Buletinul Ştiinţific al Universităţii POLITEHNICA Timişoara
Seria HIDROTEHNICĂ
TRANSACTIONS on HYDROTECHNICS
Volume 59(73), Issue 2, 2014

Hydraulic calculation off irrigation channel HCN540 closure

Robert F. Beilicci[1] Erika Beilicci[1]

Abstract – Study case is situated in Mosnita Noua county. HCN 540 drainage channel (CCS2) is located in front of parcel and requiring intubation for providing access road width of 12 m will be ducted channel. To systematize land under study work is required intubation Hcn540 channel (CCS2) existing on the front of the field length of 74 m. Upstream and downstream channel lining intubation was provided with concrete slabs or monolithic concrete poured on site. Free level uniform motion is made in white artificial straight and prismatic (canals, galleries, gutters, ditches, etc.).

Key words: Hydraulic calculation, irrigation channel, closure

I. INTRODUCTION

Study case area is 1.5019 ha and is situated in Mosnita Noua county (parcel no.408123).

For the project was carried out prior recognition of land and national geodetic network near the area of interest.

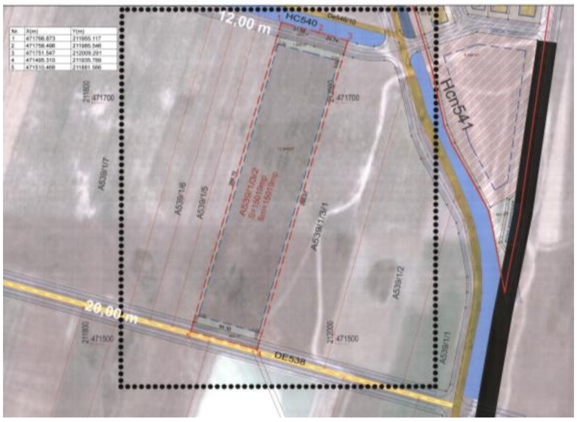

Figure 1. Orthophotomap

HCN 540 drainage channel (CCS2) is located in front parcel no. 408123 and requiring intubation for providing access road width of 12 m of which are 6 m and 6 m 4080123 cadastral parcel will be ducted channel.

To systematize land under study work is required intubation Hcn540 channel (CCS2) existing on the front of the field length of 74 m.

Intubation will be between km 0 + 040 and km 0 + 114 to km 0 + 077 and provided a road manhole size 1 mx 1 m. Intubation is made with a reinforced concrete pipe DN 800 mm diameter drain drainage channel flow collected CCS2 that the length of 2500 m (flow Q = 0.13 m3 / s).

Upstream and downstream channel lining intubation was provided with concrete slabs or monolithic concrete poured on site for a length of 2 m 3 m upstream and downstream. Lining will be done both on the channel bottom and on slopes having provided at the ends of 25x30 cm concrete spurs.

Geometry and hydraulic drainage channel CCS2 (Hcn540) involved, which is part of a complex arrangement of Sag - Topolovăţ - UD Sag are:

- Length 2500 m
- Flow Q = 0.13 m3 / s
- Maximum depth 2 m channel
- Bottom width b = 0.5 m
- Channel slope 0.006
- Tilt slopes m = 1.5
- Share downstream channel bottom 87.9
- Share upstream channel bottom 89.49

Following the recognition of the land operation have decided working methods depending on the nature of the land and geodetic points in close proximity; so decided to resort to lift satellite methods (GNSS) RTK method (radio) to raise contour points and the determination of station S1000 was determined by the VRS.

The equipment used was composed of two rovers and Trimble R8 GNSS base. Closure was performed in coordinate system ETRS 89 ', and the transformation coordinate reference plane Stereo'70 and Black Sea 75 was performed TransDatRo coordinate transformation program, the program provided by ANCPI. Were built in the land: roadsides, canal, electric grid, etc.

