Soil and Water Conservation Design of Low-Carbon Expressway

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Abstract: In the process of urbanization, various types of traffic construction projects have increased significantly, especially the construction of expressway. Expressways are mainly used to improve urban and rural traffic conditions and promote urban and rural economic and industrial development. However, the expressway project is large and the construction period is long. During the process of excavation and filling, it is easy to cause the original ecological landscape to be damaged, resulting in water and soil loss, and affecting the ecosystem along the highway. Therefore, in order to implement the water and soil conservation design of low-carbon expressway, it is necessary to start from the environmental protection perspective, do a good job in the investigation of the construction environment, do a good job in the planning of the construction area, minimize the damage to the water and soil structure of the construction area, and avoid the damage to the ecological environment of the construction area. This paper mainly discusses the main measures of soil and water conservation design in combination with the necessity and design elements of carbon highway.

1. Introduction

During the 75th United Nations General Assembly, China promised to achieve carbon peak by 2030 and carbon neutrality by 2060. Therefore, the central government, various industries and enterprises have begun to take “low carbon emission reduction” as the main goal and carry out green transformation actions. The transportation industry itself is an important industry for carbon emission reduction. Therefore, it should be studied in combination with low-carbon policies, development status, future trends, etc., to optimize and adjust the combination and promote green development. Therefore, attention should be paid to the design of soil and water conservation of low-carbon expressway, which requires designers to pay attention to the protection of ecological environment.

2. Necessity of Soil and Water Conservation Design for Low-Carbon Expressway

At present, the demand for urban economic exchange and culture has increased significantly, and the modern urban expressway construction project is at the key construction stage. Under the influence of the concept of ecological sustainable development and the concept of low-carbon environmental protection, modern highway construction has also begun to take into account the issue of water and soil conservation and pay more attention to it. In addition, in the construction of ecological cities, highway construction has been listed as a key part and a series of requirements have been put forward. At the same time, in the aspect of urban planning and construction technology, a more systematic, complete and feasible management mechanism is proposed for the scientific management and control below the water and soil structure to minimize the impact on the regional ecological environment.

From the traditional highway construction data, we can know that most of the highways have obvious water and soil loss problems in the actual construction process, and the concept of water and soil conservation is easy to be ignored. There are some situations such as obvious terrain damage and random waste on the construction site, which will have a serious impact on the original geological structure, and will also lead to significant changes in the drainage flow line of the site, It

affects the use of the highway itself. At the same time, the accumulation of a large amount of waste is also easy to cause water and soil pollution. If the river course is obviously occupied, it is also easy to affect the flow rate and flow of water, and finally cause the height of the river bed to change significantly, which makes it difficult to effectively protect the asset rights and interests of the surrounding residents.

Judging from the degree of loss caused by water and soil loss, this hazard has a long survival time on both sides, and the risk factors are very hidden, and it is difficult to be noticed by people. Once the problem occurs, it is easy to have a big problem. In the process of highway construction, weather and terrain have the greatest impact, which is easy to lead to water and soil loss. The main reason is that the space and time span of the expressway construction project are relatively large, so it is easy to cause obvious damage to the surface soil structure and vegetation in the actual excavation and other links, which leads to the expressway construction project facing more serious water and soil loss problems. In addition, during the actual construction period, if the weather such as severe rain and snow is encountered, the construction period will be prolonged and the problem of water and soil loss will be aggravated. Therefore, in the process of highway design, local climate issues need to be considered. In addition, during the construction of expressway, it is easy to encounter relatively large undulating terrain. Once the surface is damaged, it is easy to suffer from water and soil loss. At the same time, in the process of subgrade slope excavation, it is easy to form high slopes, which will also aggravate water and soil loss, and is not conducive to protecting the ecological environment. It can be seen that it is very important to do a good job in water and soil conservation design of expressway, which can largely alleviate the problem of water and soil loss and promote the effective protection of ecological environment.

