

# RESEARCH ON INNOVATIVE TALENTS TRAINING MODE OF RAIL TRANSIT MAJOR IN RESEARCH-ORIENTED UNIVERSITIES

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## Abstract

With the accelerated pace of industrial upgrading, how to adjust the training mode of undergraduate talents in a purposeful, planned and step-by-step manner in combination with the needs of the industry has become an important issue to be urgently solved in front of China's research universities. In order to improve the students' engineering practice ability and innovation ability, combined with the characteristics of research-oriented universities and the adjustment needs of rail transit industry, the new training mode of research-oriented innovative talents for rail transit safety engineering specialty is discussed from the aspects of knowledge structure, theory and practice teaching system, curriculum, teaching staff and quality supervision. The practice shows that, based on the training goal of outstanding engineers, improving the training mode of research-oriented innovative talents for rail transit safety engineering specialty meets the needs of industry development. The research will help to further improve the teaching system of characteristic specialties and meet the urgent need for research-oriented innovative talents in high-speed railway and rail transit industries.

## Key words

Rail transit; safety engineering; reform and practice; innovative talents; training mode

## 1. INTRODUCTION

The rapid advancement of China's higher education in serving the social development in the region has prompted all colleges and universities to break the traditional concept of running schools and actively explore a new mode of talent cultivation that meets the needs of industry development and the reality of running schools [1-2]. As we all know, the demand for innovative talents in today's society shows a hierarchical trend, which requires not only leading talents in scientific and technological innovation, but also a large number of research-oriented engineering and technical personnel with innovative consciousness. In order to meet the needs of the society for research-oriented innovative talents, to accurately grasp the training objectives of talents and to explore a new training mode for research-oriented innovative talents are the inevitable choices for the leapfrog development of higher education. Based on the reform and practice of the training mode of rail transit safety engineering professionals, this paper opens up a new train of thought for research-oriented innovative talents in characteristic industries.

The training mode of research-oriented innovative talents refers to the general name of the knowledge structure, education and teaching contents and method system with the basic orientation of cultivating students' strong autonomous learning ability, post adaptability, technological innovation and development ability and good innovation consciousness. Higher education has entered the stage of popularization. The enrollment scale has greatly increased. The level of students is different and the good and the bad are

intermingled, showing obvious individual differences and diversity. In order to meet the new demand for professional talents in the adjustment of industrial structure, it is necessary to change the traditional concept, reform the old knowledge structure and teaching system, and implement the training of research-oriented innovative talents.

With the rapid development of rail transit industry, higher requirements have been put forward for the training of rail transit safety engineering professionals. First, they have the practical ability to engage in planning, design, construction and operation safety management, to engage in fault detection, analysis and disposal, to learn independently, and to adapt to their posts. Second, it has the ability of technological innovation and technological development, and has a good sense of innovation and innovative spirit. In order to meet this demand, based on the international standards of professional certification, combining the "research" and "innovation" talent training mechanism, training research-oriented innovative talents who are suitable for the safe development of China's rail transit industry and competent for the safety technology and management of modern rail transit are the key issues that need to be solved urgently.

## 2. THE PROBLEMS EXISTING IN THE TRAINING MODE OF INNOVATIVE TALENTS FOR RAIL TRANSPORTATION MAJOR IN RESEARCH UNIVERSITIES AT THE PRESENT STAGE

According to the Ministry of Education's "Safety Engineering Undergraduate Education Certification

