CONSIDERATIONS ON TOPOGRAPHIC PARAMETERS OF REHABILITATION SEWER COLLECTORS

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***Abstract**: Sewerage collectors into operation a high degree of wear, which increases the flow section degradation. Decay most important processes occurring in the foundation plate collectors by processes of erosion or clogging. Rehabilitation sewerage collectors are distinguished by the geometric shape and dimensions of the cross section. Rehabilitation technology can alter the shape of the flow section and longitudinal slope default collector. To determine the functional parameters must be known collector slope created through rehabilitation. Determining slope is achieved by surveying. Surveying is customized according to the size of the collector (collectors visited, collecting non-visitable). To visitable sewer collectors can take measurements inside correlated with those outside the homes of visit. The non-visitable sewers can take measurements on the outside, inside homes to visit.*

***Keywords**: rehabilitation, section flow, longitudinal slope, hydraulic parameters*

1. Introduction

Sewer systems for wastewater were carried out in Romania in various periods of time. Urban sewage systems have a long service life, a situation that led to degradation of structural components. Visitable sewage system was done by using different materials (stone, basalt, concrete, reinforced concrete). The main share in the achievement visitable collectors have a plain concrete and reinforced concrete. Visitable sewerage collectors are most period of operation. Constructions and installations entering the sewer system structure is present in different stages of aging. Shares of the site are being felt in the form of degradation processes ongoing structural parameters of the collector.

A special problem is presented sewerage visitable collectors, where degradation phenomenon strongly affects the flow section. Most exhaust manifolds are in the last phase of operation. This phase is represented the rapid aging of structural elements of the sewerage network. Degradation of the flow section takes place by erosion and silting phenomena.

Visitable sewers collectors flow type shows sections ovoid, bell and sections of curves and straight mixed results. Large collectors allow their free inspection and making optimal use of repairs. The rehabilitation works implemented of the visitable collectors modify flow section parameters. One of geometrical parameters change is the longitudinal slope of the collector. Determination of hydraulic parameters of collector requires knowledge longitudinal slope. This is determined by the topographical methods inside or outside the collector.

2. Material and method of research

The research material consists of collectors visitable existing sewerage systems in the cities of Iasi and Pascani [Luca M., 2005]. Theoretical and experimental studies conducted in the form of technical expertise highlighted a number of parameters and data relating to the structuring and functioning of collectors. Sewerage collectors are in operation for a long period of time.

The collector sewer visitors from Pascani city show a section of flow-type bell. The collector is placed starting str. Stadium in the north-western part of the city, continue on street Railwaymen, street Sources and finally street Station. In the final collector in a room flows intersection to which they are connected and part of the collectors in the high area of the city. The total length of the collector is 2900 m, out of which 975 m are executed Street Station.

The collector is placed on the rails of the street into the upper third and middle and lower third is arranged green space. The collector is made of plain concrete and reinforced concrete circular shape, bell and ovoid. Mounting collector slopes are made depending on slope and operating restrictions; slope values range from 1%$_0$ a (in the lower third) and a 3.5 ... 5% (in the upper third). Collector section located on the ground level has a type ovoid cross section area (1.85 x 1.70 m) and a 1.0% slope mounting. Ovoid collector flow section has a value of 3.461- 3.705 m^3/s. The depth of burial is the limit of frost. Collector presents significant degradation of the flow path.

The research method characteristic features five stages:

- The first stage consists of the documentary study on the design, implementation and operation of the collector.
- The second stage consists of research in the field of the header. The analysis and the data collection was carried out from inside and outside the collector.
- The third stage analyzes the structural and functional processes by simulating flow collector in the section amended.
- The fourth stage of research consists of field measurements to determine the geometrical parameters of the hydraulic manifold and rehabilitated.
- The fifth stage of research simulates the flow in the collector section rehabilitated for various flow regimes and accidental situations. With data collected simulates the process flow in the rehabilitated section of the sewer collector.

Constructive rehabilitation of the collector path may change of the flow section. Section standardized collector sewer (ovoid-shaped or bell) can move to a section that does not comply with geometrical parameters. For modified sections flow is achieved computer programs to determine the hydraulic parameters.

