Buletinul Ştiinţific al Universităţii „POLITEHNICA” din Timişoara

Seria HIDROTEHNICA
TRANSACTIONS on HYDROTECHNICS

Tom 57(71), Fascicola 2, 2012

Case of emergency effects due to meteorological phenomena in 10th of June 2012 and rectification solutions on DC 111 communal road, Pietroasa village, Timiş County

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Abstract: This paper's aim is to present the negative effects of increased flow at Puştiul stream above the permissible limit near the Pietroasa village on communal road DC 111 near which it has its the water course. DC 111 communal road crosses the Fărăşeşti village and ensures the connection with DJ 684 B county road and is situated on the right shore of the Puştiul stream (branch of Bega River), which flows from Glodea mountain peak, to the mouth of the Bega River in Poieni. Also, the paper presents technical solutions recommended for removing disastrous effects produced by the flood and bringing communal road 111 to a corresponding state of viability.
Keywords: stream, calamity, restoration, shore consolidation, state of viability.

1. INTRODUCTION

Pietroasa village is situated in the eastern part of Timiş county, at 28 km from Făget city and approximately 122 km away from Timişoara city, on the route DN 6, DN 68 A and 684 B DJ. This village is bordered with Curtea village in the north – western part, with Tomeşti village in south-west and in the east with Hunedoara County, located at 78 km distance from Deva.

Communal road DC 111 crosses Fărăşeşti village which belongs administratively to the Pietroasa village and connects the village with the county road DJ 684 B.

This road is located on the shore of Puştiul stream (branch of Bega River), which flows from Glodea mountain peak, to the mouth of the Bega River Poieni.

The length of road sector that represents the subject of this paper work is approximately 6.3 km.

The rehabilitation of DC 111 communal road is necessary because it was damaged by floods on 10th of June 2012 and it was necessary to protect the road body by the destructive action of Puştiul stream, situated near this road.

2. EXISTING SITUATION

DC 111 Communal Road routing is located along a stream and therefore has a rather sinuous route. In some areas water affects the road body and therefore, in these areas is recommended to design riverbank protection works.

Due to the floods from 6th of June 2012, DC 111 communal road, connecting DJ 648 B county road and Fărăşeşti village, was affected, being flooding over a length of approximately 4.9 km (78% of the investigated sector length) and floods causing serious damage to the entire complex road on this road section (Fig. 1).

Figure 1.

The floods destroyed several road sections, leaving the inhabitants of Fărăşeşti village completely isolated. The flood gathered a large amount of alluvium (mud, gravel, boulders) and floating elements (trees, roots), that clogged the entire existing road structure, thus jeopardizing the bearing capacity of the road (Fig. 2). Regarding the transverse profile, the road platform became very narrow in some areas, reaching even a width of 3.0 ... 4.0 m and the carriageway reached a width of 2.0 ... 3.5 m.

Devices for collection and disposal of existing surface water were clogged with alluvium that flowed from the slopes and in some places appeared even rupture of slopes. It is required to clean and reshape

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the existing ditches and building new ditches and gullies with the recommendation that they must have protected sections where necessary, so that the water does not enter into road body and does not cause major degradations in the road complex.

Due to the rocky ground and narrow riverbed, the flood has broken the road body. The road has a sinuous routing and follows the creek stream, having the opportunity to increase its road territory due to delimitation by the water on one side and a rocky slope on the other side.

Figure 2.

To assure the road stability and the carriageway width according to Romanian norms in force and to protect the road from possible floods, we recommend to protect the road with riverbank protection works, where circumstances so require.

Generally speaking, the analyzed road does not comply with prescriptions of "Normative regarding the technical quality requirements function of road users requirements", indicative NE 021-2003 and "Technical Instructions on determining the technical condition of roads", reason for which requires urgent works of reconstruction and modernization.

3. GENERAL INVESTIGATIONS

Regarding the hydrology of the area of Pietroasa, the entire area of Timiş County is characterized by a moderate continental climate with some oceanic and Mediterranean influences due to influence of air masses from the west and south-west.

