

# Research on Practical Teaching of Railway Engineering Specialty Based on Temperature Test of Rubber Sleepers

Zixiao Shi, Zhiping Zeng\*, Zhihui Zhu, Weidong Wang, Ping Lou, Bin Yan, Wendeng Qiao, Shunshun Zhang \* Corresponding Author: Zhiping Zeng, Professor.

School of Civil Engineering, Central South University, Changsha, Hunan, 410075, China.

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**Abstract:** Experimental teaching plays an important role in cultivating college students' innovative ability. This paper takes the practical teaching of the temperature test of the new rubber sleeper as an example to analyze the current situation and problems of the practical teaching of railway engineering. The specific measures of the new system of practical teaching of railway engineering are put forward: Build a practical teaching curriculum system, improve the practical teaching evaluation mechanism, and promote the sharing of school-enterprise resources, so as to cultivate outstanding railway engineering talents with engineering ability and innovative spirit.

**Keywords:** Rubber Sleepers; Temperature Test; Railway Engineering; College Students; Practical Teaching; Teaching Methods

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## 1. Introduction

Driven by a new round of scientific and technological revolution and industrial revolution, the reform and transformation of the railway engineering industry is imperative, which puts forward higher requirements for the teaching of railway engineering in higher education<sup>[1]</sup>. Because railway engineering has the characteristics of strong applicability, it is of great educational and practical significance to improve the practical ability of college students in this major. The construction of a new system of practical teaching of railway engineering is conducive to improving the quality of practical teaching of railway engineering, so as to meet the training needs of railway engineering talents under the background of the new era<sup>[2]</sup>.

Although most college students have innovative awareness and motivation, they generally lack practical ability and innovative thinking in the undergraduate education stage<sup>[3]</sup>. The professional practice of railway engineering needs to improve the students' operation ability as much as possible, and tap the students' own innovation potential. We need to guide students to think about problems in the process of practical teaching, which can train students' thinking ability and develop the habit of independent thinking. Knowledge comes from practice, and quality needs to be cultivated in practice. Practical teaching is the key to the growth of college students, especially those majoring in railway engineering.

## 2. Introduction of rubber sleeper and its inspiration to experimental teaching

In terms of environmental protection, plastic composite sleepers are a new generation of environmental protection and energy-saving green railway sleepers, which use non decomposable waste plastics, waste rubber and waste rubber as raw materials. Compared with traditional sleepers, composite sleepers have many advantages in material mechanical properties. At the same time, with the development of technology, it has great potential to improve.

Rubber sleeper is a new type of environmentally friendly sleeper developed by TIETEK company in the United States and made of waste plastic from old tires, but there are few domestic studies on it at present. Due to its outstanding characteristics, rubber sleepers have been laid on some heavy-haul railways in my country, but as a new type of sleeper structure, its theoretical research lags behind engineering practice, and the dynamic and static characteristics of rubber sleepers are still unclear, which hinders its further promotion and application in China.

In order to solve the problems existing in traditional practice teaching, the development direction of railway engineering practice teaching is to build a relatively perfect new system of practice teaching<sup>[4]</sup>. Therefore, taking the practical teaching of "Mechanical Characteristics Analysis and Optimal Design of Plastic Rubber Sleeper Tracks" in this major as an example, the main measures of the new system are explained in detail, in order to provide reference for the training of talents in related fields.

The main work of the undergraduate research project is to analyze and optimize the mechanical properties of the plastic composite track, including calculation software and mathematical analysis. Through theoretical analysis and experimental research, the technical data of the new type of composite sleeper is preliminarily established, which provides a reliable basis for market development, and further promotes the development of urban transportation track in the direction of environmental protection, energy saving, green and other national initiatives.

### **3. Specific implementation method**

#### **3.1 Constructing a practical teaching curriculum system**

According to the teaching law of "theory-practice-re-theory-re-practice", both theoretical teaching and practical operation are emphasized. We also need to formulate independent teaching plans, carefully design teaching plans, and standardize class time requirements and standards<sup>[5]</sup>. At the same time, we also need to increase the opening of laboratories for undergraduates, and encourage students to learn and innovate independently.

