Intruziunile de rădăcini în conductele de canalizare

Root intrusions in sewer pipes.

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Rezumat. *Intruziunile de rădăcini în conductele de canalizare amplasate în subsolul orașelor reprezintă o defecțiune destul de frecvent întâlnită pe parcursul operațiunilor de diagnosticare imagistică. Este considerată o defecțiune gravă, care trebuie remediată într-un timp relativ scurt, întrucât poate conduce chiar la colapsul conductei. Sunt prezentate cazurile în care apare acest tip de defecțiune, cu exemple și ce metode de remediere există.*

Cuvinte cheie: intruziuni de rădăcini, conducte de canalizare, diagnosticare imagistică

Abstract. *Root intrusions in sewer pipes buried in the subsoil of urban areas represent a common fault found during CCTV inspection of sewer mains. It is considered a serious fault which must be addressed in a short period of time, or else it can lead even to the collapse of the pipe. Manifestations of this type of fault are presented, with examples, along with the means of remediation.*

Key words: root intrusions, sewer mains, CCTV inspection

1. Introduction

During an extensive research activity the author had access to the CCTV inspection archive of the local provider of water and sewerage services. After studying a considerable amount of footage and printed inspections reports, the faults found were classified in several categories but for this paper the focus will be on root intrusions. The fault appears when trees are planted too close to the alignment of the sewer pipe. There were cases found both in sewer mains and in sewer laterals. Although initially is a fault with a slow progress, ignoring it could result in the impossibility of usage of the sewer section due to total blockage of it or even worse it could lead to the collapse of the sewer pipe. The fault mechanism is simple. Trees in the vicinity of the sewer pipe will grow more and more and will develop stronger and wider roots. If the root filaments meet in their path a sewer pipe, they will get in the cracks found on the pipe

wall and/or in the junctions between two consecutive segments of pipe. As they grow, the root filaments will gain in diameter and will become stronger, opening even more the cracks in the pipe's wall, hence the potential collapse of the pipe. In other instances, the root filaments will not get very thick in diameter but will branch inside the pipe creating a dense obstacle in the way of the residual waters. Real dams may form in the pipe starting from these points of root intrusions because debris and sediments will accumulate here.

2. Inspection reports

In the studied materials (footage and printed inspection reports) there were found 9 instances of root intrusions. All of them were in concrete pipes of round section with diameters of 300 and 400mm. As a matter of fact, the material of the pipe's wall may facilitate this type of fault especially if is a material prone to cracks, like concrete. In sewer pipes made of plastics the fault is far less common. These pipes may be affected only if the roots grow thick enough right next to the pipe and deform it severely. In table 1 are presented the cases of root intrusions found.

Table 1

Cases of root intrusions

No.	Place	Street	Sewer segment	Fault location	Pipe material	Cross section	Diameter (mm)
	1	2	3	4	5	6	7
1	Cluj-Napoca	A. Densușianu	nr.3 - downstream	+17,40m	concrete	round	400
2	Cluj-Napoca	I.B. Deleanu	nr.21 - upstream	+32,00m	concrete	round	300
3	Cluj - Napoca	Mălinului	nr.14 - downstream	+3,00m	concrete	round	300
4	Cluj - Napoca	Mălinului	nr.14 - downstream	+4,10m	concrete	round	300
5	Cluj - Napoca	Mălinului	nr.14 - downstream	+12,00m	concrete	round	300
6	Cluj - Napoca	Mălinului	nr.14 - downstream	+13,10m	concrete	round	300
7	Cluj - Napoca	Mălinului	nr.14 - downstream	+18,70m	concrete	round	300
8	Cluj - Napoca	Mălinului	nr.14 - downstream	+19,10m	concrete	round	300
9	Cluj - Napoca	Mălinului	nr.14 - downstream	+19,90m	concrete	round	300

Please note that in the above table the fault location is given in the usual manner for sewer CCTV inspection. Namely, is measured from the insertion point of the CCTV robot in the sewer pipe which is the starting manhole for the inspection. So, if we take for example the first line of the table, the fault is located at 17 meters and 40 centimeters from the manhole in front of the building having the street number 3 on

the A. Densuşeanu street. In the following two images are examples taken from the sewer pipes.

