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SOME TECHNICAL SOLLUTIONS FOR A ROAD CONSOLIDATION AFFECTED BY LANDSLIDES

Elena-Claudia BOŞOMOIU, Ionuţ-Alexandru MIHAI

Scientific Coordinator: Prof. PhD. Sevastel MIRCEA

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67.

Corresponding author email: ionutmihaialex@yahoo.com

Abstract

The paper presentssome technical solutions for the rehabilitation and modernization of a road sector, located at approx. 500m from the intersection with Marina, opposite the house no. 24 and 26, respectively P27- P27 + 60m, P28- P28 + 5m, Arges County.Crack length, measured along the road, is of approx. 18m.This area has been recently affected by landslides, which resulted in damage to the roadway, including putting difficulties into traffic.A consolidation path solution was established according to the recommendations of technical expertise and geotechnical studies. All these aspects are being achieved through: culverts drainage works controlled by collectors; civil engineering works and restoration of the road embankment.

Key words: *landslides, rehabilitation, road*

INTRODUCTION

The paper presents some general aspects concerning the technical solutions for the rehabilitation and modernization of a road sector from Arges County. The beneficiary - municipality of Curtea de Arges, have required technical documentation during PE, DE phase for "Road rehabilitation, consolidation and modernizing, Corbenilor Street to approx. 500 m with Marina Street, Argeş County" (Figure 1).

Figure 1. Corbenilor Street, map view

The area affected by landslides is approx. 500 m from the intersection with Marina Street, opposite the houses no. 24-26, respectively P27-, P27+ 50M, P28-, P28+5 m.

The crack length, measured along the road, is approx. 18m (Figure 2).

The vertical gap of fallen compartment towards Silistea Valley, it is approx. 0.5 cm downstream and approx. 13cm upstream.

Figure 2. View of the crack length on the road

MATERIALS AND METHODS

As a result of landslides, the roadway presents the following damages: longitudinal and transversal cracks and crevices, holes in the asphalt; slides and detachments of existing asphalt.

The causes that led to the degradation of the road structure have both immediate and long-term effect. They are listed below as follows:

1. Lack of a rainwater collecting culvert (Figure 3);
2. Uninsured drainage with influences over the road body;
3. Lack of the water drainage from the road body (Figure 4);
4. Lack of carrying capacity;
5. Lack of regular interventions to halt the progression of degradation (Figure 5);
6. The ageing of the asphalt structures;

Figure 3. Lack of a rainwater collecting culver

Figure 4. Lack of the water drainage from the road body

Figure 5. Lack of regular interventions to halt the progression of degradation

RESULTS AND DISCUSSIONS

There were established solutions for the implementation of the roadway rehabilitation measures, such as:

For the traffic safety:

- there will be installed on the retaining wall a an NI metal guardrail;
- it will be provided a proper road marking: pedestrian crossings, speed slowing systems where pedestrian traffic is intense;
- It was provided the achievement of signaling through horizontal and vertical road markings according to the rules imposed by standards.

In setting up the rehabilitation works it was taken into consideration the following:

- Importance of the road class;
- The possibility of execution in a timely manner;
- Adapting to the natural configuration of the land;
- Finding ways to remove water from the road;
- An easy and efficient execution that does not have a destructive impact on the environment;
- Static and mechanical resistance.

STAGES OF EXECUTION

Preparatory works:

- Marking the work area;
- Marking the field of utilities and possible obstacles;
- Drawing works;
- Supply of materials.

Excavation and transportation of debris in the road structure deposit:

- Execution gabion wall;
- Digging enclosure and gear twinning;
- Execution baskets gabion mattresses, including laying of geotextile;
- Execution baskets gabion mattresses;
- Execution of gabion baskets to wall, including the laying of geotextile;
- Execution of road embankment;
- Basic ground compaction laying geotextile;
- Making the stuffing compacted ballast in several layers of 15-20cm thickness after compaction, the laying of geogrid in 50 in 50cm (Figure 6);
- Protecting newly created vegetable earth embankment seeded.

Figure 6. Geogrids covered with ballast

Execution of water flow:

- Execution of excavations with support;
- Laying on the bottom layer of sand excavation;
- Laying steel pipe ø 355.6 x 7.9mm;
- Installation of PVC pipe ø 300 mm;
- Making the connection of pipes and manholes in the roadway ditch;
- Making compacted fill the trench to under-crossing with a grade of compaction of 98%.

In order to secure the road project is divided into 2 parts as follows:

Objective I - Road works and water drainage

The proposed works have as target to ensure monitored water drainage, both on the road platform and upstream area and water discharge downstream by making a tailboard.

The following works will be performed:

1. Demolition of the existing structure;
2. Roadway culvert (in order to eliminate the infiltrations from the road body and rainwater that moves erratically on the road surface) (Figure 7).

Figure 7. Roadway culvert

The water collected by the culvert will be drained into a manhole segment and discharged downstream by an under crossing.

Drainage in good conditions has a role in preventing degradation in the road structure. In this regard there will be made:

- New ditches, where they were missing;
- The design of tubular culverts at the entrances to properties;
- Replacing culverts where they are completely damaged;
- The design of road gutters at the intersection with side roads that have slopes towardcounty roadsin order to take over water and avoid spillage on the road surface;

3. Undercrossing

Objective II – Consolidation works

The proposed works aim the following:

- Consolidation of the road section affected by the landslide;
- Improving the bearing capacity of the land;
- Making a cross section with geometric elements that fits the legal requirements;
- Bringing the road width to the technical parameters suitable to the class importance, thus ensuring optimum safety in circulation.

This work aims to consolidate the road embankment by making a gabion wallon a length of 26m.

Objective III – road embankment restoration

Road embankment restorationconsists of ensuring the stability of the road platform maintaining the current width. Parallel with the gabion wall the road embankment will be restored too. The road embankment will be made of drainage material (ballast) reinforced with geogrid. The geogrid will be positioned from 50 to 50cm and will be anchored to the gabion wall.

MATERIALS USED IN THIS CASE

Water to Compact the Earthworks

It may come from the public network or from another source, but in this case it must meet the requirements of SR EN 1008/2003.

While using it on the site it will avoid the water to be polluted with detergents, organic matter, vegetable oils, clays etc.

Natural Aggregates

Ballast

For the embankment fillings it can be used river ballast as well. The granularity of the ballast can be between 6-61 mm, having an internal friction angle of 30 to 33 °.

The material supplying will be done from a single source. It is not accepted the presence of visible plant debris, wood pieces, organic matter, household waste.

Sand

The sand used for making the culvert and the protection pipe for the undercrossing will have to meet the requirements of STAS 662-2002.

They will be:

- The maximum size of grain, 7mm;
- The minimum size grain, 0.05mm;
- Organic matter coefficient <1%,;
- Non-uniformity coefficient> 7, STAS 7582-91.

The recommended works don't induce any negative effects on the environment, surface water, and noise level. It will be respected the current regulations regarding the execution of the works by signalling during the construction as well as final signalling.

Throughout the period of execution, it will be provided access to properties.

CONCLUSIONS

The road was in a deplorable state and because of this problem it could not be exploited in terms of road safety; therefore it was necessary to rehabilitate the affected section.

The rehabilitation was achieved by stripping processes, earthmoving, compaction, levelling and asphalting.

Following the above mentioned civil engineering works, the level of road safety has been increased significantly.

REFERENCES

STAS 7582-91 "Railway works.Embankments. Design and quality checking up specifications";

SR EN 1008:2003 "Mixing water for concrete – Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete".