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Route Selection and Route Design Ideas for Highways

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Abstract: ***The construction of highway projects is a relatively complex and systematic task, especially the route selection in the preliminary design, which directly affects the smooth completion of the entire project. Therefore, it is necessary to take reasonable and feasible technical measures to optimize the route, and evaluate it through corresponding methods after determining the route plan. In the future, research on highway route selection technology should be intensified. In addition to improving and perfecting existing methods, new technologies should also be developed to better serve the construction of highway projects.***

Keywords: Expressway; Route selection ideas; Route design.

1. INTRODUCTION

When carrying out highway route selection and design work, designers need to adhere to the principles of safety and economy, and focus on implementing the requirements of green highways. They should fully consider factors such as geological conditions, natural and cultural characteristics of the project area, and select appropriate route plans with minimal demolition, land use, and damage to the ecological environment. They should flexibly use design indicators to design routes that match the changes in terrain, G1221 Yanji–Changchun Expressway, improve the overall service performance, minimize the initial investment, and create higher economic benefits.

2. DESIGN IDEAS FOR HIGHWAY ROUTES

2.1 Safety and Environmental Design

The prerequisite for designing highways is to ensure road safety. Improving the 'safety awareness' of highways from the design stage can eliminate safety hazards as much as possible and prevent traffic accidents in mountainous areas. In the specific design of highways, sufficient fault tolerance mechanisms should be established to continuously improve the design of highways and prevent potential design hazards from causing accidents. When designing, full consideration should also be given to the actual terrain and geological characteristics of the area where the route passes, and on the basis of meeting environmental requirements, reasonable control should be exercised over infrastructure such as slope height. In addition, the inevitable filling and excavation operations during construction can lead to movement and deformation of the surrounding soil, and in severe cases, it can also cause soil erosion and damage to vegetation in mountainous areas, posing a great threat to the environment.

2.2 Adaptation to terrain and reasonable conservation

When constructing highways in plain areas, the "straight line positioning method" is often used for route selection, but this method is clearly not suitable for mountainous areas. When constructing highways in mountainous areas, flexible route selection should be carried out through the "curve positioning method" based on the terrain characteristics and geological conditions of each section. The determination of the route should make maximum use of the terrain conditions, avoid dismantling the surrounding facilities as much as possible, and also reduce the construction volume of high filling and deep excavation to a certain extent. When designing the route, the rationality of the design scheme greatly affects the construction quality, cost, and speed of the highway. The operational capacity of highways. During the design phase, the construction cost was minimized and the maximum savings in highway construction were achieved. In the actual route selection process, the principle of economy should also be adhered to. In the pre construction survey process, the principle of reducing construction costs should be adhered to. On the premise of meeting safety and environmental protection, the route should be reasonably determined to ensure that the quality of the highway meets the production and operation activities of mountainous areas and the needs of people's lives. In addition, comprehensive consideration should also be given to various factors that affect highway construction, constantly adjusting and improving design plans, and

enhancing the ability to select routes.

3. PRINCIPLES OF HIGHWAY ROUTE SELECTION AND ROUTE DESIGN

In order to realize greater value and seek further development space on the basis of their own core products and technologies, enterprises often choose diversification strategies, including vertical diversification and horizontal diversification. In order to break through its own bottleneck, Zhuhai Gree Electric Co., Ltd. started the vertical diversification strategy, and then carried out the horizontal diversification strategy. This paper first analyzes the motivation and degree of diversification strategy in Gree Electric, and then analyzes the financial risk in Gree Electric from three aspects: financing risk, investment risk and operation risk. Finally, the F-score model is used to evaluate the overall financial risk of Gree Electric and make suggestions.

In recent years, as China's various markets tend to be saturated and the core products of enterprises tend to be stable, diversified expansion has become the first choice strategy for enterprises to cope with the future market and economic development and changes. However, due to the vagaries of the market economy environment, some enterprises blindly carry out diversification strategies without in-depth research and analysis, and their development prospects are not optimistic because the market development tends to be mature and the remaining market share is small. Some enterprises will even increase their financial risks and even go to the brink of bankruptcy because of the lack of concentration of business due to diversification. Therefore, the key to the successful implementation of enterprise diversification strategy lies in the effective management of enterprise financial risks. If the enterprise pays attention to one thing and loses another, the financial risks caused by forcibly implementing diversification strategy will cause great financial crisis to the enterprise, and even make the enterprise face the situation of bankruptcy. How to ensure the scientific and correct decision-making of enterprise diversification strategy and how to deal with the influence of diversification strategy on enterprise financial risk is particularly important.

