

# Exploration on Technical Measures for Compaction Construction of Highway Engineering Roadbed and Pavement

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**Abstract:** *The compaction of roadbed and pavement in highway engineering is an important process in the entire pavement construction. Adequate compaction of the roadbed and pavement structural layer is an important condition to ensure the strength of the roadbed and pavement, which is related to the quality of the entire construction and the service life after it is put into operation. If the compaction construction quality does not meet the standards, it will not only affect the actual application and durability of the project, but also increase traffic risks in highway applications. Therefore, attention must be paid to the compaction quality of the roadbed and pavement during construction. To achieve this, construction enterprises and personnel should strive to improve compaction technology and management level based on the specific situation of the construction site and local natural and geological conditions, and use relevant technical measures in a targeted manner. Only in this way can the overall quality of highway engineering be ensured. Therefore, it is necessary to conduct relevant research on the technical measures for compaction construction of roadbed and pavement in highway engineering.*

**Keywords:** road engineering; Roadbed and pavement construction; Compaction technology.

## 1. INTRODUCTION

Highway is an important component of China's transportation system, and urban construction and socio-economic development cannot do without highway transportation. The common diseases in highway engineering mainly include roadbed settlement, road potholes, cracks, honeycomb pits, ruts, etc. The occurrence of common diseases in highway engineering is mostly related to the compaction technology and effect of roadbed and pavement. The compaction construction technology of roadbed and pavement plays an important role in highway engineering construction. In the construction process of highway engineering, scientific construction techniques should be applied, with particular emphasis on the compaction construction technology of roadbed and pavement, to improve the overall quality of highway engineering and ensure the durability and driving comfort of highway engineering.

**Table 1:** Segmentation of Coupling Harmonization Results

degree of coupling coordination	hierarchy	degree of coupling coordination	hierarchy
$0 \leq D < 0.3$	severe disorder	$0.5 \leq D < 0.7$	Intermediate level coordination
$0.3 \leq D < 0.5$	Primary coordination	$0.7 \leq D$	Senior coordination

### 1.1 Enhance the firmness of highway pavement to ensure its long-term stability

In order to implement it efficiently, relevant design parties often focus on the strength of the road surface, and the compaction construction of the roadbed and pavement involved has received special attention [1]. To effectively ensure the stability and efficiency of the construction process at this stage, the specific progress must be carried out according to the most standardized and rigorous standards. Only in this way can the construction quality of the entire project be guaranteed to the greatest extent.

### 1.2 Maximizing the Stability of Highway Pavements

For highway engineering, the compaction construction of the roadbed and pavement involved is specifically implemented to reduce the pores between various construction materials, reduce the damage of external erosion such as rainwater to the roadbed and pavement, and thus ensure the stable operation of the highway to the greatest extent possible.

### 1.3 Effectively ensuring the smoothness and smoothness of road surfaces

During the construction process of highway engineering, the roadbed and pavement must undergo layered compaction, quality testing, and acceptance. Only after passing the acceptance can they enter the next construction process. If the compaction quality control is not in place, the uncompacted roadbed and pavement during the construction phase will be crushed by heavy construction vehicles, causing local settlement of the already constructed roadbed and pavement, resulting in unevenness and poor flatness of the roadbed and pavement, thereby affecting the compaction construction quality and flatness of the next layer or the entire roadbed and pavement. Long periods of vehicle compaction during the operation phase can cause uneven settlement of the road, gradually leading to dents, cracks, or fractures. Therefore, in highway engineering construction, strict control of roadbed and pavement compaction can effectively solve the problems of smoothness during the construction and operation periods.

## **2. FACTORS AFFECTING THE COMPACTION CONSTRUCTION QUALITY OF ROADBED AND PAVEMENT**

Self-efficacy is an assessment of an individual's confidence and ability to perform a specific task. This paper reviews the existing literature on self-efficacy by synthesising and analysing it in terms of theoretical frameworks, measurement tools, and influencing factors. The results show that self-efficacy has an important impact on individuals' learning, work, and health. However, there are some shortcomings in the research on self-efficacy in different fields, which need to be further strengthened. Self-efficacy, as an important psychological concept, is of great significance in different fields of application. However, there are still some shortcomings in the research on self-efficacy. Firstly, the current measurement tools for self-efficacy still need to be further improved. Second, research on self-efficacy in different fields is not systematic and comprehensive enough, and more in-depth studies are needed. Finally, future research could explore the differences and influencing factors of self-efficacy in different cultures. Self-efficacy, as an important psychological concept, has attracted widespread attention. It was first proposed by Albert Bandura, one of the founders of social cognitive theory, in the 1970s and has been supported by a large number of empirical studies. Self-efficacy refers to an individual's assessment of his or her confidence and ability to perform a specific task. It is widely recognised in the academic community that self-efficacy has a significant impact on an individual's learning, work and health. In this paper, we will review self-efficacy from the theoretical framework, measurement tools, and influencing factors.

