railways determined the reform policy of “paying equal attention to diesel and electric locomotives, focusing on diesel locomotives.” In the

development of diesel locomotives, “high-speed diesel engines and medium-speed diesel engines should be developed simultaneously, and electric transmission and hydraulic transmission should be developed simultaneously,” and the trial manufacture of diesel locomotives should be strengthened. By the end of 1964, nine diesel locomotives of four types had been made. With the change of traction power and the application of new locomotives, new requirements are put forward for railway technical equipment management and organization management of train operation. During this period, the level of railway scientific and technological improvement was significantly improved, the carrier telephone was localized and AX series safety relays were independently designed. In addition, the use and promotion of a series of new technical equipment, such as prestressed reinforced concrete beams and steel beams, automatic blocking and semi-automatic blocking equipment. In order to adapt to the accumulation of advanced operation experience and the application of new technology and equipment, the former Ministry of Railways revised and issued the 5th edition of the Regulations in 1964 ([Ministry of Railways of the People's Republic of China, 1964](#)).

2.6 The 6th edition of the regulations

From 1965 to 1973, the railway system reduced the scale of new line construction and began to strengthen the railway capacity in the first and second line areas. On the basis of detailed examination and study, some main technical standards in the Regulations had been redefined so as to prevent capacity waste caused by high standards and restrictions on railway development caused by low standards. The former Ministry of Railways revised and issued the 6th edition of the Regulations in 1973 ([Ministry of Transport of the People's Republic of China, 1972](#)).

2.7 The 7th edition of the regulations

From 1974 to 1983, the advanced railway equipment appeared continuously, the electrical concentration of large stations and the relay concentration of small stations were widely used, new technologies and equipment such as large vehicles, long rails and track maintenance machinery were put into use and new concepts such as comprehensive transportation schemes gradually matured, all of which put forward a series of new requirements for the technical management work at that time. In October 1977, when the technical policy was discussed at the National Railway Science and Technology Planning Conference, it was proposed to vigorously develop diesel and electric traction, with electric traction as the main development direction. The “Main Railway Technical Policy” issued in May 1983 clearly stipulates that “Carrying out the reform of railway traction power, and Replacing steam locomotives with diesel and electric locomotives which perform better traction capacity and higher thermal efficiency gradually,” thus a large number of diesel and electric locomotives was put into use. In order to adapt to the further development of railway technical equipment modernization, the former Ministry of Railways started the revision of the Regulations in 1981 and implemented it in 1983 ([Ministry of Railways of the People's Republic of China, 1983](#)).

2.8 The 8th edition of the regulations

From 1984 to 1992, the railway completed the Seventh Five-Year Plan and began to implement the Eighth Five-Year Plan. During the “Seventh Five-Year Plan” period, the railway focused on capacity expansion, persisted in developing technology and improving management capability and greatly improved production capacity and transportation capacity. The main objective during the “Eighth Five-Year Plan” period was to speed up the reconstruction of old railway lines and the construction of new lines urgently needed, and

strove to ease the shortage of transportation capacity. From 1989 to 1990, Railway Transportation Safety Protection Regulations and Railway Law of the People's Republic of China were issued successively as superior laws; the relevant provisions played a guiding role in the revision of the Regulations. In addition, with the increase of railway traffic volume and transportation demand and the development of railway technology and equipment, some speed limit indexes were relaxed accordingly to improve transportation efficiency after a series of scientific research and tests, such as the approaching speed during shunting operations, and the speed entering the station during calling-on reception of the train, etc. The former Ministry of Railways started the revision of the Regulations in 1991 and implemented it in 1992 ([Ministry of Railways of the People's Republic of China, 1992](#)).