3.1 Safety principles

The first principle that should be followed in the selection and design of highway routes is the principle of safety. From the perspective of highway route design, the safety principle mainly includes the following two aspects: first, ensuring the engineering safety of the project during survey, construction, and operation. The area along the project is part of the middle mountains and hills in southwest Guizhou and low mountains and hills in south China. According to the field survey, the types of unfavorable geology in the line corridor are mainly Karst Plateau, coal mine goafs, landslides, dangerous rocks, bedding slopes, soft soil, high liquid limit soil, etc. Therefore, the overall and route professional leaders should participate in the investigation and research work of the engineering geology profession throughout the entire process, fully understand the geological conditions along the project, fully implement the concept of geological route selection+terrain route selection, balance the relationship between "avoiding unfavorable geology" and "strengthening engineering measures", actively carry out local route scheme comparison and selection, and maximize the engineering safety of the project. The second is to ensure the safety of vehicles traveling on the expressway during operation, which requires designers to fully understand the design specifications and local customs, flexibly use the horizontal and vertical design indicators of the route [1], focus on Stopping sight distance, horizontal and vertical combination design and other contents, and improve the safety and comfort of highway alignment.

3.2 Adapting to local conditions

When designing routes for highways, it is necessary to fully consider the regional environmental characteristics, and only by fully considering the local terrain conditions can the rationality of highway route design be ensured. Reasonable application of cross-section and ensuring its various aspects. When the plane is in a smooth state and the terrain advantages are integrated, the goal of integrating the highway with the environment can be achieved by connecting the surface design and linear factors. While ensuring the operation effect of the highway, it also extends the service life of the highway to a certain extent.

3.3 Green development principles

During the construction process of highway projects, surveying, construction, operation and other links may have adverse effects on the natural and cultural environment along the route, and in severe cases, irreparable damage may be caused; Project land acquisition and demolition are generally difficult to avoid, but a large amount of

demolition and concentrated occupation of fertile land will not only significantly increase the cost of project land acquisition and demolition and the coordination and resettlement workload of the construction unit, but also easily form adverse factors that affect social harmony and stability. The project has a large amount of roadbed waste, and a large amount of excavation and waste engineering is prone to damage to the natural environment. This requires designers to objectively and actively conduct targeted multi-plan comparison and thematic research when designing routes; Emphasis should be placed on strengthening the comparison and selection of fill embankments, bridges, and high slopes. Specific analysis should be carried out based on the terrain and geological conditions of the location, combined with the construction plan, to digest as much roadbed waste as possible, and to avoid or reduce the impact of engineering project construction on residential areas, farmland, and natural environment along the project line. In the construction organization design, it is necessary to predict the potential damage to the surrounding environment during the construction process, formulate practical and feasible environmental protection and restoration plans, ensure the harmony and unity of engineering construction with the natural and cultural environment, and implement the new requirements of green development.

3.4 Ecological and Environmental Protection Standards

During the construction process of highways, it is inevitable that they will cause certain damage to the surrounding ecological environment. Therefore, at the beginning of route design, it is necessary to consider the ecological and environmental requirements of different regions, and try to protect the human and natural environment within the areas covered by highways. Especially for cultural relics and buildings with important historical value, scientific and reasonable protection plans need to be formulated in advance, Choose an extended route to bypass the area in an unavoidable location [2]. After the construction is completed, it is necessary to calculate the damage caused to the surrounding ecological environment during the construction process, and to carry out environmental restoration in the later stage of the project construction to ensure the final construction quality of the highway.

3.5 Principle of full cycle economy

This project is one of the largest individual projects with a total investment scale in the southwest region, ensuring the economic benefits of highway projects and also one of the basic principles of highway route selection and design. The project covers a wide area and takes a long time, consuming huge resources throughout the entire construction process; After the opening of the highway, in order to ensure the functionality, safety, and comfort of drivers and passengers, the inspection and maintenance of the project's roadbed, pavement, bridges, tunnels, and the use and maintenance of traffic safety mechanical and electrical facilities also require continuous investment of funds and resources. Overall, the entire cycle of project construction and operation is a long-term process. How to scientifically and reasonably control project construction and operation costs during the design phase is a key issue that modern survey and design personnel need to focus on.

4. DESIGN METHOD FOR EXPRESSWAY ROUTE

Founded in 1991, Zhuhai Gree Electric Co., Ltd. (hereinafter referred to as Gree Electric) was listed on Shenzhen Stock Exchange in 1996. At the beginning of the company's establishment, the core product was household air conditioning, and now it has developed into a diversified and scientific global industrial manufacturing group. In order to maximize the enterprise value, strengthen and improve the supporting industrial chain, in 2005, Gree Electric vertically acquired its subsidiaries such as Lingda Compressor, and completed its first vertical diversification strategy. Since then, it has been concentrating on the air-conditioning industry and firmly holding the core technology of air-conditioning. However, in the past six years, Gree Electric has rapidly entered many fields, such as small household appliances, water purifiers, water heaters, mobile phones, new energy, and started a horizontal diversification strategy.

4.1 Line Crossing Design

As an inevitable situation in the actual construction process of highways, line intersections need to be carefully considered by designers, among which interchanges are the top priority in the engineering construction process. Excessive line intersections or improper setting of line intersections will increase the difficulty of highway construction, mainly including the following points: first, if a small-scale intersection scheme is chosen, It is difficult to ensure the expansion effect of the intersection area due to the terrain limitations of the location of this project; The second reason is that choosing to build steep roads will affect the stability and comfort of driving [3], which is also the main reason why traffic safety accidents are prone to occur at intersections; Thirdly, if the driving

sight distance is small, the safety risk of driving will increase. To address the above issues, it is not only necessary to optimize the horizontal and vertical linetypes of interchanges, but also to improve the excessive linetypes of ramp separation and merging sections, emphasizing the importance of channelization design at level crossings [3], and developing improvement plans for highway service quality in conjunction with surrounding actual conditions to ensure that the safety performance of driving vehicles is consistent with the expected design goals.