Standard", it is not difficult to find that the training mode of safety engineering undergraduate talents in China's existing transportation universities is not obvious, and it is difficult to meet the professional requirements of rail transit industry for safety engineering technicians, which are highlighted in three aspects: first, the training target is not accurately positioned and deviates from the needs of the industry. The original goal of undergraduate talents training focuses more on the so-called "universal" talents training that is divorced from the actual situation of the industry. The training mode emphasizes too much on the universal applicability of talents and fails to keep pace with the rapid development of China's rail transit industry. Second, the knowledge structure is unreasonable and the curriculum system is not distinctive. Some courses are offered with blindness and arbitrariness. Judging from the knowledge structure, course system and course content, the courses on rail transit safety engineering with distinctive rail transit characteristics are less, the teaching materials are old and repetitive, and the practice links are less. In the process of teaching organization, a unified and standardized curriculum outline has not been formed and teaching is quite random. Third, there is a lack of cooperative training mechanism of production, teaching and research. In

terms of subject knowledge structure, due to over-emphasis on the wide range of specialties, specialty learning has become a castle in the air, and specialty curriculum lacks engineering practice background and vocational skills training. Students have fewer opportunities to participate in scientific research projects and projects, weak awareness of innovation and lack of innovation experience. In the teaching of professional knowledge, it failed to integrate with rail transit construction and maintenance skills training, ignoring the characteristic construction work, resulting in increased employment pressure.

Therefore, closely surrounding the reality of the safety development of high-speed railway and urban rail transit industry, based on the concept of research-oriented innovative undergraduate professional training, combined with the research on the knowledge system of safety engineering discipline in rail transit colleges and universities at home and abroad and the discussion on the knowledge hierarchy structure, a new training mode for rail transit safety engineering professionals is studied in order to meet the development needs of China's rail transit and meet the goal of research-oriented innovative professional and technical personnel meeting the standards of outstanding engineers (Figure 1).

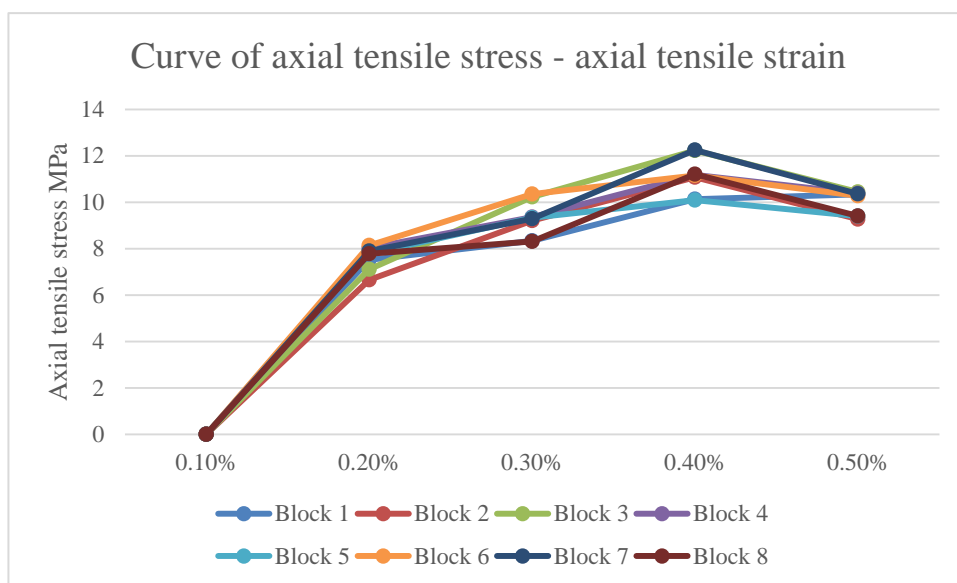


Fig 1 Axial tensile stress-strain curve

### 3. IMPLEMENTATION PLAN OF INNOVATIVE TALENTS TRAINING MODE FOR RAIL TRANSIT MAJOR IN RESEARCH UNIVERSITY

Based on the characteristics of rail transit in running schools, the dialectical relationship between inheritance and development should be correctly handled, the achievements and experiences of the education and teaching reform that have been achieved should be carefully summarized, the continuity, integrity, operability and foresight of the reform should be adhered to, the combination of teaching, scientific research and production should be adhered to, and the idea of "research, practice, perfection and

popularization should be adhered to". Around the new requirements for the cultivation of innovative talents in China's rail transit industry, the knowledge structure for the cultivation of undergraduate talents in safety engineering should be further improved, the curriculum system should be optimized, the training scheme should be revised, the teaching content should be updated, and specialized courses should be set up. Taking the characteristic education of rail transit safety engineering as the main line, taking the construction of quality engineering as the standard, combining the training of outstanding engineers to standardize the theoretical teaching and practical teaching process, improving teaching methods, strengthening production

practice and graduation design (thesis) work, adding graduation practice, standardizing the management of teaching process, formulating incentive policies and exploring management mechanisms, so as to improve students' comprehensive practical ability and comprehensive quality.

