Soil and Water Conservation Measures in mountain highway

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Abstract. More and more attention should be paid to the soil erosion in the process of highway construction in mountainous areas. According to the characteristics of highway construction in mountainous areas, the methods of combining permanent measures with temporary measures and combining engineering measures with plant measures are adopted to realize soil and water conservation. In the project construction, the establishment of a sound soil and Water Conservation Prevention and control system has achieved good results in the prevention and control of soil erosion.

1. Introduction
The construction of mountain expressway will inevitably cause certain environmental pollution and ecological damage to the areas along the line [1]. Mountainous expressway is characterized by undulating terrain, complex geological conditions and numerous bridge and culvert structures, which puts forward higher requirements for construction control. Soil and water conservation in engineering construction is a problem that must be faced and solved.

2. Project Overview
The project is located in the hinterland of Qinba Mountain Area in the middle of China, belonging to the landform of mountains, heavy hills, structural erosion and medium low mountains. The terrain is generally high in the northwest and low in the southeast, with high mountains, steep slopes and crisscross gullies. The surface water mainly comes from the atmospheric precipitation in the region. The groundwater is mainly pore water of loose rock and fissure water of bedrock. The pore water of loose rock is mainly supplied by river water and atmospheric precipitation. Bedrock fissure water is mainly supplied by atmospheric precipitation. The water level changes obviously with seasons, climate and topography.

The overall goal of the water and soil conservation plan is to prevent and control the new water and soil loss in the project construction [2]. On the premise of ensuring the smooth construction and safety of the project, reasonably utilize the water and soil resources and improve the land productivity. The specific contents of water and soil conservation plan are as follows.

(1) for the land disturbed by the project construction, the prevention and control measures for water and soil loss shall be arranged in different areas.
(2) the waste slag generated by the project construction is stacked in the planned waste slag yard.
(3) effectively control soil erosion in the project area.
(4) after the completion of the project, all temporary construction land and waste disposal area shall be reclaimed as forest and grass land.
3. Prevention and control of soil and water conservation

3.1. Division of prevention and control areas
The project is divided into construction area and direct impact area. On the basis of these two first-class divisions, according to the characteristics of highway construction, it is further subdivided into five second-class prevention and control divisions: the prevention and control division of main works (subgrade, embankment, cutting, and intermediate isolation zone, pavement drainage works, bridge, culvert, tunnel and ancillary works of highway), the prevention and control division of waste disposal area, construction access area, construction site area and borrow area.

3.2. Soil and water conservation measures
The project construction management should strengthen the awareness of ecological protection and water and soil conservation, and strictly implement the "three Simultaneities" system of water and soil conservation [3]. In the project construction, the waste slag shall be minimized to avoid the occurrence of water and soil loss. In the construction of the project, the amount of foundation excavation is reduced by optimizing the design scheme. For example, the quantity of foundation excavation is reduced by 30% when the reinforced gabion retaining wall is changed to concrete retaining wall, masonry retaining wall and revetment.

The subgrade is excavated from top to bottom. Presplitting blasting is adopted in the excavation of rock slope. In the process of slope reinforcement, the unstable and dangerous rock mass should be excavated first, and then the broken rock mass should be reinforced by prestressed anchor cable. The shoulder retaining wall adopts the masonry gravity retaining wall. A settlement joint shall be set for the retaining wall every 10-15m. When the height of retaining wall is more than 2m, drain holes shall be set. The highly weathered rock slope is protected by shotcreting with mesh. The weakly weathered rock slope is protected by plain shotcrete. Subgrade drainage mainly includes side ditch and intercepting ditch, drop water or chute. When the length of side ditch and intercepting ditch exceeds 500m, water outlet shall be set.

Slope protection measures mainly include gravity retaining wall, reinforced retaining wall, anti slide pile, bolt protection, masonry slope protection, masonry face wall and masonry arch skeleton. Intercepting ditch shall be set around the slope with large catchment area. When the slope height is high, a platform is set, and a drainage ditch is set on the platform. The horizontal drainage ditch shall be used to connect the platform drainage ditch at all levels.

