

Loess area roadbed water damage and prevention measures

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Abstract: In the past two decades, the highway mileage of rapid growth, while the rapid development of highway construction, the adverse effects of natural disasters on road transport infrastructure has become increasingly prominent, Loess region has a special terrain, geology and geological climatic conditions, is the western regional road Washout one of the worst areas, severe water flood disaster losses annually roads, severely restricted the areas of highway construction and economic development. Due to the special nature of engineering loess prone to various disasters, this paper analyzes the main types of the loess areas damaged by flood and the corresponding control measures.

In Shanbei region of natural climate conditions

Geographic location

Northern Shaanxi loess plateau is located in the north of the Shaanxi, the northeast of Qinghai-Tibet plateau and the loess plateau central, mainly including Shaanxi Yulin and Yanan, Tongchuan city, including 25 counties four districts, North China's Inner Mongolia autonomous region, Gansu province, east and west of Shanxi Province, adjacent to, south connected to Weinan,.

Landform characteristics

Northern Shaanxi loess plateau is the main part of the loess plateau in China, is located in the central loess plateau, located in the second step of our country, at an altitude of 900 meter, an average elevation of 1100 m. For wide loess covering on the bedrock of the ancient lower undulating terrain, under the influence of construction movement, the river branch lander development, long-term erosion of Sichuan river and its tributaries cut, formed the current Mao ups and downs, deep valley terrain. The general characteristics of northwest, southeast low, terrain tilt from west to east. The loess landslide development in river and the second terrace loess tableland edge.

The characteristics of northern Shaanxi loess

The loess characteristics

Loess contains a large amount of silt, general is above 55%; Is visible to the naked eye big pore, pore ratio around 1; Contains calcium carbonate composition and tuberculosis; Bedding is not obvious, the vertical joint development; With wet sex and fragility, easy washing. These characteristics of loess resulted in the loess area, the road have some special diseases and **water damage**.

The multiple space of loess

Pore of loess structure can be divided into three categories: large pore (basic is visible to the naked eye); Fine pore (overhead structure of large particle pore, invisible to the naked eye, can be observed under binocular loupe); Capillary porosity (by soil particles and adhere to the above the formation of small particles of pore, more invisible to the naked eye). The three kinds of pore forming loess high porosity. In the soil pore are vertical or inclined tube, give priority to with vertically, from top to bottom, calcium carbonate membrane attached to the wall white.

The hydraulic characteristics of loess

- (1) water permeability
- (2) the shrinkage and swelling
- (3) collapse

The mechanical properties of loess

- (1) the collapsibility of loess soil
- (2) the shear strength of loess

The main types of highway roadbed water damage

Embankment collapse

Mountain along the subgrade soil or the water softening, under the condition of the subgrade slope losing support, integrity stability decreased, its weight and shear force generated by the action of vehicle load, over shear capacity of the soil, subgrade caused by partial or whole along loose irregular surface collapse; At the ends of the bridge structures are the subgrade under the action of current scour local or overall collapse.

The subgrade slope sliding

Slope erosion slump is when highway subgrade slope in under the influence of atmospheric precipitation and so on slope erosion damage phenomenon. Erosion intensity of slope itself with the size of the scour resistance and flow kinetic energy of the slope are linked. Here only for soil slope, soil slope erosion size is closely related with the size of the anti-scouring ability.

Roadbed subsidence

Subgrade due to the infiltration of water, soaking, strength decline, the driving load under the action of external force, such as the subgrade in the vertical direction have great uneven settlement, local road subgrade pavement crack, damage.

Protection engineering

Scour protection installations in water scouring based instability or structure, under the action of impact damage; Or the improper setting of scour protection Settings or modulation structure itself, causing damage.

Water damage drainage facilities

The loess region confronted with torrential rain, because of highway drainage system is not perfect, will make the ditches, slant of the jet flow within the drainage amount is too large, cause the overflowing, bursts out of the water constantly scour the basis of drainage facilities, leading to the destruction of drainage.