In the process of concrete implementation of the project construction implementation plan, teachers should be adjusted, introduced, trained and optimized in accordance with the requirements of training research-oriented innovative talents in safety engineering urgently needed by the rail transit industry [3]. To strengthen the training of young teachers, the implementation of the combination of old, middle-aged and young, carry forward the "mentoring" Role; Make full use of domestic and foreign talent resources, through policy guidance, to attract high level teachers to engage in practical teaching; Invite famous experts and scholars at home and abroad and high-level professionals to undertake teaching tasks and participate in education and teaching reform. Make full use of all resources, strengthen the construction of various forms of practical teaching bases, strengthen the practical link of "scientific research feeding back teaching", implement the school-enterprise cooperation and "production-study-research" combination education mode, cultivate students' engineering and research abilities, and reach the "zero probation period" talent training goal for safety engineering undergraduate majors.

#### **4. THE SPECIFIC REFORM CONTENTS OF THE TRAINING MODE OF INNOVATIVE TALENTS FOR RAIL TRANSPORTATION MAJOR IN RESEARCH UNIVERSITIES**

##### **4.1 Adjustment of Knowledge Structure for Innovative Talents Training**

According to the education department's standard undergraduate training goal of "solid foundation, wide knowledge, strong ability and high quality" and the undergraduate academic standard of "having the initial ability to engage in practical work and research work of the specialty" stipulated in the higher education law, in accordance with the laws of higher education and the new characteristics of rail transit safety engineering talents demand, based on years of construction and development practice of safety engineering specialty, and based on the knowledge system of excellent engineer training, We will adjust the knowledge structure of personnel training with safety engineering characteristics, further strengthen practical training, improve specialized computer application training, consolidate basic technical courses, reduce the number of hours of specialized courses, and increase the number of elective courses in rail transit engineering and rail transit, so as to develop the professional knowledge structure to the innovative engineering ability training of outstanding safety engineers in rail transit. So as to improve the professional knowledge structure of safety engineering undergraduates and make it more suitable for the training of talents for

China's high-speed railway and urban rail transit.

##### **4.2 Optimization of Teaching System for Specialty with Characteristics**

(1) Based on the concept of cultivating research-oriented innovative talents, absorb the latest technical knowledge of the industry and optimize the theoretical teaching system. Optimizing and integrating the framework of professional curriculum system. Adhere to the principle of "taking general safety as the foundation and rail transit as the feature" in the construction of undergraduate safety engineering major, and follow the principle of "3 minus 4 strengthening (reducing subjects, hours and repetitions); To strengthen the intensity of homework, strengthen the practice link, strengthen curriculum links, strengthen personnel training) "principle, build a characteristic curriculum system, form a combination of" general education, professional foundation and professional skills "as one of the three types of curriculum group, to clearly define the nature and content of the curriculum. Measures to reform the curriculum system. The curriculum group of general education covers the basic theories and technical foundations of science and engineering to support safety disciplines. The professional basic course group covers the basic theory and technical knowledge of safety science and engineering. Based on the reform of the characteristic curriculum system, the professional skill curriculum group is oriented to the fields of China's high-speed railway and urban rail transit, and includes rail engineering safety and rail transportation safety. Reform of teaching content. Focusing on the actual development of rail transit industry, special education should be emphasized. According to the principle of "fewer hours, new content, high level and good results", the teaching (course) content system is constructed. Every course should be appropriately simplified and new scientific and technological achievements should be introduced. To solve the problems of duplication, cross infiltration and scientific updating of teaching contents among relevant courses. Reform of teaching methods. In order to achieve the teaching goal of "zero probation period" graduates, on the one hand, we should pay attention to the comprehensive comparative teaching method of classroom teaching, experiment, second class and practice, pay attention to the continuity and gradual progress of each teaching link, and cultivate students' engineering ability, practical ability and research ability; On the other hand, "special lecture" specialized courses are newly added, and "teacher's classroom instruction, students' autonomous learning and lecture in class" are adopted to stimulate students' innovative potential, insight into and analysis of talents and ability to analyze and solve problems, so as to gradually realize the specialization of specialized theoretical and practical teaching links and the refinement of teaching courses.

