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SOLUTIONS FOR MODERNIZING LAND COMMUNICATION ROUTES IN THE CONDITIONS OF INTERSECTING LAND IMPROVEMENT ARRANGEMENTS

Ioana Alina Cretan [1]

Abstract: From a functional and administrative point of view, according to O.G. no. 43/1997 on the road regime and the Orders of the Ministry of Transport no. 1,296/2017 "Technical norms regarding the design, construction and modernization of roads", published in the Official Gazette of Romania, part I, no. 746/18.09.2017, the county roads on which the proposed footbridges will be built are classified as a two-lane county road, technical class IV according to the Order of the Ministry of Transport no. 1,295/2017 "Technical norms regarding the establishment of the technical class of public roads", administered by the County Council, being intended for the circulation of motor vehicles, as well as for the needs of access to properties of residents. According to AND 522-2006, certain existing bridges fall into technical class V - CRITICAL STATE. The existing bridge does not ensure the minimum conditions for traffic safety.

Keywords: infrastructure works, quality of life, land improvement works, land improvement arrangements.

1. INTRODUCTION

The arrangements of communication routes and intersections are carried out according to the "Regulation 600/2010 on the arrangement of level intersections on public roads" [1] with the aim of ensuring the flow of road traffic in safe and comfortable conditions, calming traffic in order to reduce the risk of accidents and reducing the level of air pollution by reducing waiting times when crossing the intersection as a whole and thus improving the quality of the environment.

According to the cadastral plans, the existing bridges located on the county roads that cross the canals under the administration of National Land Improvement Agency are often severely degraded, non-functional, unable to serve road traffic.

From a functional and administrative point of view, according to O.G. no. 43/1997 on the road regime and the Order of the Ministry of Transport no. 1,296/2017 "Technical norms regarding the design, construction and modernization of roads", [2] respectively no. 50/27.01.1998 "Technical norms regarding the design and construction of streets in rural localities", published in the Official Gazette of Romania, part I, no. 746/18.09.2017, [3] with the consultation of the provisions of STAS 10144/1-90 "Layers. Transverse profiles" [4] and the Order of the Ministry of Transport no. 1.295/2017 "Technical norms regarding the establishment of the technical class of public roads" [5].

In this case study, the bridge presents serious degradation processes at the level of the resistance structure of the arch in span 1 through key damage in the axis and on the downstream side. The arch in span 1 presents a failure at the key level with an approximately rectangular section with dimensions of approx. 1.20 m x 1.80 m, approximately in the longitudinal axis of the bridge.

Also, cracks were observed in the masonry substructure, starting from the landings and reaching the key, detached elements that fell into the riverbed, degradation and leaks at the landings.

2. CASE STUDY THE DESIGNED SOLUTION WITH PROTECTION OF EXISTING WORKS

Considering the fact that the bridge degradation currently makes it impossible to cross it, access from the lcalities to the agricultural lands located on the other side of the Canal, is impossible, endangering all road traffic in the area, including the possible intervention of rescue, firefighters, police, public transport, or local cars in the area.

Although the bridge is closed to road traffic, it may represent a danger for traffic participants who ignore this status and will proceed to cross it.

At the request of the Beneficiary, the existing bridge will be maintained, and the proposed new footbridges will be built downstream.

The current state of the existing bridge is also presented in the following pictures:

In the area of the intersections proposed for development, according to the cadastral plans, the county roads cross existing earth channels, for which it is important to identify the elements of the channels in the land improvement development under the administration of National Land Improvement Agency.

Field situations of the drainage channels in the intersections with the county roads are also illustrated in the photographs below:

[1] Faculty of Civil Engineering, Department of Hydrotechnical Engineering, Splaiul Spiru Haret No. 1/A, 300022, Timişoara, Romania, e-mail: alina.cretan@upt.ro

Figure 1

Figure 2

Figure 3

Figure 4

From the point of view of traffic safety, horizontal signaling and vertical signaling through traffic signs are missing.

According to AND 522-2006, the existing bridge falls into technical class V - CRITICAL STATE. The existing bridge does not ensure the minimum traffic safety conditions.

For these reasons, the investment is necessary and opportune, falling within the beneficial requirements of modernizing the road infrastructure, as well as increasing the standard of living of the local population.