4.2 Vertical linear design

Vertical linear design, in simple terms, is a highway route design diagram developed based on vertical changes. Taking the determination of design parameters such as slope and vertical curve radius during highway construction as an example, full consideration should be given to the changes highlighted during the construction process of the highway and the construction status of the surrounding environment. The final data obtained is closely related to the maximum speed of vehicles driving on the highway. Due to the location of this highway containing multiple mountain ranges, the elevation changes are very significant due to the large fluctuations in the terrain. To ensure driving safety after the completion of highway construction, it is necessary to fully consider the minimum value of logarithmic curve radius to ensure the shortest effect of slope length distance. After fully considering the surrounding environmental conditions and analyzing the results based on the design drawings, it was found that the optimal application effect can be highlighted when the longitudinal slope change is around 2%. On the basis of meeting the driving sight distance regulations, the effectiveness of speed regulation can be ensured [4], which is also an important basis for ensuring the safety of vehicles driving on high-speed highways.

4.3 Vertical and horizontal linear combination design

In order to avoid unfavorable geological conditions or meet the relevant requirements of design specifications as much as possible, detours are inevitable during the construction process of highways. This requires that as a highway designer, the comfort and adaptability of the linear combination should be combined with the plane and vertical lines, which determine the final driving safety and usage effect of highways. Due to the undulating terrain and unnatural line shape of this highway, designers should fully consider driving safety and therefore take the following measures: firstly, traffic sign lines that meet the design conditions should be constructed, and the color of the traffic sign lines should be eye-catching to better remind drivers of the attention of the road section; The second is to set up appropriate sight guidance facilities and construct reasonable protective facilities that can maximize. Reduce the risk of traffic accidents [5]. In addition, to ensure the safety of the use of highways after construction, the initial design of the route should also comprehensively consider different terrain and environmental conditions, and ensure the rationality of the application of straight lines, transition curves, and original curves. In flat terrain areas, straight line design schemes should be applied as much as possible. It should be noted that maintaining long-term driving in straight line areas can easily cause driver fatigue.

5. CONCLUSION

In summary, economic progress has injected new impetus into the sustainable development of society. In order to meet the development needs of society, the number of basic projects and supporting facilities has also significantly increased compared to before. As a key factor determining the quality of transportation, the importance of highways is beyond doubt. The progress of such engineering construction work is complex and arduous. Therefore, in order to ensure the overall quality of engineering construction, it is necessary to clarify the importance of route selection and design for its final construction effect. The design effect of the route directly determines the later operation status and safety of the highway, and its service life is also related to the route selection and design are closely related, so in-depth analysis of the application process of this type of work has extremely important practical application value.

REFERENCES

[1] Xie Wei Route selection and design strategies for highways [J] Sichuan Building Materials, 2019 (8): 182-183
[2] Chang li Discussion on optimization model of road route selection based on road design and Transportation planning [J] Science and Technology Innovation, 2019, 11 (25): 116-117
[3] Lv Yaolong Research on the Basic Ideas and Route Selection Methods of Expressway Route Design [J] Smart City, 2018 (13): 56-57

[4] Huang Jianfeng Basic ideas and route selection methods for highway route design [J] Highway Transportation Technology (Applied Technology Edition), 2018, 14 (10): 144-146
[5] Yu Dongbo Analysis of the Basic Principles and Methods of Highway Route Selection [J] Theoretical Research on Urban Construction (Electronic Version), 2020, 11 (07): 134-135
[6] Zhou Shouhua, Yang Jihua, Wang Ping. On the early warning analysis of financial crisis-F-score model [J]. Accounting Research, 1996(08):8-11.
[7] Wu Weizhong, Wang Fanghua. Motivation analysis of enterprise diversification [J]. Journal of Huazhong University of Science and Technology (Urban Science Edition), 2005(04):73-75.
[8] Liu Xuebing, Yuan Zhihui, Zhong Liling. Comparative analysis of F score model and Z score model- taking ST Qingqi as an example [J]. Friends of Accounting, 2011(18):101-103.
[9] Chen Tao. Research on the measurement method of enterprise diversification-based on three dimensions of diversification [J]. Human Resource Management, 2011(06):236-238.
[10] Fu Bin. Discussion on financial risk control of enterprises based on diversification [J]. Accounting Newsletter, 2014,(35):110-111.
[11] Chen Suqin, Zheng Danfeng. Research on the correlation between diversification and financial performance of household appliances enterprises [J]. Accounting Newsletter 2017(35):37-42.
[12] Lun Shujuan. Corporate Financial Risk and Control under Diversification Strategy-Taking Evergrande Real Estate as an Example [J]. Accounting Newsletter, 2018,(32):118-121.
[13] Source: Gree Electric's financial statements from 2013 to 2022.