### **2.1 Soil moisture content of roadbed**

In the construction of compacting the roadbed and soil, it is necessary to strictly control the moisture content of the soil and roadbed. Only by ensuring that the moisture content of the soil is in the optimal state can the construction after soil compaction be carried out, and the compactness of the roadbed and soil can be fundamentally ensured. In the construction of compacting the roadbed and road surface, the soil moisture content constantly changes with its depth, which also affects the soil compactness. In addition, due to factors such as pressure, the soil density also becomes increasingly high, and the corresponding water ratio in the soil also increases, thereby affecting the compaction effect. Therefore, in the compaction construction of the roadbed and soil, it is required that construction personnel strictly control the moisture content of the roadbed soil, especially attach great importance to the management of the filler and soil moisture content, ensuring that the filler can be compacted and constructed under the best moisture content, in order to effectively ensure the quality of construction required after compaction of the roadbed and soil.

### **2.2 Rolling process**

The rolling process is the main process technology of subgrade and pavement compaction construction, which aims to use equipment to compact the Soil compaction of subgrade and pavement to make it more stable and hard. The rolling process is relatively complex, and some factors have a direct impact on the compaction quality. However, no matter what type of rolling method is used, the principle of edge first, middle first, slow first, fast first, light first and heavy second must be followed when rolling in accordance with relevant national and industrial regulations. Generally, in compaction construction, it is necessary to roll at a uniform speed from the lower part of the road surface to the higher part; For some special sections, it is necessary to redefine the rolling sequence. In addition, the rolling speed will also have a certain impact on the compaction effect of the roadbed and pavement. When the rolling speed is too fast, the road surface cannot be rolled in place and there will be ups and downs; When the rolling speed is too slow, the road load may exceed the limit it can withstand, leading to construction quality issues. In addition, the thickness of rolling compaction is also a major quality influencing factor, which is

not conducive to the control of important quality indicators such as road strength, and requires construction personnel to pay attention.

### **2.3 Driving speed of rolling machinery**

Because the compaction process of roadbed and pavement requires the use of specialized equipment, the driving speed of mechanical compaction is also an important indicator that needs to be paid attention to in compaction quality control. Based on the experience of road engineering roadbed and pavement compaction construction, once the construction operation on site is carried out, the driving speed of the rolling machinery is too fast, and the precision of the on-site roadbed and pavement compaction is not enough. The compaction index is lower than the normal standard, and in some serious cases, the phenomenon of uneven pavement will inevitably occur, which cannot guarantee the performance of the pavement; But if the driving speed of the rolling machinery is too slow, it means that the machinery will stay on each fixed road surface for a long time, and the road surface will undergo significant pressure for a long time, leading to damage to the internal structure. Even after the road is put into normal use, it is highly susceptible to internal and external factors that exacerbate road diseases, such as road potholes and other problems, seriously reducing the performance of the road surface.

## **3. APPLICATION STRATEGY OF SUBGRADE AND PAVEMENT COMPACTION TECHNOLOGY IN ROADWORKS**

This paper studies the impact of China's four climate change policies on the stock index of the carbon neutral industry chain sector from 2020 to 2023. Based on six contagion tests, determine how policy shocks affect relevant sectors. Empirical results show that China's climate change policy has had a significant impact on the carbon neutral industry chain sector through the channel of correlation change. Among the four policies, Policy 2 Coordinating Environmental Protection and Climate Change Adaptation Policy was found to be the most effective tool, followed by Policy 4 Climate Change Adaptation Strategies for 2035, and Policy 3 China's Policies and Actions on Climate Change had the least effect. This provides useful information for policymakers to design the best policy responses and for investors to design effective investment strategies.

