

Analysis of the key points of route design for low-grade highway reconstruction and expansion

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Abstract

With China's economy and people's living standards increased significantly, the number of vehicles held by the national rising, the road transport has a greater impact on the existing low-grade roads can not meet the people's growing demand for traffic, the expansion project will be more and more. This paper analyses the reasons for the expansion of the existing highway, and then in the specification of the provisions of the basis, this paper according to the actual expansion project experience, this paper from the plane, longitudinal section and linear combination of the three aspects of the expansion project route design points to analyse and summarize, describes the expansion of highway engineering route design of the key points for the later expansion of highway engineering design reference to promote the project construction.

Keywords: reconstruction and expansion projects, low-grade roads, routes, traffic volumes, engineering and construction

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1. Introduction

With China's sustained and solid economic development in recent years, the people's traffic demand is increasing, the construction of highways as well as primary and secondary roads develop vigorously, and the reconstruction and expansion projects are gradually able to meet the traffic demand (Yang, et al. 2017). But the main service in the county, townships, villages between the connection of the low-grade highway currently exists in the poor quality of road surface, serious damage, poor route technical indicators, slow speed, narrow road surface and so on, so China's low-grade highway service level needs to be improved. The service level of the road and the core of the technical grade improvement is the improvement of the route technical index of the road, so this paper starts from the technical index of the route in the upgrading of the low-grade highway reconstruction and expansion, studies the problems in the low-grade reconstruction and expansion, and provides a reference role for the future reconstruction and expansion of low-grade highway.

2. The current problems of low-grade roads

(1) Existing roads can not meet the demand for traffic volume, the level of service is reduced

With the rapid development of China's social and economic development, China's counties, townships, villages, three levels of economic level has also increased dramatically, the traffic volume has increased dramatically, the original old road of the scheduled level of growth in service can not meet the high speed development of the traffic and economy, there is a disconnect between the level of service of the existing highway and the county and countryside of the development of the problem of highway problems constraints on the town's development. Taking into account the sustained and stable development of towns and cities, existing roads should be redesigned and constructed so as to give full play to the fundamental role of roads in economic development and not to become a constraint.



Fig. 1. High levels of congestion on low-grade roads

(2) Serious Road Disease

The current level of service is insufficient for low-grade highway is generally a long service time, serious

disease road, most of which cannot reach the design of the use of the period, the early construction of the road has appeared to varying degrees of disease phenomena such as uneven settlement of the base pavement, cracking, rutting and other undesirable phenomena, which reduces the safety of travelling and comfort, a variety of diseases affecting the vehicle's operating speed and travelling comfort, which leads to the level of service cannot meet the expectations. This leads to the level of service of the road cannot meet expectations (Sun, 2018).

(3) Bridge quality problems

Due to the long service life of the bridge or the development of urbanisation, the traffic volume is increasing, the original low-grade highway travelling on the number of heavy vehicles is more serious, the bridge is more serious, there are a variety of overweight overloaded vehicle damage to the bridge, the existing bridge structure and bearing capacity cannot meet the current demand, so in the reconstruction and expansion project, only rely on the reinforcement of the bridge to maintain cannot be effective in improving the problem, so for certain projects, the bridge will be replaced by a bridge, the bridge will be replaced by a bridge. Therefore, for some projects, it is a more reasonable choice to dismantle the bridge and build a new one.



Fig. 2 Diseases of low-grade highway bridges

(4) Highway reconstruction and demolition problems

With the continuous development of urbanization, the scale of China's cities has gradually become larger, originally located in the urban fringe of the national and provincial trunk roads, county roads and other highways gradually into the city limits, becoming part of the urban area, in the process of reconstruction and expansion, the houses built on both sides of the highway one after another on the highway capacity also has a great impact on the limitations of the vehicle's operating speed as well as the driving distance.

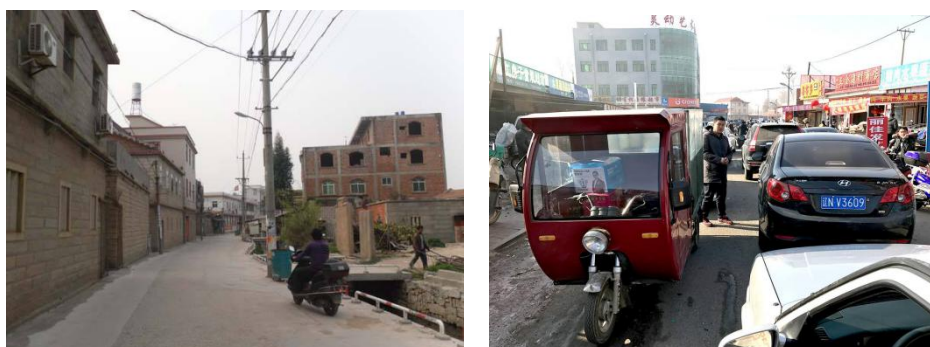


Fig. 3 Buildings on both sides of low-grade highways

3. Principles of low-level road reconstruction and expansion wiring

(1) The main principle of the new alignment is to make use of the corridor belt of the existing road, and to

upgrade and transform the technical index of the road as well as the width of the road surface on the basis of the existing road. The routes are laid out on the basis of maintaining the existing corridor belt in combination with the topography, geomorphology and geological conditions along the routes.