(2) Based on the training goal of outstanding engineers, build an innovative system of practical teaching. Based on the training goal of excellent engineers in rail transit, and centering on the actual situation of the industry, the practice teaching link is divided into three levels by taking theoretical and practical teaching as the main

channel: first, basic practice teaching, training and training students' basic skills and basic experimental skills, including basic course experiments and practice, various kinds of cognitive practice, social investigation, etc.; The second is professional practical teaching, which trains and trains students' professional ability, practical ability and engineering application ability to be engaged in rail transit engineering construction and transportation fault diagnosis analysis and safety management, including professional course experiment and practice, production practice, course design, graduation practice and graduation design (thesis), professional investigation, etc. Third, innovative practical teaching encourages students with certain scientific research quality to participate in the research work of teachers' scientific research projects, and trains and trains students' comprehensive application ability, preliminary scientific research ability and innovation ability, etc. The specific implementation forms include: scientific and technological innovation activities, engineering practice activities, scientific research and training programs, comprehensive and design experiments, various subject competitions, employment training, etc.

**4.3 Integration of Quality Education Resources**

(1) Optimizing educational resources. After years of construction practice with rail transit characteristics, efforts have been made to optimize the construction team of rail transit safety engineering specialty. On the basis of the existing scientific research and teaching platform, the international perspective has been broadened, and well-known foreign experts have been employed as part-time professors to form a high-quality education resource platform. Through several years of construction, a teaching echelon has been formed with "reasonable structure of knowledge, academic qualifications and professional titles, rich experience in teaching and scientific research, complete levels, active academic thinking and strong sense of innovation". So as to lay a foundation for the training of research-oriented innovative talents of rail transit safety engineering specialty.

(2) Highlight the integrated teaching mode of production, teaching and research. Relying on the national engineering research center, research institute and innovation team, and based on the teaching and scientific research practice platform provided by the safety evaluation center and safety training institutions with national evaluation qualifications, the new teaching mode of industry-university-research integration is explored. Through more participation in teachers' scientific research practice, enterprise consultation and service, students' engineering practice and innovation ability have been greatly improved.

(3) Strengthen the construction of excellent video courses and excellent resource sharing courses. Starting from the teaching of specialized basic courses, teachers, especially middle-aged teachers, are encouraged to actively apply for the construction of provincial and national quality courses. From the organization and mechanism, to ensure the effectiveness and sustainability of the construction of quality courses, to ensure the healthy development of specialized courses.

**4.4 Construction of Teaching Quality Monitoring and Management Guarantee System**

With the aim of serving teachers and students as well as parents of students, a curriculum management system for safety engineering specialty with rail transit characteristics is constructed, which covers multi-functional intelligent teaching information platform for professional teaching management, teaching research, teaching material service, etc. Students can browse the curriculum outline and multimedia teaching courseware, check the teaching progress, download exercises, hand in homework, engage in scientific research practice, etc. On the one hand, teachers can use the system to interact with students and improve the construction level of specialized courses. On the other hand, it is conducive to timely detection of problems and timely improvement. So as to realize the timeliness and convenience of the interaction between teaching management and research information (Figure 2).