3. DESIGNED SOLUTION

In correlation with the geometric elements and flows provided by National Land Improvement Agency, respectively the existing width canal), the chosen solution is the design of 4 pieces of bridges made of prefabricated concrete frames type P2.

The new bridges made of prefabricated concrete frames type P2 were designed in the current route. Road structures for ring roads and access arms at intersections will be dimensioned for flexible or mixed structures according to the "Standard for dimensioning flexible and semi-rigid road systems (analytical method)", Indicative PD 177-2001 [6], and for rigid structures, according to the "Standard for dimensioning rigid road structures", Indicative NP 081-2002 [7].

Also, the designed road structures will be verified from the point of view of resistance to the action of the freeze-thaw phenomenon, according to the provisions of STAS 1709/1 [8] and STAS 1709/2 [9].

Each designed bridge will consist of 12 prefabricated frames type P2 and two prefabricated end elements type CP2.

The prefabricated concrete frames type P2 have a rectangular shape, with a length of 120 cm, a width of 234 cm and a height of 160 cm and are made of concrete of class C35/45, placed on a foundation of plain concrete C30/37.

The prefabricated end elements type CP2 have a length of 245 cm, a width of 359 cm and a height of 190 cm, are made of concrete of class C35/45 and are placed on a foundation of plain concrete C30/37, which in turn will be made on an improved foundation ground of crushed concrete blockage or raw quarry stone.

The new designed bridges will be built downstream of the existing bridge, and this, at the request of the Beneficiary, will be maintained. For this reason, it is necessary to restore the route of the county road currently under construction over a length of approximately 100 m.

In order to minimize the risk of clogging, the concrete walling of the canal in the area of the water inlet and outlet from the footbridges was planned, along the length of the prefabricated end elements type CP2, and the walling with rockfill over a length of 5.00 m, upstream and downstream in the continuation of the end elements, respectively 1.50 m up the slope according to the cross-section.

In addition, works will be carried out to unclog the riverbed, recalibration and cleaning of garbage, vegetation and solid material. The connection of the new footbridges to the banks of the existing canal will

be ensured by recalibrating the riverbed both upstream and downstream of the footbridges, on both banks.

The runoff of rainwater from the area of the county road will be directed towards the existing ditches of the county road, designed as part of the investment and further outside the road area, towards the neighboring lands around the site (road protection zone according to O.G. 43/1997 UPDATED ON THE ROAD REGIME), owned by the holder of the Territorial Administrative Unit within the radius of which the investment itself is being carried out.

The county road sector for which the route will be reconstructed is a two-lane road, of technical class IV, with a carriageway width of 6.00 m and shoulders of 2 x 1.00 m (including 2 x 0.25 m shoulder strips), resulting in a road platform of 8.00 m.

The road structure of the county road on which the route is reconstructed will be identical to the road structure in the project and is composed of:

- 4 cm wearing course of asphalt concrete B.A. 16;
- 6 cm connecting course of open asphalt concrete B.A.D. 22.4;
- 20 cm upper foundation layer of large crushed stone;
- 30 cm lower foundation layer of ballast;
- 30 cm of crushed concrete or raw quarry stone.

The shoulders along the entire route are 1.00 m wide, of which 0.25 m of the framing strip will be reinforced, on a width of 0.75 m, with earth filling and a layer of optimally mixed crushed stone on the upper part, and the framing strips, on a width of 0.25 m, will have the same road structure as the one on the current route. The transverse slope of the shoulders is 4.0%.

The road structure on the bridges is made up of:

- 4 cm of asphalt concrete wear layer B.A. 16;
- 6 cm of open asphalt concrete connection layer B.A.D. 22.4;
- 20 cm of upper foundation layer of large crushed stone;
- 30 cm of lower foundation layer of ballast;
- filling with non-cohesive material of appropriate quality for embankments;
- waterproofing 1 m + protective concrete 4 cm.

The road structure on the access ramps consists of:

- 4 cm wearing course of asphalt concrete B.A. 16;
- 6 cm connecting course of open asphalt concrete B.A.D. 22.4;
- 20 cm upper foundation layer of large crushed stone;
- 30 cm lower foundation layer of ballast;
- filling with non-cohesive material of appropriate quality for embankments;
- improvement of the foundation ground (approx. 1.50 m blockage of crushed concrete or raw quarry stone).

From the point of view of road traffic safety, road markings will be made and traffic signs will be placed on the route of the county road.