Take this practice as an example: before the practice is carried out, the teacher team conducts the analysis of the mechanical properties of the plastic composite track and the optimization design, including the calculation software and mathematical analysis research. Through theoretical analysis and experimental research, the technical data of the new type of rubber sleeper are initially obtained, and a scientific theoretical teaching syllabus and practical guidance scheme are established.

During the experiment, the students walked into the laboratory of our school many times for practical operation. Students obtain static analysis data through theoretical analysis and modeling. According to the predetermined plan, each experimental part was completed in batches, and the experimental results were recorded and compared and analyzed. Finally, comprehensive theoretical analysis and experimental operation are carried out to study the applicability of plastic rubber sleepers.

#### **3.2 Promote school-enterprise resource sharing**

The design of practical courses should be close to the actual engineering, give full play to the role of practice and training bases inside and outside the school, continue to develop contacts and cooperation with enterprises, cultivate a double-qualified teaching team, and establish diversified cooperative education.

Take this practice as an example: in the course of the practice, the student team also continuously collects the latest research materials and engineering applications in this field at home and abroad<sup>[6]</sup>. This process is supported by the enterprise, and students can learn the latest application information of rubber composite track efficiently.

#### **3.3 Improve the evaluation mechanism of practical teaching**

Establish a scientific practical teaching evaluation mechanism, change the single evaluation method based on practical reports, and conduct inspections from multiple dimensions such as practical performance, practical gains, and innovation ability and team ability.

Take this practice as an example: in the practice summary part, the student team completed two parts of theoretical analysis and experimental operation according to the predetermined technical route, and obtained relevant data and analysis theory accordingly. The team finally sorted out and perfected a practice report<sup>[7]</sup>. According to the practical teaching evaluation mechanism, the subject has achieved good results.

### **4. Analysis of the application effect of the new system of practical teaching**

#### **4.1 Effectiveness of the new system**

The practical teaching system allows students to deeply understand the basic process of engineering practice and scientific research, and learn the basic methods of scientific research in railway engineering. Students said that through this

course, they deeply realized the charm of practice and scientific research, and learned from it a rigorous scientific research attitude, perseverance research spirit, and practical courage to dare to innovate.

According to the judging mechanism under the new system, the student team combines the knowledge learned with practice, and initially has strong innovation ability. Its subject has been supported by the Hunan Provincial Project of the Innovation and Entrepreneurship Training Program for College Students, and has achieved good teaching results.

## **4.2 The new system is insufficient**

During the initial establishment of the system, the practical part was overemphasized, and the importance of theoretical knowledge was underestimated. Due to the lack of knowledge of students and the unfamiliarity of modeling procedures, the progress of the previous projects was relatively slow.

Teachers and student teams summarize their own problems and adjust their learning methods. Under the guidance of teachers, students gradually exercise their ability to discover and solve problems, so that the practice project can be carried out smoothly, and finally the expected results can be achieved. This also prompts us to optimize the new system and combine theoretical knowledge with practical operations.

## **5. Conclusion**

In order to achieve the goal of transforming railway engineering professional education from "extensive" training to "excellence" training and creating outstanding engineers in railway engineering, we must not only pass the theoretical teaching, but also work hard in practical teaching. The new system of practical teaching for railway engineering majors is based on the construction of a practical teaching curriculum system, the improvement of the practical teaching evaluation mechanism, and the promotion of school-enterprise resource sharing, and has achieved good results in specific topics. This research inspires educators to constantly reflect on teaching methods, improve the teaching system, and ensure that the talent supply structure for training matches the talent demand structure of the society.

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## **Acknowledgment**

The research is financially supported by Hunan Excellent Postgraduate Teaching Team (Training Engineering Teaching Team) (Xiang Jiao Tong [2019] No. 370); National Experimental Teaching Center of Civil Engineering Virtual Simulation (Central South University) Open Project (202001); Education and Teaching Reform Project of Central South University (2020jy063); Graduate Course Ideological and Political Construction Project of Central South University (2020YJSKSA32); Innovative experimental project for undergraduates of Central South University (S2020105330462), which is gratefully acknowledged by the authors.

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