### **3.1 Strengthen strict control over construction materials**

In the compaction construction process of roadbed and pavement in road engineering, in order to ensure the compaction construction effect, it is necessary to follow the quality standards and requirements of road construction, select appropriate materials, and ensure the qualification of material quality during the construction process. Therefore, in addition to scientific selection of compaction technology, strict control of construction materials should be carried out in combination with the overall requirements of Roadworks in the early work. In the procurement process of materials, it is necessary to compare the same type of materials in the market, select high-quality and high-performance materials from qualified suppliers, and conduct spot checks and inspections when materials enter the site. Unqualified materials are strictly prohibited from entering and using. When implementing road engineering projects, the soil and geology on site are poor. In order to improve the compaction construction effect, it is necessary to excavate these poor soil qualities to avoid mixing them with the compacted material. After completing the soil excavation treatment, the construction personnel should conduct tests and analysis on the materials, and verify whether the various indicators of the materials meet the requirements based on the test results. As required, only when the material meets the requirements in all aspects of performance can it be used as the preferred material for compaction construction. In the implementation of some road engineering projects, composite materials are used. In the use of these materials, it is even more necessary to ensure quality control and ensure the scientific application of materials based on the grasp of material properties.

### **3.2 Moisture content of roadbed filling material**

When the moisture content of the filler is low, the gravitational force between the filler particles keeps the soil layer in a relatively loose state or cohesive structure. The pores in the filling material are interconnected, with less water and more air. During compaction by mechanical compaction, although the gas in the particle pores is easily discharged, the compactness of the filling material can be increased. However, due to the lack of lubrication by the water film, the external compaction effect is not sufficient to overcome the gravitational and frictional resistance between the filling materials, and the relative movement between particles is not significant. Therefore, the compaction effect is poor [4].

As the moisture content of the filling material gradually increases, the water film thickens, the soil blocks soften,

and the gravitational and frictional forces between the particles also decrease accordingly. Under the rolling action of the compaction machinery, the soil particles gradually compact, and the compaction effect gradually improves. At the optimal moisture content of the filling material, although the particle pores are less connected or disconnected, the water and air in the pores are closed and cannot be discharged. Although the pore water pressure and air pressure generated inside the filling material during rolling also weaken the rolling effect, the experimental results show that the water contained in the filling material is conducive to the relative movement of particles under the external pressure generated by rolling, enabling the filling material to achieve the optimal dry bulk density and become more dense. When the optimal moisture content is reached, the density of the filler reaches the limit value under the compaction function [5].

### **3.3 Compaction equipment and number of passes**

Compaction construction, which refers to the compaction of roadbed and pavement, is generally divided into two stages. The first stage should be carried out immediately after the paving construction, and the speed and route of the two should be consistent, mainly playing a preliminary compaction role, providing a good foundation for the second stage of compaction construction. The requirements for the second stage of compaction construction are relatively complex, and it is usually recommended to use segmented compaction method. This method divides the entire compaction range into several sections, and each section is checked for accuracy before proceeding to the next section of compaction. During the secondary compaction process, construction personnel should pay attention to the number of compaction times and rolling speed. Firstly, the number of compaction times can be confirmed according to the construction plan requirements. However, after reaching the number of times, the compaction effect needs to be tested. If the requirements are not met, the number of times needs to be increased and the compaction parameters need to be optimized. The second is the compaction speed, with the second compaction speed slightly faster than the first compaction, which should also be determined based on the actual situation. It is worth noting that according to the basic process of "roadbed first, then pavement", the compaction construction of roadbed and pavement must be carried out separately. In roadbed compaction, heavy vibration compaction equipment is generally used, because roadbed compaction must ensure the stable combination of asphalt and substrate, and be flat. However, in actual situations, there may be difficult to compact objects such as crushed stones at the substrate, so using heavy vibration compaction equipment can solve this problem. As long as the rolling scheme design is done well, the 16t double steel wheel vibration rolling can be used. For example, if the number of passes is 7, the speed of the first two passes is generally 1.5~2.0km/h, the speed of the middle three passes is generally 3.5~4.5km/h, and the speed of the last two passes is generally 2.5~3.5km/h. During each pass, it is important to note that there is a certain overlap between adjacent areas, with an overlap range of no more than 20cm and no less than 15cm, which can ensure consistent overall compaction and ensure the quality of the roadbed. In terms of road surface compaction, two wheel steel drum rollers, three wheel steel drum rollers, etc. can generally be selected, with a weight of 8-15t (depending on the situation). These types of rollers do not have vibration function, and the rolling pressure is stable, thus ensuring the smoothness of the road surface. However, attention should also be paid to the design of the rolling plan for road surface compaction to avoid problems.