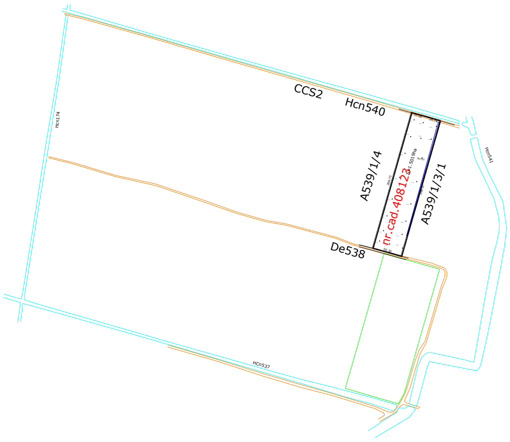

Figure 2. Topographical measurements

1 Politehnica University of Timisoara, Faculty of Civil Engineering, Department of Hydrotecnnics, Timisoara, Str. George Enescu, no. 1/A, Timisoara, Romania, www.hidro.upt.ro

Topographic measurements performed topo-cadastral purpose of drafting plans were made in 1970 stereographic projection system.
In order to execute documents, after having first been processed raw data from measurements using Version 10.3 software Terramodel Trimble product were determined coordinates of the points that define the limits of the real estate cadastre, the default shape and dimensions, in the stereographic projection system 1970.
Based on topographic measurements were performed transverse profiles along the channel by banks stng and right and bottom.

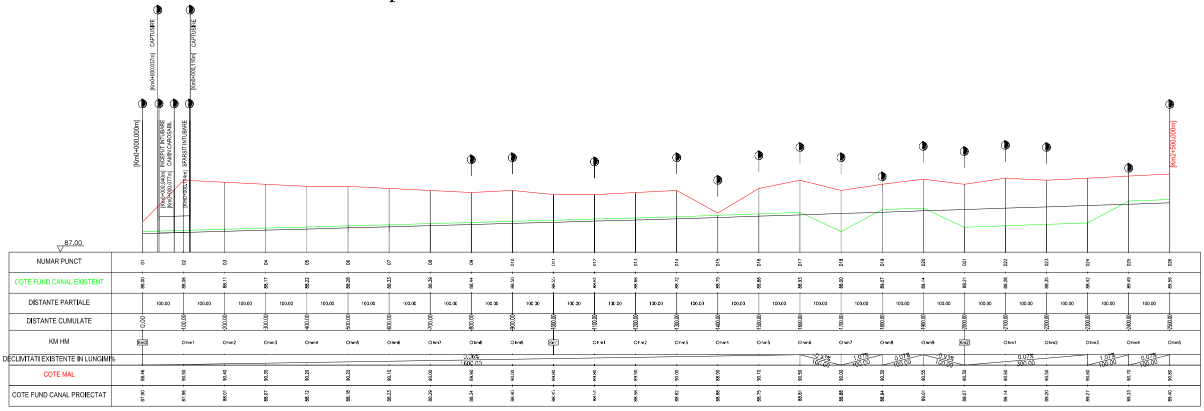

Figure 3. Longitudinal profile

II. MATERIAL AND METHODS

Free level uniform motion is made in white artificial straight and prismatic (canals, galleries, gutters, ditches, etc.).
In general, technical applications currently are using Chezy formula type:

$$V = C\sqrt{Ri} \tag{1}$$

Associating continuity equation is obtained for flow:

$$Q = VS = SC\sqrt{Ri} \tag{2}$$

Hydraulic radius is explicit and obtain

$$Q = SC\sqrt{\frac{S}{P}i} = \frac{S^{\frac{3}{2}}}{P}C\sqrt{i} \tag{3}$$

Associating Chezy formula is obtained for flow:

$$Q = \frac{1}{n}\frac{S^{1,5+y}}{P^{0,5+y}}\sqrt{i} \tag{4}$$

By replacing Manning relationship is obtained:

$$Q = \frac{1}{n}\frac{S^{\frac{5}{3}}}{P^{\frac{2}{3}}}\sqrt{i} \tag{5}$$

For the particular case of trapezoidal section is noted that the area (S) and the wetted perimeter (P) can be expressed as:

$$S = bh + mh^2 = (\beta + m)h^2 \tag{6}$$

$$P = b + 2\sqrt{1+m^2}\,h = \left(\beta + 2\sqrt{1+m^2}\right)h \tag{7}$$

Resulting in replacement:

$$Q = \frac{1}{n}\frac{(\beta + m)^{1,5+y}}{\left(\beta + m^{'}\right)^{1,5+y}}h^{2,5+y}\sqrt{i} \tag{8}$$

where the m' were noted:

$$m^{'} = 2\sqrt{1+m^2} \tag{9}$$

Commonly used in engineering applications, especially in sewers, standardized profiles such as circular profile, ovoid etc.