2.9 The 9th edition of technical regulations

From 1993 to 2000, passenger trains experienced the first and second railway speed increases. Before 1995, the maximum operation speed of passenger trains was below 120 km/h. In October 1995, the former Ministry of Railways organized a series of train speed increase tests and carried out two large-area speed increase maps on April 1, 1997 and October 1, 1998, respectively. After adjustment, the maximum operation speed of the train for the existing line reached 140 km/h to 160 km/h. Under the background of railway speed increase, railway technology and equipment had made extensive and considerable progress, a mass of new technologies and equipment, such as new rolling stock, train operation monitoring and controlling devices and station computer interlocking, were put into use. With the wide application of railway information technology, computer information management systems became an indispensable part of railway transportation management. As for freight trains, the successful development of the end of train device (EOT) protection device provided technical support for canceling the guard car and staff of freight trains. In order to adapt to the great changes in railway technology, the former Ministry of Railways started the revision of the Regulations in 1998 and implemented it in 2000 ([Ministry of Railways of the People's Republic of China, 1999](#)).

2.10 The 10th edition of the regulations

From 2001 to 2007, in terms of technical development, China Railways experienced the fifth large-scale speed increase, and the subgrade in some sections of several main lines reached the speed requirement of 200 km/h. With the speed increase of 200 km/h on existing lines, a large number of new technical equipment had been put into use during this period, such as the EMU train, special self-running equipment, train safety monitoring equipment, train dispatching command system, centralized dispatch and command, digital mobile communication system and so on. In terms of system reform, in order to implement the reform deployment of the State Council, the former Ministry of Railways implemented the system reform of railway bureaus in March 2005, abolishing railway sub-bureaus and directly managing stations and sections by railway bureaus. In order to adapt to the great changes in railway development, the former Ministry of Railways started the revision of the Regulations in 2004 and implemented it in 2007 ([Ministry of Railways of the People's Republic of China, 2007](#)).

2.11 The 11th edition of the regulations

From 2008 to 2014, in terms of system reform, the railway experienced the reform of separating administrative functions from enterprises management, established China Railway Corporation, assumed the enterprises management responsibilities of the former Ministry of Railways, and no longer assumed other administrative functions of the former

Ministry of Railways; In terms of technological development, following the fifth railway speed increases from 1997 to 2004, on April 18, 2007, the former Ministry of Railways implemented the sixth railway speed increase, involving 18 lines including Beijing–Harbin and Beijing–Guangzhou, and China Railways entered a brand-new high-speed era. With the sixth railway speed increase, the high-speed EMU trains of 200 km/h ~ 250 km/h were operated on a large scale for the first time. Beijing–Tianjin Intercity Railway, Wuhan–Guangzhou High-speed Railway, Beijing–Shanghai High-speed Railway and Beijing–Guangzhou High-speed Railway were put into operation successively. By the end of 2013, the mileage of the China High-speed Railway exceeded 10,000 km, accounting for about 45% of the mileage of the world’s high-speed railway at that time. With the continuous development of high-speed railway, great changes had taken place in railway technology and equipment. Equipment suitable for high-speed railway, such as lines, bridges and tunnels, communication signals, station hubs, locomotives and rolling stock, were widely verified, and a large number of new high-speed railway technology and equipment, such as GSM-R, CTCS-2/3 train control systems and onboard signals, emerged. In terms of rules and regulations, in order to adapt to the rapid development of high-speed railway, the former Ministry of Railways of the People’s Republic of China successively formulated a series of regulations, such as Technical Management Measures for Railway Passenger-dedicated Lines (200 ~ 250 km/h Part) and Technical Management Measures for Railway Passenger-dedicated Lines (300 ~ 350 km/h Part). Great changes in the railway system and rapid development of high-speed railway technology forced the revision of the Regulations urgently. The former China Railway Corporation started the revision of the Regulations in 2013 and implemented it in 2014. For the first time, the Regulations were divided into two parts: conventional speed and high speed.

Through the above research, it can be seen that the revision of the calendar edition of the Regulations takes technological development as the first driving force and summarizes the experience in railway technical management in combination with the development requirements for the railway industry in a certain period of time and the internal changes of the railway to adapt to the development needs. Therefore, through the research on the traceability and evolution of clauses, we can summarize the ins and outs of the revision of the Regulations, which is an important means to understand and master the current clauses.

3. Research basis of traceability and evolution

The research on the traceability and evolution of the Regulations is a complicated work. Basic research is carried out from four aspects: the continuity of the development of the Regulations, the authority of contents, the relevance of clauses and the richness of historical materials.