Also, in order to increase traffic safety and reduce the risk of accidents, a directional metal parapet type H1, with reflectors, was placed on both sides of the county road arranged as part of this investment.

Horizontal and vertical signaling will be executed according to SR 1848-1/2024 [10], SR 1848-2/2011 [11], SR 1848-3/2011 [12], and SR 1848-7/2015 [13], respectively.

Longitudinal road markings and delimitation of the carriageway will be executed on the entire route with a long-lasting two-component (2K) product, with a thickness of 2,000 microns, with glass microbeads.

The determination of the transport capacity of the canal on the areas of rectangular bridges made of prefabricated concrete frames type P 2 is carried out according to the geometric characteristics on the segment interested in the works: b (m), m = 1,50, and hydraulic characteristics on the segment interested in the works: $Qt_{ransport}$ (m^3/s); I(‰) [14];

The dimensioning of rectangular bridges made of frames to ensure the transported flows of the drainage channels was carried out using the Manning - Strickler method. The equations that are used:

$Q = S \times V$; $V = C\sqrt{R.I}$; $C = 1/n \times R^{1/6}$

For the execution of the bridge, the solution was chosen to create a rectangular bridge made of concrete frames, with a maximum opening of 2.00 m and a height of 1.2 m, with monolithic concrete tympans.

The geometric elements of this profile are:

-Maximum opening: m;
-Maximum height: m,
-Section: m^2;
-Perimeter: m;
-Roughness coefficient: ;
-Longitudinal slope: ‰;

Table 1 Example 1 of calculation of transport capacity

Baza canal	h apa canal	I	n	P	Aria	Perimetrul udat	Raza hidraulică	C	v	Q
m	m	m/m	-	m	mp	m	m	-	m/s	mc/s
2	0.2	0.0003	0.015	2.4	0.4	2.40	0.17	49.46	0.35	0.14
2	0.4	0.0003	0.015	2.8	0.8	2.80	0.29	54.10	0.50	0.40
2	0.6	0.0003	0.015	3.2	1.2	3.20	0.38	56.61	0.60	0.72
2	0.8	0.0003	0.015	3.6	1.6	3.60	0.44	58.24	0.67	1.08
2	1	0.0003	0.015	4	2	4.00	0.50	59.39	0.73	1.45
2	1.18	0.0003	0.015	4.36	2.36	4.36	0.54	60.18	0.77	1.81

The calculations performed must highlight the fact that the dimensioned structure for the proposed rectangular bridge, made of concrete frames, ensures the transport of the flow of the drainage channel under the administration of National Land Improvement Agency for different surface channel transport capacities (h/H) and water depths (h).

For the safety of road traffic during the execution of the works, the contractor is obliged to carry out, at his own expense, the temporary signaling of the work points according to the "Methodological norms regarding the conditions for closing traffic and establishing traffic restrictions for the execution of works in the area of public roads", approved by order of the Minister of Transport and the Minister of Transport no. 1112/411/2000 (reissue 2014).

4. CONCLUSIONS

The designed intersection must ensure all the geometric elements necessary for road access for fire trucks or special vehicles, respecting all regulatory acts regarding P.S.I. measures, labor protection and traffic safety.

The beneficiaries of the investment are the administrative-territorial units within the localities or county councils, with the works to be financed from

funds from the state budget / county budget and / or other legally established sources, of them.

REFERENCES

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[5] *The Order of the Ministry of Transport no. 1.295/2017* "Technical norms regarding the establishment of the technical class of public roads";

[6] *Indicative PD 177-2001* "Standard for dimensioning flexible and semi-rigid road systems (analytical method)",

[7] *Indicative NP 081-2002* "Standard for dimensioning rigid road structures",

[8] *STAS 1709/1* "Freezing thawing effect on road works. Freezing depth in structure of the pavement";

[9] STAS 1709/2 "Freezing thawing effect on road works. Prevention and curing of damages due to freezing thawing effect. Technical specifications";

[10] *Indicative NE 012/1-2022* Concrete production;

[11] *SR 1848-7:2015/A91:2021* "Road signs. Road markings";

[12] *SR 1848-1:2011/A91:2021* "Road signs and signals. Road signs and signals. Part 1: Classification, symbols and location. "

[13] *AND 603/2012* "Guide to lighting conditions on national roads and motorways";

[14] *AND 600/2010* "Standard for the arrangement of level crossings on public roads".