An important feature of these channels is hydraulic fill level defined by:

$$\lambda = \frac{h}{H} \tag{10}$$

where:
h is the depth to fill current free level partial section;
H - current depth of the solid section (geometric height section).
It can be seen that the analyzed sections can define two characteristic features:
- Report to the partially filled flow (Q_λ) and full (Q), which assuming a constant roughness coefficient can be put as a function of the degree of filling:

$$A = \frac{Q_\lambda}{Q} = \frac{K_\lambda\sqrt{i}}{K\sqrt{i}} = \frac{K_\lambda}{K} = f_1(\lambda) \tag{11}$$

- Gear ratio under the same conditions as above:

$$B = \frac{V_\lambda}{V} = \frac{C_\lambda\sqrt{R_\lambda}}{C\sqrt{R}} = \frac{K_\lambda}{K} = f_2(\lambda) \tag{12}$$

These functions can be standardized for different sections.

III. RESULTS AND DISCUSSIONS

Based on these theoretical foundations analytical calculations were performed for proposed pipeline and the existing channel.
Topographic studies for existing channel result input the following data:
b = 0,5 m,
m = 1.5,
i = 0,0006,
n = 0,02 (concrete)
The construction curve Q = Q (h) is presented in Figure 4:

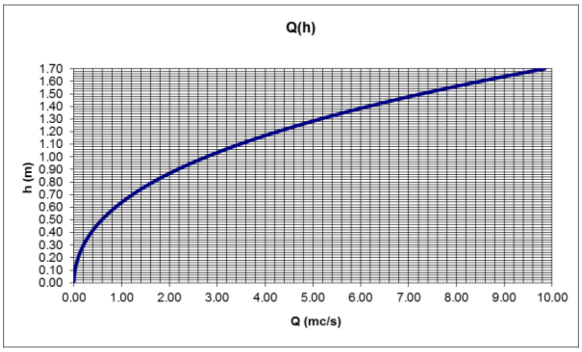

Figure 4. The construction curve Q = Q (h)

The projected flow results the following data for existing open channel:

h = 0.24 m
v = 0.21 m/s
Q = 0.13 m3/s

The volume of water that can be stored in the channel is determined by the relationship:

$$V = (b + m \cdot h) \cdot h \cdot L_{canal} \quad (13)$$

$\cdot L_{canal} = 74m$ the length of the channel is designed

Respectively calculate the volume of water that can be stored in the drainage channel for different water depths curve was drawn next channel. The construction curve V = V (h) is presented in Figure 5:

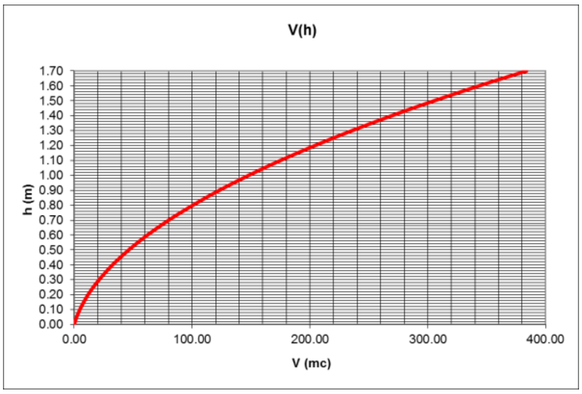

Figure 5. The construction curve Q = Q (h)

For example for a concrete pipe diameter of 800 mm, circular cross section and roughness n = 0.018, can build curves Q = Q (h), A = A (λ) and B = B (λ), curves are shown in Figure 6.

