

Needs-orientated conduit cleaning

We drive our cars through the car wash only when they're dirty - and that's totally logical. But many operators of waste-water systems continue to clean their drains and sewers to a fixed schedule. The IKT has conducted a research project into the optimisation potentials of needs-oriented cleaning strategies.

Cleaning of conduits makes an important contribution to assuring the functioning of our drain and sewer systems, and accounts for a significant portion of the responsible municipalities' budgets. It is often the case, however, that system operators' resources are not used efficiently and/or that, due to inadequate knowledge of the current condition of the conduit systems, lengths are cleaned without this really being necessary. Many sectors are not, or only insignificantly, fouled when they are cleaned, for example, whereas other lengths exhibit heavy fouling. It is therefore possible to exploit potentials for optimisation and save costs by introducing a needs-orientated cleaning strategy, without risking impaired operational safety and reliability by universally increasing cleaning intervals.

Investigation of needs-orientated drain/sewer cleaning

The IKT focused on this topic, in co-operation with the Ruhr University of Bochum, in the context of a research project funded by the environmental ministry of the state of North Rhine-Westphalia (NRW). Measurements of pollutant burden and hydrogen sulphide content, and also fouling analyses, were performed in real-life drains and sewers under the project title of „Investigation of needs-orientated drain/sewer cleaning exploiting operational synergies“. Particular attention was devoted, inter alia, to the analysis of typical weak points in the drain/sewer system. A statistical problem survey was conducted and the statistics evaluated.

Problems in drain and sewer systems

Very largely trouble-free disposal of waste-water is, with very little doubt, the aim of every waste-water system operator. The real situation is generally rather different, however. In practice, a range of problems can occur and impair correct functioning of the drain/sewer network in a number of ways, extending from minor obstructions up to and including total blockage of the conduit. Such problems attract particular attention when they directly result in complaints by customers, as a result, for example, of overflows or odour nuisances.

Practical experience up to now demonstrates that no statistics complete with details of location, frequency, effects and causes, are generally kept on such problems. There has, correspondingly, also been no available information up to now on the problem situations that are of particular practical relevance. A „Problems in drain/sewer operation“ operators' hotline was set up as part of this research project, in order to obtain an initial overview. The aim here was that of identifying the relevant problem situations and elaborating suitable conceptual solutions. Problems could be reported by telephone, e-mail or using a special problem-report form. More than seven hundred problems were ultimately notified by seven waste-water authorities using this hotline.

The following problem groups were noted:

- Blockage in the public part of the system
- Blockage in the private part of the system
- Rattling drain/sewer covers
- Odour nuisances
- Rodent (rat) infestation
- Sagging and subsidence
- Gas emissions from odour traps
- Miscellaneous



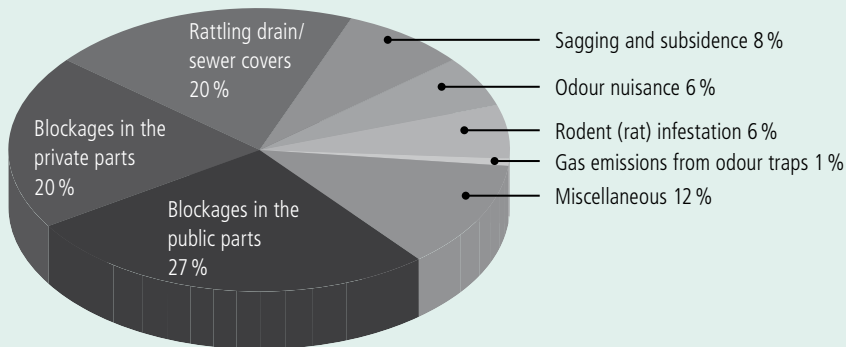
There is still a need for discussion.



Cleaning crews retrieve foreign objects like these from drains and sewers again and again.

Analysis of the problem data survey showed that the largest proportion (27 percent) of the problems reported involved blockages in the public part of the system. The second and third highest rankings of the cases reported were held by blockages in the private part of the system and rattling drain/sewer covers, each at 20 percent. These three problem situations in practice account for nearly 70 percent of all problems.

Conduit Cleaning



Together, blockages in the public and the private parts of the system, plus rattling drain/sewer covers, are responsible for two thirds of problems.

Other problems in the drain/sewer network occurring regularly in practice include sagging and subsidence, odour nuisances, rodent infestation and gas emissions from odour traps. In everyday practice, however, these phenomena occur rather more rarely. Finally, all other "isolated incident" reports, such as oil spills, etc., were all grouped together in the "Miscellaneous" category. Such problems also occur only extremely rarely.

Talks on cause analysis with system operators showed that the occurrence of a problem is generally preceded by a particular event or a particular deviation from planned figures. These apply, for example, to the structure and geometry of the waste-water conduit, such as narrowing cross-sections and adverse gradients, unscheduled discharges of water and/or the fly tipping or other ingress of foreign bodies, such as building rubble or tree/plant roots.



Recurring problems: Knowing where depositions regularly occur permits systematic cleaning.

Results, remarks and recommendations for cleaning practice

In most cases, no recording and documentation of such problems has generally taken place in practice up to now. Those system operators that do document problem reports only rarely also record the possible causes. Even when they do, only generalised categories, such as "Blockage in the public part of the system" are usually noted. It is therefore not, or at best only scantily, possible to identify weak points in the drain/sewer system, with the result that this factor, too, is also initially left out of account in cleaning planning. It is better practice to record reports of problems and to follow through until the cause has been found. This makes it possible to detect weaknesses in the drain/sewer system and take them into account in cleaning planning. The setting-up of a problem register is an option for documentation of such problems. The sites, frequency and effects of problems arising during system operation should be continuously logged and documented for this purpose.