(2) Low-grade roads are the end point of travelling to connect households, so buildings have been constructed on both sides of the road to varying degrees. One of the main problems in the expansion of low-grade highway is the impact of highway expansion on the buildings on both sides of the road, in order to meet the technical indicators on the basis of minimizing the demolition and relocation, if necessary, you can choose to re-route the road, crossing from the outside of villages and towns, to keep the existing road, reducing the demolition and relocation of the two sides of the highway.

(3) Combine the natural environment on both sides of the road, reduce the adverse impact on the environment, and reasonably carry out the landscape design, so that the design of the highway route coincides with the surrounding environment.

(4) Under the premise of guaranteeing the clearance requirements of various facilities along the route, try to reduce the average filling and digging height of the roadbed, so as to reduce the number of projects and lower the project.

4. Analysis of the main points of the route design of the reconstruction and expansion of highway

projects

(1) Plane line fitting design

The most basic principle of low-grade highway expansion is to try to fit the old road on the basis of the corridor belt is unchanged, on the basis of the old road can reduce the amount of demolition and relocation, land acquisition, engineering.

The corridor belt of low-grade road has a vital role in the county and countryside within the scope of the road can be radiated, so the expansion of low-grade highway project in the wiring should be combined with the local urban development planning, combined with the local future traffic development needs and consider the combination of the landscape, focusing on combining with the line along the line of the actual situation of the impact of the expansion of highway line design factors and the existence of the problem of analysing and researching, so as to reasonably put forward the expansion of highway line design factors and problems(Wang, 2015). So as to reasonably propose the expansion of highway routes.

When designing the straight line and flat curve, the straight line length is too small, which will seriously affect the comfort and safety of driving; if the straight line is too long, it will easily lead to driver fatigue, which is not conducive to the safety of the vehicle. Flat curve radius is mainly through the centrifugal force and then affect the safety of driving, so the choice of the radius of the round curve and the choice of the length of the mitigation curve is a key factor for the safety and comfort of driving. In the reconstruction and expansion project, in the reasonable choice of parameters at the same time, but also pay attention to the combination of the current road curve line to the comprehensive consideration.

(2) Longitudinal section design

In the reconstruction and expansion project, the longitudinal section of the design should try to fit the original longitudinal section of the old road, not only can reduce the earth to reduce the amount of work, but also to reduce the original drainage system interference. Road longitudinal section line should be combined with the longitudinal section of the existing road, under the condition of making full use of the existing road line, and at the same time to ensure the rationality and safety of the reconstruction design.

Longitudinal section design of reasonable slope length is crucial, the slope length is too long or too short have an impact on the comfort and safety of vehicle travelling. Maximum longitudinal slope and minimum longitudinal slope should meet the relevant norms. Slope is too large will affect the safety of driving, slope is too small is not conducive to road surface drainage.

(3) Line combination

In order to meet the plane and longitudinal section design requirements under the premise of the combination of flat and longitudinal design as well as the combination of linear design has a great impact on the safety and comfort of driving (Huang, 2011). The design method to reduce the occurrence of traffic safety accidents is to combine the relationship between plane and longitudinal section, study the driver's visual and psychological changes, study the impact on the surrounding environment, and then correct the combination of longitudinal and flat line, so that the combination of line is more reasonable (Li, 2016).

(4) Requirements of town planning and development

Low-grade highway mainly serves the people's traffic travelling between counties and townships, due to the limitations of economic and other reasons, in many cases, low-grade roads not only undertake transit traffic but also undertake the function of the city's main road, not only is it dangerous to drive but also prone to congestion and environmental pollution and other problems (Zheng, 2018). For the reconstruction and expansion of such roads, should avoid the city centre, so that the old road to assume the function of the city trunk road, upgrading works to assume the function of transit traffic.

(5) Reduce house demolition and relocation

Most of the highway in the process of upgrading and reconstruction of the city's main roads will often appear on both sides of the road building intensive, such as in the original basis of reconstruction and upgrading of the two sides of the building will face a large area of demolition and relocation, which will not only result in an increase in construction costs, but will also affect the social stability. Therefore, in the process of upgrading and change in the process as far as possible to avoid the demolition of the two sides of the city's main roads, change the shift line position or not directly to the section of the upgrading and transformation of the use of the old road, to ensure that the project can be carried out smoothly.

5. Conclusion

With the rapid and stable development of China's economy in recent years, the county and countryside between the passage of the low-grade highway has been unable to meet the growing demand for traffic travel, the upgrading of low-grade highway project is imminent. In the process of upgrading and reconstruction of low-grade highway, it can not only repair and reinforce the road surface, not to mention the upgrade and reconstruction of the bold and aimless. From the route linear index, traffic demand, environmental impact, social stability and so on. This paper from the low-grade highway upgrading and transformation of the route design points, summed up part of the low-grade road expansion process should pay attention to the problem, and hope that the expansion of low-grade highway route design to play a role in reference.

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