Global thermal potential along the road routing is relatively high, the average annual temperature being between 9.0 ... 10.0 ° C. Function of rainfall quantities, the area of the Pietroasa has an average annual rainfall quantity between 600 and 700 mm.

According to STAS 1709/1-90 and prescriptions of the Normative PD 177-2001, the investigated road belongs to the climate type I with moisture content index Im = -20 ... 0.

Minimum values for the freezing index, according to STAS 1709/1 - 90, is Imax30 = 480, Imed3/30 = 440 and the average value can be determined as Imed5/30 = 370. Maximum freezing depth is 0.80 m

For modernization works of DC 111 road was performed a geotechnical report for determining the foundation ground conditions, the ground stratification and the physical and mechanical characteristics of the ground from the active zone. From geomorphologic point of view, the road routing belongs to "Mountains of geosincinal" area, from morphogenetic point of view to "Type Poiana Rusca", characterized by low crystalline mountains, by Mesozoic sediments and a poorly developed karst relief.

From geologic point of view, the area belongs to Getic bed, individualized as a structural unit of the Meridional Carpathians at the end of the Cretaceous. The lithological complex of the area belongs to Padeş series, which includes more complex rocks whose thickness can reach 7.000 m. In these rocks predominates terrigenous material and carbonates develop, depositing further on above the basic tuff schist complex.

According to the Guide regarding the performance and verification of geotechnical documents for constructions, GT 035/2002 and to the Norms on the principles, requirements and methods of geotechnical design of the foundation ground, indicative NP 074/2002, the analyzed road belongs to geotechnical category 2, with a moderate geotechnical risk.

On the road were performed boreholes, from which were sampled undisturbed samples and disturbed samples, these being analyzed macroscopically and correlated with the results of laboratory tests carried on drill cores sampled from the boreholes. The ground stratification can be described as follows (0.0 level of the boreholes is the same as that of the road level): crushed stone with a depth between 0.1 to 0.4 m, with rare boulders; embankment material consists of alluvial gravels represented by silty sand, silty sandy gravel, sandy gravel clay powder, with brown colour, sometimes mixed with angular, flat and cube shaped rock fragments, having a smooth surface and with boulders, followed by bedrock represented by limestone.

Groundwater level was reached only in three boreholes, at depths of 0.8 to 0.9 m and the absolute maximum hydrostatic level can be determined only after complex hydrogeological studies carried out on the basis of observations of groundwater level fluctuations over a long period of time. However, it is estimated that the maximum groundwater level equals to the maximum hydrostatic water of Pustiu River.

4. GENERAL RECOMANDATIONS

In cross section (Fig. 3), regarding the situation of the existing ground and the importance of the analyzed road, the public road geometry will be performed corresponding to the Technical Class V with one lane, according to the "Technical Norms regarding the design, construction and modernization roads" (Order of the Ministry of Transport no. 45/06.04.1998 published in the Official Gazette of Romania, part I, No. 138 bis/06.06.1998).

Depending on the actual situation of the existing ground and space, will be constructed cross platforms for the cases when the road has only one lane, at

distances of maximum 300 m between them according to 582-2002 Indicative.

In plan and in the longitudinal profile, will be performed geometric elements corresponding to a design speed of 25 km / h (region of hills and a Technical Class V), fully preserving the existing road routing, planning and fitting out the curves, according to STAS 863 - 85.

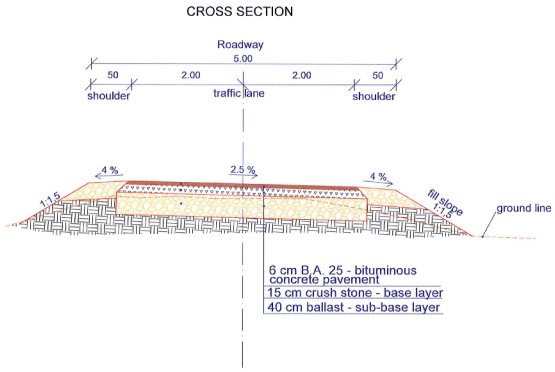

Figure 3.

