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ADAPTIVE CLEANING OF SEWAGE NETWORKS

Introduction

In the future only 40 % of today's demand of drinking water will be discharged as waste water into the sewerage system [i]. Rainwater flow also will decline as seepage has become a notable alternative to traditional drainage systems, especially for environmental reasons [ii]. As a result of the reduced flow rates, the sedimentation of solids will increase with the consequence of higher cleaning rates being needed for the whole sewer system. To keep costs on a reasonable level, holistic concepts are needed to improve the cost-benefit relation of the cleaning process itself.

In 2000 a preliminary study "Recommendations for the cleaning of sewers" [iii] was completed. On an empirical and representative basis the cleaning practises of sewage network operators in Northrhine-Westfalia were investigated. With 18 million inhabitants (527 inhabitants/km²) NRW covers about 5 % of the EU population. The public sewage network has a length of 80.000 km and network operators spend over 50 million euros a year for the cleaning of sewers, not including service house connections and private sewerage.

Most operators of sewage networks choose specific "cleaning recipes" using different spray nozzles, water pressures, jetting intervals etc. The opinions about "what is a clean sewer?". and "what are the proper jetting techniques and methods?" are wide spread, resulting in costs ranging from 700 to 1.200 euros/km. Moreover, damages caused by unsuitable cleaning methods involve infiltration of groundwater or exfiltration of sewage, eventually resulting in great rehabilitation costs. About 25 % of the municipalities in NRW experienced such jetting damages, for example by striking of the jetting head, whirling of stones or the operating jet remaining at one position. Today's concepts for operation are not yet based on systematic documentation and evaluation of operational data, although 40 % of the operators interviewed already plan to work out an adaptive cleaning schedule with adjusted time intervals
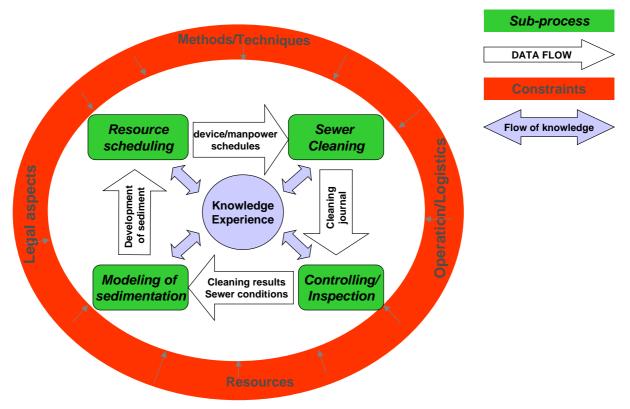
depending on the local requirements. Legal pressure certainly being a determining factor for those efforts.

State of the Art

Operators of sewage networks and jetting companies have little information about the organisation, planning and realisation of sewer cleaning [iv]. Two standards for high pressure water jetting have been being developed by the European Committee for Standardisation (CEN/TC 165) [v], the drafts (pink prints) being available in mid-2001 [vi]. In Switzerland, at the Institute for Construction Engineering and Management of the ETH Zürich and the Centre of Disposal and Recycling, Zürich, the impact of high pressure water jetting on commercially available 300 mm (D) sewer pipes has been investigated recently, following the draft [v] of CEN/TC 165 / WG 22 for the testing of pipe material. More information about jetting techniques can be taken from [vii], [viii].

Approach

Based on the results of the preliminary study, IKT derived an application-oriented structure for the business process "adaptive cleaning of sewer networks" (picture 1). Organisation, planning, realisation and controlling are integrated into a single management process. The planning of cleaning activities is adjusted to the necessity and urgency of removing sediments, e.g. to ensure the hydraulic capacity. The sewer system operator is collecting systematically the know-how of all parties involved, evaluating the gained knowledge base and using it for an adapted planning of the cleaning itself. This implies co-operation between engineers, manufacturers of vehicles and devices, sewer jetting services, software-providers and research institutions. The creation of a special data-base including the know-how and experience of the respective network operator is part of the process.

Picture 1: Process: Adaptive Cleaning of Sewage Networks

The sedimentation process (time and location) would be considered both in the planning process and the cleaning process. The specific sewer conditions of the individual network will be judged and an adapted cleaning concept will be worked out, the realisation of which being controlled and supervised in a reliable manner. In practise this implies specifications about cleaning time and place, operating conditions and schedule. The immediate integration of the continuously growing experience of the operational staff is essential as well as the quick adaptation of the planning process to the short-term demands of the operational units.

The IKT will address the following issues in the near future :

- Modelling and description of the effect of jetting techniques regarding their ability to separate different substances from the sewer surface and to transport the remaining sediments away,
- Determination of the maximum allowable and minimal useful jetting force and performance,
- Optimising of the nozzle use (type, deployment, cleaning speed etc.),
- Development of methods to define and verify the cleaning success,
- Development of performance standards for vehicles and devices,
- Development of recommendations for planning, realisation and controlling of sewer cleaning.

To ensure a close link to practise, sewage network operators accompany the project on an expert's advisory board.

Projections

The results of the described research activities will be available in the form of various guides for sewer cleaning. Operators should then be in a better position to consider their specific network situation with regard to sewer cleaning requirements. They are able to work out suitable cleaning concepts and control and supervise the realisation thereof in a reliable way. By introducing an adaptive process "sewer cleaning" the intended improvements are likely to save resources (water/energy) as well as reduce cleaning-costs.

References

[i]   Schriftenreihe kommunaler Umweltschutz: Naturnaher Umgang mit Regenwasser, Heft Nr. 30, Hannover-Umweltdezernat, 05.2000

[ii]   §51 Landeswassergesetz NRW

[iii]   Forschungsprojekt: Empfehlungen zur Kanalreinigung. Im Auftrag des Ministerium für Umwelt, Raumordnung und Landwirtschaft des Landes Nordrhein-Westfalen bearbeitet durch das Institut für Kanalisationstechnik, Gelsenkirchen (5.2000).

[iv]   Lenz J., Wielenberg M.: Sedimentation in Abwasserkanälen und Kanalreinigung, 3R international, Heft 9 S. 513- 517, (9.97).

[v]   Draft European Standard for the Determination of Jetting Resistance of Drain and Sewer Pipes – Requirements and Test Methods, CEN document TC 165 / WG 22 N 3372 E Draft prEN xxxxx, secretary of the Britsh Standard Institution, Drain & Sewer Systems Outside Buildings, Ed. 03/1999.

[vi] Euro-Info zur 21. Sitzung von CEN/TC 165 „Abwassertechnik" am 8./9. November 1999 in Zürich. KA-Wasserwirtschaft, Abwasser, Abfall 2000 (47) Nr.1.

[vii] Info IRO, Informationsschrift des Institutes für Rohrleitungsbau Oldenburg „Hochdruck-Wasser-Test: Eine praxisorientierte Versuchsdurchführung" (1999).

[viii] Sewer Jetting, Code of Practice, 1st ed., WRc (June 1997)