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RESEARCH ARTICLE

ANALYSIS ON CONSTRUCTION OF GEOTECHNICAL ENGINEERING CURRICULUM GROUP IN THE CIVIL ENGINEERING FOR LOCAL COLLEGES

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ABSTRACT

Geotechnical engineering course group construction is an important part of the current "large civil" personnel training, involving a wide range of engineering, is a complex knowledge system, contains the precipitation of the wisdom of construction projects. Firstly, combined with the goal of training talents and the realization of training standard language, the paper roughly completes the construction of four related curriculum groups through questionnaire survey and statistics. Based on the theory of fault tree evaluation, the fault tree calculation diagram of geotechnical engineering course group is established. Ten cut sets are obtained according to the results of investigation and statistical analysis. The conclusion that the theory of fault tree evaluation coincides with the personnel training objectives and graduation requirements of civil engineering professional committee is verified. The construction of course group and specialty are also verified.

INTRODUCTION

The optimization and allocation of university courses is the key to the realization of college talents training goals, training standards and requirements for graduation. It plays a pivotal role in promoting local college students to have strong practical skills and innovation ability after graduation and meet the needs of modern industrial development. With the advent of the new era of higher education in China, the implementation of high-quality education and the improvement of the quality of higher education, actively promoting the popularization of higher education, has put forward new requirements for the cultivation and value rationality of the comprehensive quality of talents. Especially in the knowledge system, ability requirements, learning evaluation and other aspects, it is necessary to adapt to the increasing international competition in education, especially in China's economic transformation and the rapid development of the new economy. Local colleges and universities serve as useful supplements to higher education. In order to serve local economic construction, facilitate technology research and development and industrial transformation, and align with the new layout of the National development strategy, it has provided strong intellectual support and services [XIA, 2017] .Therefore, it is imperative to constantly update the teaching model, change the concept, optimize the curriculum and the construction of the curriculum group, and chase the superb skills and technology. It is well known that teaching is a special activity to train talents and an important way to realize social development and human progress. In higher education, curriculum and teaching are the paradigm relations between tools and operations. The performance of operations and the advantages and disadvantages of tools are dialectical [QIN Heying, 2017]. At present, university courses are organized according to specialized characteristics and personnel training goals, and teaching arrangements are implemented. Among them, project teaching and modular teaching methods are proposed based on the micro-level. This has become a hot topic in the current teaching model and curriculum reform research, and has achieved many research results [Mingsheng, 2013]. Project teaching began in the late 16th century in Italy's architectural and engineering education campaign. It was promoted in the international vocational education curriculum reform in the 1970s and has become popular in higher education in Europe. Project teaching realizes the organic combination of theory and practice teaching, and improves students 'comprehensive ability to solve practical problems. Modular teaching was realized by the International Labor Organization in the early 1970s as the superiority of on-site teaching. It requires the training of talents with skills training as the core and the completion process of actual work as the main line, namely modular teaching model. In the 1990s, it was explored and practiced in China. And module teaching research earlier than "project-based" teaching. With the internationalization of education, both project-based teaching and modular teaching have been widely studied and practiced, and have accumulated a lot of beneficial experience for college personnel training and curriculum reform. At the same time,, the core goal of personnel training and employment in higher education is to take the opportunity to improve comprehensive quality, dilute professional characteristics, and form a new

strategy for the integration of talents into multiple specialties [Xiuping, 2004]. The curriculum group can closely integrate the relevant knowledge and skills of multiple majors from the overall system, thereby enabling students to consolidate their knowledge and practical application capabilities. This is to guide colleges and universities to actively adapt to the needs of national strategies and local economic and social development, and optimize their professional structure. It has played a positive role in strengthening the construction of professional connotation, innovating the training mode of talents, and greatly improving the training level of talents. The curriculum and teaching resources construction as one of the important contents of the reform has been mentioned in the agenda, and vigorously proposed the construction of distinctive general knowledge basic courses and professional core courses, and abandoned courses with complex courses, little relevance to social needs, and unreasonable convergence. Therefore, combining with the comprehensive reform project of civil engineering specialty, it is the main purpose of this article to explore the practice method of constructing geotechnical course group of civil engineering specialty in local universities on the background of new engineering construction.

Construction Thought and Reform Constraint of Course Group of Geotechnical Engineering Direction: Geotechnical engineering was a new technology on rock and earth engineering first established in Europe and the United States in the 1960s. It is an important part of civil engineering and an extremely applied science. Geotechnical engineering involves construction projects of many geotechnical materials such as architecture, transportation, water Conservancy, and mines. It has a variety of features, complex and changeable conditions, large regional differences, high technical difficulty, and high cost. Therefore, engineering technicians are required very high.