First, the continuity of the development of “the Regulations.” From the first edition of the Regulations in 1950 to the current edition of the Regulations in 2014, the evolution of the Regulations runs through the development history of China’s railway technical management for more than 70 years and keeps a complete time series in version change. Every revision of the Regulations connects with the background of railway development at that time closely and is based on the basis of summarizing the experience of the previous edition of the Regulations. The railway development achievements are summarized and refined from the aspects of technical development, transportation organization and system management during every revision.

Second, the authority of the contents of the Regulations. The second edition of the Regulations characterized the Regulations as “the basic regulations to ensure driving safety, coordinate and accurately complete railway transportation tasks and labor discipline of

railway staff.” Since then, the general provisions of the previous editions of the Regulations contain contents similar to “No department, no unit or any personnel shall violate the provisions of the Regulation,” and each edition of the Regulations is the highest regulation in the corresponding railway historical stage.

Third, the relevance of clauses of the Regulations. The chapter structure of the Regulations has strong stability (Jia, Dai & Chao, 2017). The number of clauses in the previous editions of the Regulations (excluding general rules, drawings and annexes) is shown in Figure 1. Taking the 11th edition of the Regulations (conventional speed) as an example, there are 462 clauses, of which 385 are based on the evolution of the previous versions, accounting for 83% of the total clauses; only 77 new clauses are added. In addition, 90 articles can be traced back to the first edition of the Regulations, and some provisions have continued since the first edition of the Regulations, such as the provision that a train should take a brief brake test if it stops for more than 20 min. It can be seen from this that the historical editions of the Regulations have strong relevance in terms of chapter structure and clause content.

Fourth, the richness of research materials. Generally, the revision of the Regulations has gone through extensive consultation, a large number of on-site investigations and sufficient conference research, during which abundant historical materials such as countersignatures, research materials and authoritative interpretations have been accumulated, which provides a basis for the research work on the traceability and evolution of the Regulations.

4. Research significance of traceability and evolution

With the development of new technology and equipment, the application of railway information technology, the adjustment of transportation organization mode and the revision of management measures of transportation technical regulations in recent years, some problems have been gradually exposed during the implementation of the 11th Regulations, such as individual clauses are no longer implemented, some emergency response procedures need to be optimized, some clauses don’t meet with industry

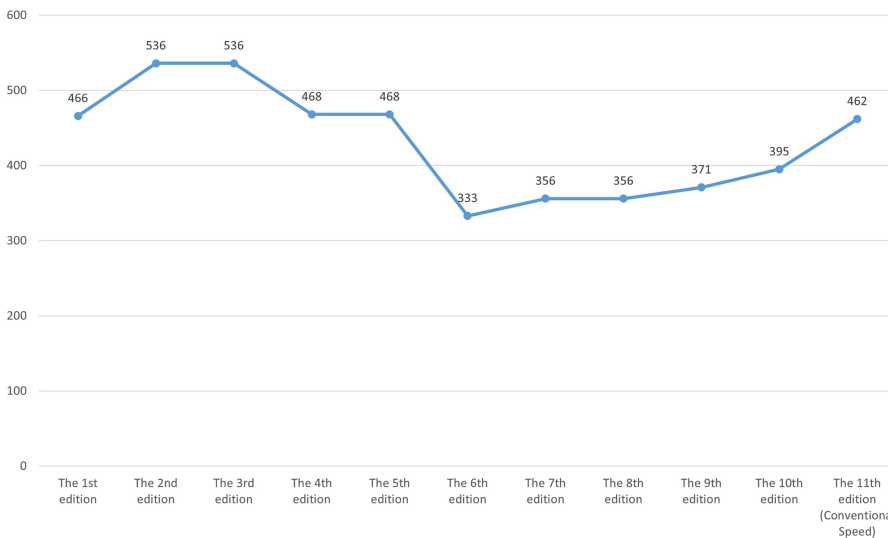


Figure 1. Number of articles in calendar edition of the regulations (excluding general rules, drawings and annexes)

Source(s): Author’s own work

standards, and some contents are no longer suitable for the actual needs of the site. As the basic technical regulations of China Railway, the formulation, development and change of its clauses and contents have important reasons, such as the progress of technical equipment, the change of management mode and the accumulation of accident experience.