In that direction, all curves in plan with radiuses below 250 m will be provided with all necessary overwidenings and all the curves with the radius less than the recommended one will be arranged by conversion or by increasing height, according to current regulations. In isolated cases to avoid the demolition of existing buildings, relocation of facilities, the expropriation of land or because the terrain is rocky and the road territory requirement cannot be increased, the design speed is reduced for solving some plan junctions.

Regarding the water drainage, there will be performed drainage devices in accordance with the existing situation (gutters, ditches, channels according to STAS 10796/1-77, STAS 10796/2- 79 and STAS 10796/3-88). The protection of the devices' walls surface or keeping them out in the ground will be based on the provisions, due to the current rules, function of the value of gradients these devices follow and function of the specific procedures for water evacuation from the analyzed public road sector.

Collection devices protecting walls surfaces from waters will be performed using concrete, cement concrete monolith (recommended min C25/30) or ballast layer of sand or pitching. The protection for the device surface water drainage must be done, generally, for gradients less than 0.5 % and for gradients greater than 4.0 %, respectively for the protection of the road sections located in the village.

The different types of devices used for collection and disposal of surface water are shown in Fig. 4.

For roads and side streets intersections will be assured the continuity of surface water drainage by designed ditches (drains), provided by pipe culverts or by slab culvert with adequate size or by conducting the waters along the streets (roads) that are intersected (if this thing is possible). Waters from the ditches or drains will discharge through corresponding culverts (strength and stability, width, drainage capacity and so on). The existing pipe culverts which were partially or completely destroyed by the floods will be replaced with culverts with a diameter less than 500 mm. The corresponding existing pipe culverts will be cleaned and repaired (drop rooms, crown, bed arrangement, fitting wings and so on). The adaptation to the field conditions of the pipe culverts will be performed in accordance with PD19-2003 Normative.

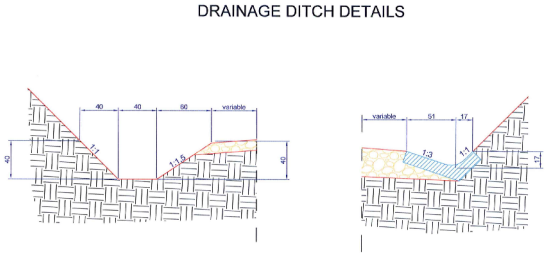

Figure 4.

On the road sections where the flood destroyed the embankments of the road and where the natural slope of the road is close to water (Fig. 5), for assuring the protection and integrity of the valley road by destructive action there are recommended protection walls.

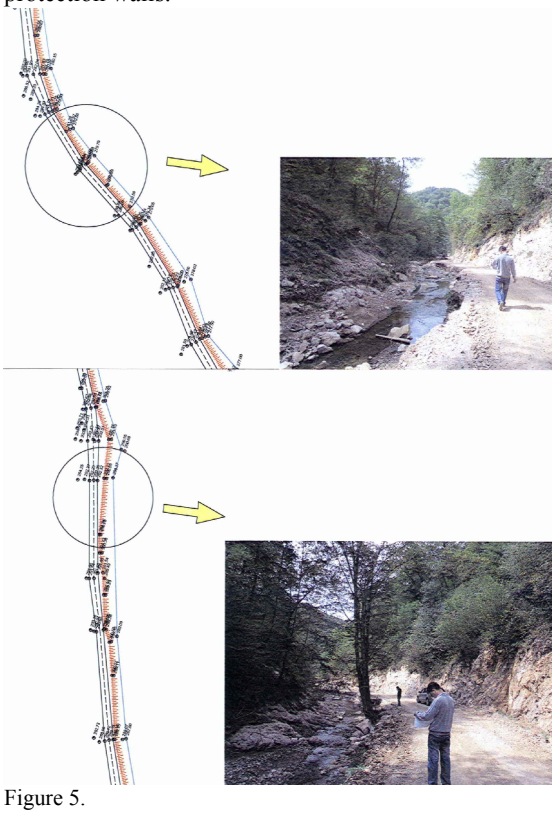

Figure 5.