The concept of "Great Civil Engineering(discipline code 0814)", which fully embodies the foundation and sharing characteristics of geotechnical engineering technology. In accordance with the contents of the "Objectives and Cultivation Plan for Undergraduate Education in Civil Engineering in Colleges and Universities" of the Civil Engineering Professional Steering Committee, a model text for the course setting of geotechnical engineering has been formulated and widely adopted in universities. At the same time, it also summarizes the main research objects and topics in the direction of geotechnical engineering: foundation and basic engineering, slope and foundation pit engineering, underground engineering, and geological disaster prevention and control, and other engineering applications and scientific issues. However, due to the complexity of the direction of rock and earth, there have been scattered, mixed, and illogical professional courses, resulting in students 'miscellaneous but not refined and lack of systematic thinking. It severely restricts the improvement of students 'practical application ability and the requirements for the training of contemporary "great craftsman" applied talents. Therefore, it is the reason why the geotechnical course group needs to be constructed in order to cultivate talents in the direction of large-scale civil engineering, optimize the knowledge structure, cultivate applied talents, and improve the core competition of innovation, entrepreneurship and employment. At present, the construction of geotechnical engineering courses in local universities is mainly based on the characteristics of geotechnical engineering applications and the relevance of courses. Several professional courses and professional basic courses are roughly assembled to establish course groups for the purpose of completing the convergence and replacement of teaching tasks. For example, engineering geology-engineering measurement-soil mechanics-underground structure-geotechnical test course group, engineering measurement-underground structure-geotechnical engineering construction-project management budget-slope engineering-foundation pit support-tunnel engineering-Geological disaster-underground engineering and other course groups The presentation architecture is huge, the knowledge structure chain is long, but little attention is paid to the repetition and refinement of professional knowledge between courses, and even the unreasonable connection between time and space occurs, resulting in a waste of a large amount of time and teaching resources. We should take the new paradigm as a guide, foster applied and highly skilled personnel as the driving force, take the teaching plan as the main line, comprehensively analyze the knowledge points of the curriculum from a multidimensional perspective, and organize the structure of the curriculum framework globally to establish a curriculum group. In order to achieve the goal of training talents in local colleges and universities, the coordinated development of geotechnical engineering education and basic engineering construction is realized.

Survey Method to Construct the Course Group of Rock and Earth Direction: Civil engineering, as one of the major majors in Chinese universities, generally adopts directional teaching, while local universities are divided into three directions: construction engineering, road and bridge engineering, and geotechnical and urban underground engineering. To develop students 'basic skills and ability to solve practical problems. In this paper, we investigate the target of talents training in geotechnical engineering and the course group construction for 62 undergraduate graduates in the direction of geotechnical engineering in civil engineering for two consecutive years. According to the statistical results to analyze the construction of the curriculum group, the statistical results of the questionnaire survey are shown in Table 1. According to the statistical results, in terms of graduation employment, the vast majority of students choose to engage in railway engineering construction. This is related to the strong construction of railway projects and the strong demand for talents. However, a very small number of students choose to study for further studies and choose underground tunnel construction. The number of students in the industry is small. It reflects the current social demand for talents in this field and the weak characteristics of students 'related professional knowledge. In the core course survey, tunnel engineering and underground engineering construction have first formed a consensus, and little is known about typical geotechnical foundation pit engineering and slope engineering, and insufficient attention is paid to geotechnical monitoring and testing and rock mechanics. This is related to the demand of social industry and the difficulty of industry construction. For the related courses, the students realized the importance and the significance of the combination of engineering geology-soil mechanics-foundation treatment-basic engineering courses, and the importance of the effective connection, and the general lack of attention to geotechnical survey and testing-underground engineering construction-geotechnical budget-geotechnical bidding. This has a great relationship with learning interests and teaching base construction such as innovation ability, production and teaching services, and engineering. Finally, in the statistical results of practical ability training, students prefer geotechnical experiments,

Table 1. Survey of undergraduate students with geotechnical orientation

project	Results of questionnaire survey
Direction of employment	Railway construction 41, Metro construction 16, Underground gallery 6, Road construction 20, Geotechnical monitoring and testing 12, Construction of water Conservancy projects 14, Exam graduate students 4
Core courses	engineering geology 32, Rock mechanics 24, Underground structure 35, Tunnel works 58, slope engineering 23, Foundation treatment 32, Underground construction 52, Base pit project 16, Shallow foundation and deep foundation 43, Monitoring and testing 21
Associate Courses(3 and above)	Three mechanics 34, engineering geology –earth mechancis- Foundation treatment –foundation engineering45, earth mechancis - Rock mechanics - slope engineering 25, Rock mechanics - Underground structure - Tunnel works 25, Geotechnical survey and testing - Underground construction - Rock and earth budget outline - Geotechnical bidding 12
Practical capacity development	Geological knowledge 12, Geotechnical experiments 60, Geotechnical testing 57, Basic Engineering Design 30, Model experiment 48, Slope and foundation pit support 32, Construction organizational design and budget outline 23, Geotechnical testing and software application 44

Note: Figures indicate the number of students counted

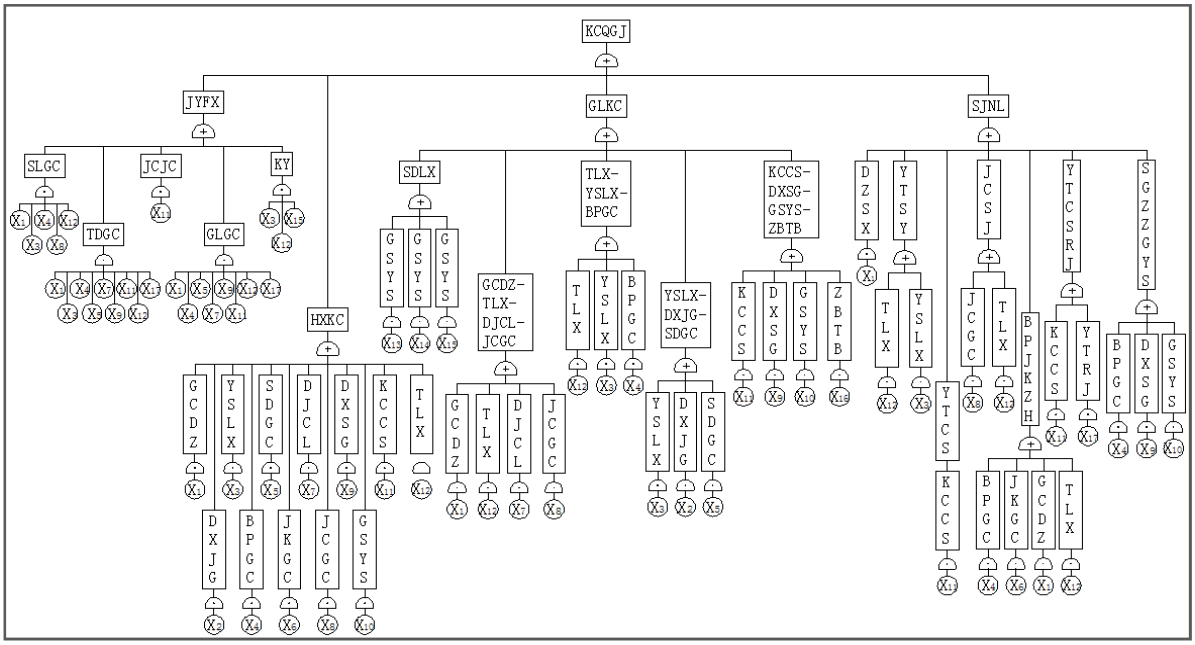

Figure 1. Fault tree calculation diagram

geotechnical tests and model experiments, and are also very interested in the application of software, but they ignore the foundation of geological cognition practice and are even very exclusive. This also reflects the commonality of practical courses such as indoor and outdoor experiments and computer applications, and the lack of interest in traditional written task-style course design. Therefore, according to the statistical results of many surveys, professional teachers in the direction of geotechnical engineering in the teaching and research office have also discussed and exchanged studies several times, and have carefully revised the personnel training plan for the follow-up school year. Pay attention to the comprehensive consideration of professional course knowledge points, course structure, course resources and social needs, and carry out the organization and construction of geotechnical engineering course groups, and earnestly implement the orientation and role playing of local colleges and universities in the training of applied talents.