Through the research on the traceability and evolution of the provisions of the Regulations, the first purpose is to explore the development of railway technical equipment, such as the clause about train block equipment change from road signs to semi-automatic block equipment, automatic block equipment, centralized dispatching system, and then CTCS-2 and CTCS-3 train control systems. The second purpose is to clarify the historical background when the clauses were formulated. For example, according to the lessons of the accident, Article 244 of the 7th edition of the Regulations added the prohibitive requirements for simultaneous train receptions at opposite directions and simultaneous train departure/reception at the same direction. The third purpose is tracking the development and evolution of clauses, such as the requirement that a train stop for more than 20 min must take a brief brake test.

The revision of the Regulations, which bases on an accurate grasp of the ins and outs of the clauses, can effectively judge the potential safety hazards brought by the revision and avoid the possible risks during on-site implementation from the source.

5. Conclusion

In order to adapt to the changes of railway technical management, such as the development of railway technologies and equipment, the application of railway information technology, the adjustment of transportation organization mode and the revision of management measures of transportation technical regulations, China Railway started the comprehensive revision of the Regulations. From the perspective of the development process, although the Regulations have undergone more than 70 years of development and evolution, they have maintained strong relevance in terms of clauses. Through the tracing and evolution of the provisions of the Regulations, we can explore the source of technical management regulations, understand the reasons behind the changes of the provisions, avoid the potential safety hazards that may remain in the revision of the provisions and provide important technical material for the revision research of the Regulations.

References

- China Railway (2014). *Technical management regulations for railway*. Beijing: China Railway Publishing House.
- Jia, Y. (2019). A research of the change mechanism and path of railway technical regulations in China. *Railway Transport and Economy*, (09), 63–68. doi: [10.16668/j.cnki.issn.1003-1421.2019.09.12](https://doi.org/10.16668/j.cnki.issn.1003-1421.2019.09.12).
- Jia, Y., & Sun, G. (2020). Research on evolution motivation and mechanism of railway technology management regulations. *China Transportation Review*, (03), 43–48.
- Jia, Y., Dai, Y., & Yang, C. (2017). Development history and outlook of technical management regulations for railway in China. *China Railway*, (03), 45–50. doi: [10.19549/j.issn.1001-683x.2017.03.045](https://doi.org/10.19549/j.issn.1001-683x.2017.03.045).
- Jia, Y., Bao, L., Yang, C., Sun, G., & Wang, Y. (2018). Revision of regulations on railway technical management. *China Railway*, (11), 22–26. doi: [10.19549/j.issn.1001-683x.2018.11.022](https://doi.org/10.19549/j.issn.1001-683x.2018.11.022).
- Ministry of Railways (1954). *Technical management regulations for railway*. Beijing: People's Railway Publishing House.

-
- Ministry of Railways of the People's Republic of China (1950). *Technical management regulations for railway (draft)*. Beijing: People's Railway Publishing House.
- Ministry of Railways of the People's Republic of China (1956). *Technical management regulations for railway*. Beijing: People's Railway Publishing House.
- Ministry of Railways of the People's Republic of China (1960). *Technical management regulations for railway*. Beijing: People's Railway Publishing House.
- Ministry of Railways of the People's Republic of China (1964). *Technical management regulations for railway*. Beijing: People's Railway Publishing House.
- Ministry of Railways of the People's Republic of China (1983). *Technical management regulations for railway*. Beijing: China Railway Publishing House.
- Ministry of Railways of the People's Republic of China (1992). *Technical management regulations for railway*. Beijing: China Railway Publishing House.
- Ministry of Railways of the People's Republic of China (1999). *Technical management regulations for railway*. Beijing: China Railway Publishing House.
- Ministry of Railways of the People's Republic of China (2007). *Technical management regulations for railway*. Beijing: China Railway Publishing House.
- Ministry of Transport of the People's Republic of China (1972). *Technical management regulations for railway*. Beijing: People's Railway Publishing House.

Corresponding author

Lei Tian can be contacted at: tianleiktm@163.com

For instructions on how to order reprints of this article, please visit our website:

www.emeraldgrouppublishing.com/licensing/reprints.htm

Or contact us for further details: permissions@emeraldinsight.com