3. Experimental results

Research carried out in situ on the two visitable sewer collectors has highlighted the following aspects:

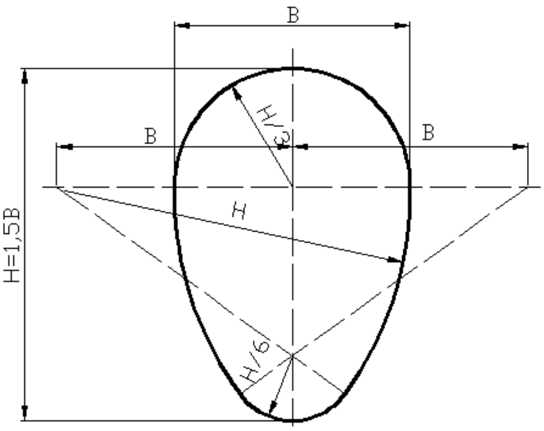
- The collector is clogged some sections, the material was deposited on the cement slab. Flow section amended, which took the ovoid form a polycentric section. Section polycentric can no longer provide low flow speed wash.
- Section flow collector has been modified by erosion hydrodynamic phenomena. Erosion has changed the geometric shape of the collector longitudinal slope and roughness of the wetted perimeter. Changing the slope and roughness influences the level of speed and flow transported of the collector.

- Architectural collector was physically degraded by the action of water physicochemical and environmental foundation. Degradation is evidenced by fissures and cracks in walls, peeling plaster wall and dome, reinforced concrete reinforcement corrosion, erosion of the concrete structure etc.
- External actions caused degradation and expulsion of material from the collector structure:
  1. The collapse of the dome collector affected by the street movement.
  2. Flasks displaced following land subsidence of the foundation.
  3. Penetrating collector wall of the tree roots or accidental actions.
- Apron and collector wall shows cracks and crevices through which the process water infiltration to the outside and vice versa. The phenomenon of infiltration caused land subsidence foundation and the effect of misalignment tubes.

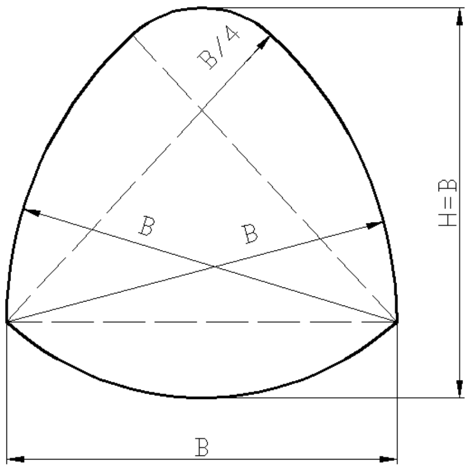

a


b

Fig. 1. Degradation one flow path to the sewage collectors visit; a - clogging invert and cementing material deposits; b - the degradation of concrete soffit plate coverage to a collector type ovoid.



a



b

Fig. 2. Profile sewer visitable collectors standardized; a - kind ovoid; b - semi-elliptical bell.

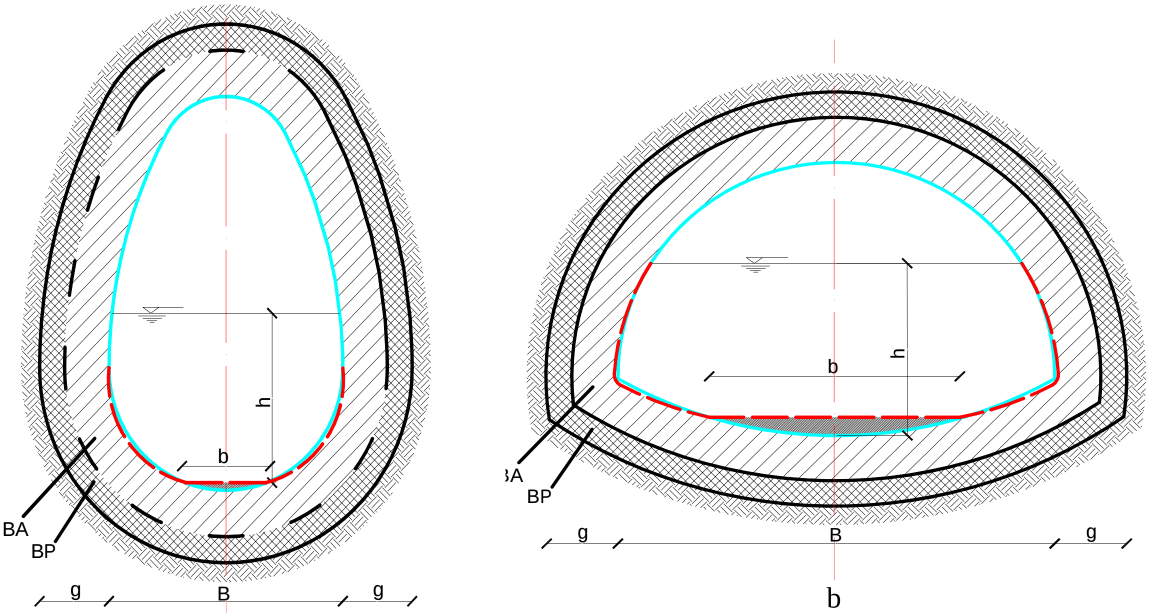
By applying rehabilitation work changes parameters flow section of the visitable collectors. Changes occur in cross section and longitudinal section of the collector. Changes in the flow section (longitudinal section) can be distinguished in the following way:

a. Changes in the apron: a - restoring linearity and obtain a new and continuous slopes on a stretch of collector; b - changing shape; c - changing roughness.