Application of Fault Tree Theory in Course Group Construction of Rock and Earth Direction: The research literature on the construction of geoengineering orientation curriculum by fault tree method is rare [5]. Since the curriculum group system and construction is a complex knowledge system, which consists of multiple factors that are logically related(in this article, mainly refers to the curriculum elements), and the weight of the elements can be obtained through statistical analysis, the curriculum system meets the application conditions of the fault tree method. The fault tree method calculation process for the construction of geotechnical engineering course group is as follows:

- To collect information on industry needs and personnel training plans, to be familiar with the geotechnical direction course system, and to have a detailed understanding of the elements of the basic courses and professional courses of geotechnical direction, and to combine the implementation process and application significance of each course in teaching. From the knowledge association and the space-time convergence, the curriculum group layout map is roughly drawn;
- Questionnaire survey, statistical analysis and evaluation of personnel training goals and statistical projects, determine the logical relationship of statistical projects, mainly logic and logic;
- From the analysis of the overall structure of the curriculum system listed in the geotechnical application skills training goal, the logical relations between the course elements in the system are summarized;

- The top event of the fault tree is determined. In this article, the construction of the geotechnical course group is the top event. The professional basic course and professional course are the basic events, and the employment direction and core course are the basic events. The element system of related curriculum and practice ability cultivation is analyzed comprehensively, and the key components are found out.
- Determine the target value and solve the probability of the occurrence of course elements based on statistical results, and its value is the target value of the controlled course;
- Then draw a fault tree calculation map according to the logical relationship of the course elements;
- Combining the theoretical knowledge of security system evaluation, logical calculation is carried out to determine the structural importance and minimum cutting set of each course element event;
- Finally, the probability of occurrence of the curriculum element is calculated to calculate the probability of occurrence of the top event, and the validity, applicability, and rationality of the construction of the curriculum group are determined.

According to the statistical results of the survey in table 1, the teaching management measures of curriculum and teaching resources, curriculum and teaching practice, curriculum and teaching effect evaluation, etc. in the course of teaching operation, the fault tree calculation map is established, as shown in figure 1. Figure 1,(for the basic events in the fault tree analysis method, that is, the professional basic course and professional course in the direction of geotechnical engineering, which are: for engineering geology, for underground structure, for rock mechanics, for slope engineering, for tunnel engineering, for foundation pit engineering, For foundation treatment, basic engineering, underground engineering construction, budget estimates, geotechnical survey and testing, geotechnical mechanics, theoretical mechanics, material mechanics, structural mechanics, bidding and bidding, geotechnical software, KCQGJ is constructed for geotechnical engineering courses, JYFX is the employment direction, HXKC is the core course, GLKC is the associated course, SJNL is the practical ability, SLGC is the water Conservancy project, TDJC is the railway project, GLGC is the road project, and JCJC is the monitoring and testing. KY is an engineering geology, GCDC is an engineering geology, DXJG is an underground structure, YSLX is a rock mechanics, BPGC is a slope engineering, SDGC is a tunnel engineering, JKGC is a foundation pit engineering, DJCL is a foundation treatment, JCGC is a foundation engineering, DXSG is an underground construction, GSYS is the proposed budget, KCCS is the geotechnical survey and testing, TLX is the geotechnical mechanics, SDLX is the three major mechanics, DZSX is the geological practice, YTSY is the geotechnical experiment, YTCE is the geotechnical test, JCCSJ is based on the design, YTCSRJ is the geotechnical testing and software application, BP JKZH is the slope and foundation pit support, and SG ZZGYS is the construction organization and budget.

According to the logical relationship of each event in the fault tree and the absorption law of the security evaluation theory, we can get:

KCQGJ=JYFX+HXKC+GLKC+SJNL

$$
\begin{aligned}
&=\mathrm{SLGC}+\mathrm{TDGC}+\mathrm{JCJC}+\mathrm{KY}+x_1\ x_2\ x_3\cdots\cdots x_{12}\\
&+\mathrm{SDLX}+(\mathrm{GCDZ}-\mathrm{TLX}-\mathrm{DJCL}-\mathrm{JCGC})\\
&+(\mathrm{TLX}-\mathrm{YSLX}-\mathrm{BPGC})+(\mathrm{YSLX}-\mathrm{DXJG}-\mathrm{SDGC})+(\mathrm{KCCS}-\mathrm{DXSG}-\mathrm{GSYS}-\mathrm{ZBTB})\\
&+x_1+\mathrm{YTSY}+\mathrm{YTCS}+\mathrm{JCSJ}+\mathrm{BPJKZH}+\mathrm{YTCSRJ}+\mathrm{SGZZGYS}\\
&=x_1\ x_3\ x_4\ x_8\ x_{12}+x_1\ x_3\ x_4\ x_5\ x_7\ x_9\ x_{11}\ x_{17}+x_{11}+x_1\\
&x_4\ x_5\ x_7\ x_9\ x_{11}\ x_{12}\ x_{17}\\
&+x_3\ x_{12}\ x_{15}+x_1\ x_2\ x_3\cdots\cdots x_{12}+x_{13}\ x_{14}\ x_{15}+x_1\ x_7\ x_8\ x_{12}\\
&+x_3\ x_4\ x_{12}+x_2\ x_3\ x_5\\
&+x_9\ x_{10}\ x_{11}\ x_{16}+x_1+x_3\ x_{12}+x_{11}+x_8\ x_{12}+x_1\ x_4\ x_6\ x_{12}+\\
&x_{11}\ x_{17}+x_4\ x_9\ x_{10}\\
&=x_1+x_{11}+x_{13}\ x_{14}\ x_{15}+x_2\ x_3\ x_5+x_9\ x_{10}\ x_{11}\ x_{16}\\
&+x_1\ x_4\ x_6\ x_{12}+x_8\ x_{12}+x_3\ x_{12}+x_{11}\ x_{17}+x_4\ x_9\ x_{10}
\end{aligned}
\tag{1}
$$