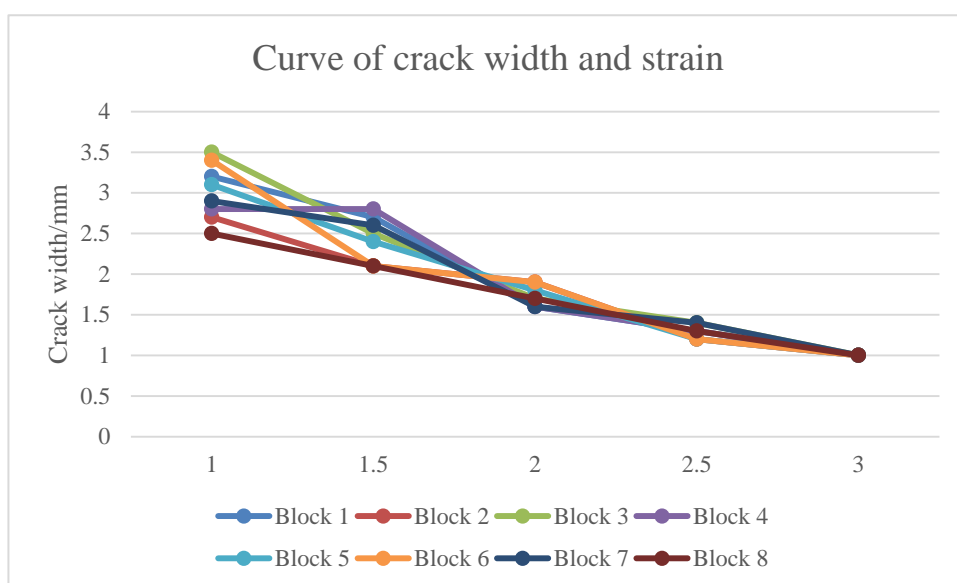


Fig 2 Seam width-strain curve

## 5. THE IMPLEMENTATION EFFECT OF THE REFORM OF THE TRAINING MODE OF INNOVATIVE TALENTS IN RAIL TRANSIT MAJOR IN RESEARCH UNIVERSITIES.

### 5.1 Improve the training plan for innovative talents in research universities

(1) It embodies the educational concept of teaching students in accordance with their aptitude. The new training mode of application-oriented innovative talents for rail transit safety engineering embodies the combination of "specialization and communication" and provides an institutionalized guarantee for the implementation of teaching methods such as individualized instruction and split-flow training. By integrating relevant professional courses through credits, students' knowledge vision is expanded and their professional adaptability is improved. Students can choose courses according to their basic professional level, ability and personal interests.

(2) Broaden the employment channels for students. With the implementation of the research-based innovative talents training mode, students can learn courses of similar or related majors during their school days, and can acquire more comprehensive knowledge and specific professional skills training in the training types they choose, thus improving their employment adaptability.

(3) strong operability, easy to organize and implement. This training mode is based on the principle of proceeding from reality, on the premise of giving full play to the role of existing facilities in research universities, and on the starting point of "less investment, high efficiency, and less difficulty in implementation". It is in line with the reality of current research universities and is therefore easy to organize and implement.

### 5.2 Improve the Education Quality of Research Universities

Relying on the professional support of safety engineering, civil engineering, tunnel and underground engineering, railway and road engineering, transportation planning and other professional support, a professional system of rail traffic safety engineering

with the characteristics of modern rail traffic engineering and operation and maintenance has been built. A complete research-based innovative practical teaching system has been established. A team of outstanding teachers represented by famous teachers has been formed.

## 6. CONCLUSION

The cultivation of research-oriented innovative talents is a higher requirement for popular higher education. Practice shows that the construction of research-oriented innovative talents training mode based on rail transit characteristics further clarifies the knowledge structure of rail transit safety engineering undergraduate talents training. The theoretical and practical teaching systems for the cultivation of research-oriented innovative talents have been optimized to make them more in line with the target standards for the cultivation of outstanding engineers. It integrates the educational resources of schools and strengthens the timeliness of the integrated teaching of production, teaching and research. The proposal of zero probation period training mechanism broadens employment channels and improves employment quality.

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