So in the process of designing low-carbon expressway, the concept of water and soil conservation should be integrated, and a more detailed highway design scheme should be prepared by combining the demand of economic development with the function of ecological environment, and attention should be paid to the rationality of the design scheme and the feasibility of construction, which requires the relevant departments to pay sufficient attention to it. In this regard, highway designers and project managers need to focus on the concept of low carbon, do a good job in the detailed investigation of the ecosystem, and then provide some optimization suggestions for the highway design scheme, so as to effectively improve the lower ecological environment while ensuring the reasonable development of natural resources. At the same time, it is also necessary to maintain the original regional ecological structure, avoid major environmental changes, and try to avoid the impact of environmental changes on the maintenance of land and water resources. In addition, the management personnel also need to consider the potential risks in the project from the perspective of traffic safety. In the process of doing a good job in the management of regional water and soil structure, a series of maintenance measures such as retaining walls should be created to avoid water and soil loss and other problems, which will have a certain impact on the normal use of the road itself, and even damage the driver's life safety.

3. Key Points of Soil and Water Conservation Design for Low-Carbon Highway

According to the previous construction survey data, the advantages and disadvantages of the regional water and soil environment itself will have a significant impact on the construction level of the low-carbon highway. If the water and soil environment conservation work is insufficient, it is easy to affect the safety of the actual use of the highway, such as mountain slope, pavement fracture, etc. If there is a large change in the surface water and soil environment, it will directly affect the infrastructure of the highway, leading to the integrity of the internal structure of the highway The stability will have a significant impact, leading to more serious damage to the road quality. Therefore, the design unit and construction unit should base on the concept of low carbon and environmental protection, and consider the potential impact factors from the road design, road construction and road operation stages.

3.1 Highway Design Stage

At the beginning of the design of the highway, the design unit needs to assign special field investigators to investigate the environment of the highway construction site, mainly to determine the quality of the construction infrastructure, clarify the potential water and soil loss and other problems in the surrounding environment of the construction, and integrate the investigated data into the specific highway design plan to provide a useful reference basis for the highway protection system, It does not provide a useful way for the integration of low-carbon and environment-friendly ideas.

In the process of designing the expressway, the designer needs to accurately determine the relationship between the slope of the highway form and the surrounding landscape in combination with the water and soil environment and the elevation parameters, so as to reduce the amount of filling and excavation and minimize the damage to the surrounding water and soil environment on the basis of ensuring the smooth driving of vehicles; Secondly, in order to further improve the utilization rate of land resources in the region, the designer also needs to follow and make more use of idle soil, etc., enter into areas that can reduce the occupation of forest land and green land, avoid occupying areas with good water and soil conditions, avoid drastic changes to the original environment of the construction area as far as possible, avoid urban and rural residents concentrated areas as far as possible, shorten the construction volume as far as possible, and avoid farmland and water conservancy projects as far as possible. If there are still a series of problems such as improper design of bridges and culverts and other structures on the site, it is easy to cause the highway infrastructure to encroach on the river course during the construction process, resulting in obvious changes in the original structure of the river bed, which will lead to a series of problems such as the slow flow rate of the river, sediment deposition of the river course, and obvious elevation of the river bed, which is easy to bury hidden dangers in the surrounding farmland, villages and towns. It can be seen that the reporter should investigate the corresponding structures such as regions, bridges and culverts in advance to determine the appropriate direction and obvious support measures. At the same time, it is also necessary to keep the bridge location and river channel as straight and stable as possible, so that the overall roadbed structure can maintain a relatively stable state, extend the service life of the roadbed, and avoid causing obvious damage to the river channel structure. At the same time, in order to effectively avoid the obvious impact on the flow velocity of the river, the highway infrastructure also needs to do a good job in the longitudinal drainage design and other work, and quickly discharge rainwater into the river through drainage ditches, so as to effectively avoid causing a series of damage to the structure system of the highway itself; At the same time, it can effectively avoid negative impact on the soil structure on both sides of the road; Finally, the designer should set up a special retaining wall near the road toe protection, so as to facilitate blocking the sand and stone that breaks through and slides down, and thus avoid the impact on the smoothness of the road itself. In this process, it is also necessary to set up a special intercepting ditch within about 5 meters outside the road slope toe, to avoid the water and soil loss problem further aggravated by the rain washing the roadside slope of the road.

