

# Research on Teaching Reform of Steel Structure Design Principle

Hongtao Zhang<sup>1</sup>

<sup>1</sup>School of Civil and Environment Engineering, University of Science and Technology Liaoning, Anshan 114001, China.

## Abstract

**The principle of steel structure design is a required course for undergraduates majoring in civil engineering. According to the current training situation of steel structure talents in China, aiming at the training objectives and existing problems of the course, this paper discusses the teaching reform of the course from market demand, teaching method, international level and practical teaching, aiming at improving the teaching level of the course and promoting the teaching reform.**

## Keywords

**Principle of steel structure design; civil engineering; teaching reform.**

## 1. INTRODUCTION

In recent years, China's steel structure industry has developed rapidly, but there is still a large gap compared with developed countries. The steel structure itself has the advantages of energy saving, short construction time and good applicability to long-span structures[1], which make the steel structure have a great use space in the field of civil engineering. At the same time, due to the strong encouragement and support of our government, steel structure is bound to have a broader development and application. However, as far as the current situation is concerned, the knowledge of steel structure design of the college students we cultivate is seriously insufficient. After graduation, the knowledge accumulated by the university cannot be very competent for the technical work related to steel structure, which directly leads to the serious lack of professional technical personnel in the field of steel structure. However, compared with the domestic situation, the foreign situation is relatively optimistic, and the overall situation is in a relatively leading level. Especially in developed countries such as the United States, Japan and the United Kingdom, due to their early use of steel structures, technology and theory are relatively mature [2]. Therefore, being able to read and understand foreign literature directly is of great help to learning, which requires our teachers to teach this knowledge content described in foreign language to students, so that students can master more professional vocabulary and terminology, so that they can better participate in international competition later. In addition, as a major course of engineering major, practice is also an indispensable part, which is also an important part of training students to use their knowledge comprehensively, and to cultivate their practical ability and innovation spirit? The traditional teaching method obviously does not adapt to the development trend[3]. Therefore, the curriculum reform of steel structure design principle is imperative.

## 2. PROBLEMS IN THE COURSE OF STEEL STRUCTURE DESIGN PRINCIPLE

(1) Teaching content is not in line with market demand

Steel structure has been developed rapidly in China, but in comparison, it also highlights the serious lack of steel structure professionals and the lack of professional quality of practitioners[4]. This problem directly reflects the problems in the cultivation of the University. The college students we have trained are seriously deficient in the knowledge of steel structure

design. Our goal of training is to cultivate the composite steel structure talents who can adapt to the modern society and understand both theory and application, but obviously the current training mode has not reached the expected goal, because the teaching content and market demand are not consistent. Under the existing teaching mode, the students have mastered the design principle of steel structure fundamentally. However, in view of the actual engineering problems, they are not proficient in the design and calculation process of a certain structural system, which to a large extent causes the "disconnection" between the students and the society Section phenomenon.

#### (2) The teaching method is relatively backward

At present, with the encouragement and support of the state, the steel structure industry is developing rapidly, which is reflected in both the increasing number and the complexity of the structure. Therefore, in modern engineering, in addition to meeting the basic needs, there must be a certain aesthetic effect. With the increasing number of steel structure buildings, a large number of efficient steel and new structures have emerged. This makes the steel structure have certain complexity. This trend also brings some difficulties to classroom teaching. As far as students are concerned, they have less experience and are not impressed by steel structure. They can only understand some structural forms through books, but also cannot see the new structure with complex shape and strong innovation in the classroom. Obviously, they cannot form the impression of straightforwardness through language description and imagination. Therefore, with the support of today's projection technology, modeling software and finite element analysis software, some advanced teaching methods should also be used, so as to create a good and intuitive classroom effect for students.

#### (3) Lack of advanced international knowledge

After China's accession to the World Trade Organization (WTO), more than ever, China is in urgent need of a number of international talents. Especially in the field of steel structure, the United States, Japan, the United Kingdom and other developed countries have earlier research, and their theory and technology are relatively mature compared with domestic, so it is necessary to obtain first-hand information to participate in international competition. For students, they need to understand the advanced international knowledge, understand the cutting-edge trends, and master the standardized use of some basic academic terms in foreign language, so as to emerge in the tide of international competition and provide endless power for the future development of the industry. As far as the current situation is concerned, some students' foreign language level is low[5], which cannot meet the requirements of the training objectives, and in the course of subject foreign language, the foreign language content learned cannot be used, cannot be combined with practice and specific knowledge. As far as the principle of steel structure design is concerned, although some proper terms are learned in the subject foreign language, they are difficult to be connected with the curriculum and applied in literature reading. Therefore, it is necessary to add foreign language teaching to the curriculum.

#### (4) Lack of practical teaching

For the core of steel structure design principle, the practical teaching is also an essential part. After the 21st century, the trend of engineering practice has become more and more obvious, but the ability of students to solve engineering problems does not meet the expected requirements because of "emphasizing theory and neglecting practice" in China's education. In the traditional classroom, the explanation of the basic knowledge points accounts for a large proportion, which is beyond reproach. Most of the students only study the theory for the purpose of examination. When they study in class and train after class, they pay more attention to the absorption of the basic knowledge points, which goes against our goal. As far as the training objectives are concerned, it is very important to master the basic theoretical knowledge, know the calculation of steel structure members as well as use the finite element

analysis software skillfully. In order to reduce the transition period between school and society, our teachers have the obligation and responsibility to bring engineering practice teaching into the classroom, taking engineering calculation examples as the training content. It is necessary to design courses carefully and set up some examples of practical engineering application calculation for steel structure, so that students can operate calculation by themselves in class or under class, which can greatly cultivate students' ability of operation, improve students' interest in learning, further shorten the distance between school and society, and apply learning to promote learning.