The plant protection measures in the project construction area are grass planting, tree planting and shrub planting. The selected tree species, turf and seeds are evergreen, drought resistant and have strong lateral root development. Plant protection can beautify the environment and conserve water and soil.

3.3. Scientific monitoring
Monitor the effect of various water and soil conservation measures [4]. Scientific selection of monitoring points, methods and frequency. During the construction of the project, the monitoring unit with grade a qualification is entrusted to carry out the monitoring of water and soil conservation. The monitoring personnel shall formulate detailed monitoring implementation rules [5]. Through regular and irregular visits to the site for fixed-point, positioning, investigation and monitoring, timely understanding of the impact of engineering construction on water and soil conservation. To provide guidance and suggestions for the scientific formulation of waste slag, land remediation and plant protection measures. Use various means and methods to timely understand the water and soil loss in the process of project construction, and make monitoring records. Monitoring is carried out by means of investigation and monitoring and ground positioning observation.

In the survey and monitoring, GPS positioning instrument is used in combination with topographic map, digital camera, benchmark, steel ruler and other tools to determine the type and area of disturbed surface according to different geomorphic types. Record the basic characteristics of each disturbance
type area and the implementation of water and soil conservation measures. It mainly includes disturbed land type, excavation face slope length, slope, slope protection engineering, land treatment engineering, etc.

The steel drill method and erosion ditch sample are used to monitor the specific area. The depth and amount of soil erosion were calculated by regularly observing the height of the steel cap from the ground every year. When the rainfall on that day is greater than 20 mm, post rain monitoring shall be increased. The amount of erosion can be determined by measuring the number and size of erosion gullies. According to the actual situation of soil erosion, the erosion intensity is calculated. The actual process of soil erosion in the construction of the project is recorded by means of photography and video recording.

The construction site of the construction project has complex changes and sometimes it is difficult to locate and monitor. The key points of site inspection are waste disposal area, large excavation working face, borrow area with large excavation volume and steep and broken working face.

4. Soil and Water Conservation control effect

Engineering measures and plant measures are mainly taken for the prevention and control of water and soil conservation in the project. Soil and water conservation engineering measures include foundation excavation, interception and drainage ditch, retaining wall, mortar rubble slope protection, etc. Soil and water conservation plant measures include planting trees, shrubs, grass, etc. During the construction process, there are also temporary water and soil conservation measures such as temporary engineering protection and vegetation restoration. The type and scale of water and soil conservation measures meet the requirements of the water and soil conservation plan of the project.

The prevention and control measures in the main project area effectively reduce soil erosion. The protection measures in the main project area are all completed according to the design. The soil erosion intensity of the main project is reduced by setting the skeleton protection, vegetation protection, skeleton plus vegetation protection, pavement drainage engineering prevention and other water and soil conservation measures. The average erosion modulus gradually falls below the allowable erosion intensity.

Due to the construction of the corresponding retaining wall, drainage ditch and other perfect protective measures, the amount of soil erosion is close to the allowable soil erosion modulus. The protective measures set up in the construction road and construction site have played a good protective effect. Due to the hardening of access road and site, and the reasonable setting of drainage facilities, the effect of water and soil protection is obvious.

Due to the reasonable design and layout of soil and water conservation measures, the control indicators of soil and water loss have reached the determined goals. The treatment rate of disturbed land is 98.28%, the total treatment rate of soil and water loss is 97.42%, the control ratio of soil loss is 1.73, the rate of retaining slag is 96.17%, the recovery rate of forest and grass vegetation is 97.93%, and the coverage rate of forest and grass is 31.65%. All water and soil conservation facilities operate normally and play a better role in water and soil conservation.

5. Conclusion

In the construction of the project, a number of prevention and control measures for water and soil conservation are implemented to better control and reduce water and soil loss. Engineering measures and plant measures have played a good role in the prevention and control of soil erosion. Among them, the vegetation restoration coefficient and the forest and grass coverage rate in the project area are continuously improved by vegetation measures. Effective soil and water conservation measures reduce the area and intensity of soil erosion. The perfect control system of soil and water conservation can achieve a good effect.
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