3.2 Highway Construction Stage

In the highway construction stage, it is mainly due to the mixing of road construction materials and the need to transport a large amount of earthwork and other materials, resulting in dust flying, which is easy to affect the growth of some vegetation around the road, and the soil around the road is also easy to sand, resulting in water and soil loss. Therefore, in the process of actual construction, vehicles operating on earth and stone should be covered with tarpaulin. In the construction section, sprinklers can also be used to spray water to reduce the occurrence of dust.

In the process of highway construction, a large amount of earth and stone is needed to fill the roadbed. The roadbed needs to be filled to a height of about 4 meters. Therefore, excavation and filling will cause comprehensive damage to the vegetation in the construction area. To reduce the water and soil loss caused by highway construction, the following measures can be taken: (1) When the subgrade is excavated at the location of rainwater and surface runoff, special temporary soil

sedimentation tanks should be set up, mainly to slow down the flow rate during the rainfall process, so that the sediment can be deposited. A special geotextile fence is set at the outlet side of the sedimentation tank, which is mainly used to intercept sediment here. When the road infrastructure is completed, the sedimentation tank shall be leveled; (2) The special geotextile blue can be set at the side of soil pile on both sides of the highway construction section to slow down the rate of water and soil loss; (3) In order to effectively avoid the impact of the surface and the corresponding climatic environment on the soil structure on both sides of the road, the management personnel need to set up special slope protection at relatively high positions on both sides of the road, and build special retaining walls on the filling side to maintain the stability of the foundation soil structure itself; (4) If there is special farming land beside the road, the construction management personnel need to start farming soil before construction. After the construction of the road foundation and surface layer is completed, the farming soil will be bulldozed and restored to the previous landform; (5) In the process of highway construction, it is also necessary to transport the mud produced to the designated location to avoid the pollution of waste materials to the surrounding water and soil environment; At the same time, in the process of highway construction, it is also necessary to pay attention to the effective protection of the surrounding ecosystem, and prepare the material transportation plan and material stacking plan at the construction site in advance. In addition, if the ecological environment around the construction area is seriously damaged during the construction of the road, it is necessary to plant shrubs with relatively suitable height at an interval of 2 meters during the construction of the high retaining wall, and replant them according to the surface environment, so that the landscape on both sides of the road can be basically consistent, and avoid excessive impact on the regional ecosystem.

3.3 Highway Operation Stage

In the process of the actual operation of the highway, the greening problem needs to be paid more attention, and corresponding measures should be taken according to the structure and grade of the road itself: (1) planting a special grass slope on the embankment slope, planting two rows of trees within the ground line of the highway and outside the foot of the highway slope, and planting two rows of flowers and shrubs between the trees; (2) The cutting is planted with holly shrubs outside the side ditch, about two rows of trees outside the slope and within the ground line, and holly, turf and flowers are planted in the central Fengte belt for ornament; (3) In order to effectively solve a series of problems such as the lack of surface water on the highway, effective water and soil conservation measures must be taken. A small bridge with a length of about 20m should be set at a distance of about 5km, and two culverts should be laid at a distance of about 1km, and water flow should be exchanged on both sides of the highway to maintain the free flow of aquatic organisms. In this regard, it is also necessary to deal with the borrow pit of the highway in time to prevent the soil erosion caused by land desertification, plant trees in the soil pit at the steep slope, or grass greening, and build the planting greening into more useful farmland.

4. Conclusion

The effective implementation of water and soil conservation design of low-carbon expressway can provide a more perfect coordination platform for highway construction, thus avoiding a series of impacts below the ecological environment and reducing the damage to the project quality. At the same time, setting up special protective nets can also reduce the risk of landslides as much as possible. Therefore, in the process of carrying out the water and soil design of the low-carbon highway, we must take the low-carbon highway and ecological environment protection as the guidance, clarify the various risks existing in the design, construction and operation of the highway, and then do a regular inspection and set up special protective measures, so as to maintain a relative balance between the water and soil environment of the highway construction area and the highway system.

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