### **3. MEASURES TO SOLVE THE PROBLEMS IN THE COURSE OF BASIC PRINCIPLES OF STEEL STRUCTURE DESIGN**

(1) In order to strengthen students' understanding and understanding of the whole steel structure, it is necessary to add calculation examples of the whole steel structure system in the course of principles of steel structure design, which not only enables students to master the design principles of basic components, It also enables students to understand the calculation process of the whole steel structure system; some good engineering examples will also make the teaching more visualized and specific, such as when teaching the knowledge of metal fatigue, the case of steel bridge damage during the Hanshin earthquake in Japan is cited, From the failure of steel bridge to the ultra-low cycle fatigue failure of steel bridge pier, the mechanism of ultra-low cycle fatigue failure is further analyzed, and the theoretical problems that are difficult to understand are transformed into fresh engineering problems, so as to help students improve their theoretical level and better adapt to the work of steel structure design market in the future.

(2) Improve multimedia teaching

It can use software to build models, finite element analysis, and multimedia courseware to present some complex steel structures to students in the form of photos, videos, modeling and other forms through screen projection equipment, and can also be used as learning materials for students to discuss and expand their thinking after class. The modeling software can switch the view freely, which ensures a more comprehensive explanation and display. At the same time, the model can show some details of the structure, so it can have a more detailed and intuitive interpretation of the whole structure. This kind of teaching method of applying new media has the features of image, intuition and large amount of information, which makes students directly stimulated in hearing and vision. It not only increases students' perceptual knowledge, but also deepens their rational knowledge, and also fully mobilizes students' learning enthusiasm, so as to improve teaching effect. This method can improve students' ability and expand their thinking, but it is a test for teachers, which puts forward higher requirements for teachers' preparatory work. For example, multimedia courseware needs to be prepared carefully before class so as to present better in class.

(3) Teaching in Chinese, English and Japanese

In the teaching process of steel structure design principle, the knowledge and vocabulary of steel structure written in English and Japanese should be increased appropriately, especially the theoretical knowledge of steel structure design code in developed countries such as Britain, America and Japan. Before the course of "principles of steel structure design", the teaching of foreign language course can be carried out. The subject foreign language course teaches some professional vocabulary and related usage forms, but after the teaching, the application scope of students is only limited to examinations and assignments, which is almost difficult to apply in general. And the course "principles of steel structure design" can give students the space to apply. Through the design of Trilingual Teaching, students' understanding of professional vocabulary and usage can be further consolidated, which can not only improve students'

interest in learning, but also lay a solid foundation for students' professional foreign language level. The Trilingual Teaching Mode enables students to have a deeper understanding of advanced steel structure theoretical knowledge and advanced technology in developed countries, master professional vocabulary and professional sentences in the field of industry, which is conducive to students' active participation in international exchanges, cooperation and competition.

#### (4) Improve teaching practice

The principle of steel structure design is a very practical course. It is difficult to achieve good results only by teachers' teaching. Therefore, in order to enhance the practicality of the course, some examples of steel structure engineering design and calculation can be set in the course, Let students participate in it in person, so that students can fully integrate into the atmosphere of engineering practice, be familiar with steel structure design and construction drawing preparation procedures, master the design checking calculation process of steel structure engineering, and also deepen students' understanding of theoretical knowledge points of steel structure design principle. Students can be organized to carry out group design and calculation for the actual steel structure engineering, and carry out manual design and calculation for the steel support system (including temporary steel pier, beret piece, I-beam steel, supporting steel pipe and other steel members) of a high-speed railway bridge by groups. After completing the manual calculation, we need to train the computer calculation. Students need to use Midas to build a three-dimensional model of steel structure system for calculation. By comparing the results of manual calculation and computer calculation, they can verify whether there are problems in the calculation process, such as whether the selected formula is reasonable and the theory is correct. Through the design and calculation of practical engineering in the classroom, students can enhance the application of theoretical knowledge, promote the combination of theory and practice, and cultivate the ability of students to use theoretical knowledge for the design and calculation of steel structure components and steel structure overall system in practical engineering.

## 4. CONCLUSION

Engineering major involves multi-disciplinary crossing, involving a wide range of practical strong. Its training goal is to cultivate excellent undergraduates who are in line with the society, understand the theory and can be flexibly applied. However, as far as the current situation is concerned, the effect is not optimistic, which requires our college teachers to reasonably carry out the reform of the classroom mode, and improve the teaching mode according to the actual situation, such as improving the teaching mode in line with the market, multimedia teaching, multilingual teaching and completion Good at practice. In the course of teaching practice, only by improving and improving step by step can we achieve our teaching objectives and cultivate more high-quality professionals for the socialist modernization drive.

## REFERENCES

- [1] Zhang Guangcheng. Modern light steel structure building and its application in China [J]. China's strategic emerging products Industry, 2018 (28): 89.
- [2] Yuan YaoMing. Summary of research on steel structure residential system [J]. House, 2019 (4): 36.
- [3] Huang Ling, Xie Hongyang. Teaching reform of steel structure design principle [J]. Higher architecture education Yu, 2010 (4): 68.
- [4] Liu Jingfeng, Dai Weizhi. Responsibility and consideration -- current situation and Countermeasures of steel structure [J]. Electric welding machine, 2013(11): 1.

- [5] Li Li, Chen Guodong, Lian Dajun. Bilingual teaching of GNSS principles and Applications China Construction Education, 2018 (6): 20.