The subgrade water damage reason analysis

Environmental factors

From the natural environment and social environment (i.e., human activity) from two aspects to study the effect of environment factors in loess area road water damage. The natural environment is a major factor in the production of road water damage, and unreasonable development and utilization of human social environment, such as increased water damage disasters from happening.

Landform and soil

The loess area, the terrain, crisscrossed in upland and gully land, the new and old loess exposure at the same time, geological and soil quality problem is very complicated. Valleys to form natural drainage channel, the region's highway disturbs the natural topography, pressure accounted for the existing drainage channel. At the same time, the subgrade under the threat of on both sides of the mountain water catchment. Collapsible loess distribution sections of foundation treatment, drainage of foundation treatment does not reach the designated position or do not, for the future and drainage facilities under the bottom of foundation and subgrade foundation uneven settlement buried hidden trouble, result in the crack of the drainage facilities, subsidence and other diseases, and even lost the drainage function.

The subgrade cross-section form

The loess area, subgrade cross-section form a deep cut, half filling and half digging high embankment and subgrade. When high embankment pressure of the channel, the channel slope embankment slope and nature formed between triangle easy seep, engineering approach is generally in embankment ditches to set, after the completion of filling slope outside in order to guide natural slope surface water into the ditch. Slope outside the fill compaction often can not meet the requirements of the water in the accumulated infiltration, infiltration from bottom of side ditch roadbed, roadbed subsidence and other diseases.

Drainage design

The loess area, restricted by terrain, ditches, drainage outlet spacing is longer than the other. Drainage in order to satisfy the need to use large longitudinal slope or larger cross section, as a result, it may cause serious erosion. Various drainage design did not form a system, location Settings, etc.

The loess area, the road water damage prevention countermeasures

Roadbed subsidence control

To build a road on soft ground should be reinforced, the foundation strength meet the design requirements. Subgrade filling generally using the same sand soil permeability, when filling the water permeability of soil at the same time, filling in the upper water permeability can be not strong. The high underground water level section is appropriate in basal laying sand gravel cushion, blocking the capillary water rise, so as not to affect the roadbed stability. Embankment ditches longitudinal slope should not be less than 0.5%, one-way drainage length should not be more than 300 meters.

Embankment collapse treatment.

The bad location, line selection, hydrogeology and try to adopt the entablature roadbed. Cutting must be set up reasonable longitudinal slope of ditches, when possible erosion, should be added a jet slot and drop drainage facilities. According to actual conditions, laying different forms of retaining wall for prevention and control, such as dry flaky retaining wall of the build by laying bricks or stones. For vulnerable to water scouring or canal embankment slope, slope protection

through paving or use bamboo cage palisade governance embankment collapse.

Drainage water damage prevention

Loess area should adopt the principle of "mainly focuses on the storage decentralized sewage" comprehensive highway drainage design, scatter ditch water line to the low areas outside of subgrade or pond. For high appraisal of visual its specific conditions set the shoulder or slurry wall build by laying bricks or stones flaky intercepting ditch, prevent slope erosion caused by the cutting top flush. Fill section rapids tank shall be in the settlement of embankment and slope natural stability after construction, and grow thorns or grass. Timely cleaning ditches, intercepting ditch drainage facilities of sundry, avoid siltation, keep the catchment is smooth.

Protection project of water damage prevention

Protective engineering location of soft ground, want to undertake in soil reinforcement, and shall meet the requirements of the degree of compaction. Along the river embankment retaining wall according to the condition of rivers, the specific setting, keep the water flow, don't squeeze the channel, foundation calculated and determined according to scour depth. Cutting retaining wall should set drainage facilities, consolidate when necessary the reinforcement.

Conclusion

The loess area, subgrade water damage and control problem, should take the scientific attitude to observe, analyze and summarize. The water damage disaster is still a serious threat to the traffic safety caused huge property losses. Many scholars to make further studies are needed.

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