Differentiation between isolated and recurring problems is recommended analytical practice. An isolated (i.e., "once-only") problem, such as a collapsed dirt trap, for example, is of no further importance for deployment planning once it has been rectified. In the case of recurring problems, such as blockages at adverse gradients, or the penetration of roots, on the other hand, the affected areas should be kept under long-term observation and cleaning intervals shortened if appropriate. Even better, such weak points



Building rubble causing obstruction to flow: after-completion inspections may be appropriate in the zone around completed civil-engineering work.

should wherever possible be eliminated by means, for example, of corresponding refurbishing. After-completion inspection of the nearby drain/sewer sectors should also be practised after civil-engineering work and, in particular, roadworks, etc., in order to detect any resultant problems.

The data survey for this research project also indicated a greater number of reports concerning rattling drain/sewer manhole covers. The solution usually selected is the installation of an underlay ring. Repair of the top of the manhole shaft is generally necessary if the problem recurs, however. Here, too, there are also possible synergy effects in terms of labour deployment. In other words, greater deployment of the freed human resources to other tasks, such as the repair of manhole shafts and similar activities, is recommendable if it has been possible to reduce the labour needed for cleaning.

Conclusions drawn from this project

A comprehensive concept for the exploitation of further potentials within needs-orientated drain/ sewer cleaning was drafted, with the involvement of NRW municipalities, in the context of this now completed research project. Internal synergies within the limits of drain/sewer operation itself, on the one hand, and also potentials for optimisation by means, for example, of inter-municipal co-operation, were outlined. Technological tests performed on a test length of conduit were used, on the other hand, for the determination of actual cleaning needs as a function of the fouling situation.

The practical tests performed during this research project clearly showed that the decision concerning cleaning of a conduit should not be made solely on the basis of an "instantaneous picture" of the level of fouling, since the latter is subject to great fluctuations as a result of precipitation events and other factors. Instead, regular inspections should be performed, since these assist in determining the characteristic state of a length of conduit and its fouling across longer periods, permitting the definition of correspondingly adjusted cleaning intervals. Such cleaning intervals must never be of infinite duration, however, since the solidity of the fouling depositions, and thus the necessary cleaning effort, increases with time. On the basis of knowledge gained up to now, the generation of hydrogen sulphide plays only a subordinate role in the scheduling of cleaning intervals, since the beneficial effects of a cleaning cycle on hydrogen sulphide evolution last only a few days.

In parallel to the practical tests conducted, the project also created numerous contacts in the context of workshops and inter-operator discussions, and these enabled system operators to exchange experience regarding the particular cleaning strategies. This generated wide-ranging insights into the boundary conditions and requirements set at the various system operators. It became apparent that there will never be a single "optimum" strategy universally applicable to all system operators and that, instead, every operator will need to find the solution that best fits his requirements and circumstances.

Download research report "Investigation of needs-orientated drain/sewer cleaning exploiting operational synergies – phase 1": www.ikt.de (German Version)

Presently, this subject is being analyzed further in the second project phase.

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IKT - Institute for Underground Infrastructure

ABOUT IKT



IKT - Institute for Underground Infrastructure is a research, consultancy and testing institute specialized in the field of sewers. It is neutral and independent and operates on a non-profit basis. It is oriented towards practical applications and works on issues surrounding underground pipe construction. Its key focus is centred on sewage systems. IKT provides scientifically backed analysis and advice.

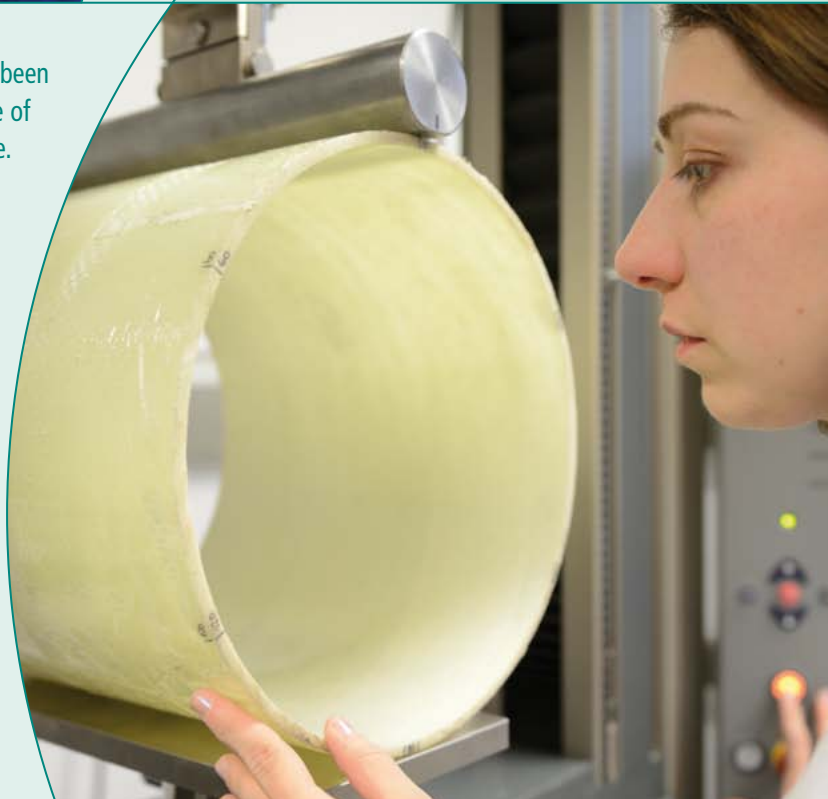
IKT has been established in 1994 as a spin-off from Bochum University, Germany.

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