From formula (1), you can get 10 cut sets of the fault tree:

(x_1), $(x_{11},\ x_3\ x_{12})$, $(x_8\ x_{12})$, $(x_{11}\ x_{17})$, $(x_{13}\ x_{14}\ x_{15})$,
$(x_2 x_3\ x_5)$, $(x_4\ x_9\ x_{10})$, $(x_9\ x_{10}\ x_{11}\ x_{16})$, $(x_1\ x_4\ x_6\ x_{12})$

Its probability function is:

$$
\begin{aligned}
g(p)=1-[&(1-p_1)(1-p_{11})(1-p_3p_{12})(1-p_8p_{12})(1-p_{11}p_{17})(1-p_{13}p_{14}p_{15})\\
&(1-p_2p_3p_5)(1-p_4p_9p_{10})(1-p_9p_{10}p_{11}p_{16})(1-p_1p_4p_6p_{12})]
\end{aligned}
$$

In the formula,(for the probability of occurrence of each element. The minimum cutting set reflects the probability of the occurrence of each constituent event of the geotechnical direction course group, that is, the degree of importance. Among them, engineering geology, soil mechanics, tunnel engineering, geotechnical survey and testing, slope engineering, rock mechanics, and basic engineering are the key courses of geotechnical engineering, and the importance of foundation treatment is the lowest, and it cannot be required in the construction of course groups. In turn, four courses were formed: engineering geology-soil mechanics-slope and foundation pit support, rock mechanics-underground building structure-tunnel engineering, engineering geology-earth mechanics-survey and testing-basic engineering, underground construction-budget outline-bidding and bidding. group, This is the main body of geotechnical engineering personnel training standards and realization and graduation requirements. This group of courses has continued to gradually develop the course, and it has also effectively avoided the repetition of professional course knowledge points. For example, in the engineering geology course, the content on the physical mechanical properties and indicators of the soil and the stability of the slope and the foundation pit can be described in the soil mechanics and slope and foundation pit support courses, and the soil slope stability in the soil mechanics course can be described in the slope engineering course; In the course of rock mechanics, the stress state of underground structures and the load calculation of tunnel structures can also be studied in underground building structures and tunnel engineering respectively. At the same time, it can also be concluded that the curriculum of the fault tree method search for the minimum cut set is in line with the curriculum and

talent training goals proposed by the National Civil Engineering Professional Committee's "Undergraduate Education Training Objectives and Training Schemes for Civil Engineering majors in Colleges and Universities". It is an optimization and improvement of course group construction, and its joint evaluation technology can provide guidance for the training goals and graduation requirements of geotechnical engineering majors in local universities.

Concluding remark: The integration of geotechnical courses and the construction of course groups of civil engineering majors need to be constantly explored and promoted in the training of talents. According to the characteristics of the teaching of civil engineering majors in colleges and other sister colleges, combined with the requirements of the National Civil Engineering Professional Committee for talent training, the four courses of geotechnical engineering direction were condensed through the comprehensive analysis of college graduate questionnaire statistics and fault tree theory. On this basis, we have completed the revision of the personnel training plan, and achieved some achievements in the areas of college students 'innovative experimental projects, subject competitions, combination of production and education, and students' graduation and employment, providing useful references the teaching reform and professional construction of geotechnical engineering courses. At the same time, it also enriched and expanded the application of the curriculum group system in teaching operation and the realization of personnel training standards.

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