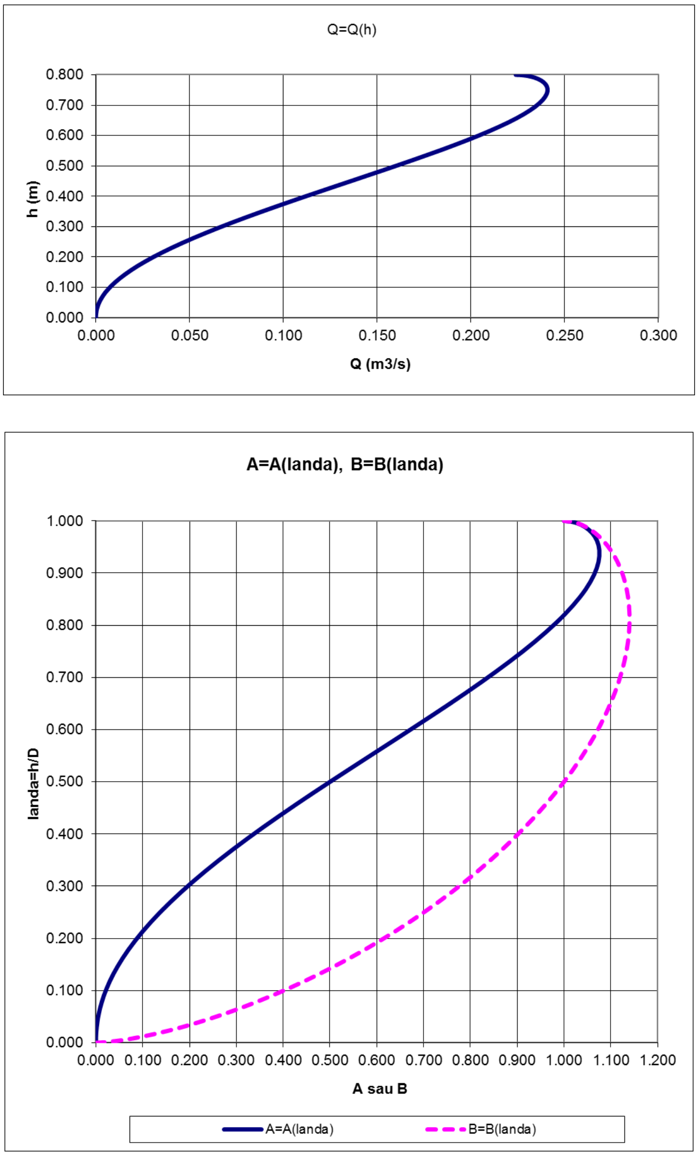

Figure 6. The construction curve

From the graph shows that the reinforced concrete pipe DN 800 mm ensures a flow discharge Q = 0.241 m / s to Q = 0.13 m3 / s flow is designed as drainage channel CCS2. At this flow rate results in a degree of filling of 54.4%.
Making channel intubation is performed according to Fig. 7,8,9.

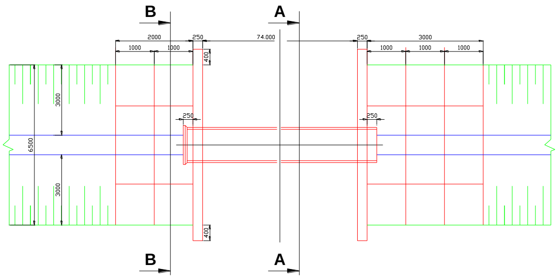

Figure 7. Intubation plan view

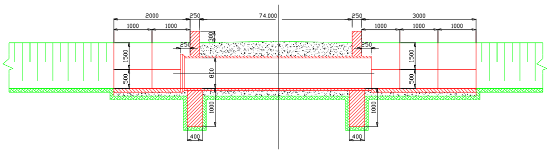

Figure 8. Intubation longitudinal profile

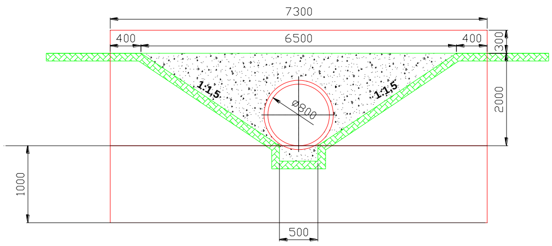

Figure 9. Intubation cross section

REFERENCES

[1] Henderson, F.M. (1966). Open Channel Flow. MacMillan Company, New York, USA.

[2] Liggett, J.A. (1975). Unsteady Flow in Open Channels WRP Publ. Vol. 1 Fort Collins, USA, pp. 29-62. Liggett, J.A. (1994). Fluid Mechanics. McGraw-Hill, New York, USA.

[3] David, I. Hydraulic I and II, Polytechnic Institute Traian Vuia Timisoara, Romania, 1984