b. Changes on the perimeter flow section: a - changing shape; b - changing roughness.

c. Changing the dome collector.

d. Changes to the geometric shape of the flow section (passing from a curvilinear shape polycentric).



a

Fig. 3. Profile of the sewer visitable collectors changed (green line-formatted geometric initial red line - as amended (polycentric)); a – type ovoid; b – type circular bell.

The most significant change in the profile longitudinal is the change of apron slope value. Determination of hydraulic parameters of collector requires knowledge longitudinal slope of the slab. The longitudinal slope is determined by the topographical methods inside or outside the collector. From outside the collector is achieved by measuring the share of apron in every home visit. At the same time measure at odds land cover home visit. This method is relatively inaccurate for-that does not consider the variation allowance apron between

a b

Fig. 4. Profile sewer visitable collectors modified; a - type ovoid; b - semi-elliptical bell.

Determination of the longitudinal slope it is most accurate by providing a levelling from inside the visitable collector. It takes into account all the peculiarities of apron geometry. Surveying is carried out on sections of the collector by the works of rehabilitation. Measurements must be made to achieve a number of:

- Empty section of collector cards;
- Laundering section collector and removing deposits of materials:
- Making definitive share the slab (if rehabilitation collector);
- Realization of levelling to obtain basic data for calculation;
- realization of the measurements in the flow section for obtaining data on roughness coefficient, water levels, heights erosion etc.

Research conducted inside the visitable collectors and galleries with free flowing indicate a significant difference between the projected longitudinal slope and slope achieved by construction (Luca M., 2005). Sewage visitable collectors or galleries with free level flow changes its longitudinal slope during operation (Luca M., 2012). Exact knowledge of the hydraulic parameters necessary to determine the flow section characteristics and longitudinal slope.

Relations hydraulic calculation of sewerage collectors in a constant and uniform flow are (Luca M., 1998):

- the flow equation,

$$Q = AC\sqrt{Ri} \quad (1)$$

- the velocity equation

$$v = AC\sqrt{R} \quad (2)$$

where A is the flow area; C - Chezy's coefficient; R - hydraulic radius; and - geodesic slab slope. The calculation formulas for geometric and hydraulic parameters are presented in detail for each type of collector in literature.

In section flow collector type polycentric hydraulic functions are calculated for each feature size ($B = f_B$ (h), $P = f_P$ (h) $A = f_A$ (h), $R_h = f_{Rh}$ (h) $z_G = f_{zG}$ (h) $W = f_W$ (h) and $K = f_K$ (h)). The calculation formulas for hydraulic parameters of collector section polycentric customizes for each type of modified section (ovoid modified, bell modified, circular modified, Fig. 3). Hydraulic calculation collector constructive rehabilitated or changed as polycentric will consider the variation coefficient of roughness on wetted perimeter (Fig. 3).

The data obtained by field measurements on manifolds section were modified computer programs used in the hydraulic verification of collectors visit (Luke M., 2016). Calculation software developed has the advantage of allowing the exact calculation of operating parameters of the collector taking into account the variation of roughness on wetted perimeter of slopes and modified. The mathematical model allows for hydraulic and functional characteristics: ($B = f_B$ (h), $P = f_P$ (h) $A = f_A$ (h), $R_h = f_{Rh}$ (h) $z_G = f_{zG}$ (h) $W = f_W$ (h) and $K = f_K$ (h)) of the sewage closed sections of type polycentric.

4. Conclusions

1. Sewage collectors of "visitable type" present being used for high, aspect that makes important implications operation and high operating expenses.

2. Visitable sewage collectors may be flowing sections modified through processes of deposition, erosion hydrodynamic and technological works of repair.

3. Knowledge of geometrical and hydraulic parameters for process control mining development requires the collector to determine the longitudinal slope after rehabilitation works.

4. Longitudinal slope from sewage collectors visitable operations is obtained by levelling from inside the collector or the surface using homes to visit.

5. Determination of the longitudinal slope it is most accurate by providing a levelling from inside the visitable collector. It takes into account all the peculiarities of apron geometry.

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