Fig. 1. Root intrusions in concrete sewer pipe [1], [2].
The roots are starting to branch already.

Fig. 2. Root intrusions in concrete sewer pipe [1], [2].
In this case the fault is in a more incipient state, the roots are long but not as branched out as in the previous image.

From Table 1 it can be observed that faults presented in the first two lines of the table are singular cases of root intrusions but the rest of 7 instances are all on the same sewer section, on Mălinului street. In this case some ornamental trees are planted along the sewer pipe path, and three of these trees have their roots in the sewer pipe. It can be observed that first two faults are close together, the roots belonging to the first tree, the second group of two faults are close – the roots belong to the second tree and the last three faults are close one of another – the roots belong to the third tree.

5. Remedial measures

What can it be done in case root intrusions are found in the sewer pipe? It depends on severity of the fault. The first step would be to remove de roots by cutting them with special tools. In this respect there are available several types of cutting heads that can be fitted on robots like those used for CCTV inspection. Figure 3 and 4 present such equipment. These robots are also useful in implementation of some rehabilitation techniques like CIPP – Cured In Place Pipe. For this reason, we can observe in figure 3 a connection for compressed air.

Fig. 3. Maxwell 250 - robot for cutting roots inside pipes from DN100 to DN250[3]

These robots have a pretty narrow domain of diameters in which they can work, for example Maxwell 250, as the name implies, goes up to 250mm. Maxwell 400, presented in figure 4, goes only up to 400mm and so on.

Fig. 4. Maxwell 400 - robot for cutting roots inside pipes from DN150 to DN400[3]

Another option would be to use the pressure of the water to do the cutting. In this respect there are available special designed cutting nozzles. These jetting heads work well in smaller diameter pipes. For example, Warthog jetting nozzle is available for different sizes and flows of water, please see figure 5.

a b c

Fig. 5. Examples of jetting nozzles. [4]
a – Warthog jetting nozzle small 1/2" (50-75 lpm) with cutting head;
b – Warthog Mini ½" jetting nozzle (45-80 lpm); c – hydraulic rootcutter

The first example in figure 5 requires a flow of water of 50 to 75 liters per minute and the second example requires 45 to 80 liters per minute. There are other kinds of cutters using the pressure of water, like the Hydraulic Rootcutter [4]. This is using the water pressure to rotate a head with serrated curved blades, much like a saw blade. Using any of these heads will result in a quantity of debris consisting of small fragments of roots which must be washed away from the pipe.
The second step of the intervention would be to locally repair the pipe employing a trenchless repair technique such as CIPP or by applying a layer of centrifugally cast

concrete or other local repair methods. If the fault is serious, it may require the replacement of the pipe segment.

6. Conclusions

Root intrusions is a fault specific for sewer pipes. It affects especially pipes made of materials prone to cracking. It can degenerate into more serious faults like pipe collapse if not addressed in early stages. It is possible to render inoperable the affected pipe section by creating dams inside the pipe. Presently there are means for removal of the root that penetrated the pipe wall, either using electrically powered cutting and milling heads mounted on sewer robots or by employing hydraulic cutting heads in an operation called "jetting". If a local repair method is not applied soon after cutting the roots, CCTV inspections should be carried out on regular bases to observe if the roots are growing back inside the pipe. This outcome is very probable if a local repair is not done. A further direction of research would be the use of chemical substances locally, in the pipe, to inhibit the growth of the roots back into it. After the use of such inhibitors if a local repair is done, the risk of future root penetration would be greatly reduced. Another aspect to be taken in consideration is to plant the trees far enough from the sewer pipe pathway, but this applies, of course, to the trees younger than the pipe.

References

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