To protect the embankments and slopes, at the edge of the platform will be constructed concrete protection walls with variable cross section depending on ground configuration (Fig. 6).

The shoulders will be filled with local granular material, quarry waste, during the realization of each road layer, that will be compacted properly and that will ensure an adequate lateral drainage of rain water on the roadway, finally, the shoulders benchmark

levels being equal with the level of the pavement benchmark.

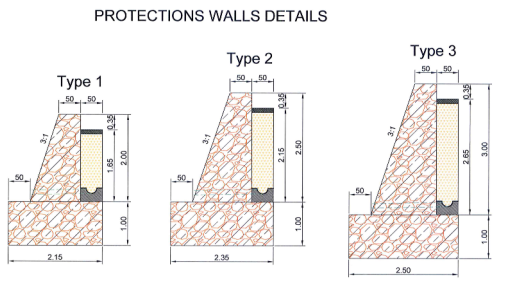

Figure 6.

The designed road structure for restoring the affected sectors is a flexible one according to PD 177-2001 Norm, with bituminous pavement in a single layer, resulting by a sizing calculation. The designed road structure is also verified for the freezing-thawing actions (STAS 17079/1-90 and STAS 17079/2-90).

Due to the advanced state of degradation of the existing pavement, of the reduced bearing capacity of the road structure, taking into account the conditions of the disaster, for bringing the road to a proper state, must be adopted some differentiated solutions as geometry and cross section.

Thus, in the affected sectors by disasters, the road structure will be composed by: 6 cm layer of bituminous concrete pavement of BA 16, 15 cm base layer of crushed stone, 40 cm ballast. In the areas which were not affected by the disaster there will be a readjustment of the existing road structure and over it will be performed a 6 cm layer of bituminous concrete pavement of BA 16.

The cross profile corresponding to rebuild the road affected by flooding of 111 Communal Road in 6th of July 2012 is shown in the figure below (Fig. 7).

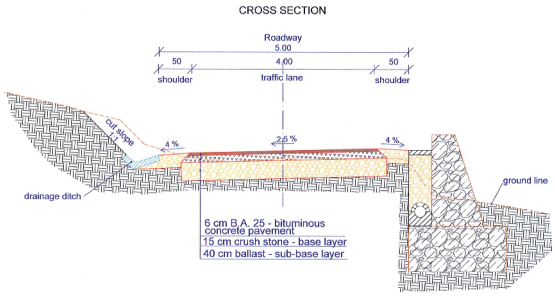

Figure 7.

Regarding the visual inspection, the field and laboratory investigations (geotechnical report), the state of degradation and the current state of the analyzed road from the Pietroasa village we can express some conclusions.

The analyzed communal road is in a very advanced state of degradation and therefore it has a bad viability and the traffic takes place under very difficult circumstances.

The carriageway has been affected by floods in June 2012 across the road routing and the whole sector of road structure was totally destroyed, its use by vehicles being almost impossible.

The surface water drainage in the investigated sectors will be correlated in cross section, longitudinal profile and site plan, function of the present situation in the ground, respecting the limits of existing property, so as to avoid directing the water to riverside residents courtyards or to avoid water bogging on the surface of the road. For gradients less than 0,3 % and higher than 4,0 %, the walls of the collection and disposal devices for surface water will be protected, according to current regulations.

Concrete walls will be realized for stability, protection and for flood prevention, with a subsequent elevation height between 2.0 and 3.0 meters.

Also, will be performed the necessary works for intersections with streets (roads) arrangement and for side and adjacent properties access to 111 communal road.

The modernization of the analyzed 111 communal road from Pietroasa, Fărăşeşti village, is important from social and economical point of view of the area and carrying out the work will significantly improve the technical condition of the carriageway and therefore, the comfort and the safety. It also, will improve environmental conditions by reducing emissions released into the atmosphere as well as reducing noise and vibration caused by motor vehicles while operating expenses incurred by participants in the road will decrease significantly.

5. FINAL CONCLUSIONS

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