## **4. FROM BASIC QUESTIONS TO A DEEP UNDERSTANDING OF BIG CONCEPTS**

### **4.1 Language lessons cannot be rushed**

Problem-based research cases are generally school-based, and most are interdisciplinary or even super-disciplinary, mainly involving social, political, legal, scientific, biological, geographical, historical and other aspects. These cases are intentionally or unintentionally combined with language subjects. Examples include functional writing, spelling when writing reports, literature as easy-to-read material, etc. Thematic-based research also often involves multiple fields. Of the more than 30 translations the author reviewed, only one, suspected of being a search for a mother's garden, raises the question of why so many women remain silent. There are two known examples of composition teaching: interviews with elders in the community and scientific creation with children. Both examples are long-term writing and have a distinct interdisciplinary character, with the former dealing with society, history, and economics and the latter with a scientific basis. In Chinese basic education, Chinese subject has always been a key soldier in curriculum and teaching reform [20]. At present, some language teachers are conducting problem-based learning in language courses. According to the relevant translation works, it is found that there is no problem-based language learning and project-based learning in foreign countries, and there are no implementation cases for reference. What, at first glance, looks like a language-driven problem is a cross-cutting area. Like how do books become classics? What is the good literature? Students' answers to such questions should include politics, history, society, culture, etc. Should language be subject-oriented in a single discipline, with

students as the main body actively engaging in multi-disciplinary, cross- professional learning plans? This point needs further verification.

The curriculum, from basic problems to a deep understanding of big concepts, is more suitable for language courses. This involves refining the concepts of the content and process skills of the language discipline, as well as the design of the basic problems, which require preliminary research and teaching experiments. Language courses include two levels: content level and program level. In terms of content, it involves the knowledge of linguistics, literature, media, etc. For example, Chinese characters are a carrier of culture, Chinese is a way of thinking of a nation, Chinese thoughts with a long history, literary classics, modern Chinese literature classics, and Chinese translation of world literature classics [21]. In the past, words, sentences, texts, language, cultivation, and logic were often referred to as the learning content of the content dimension of Chinese subjects. Procedural skill level refers to the knowledge and ability in reading, writing, and oral communication. In the Chinese curriculum standard, the essence of the Chinese curriculum is a comprehensive and practical course to learn the use of language, which indicates that the Chinese curriculum should pay attention to the process and skills. In fact, some ready-made theoretical terms reflect real-life problem situations, such as communication scenarios, communication scenarios, communication contexts, communication scenarios, etc. Luo Riye once stressed that we would rather talk about the communication situation than the problem in the Chinese course. The task-oriented English teaching in Belgium uses some theoretical words. This is called a verbal situation, in which both parties need to use natural and fluent language. The book "National Foreign Language Learning Goals in the 21st Century" adopts the concept of communicative situations and extends it to three levels.

One is the mutual communication between people. Through dialogue, students can ask questions or provide information, express emotions, exchange views, and have two-way communication with the characteristics of semantic negotiation. The second is the unidirectional understanding and interpretation of communication. Students can understand and interpret spoken and written language on various topics. The third is a form of one-way communication [22]. In English teaching, learners express their opinions and ideas through understanding various topics. It is roughly equivalent to reading and writing if it is limited to the text to understand the interpretation of communication and performance communication. Problem scenarios and communication scenarios are two relatively close concepts. The problems that arise in the communication environment are difficult. From the perspective of cognitive psychology, communication problems such as reading, writing, and oral communication can be described as problem-solving. But from the point of view of language education, this statement is too much. Because of the problem of comprehension in reading, the problem of how to express it is very different from the actual problem in the real situation, the controversial problem and so on.

Until these questions are answered, the language class should not proceed unless it is an experiment to solve these questions. For the whole language discipline, blindly following the trend when the theory and practice are not clear is likely to pay a painful price in the future.

#### **4.2 All disciplines should attach importance to the guidance of subject reading and subject writing**

Language is the most important link between various subjects in a university. To cultivate students' ability of listening, speaking, reading, writing, viewing and presentation is not only a language subject. It is a work that should be carried out in the whole curriculum of basic education, and it should also be carried out in every curriculum of primary and secondary schools. As Radel said, if you want to have deep thinking about a subject, you must learn the subject's language and be able to read and write fluently in the subject's language. So it should be the responsibility of English professionals to teach children this skill, not foreign language teachers. Language courses cannot afford to train all the literacy skills in the curriculum. In the language discipline, the level of process skills focuses on reading and creating specific texts, such as prose, poetry, novels and some articles on public topics. In the past, we took it for granted that the development of reading and writing skills in language teaching was naïve [23]. But John Hardy, through his many experiments, tells us that knowledge transfer is not an easy thing and that if one does not integrate the learning method into a specific environment, all he does is in vain. For example, information acquisition is particularly important in problem scenario-based research learning. In subject reading, middle school students need to know how to find relevant materials, know what content is in the main materials, and know what content to look for in a certain material. The role of exploratory reading and information source knowledge, inspection reading and search reading in subject reading has been paid unprecedented attention.

Reading skills, whose main goal is to acquire information, may be available only in individual subjects, which language teachers have the power to do but not to do. Therefore, problem- based learning, project-based learning,

and unit design from basic problems to deep understanding of big concepts all attach great importance to the reading and writing topics. The Agency's "Implementation of the Primary School Project: International Curriculum Framework for Primary Education" stipulates that all students participating in the program should be treated as language teachers. It is stipulated that language should be used throughout the process as an element beyond the subject itself. The Buck Institute of Education's Teacher's Guide to Project-Based Learning - Secondary Pedagogy for the 21st Century clarifies that reading and writing skills are central to schooling and must be integrated into the curriculum. We believe that there should be an important part of every curriculum that reflects literacy. It can assess a student's writing, speaking or reading skills.

According to the author's analysis, there must be some problems that have not been solved. It's not that teachers don't understand; it's that education researchers don't understand. It's like the collaboration, independence, and exploration that has been roaring for almost 20 years. Perhaps they will repeat the same mistakes, the highest level of thinking they are now saying. Nowadays, many first-line Chinese teachers are carrying out large unit teaching design, group reading, project-based learning and other work, but they often ask me what the large unit is. Why how to project a group article? To meet some advanced ideas, hurriedly keep up with the trend of The Times and do not know what to do, which may be the most important lesson to be drawn from the reform of Chinese curriculum and teaching in the past 20 years. Many of the problems in language learning and education are not suddenly realized after the fact.

On the contrary, they often realize something will go wrong before it even happens, so they don't know anything about it. There is no doubt that most of the ideas in the field of basic education come from Western countries. Therefore, there are roughly two ways to understand the mechanism and reason: to understand foreign educational concepts and practices. The second is to study local society prudently and with the spirit of exploration to find new problems and situations in the national environment.

## 5. CONCLUSION

In summary, the compaction construction of roadbed and pavement is a key step in construction. When carrying out construction, it is necessary to pay attention to various key points. To ensure that the compaction construction of roadbed and pavement meets relevant regulations and requirements, construction personnel should. According to the construction standards of road engineering, attention should be paid to controlling the various details of roadbed and pavement compaction construction to ensure roadbed stability and pavement compaction. Climate change is one of the most critical challenges facing the world in the 21st century. Addressing climate change is an important way to promote national economic and social development and incorporate green and low-carbon development into the construction of ecological civilization. Global warming can be traced back to the high consumption of coal, which typically leads to an increase in carbon dioxide emissions from coal combustion. Approximately 60% of global warming can be attributed to changes in carbon dioxide concentration. In climate change policies, improving energy efficiency and investing in renewable energy are considered key drivers that may lead to long-term sustainable outcomes. The goal of climate policy is to effectively reduce carbon emissions. With the rapid development of mobile internet technology, there are more emerging creative groups in the creation of short video content. On the basis of helping "Internet plus+agriculture", "short video+immersive live broadcast" has become an important way to sell agricultural products, and how to create a "immersive scene" marketing model is an urgent problem to be solved to promote the sale of agricultural products. This article starts from the immersive live streaming of "agriculture, rural areas, and farmers" products, analyzes its development status, facing practical problems, and marketing strategies, and further explores the promotion function of immersive agricultural product marketing.

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