BS EN 14654-1:2014

BSI Standards Publication

Management and control of operational activities in drain and sewer systems outside buildings

Part 1: Cleaning

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National foreword

This British Standard is the UK implementation of EN 14654-1:2014. It supersedes BS EN 14654-1:2005 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/505, Wastewater engineering.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Gestion et contrôle des opérations d'exploitation dans les réseaux d'évacuation et d'assainissement à l'extérieur des bâtiments - Partie 1: Nettoyage

Management und Überwachung von betrieblichen Maßnahmen in Entwässerungssystemen außerhalb von Gebäuden - Teil 1: Reinigung

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Foreword

This document (EN 14654-1:2014) has been prepared by Technical Committee CEN/TC 165 “Waste water engineering”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2014, and conflicting national standards shall be withdrawn at the latest by December 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 14654-1:2005.

EN 14654 “*Management and control of operational activities in drain and sewer systems outside buildings*” contains the following parts:

— *Part 1: Cleaning*;

— *Part 2: Rehabilitation*.

Other parts, dealing with other activities, may be added later.

In drafting this part of EN 14654, account has been taken of other available standards, in particular EN 752 “*Drain and sewer systems outside buildings*” and EN 13508 “*Investigation and assessment of drain and sewer systems outside buildings*”.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This European Standard deals with the management and control of cleaning operations in drain and sewer systems. Cleaning operations are a part of the general management of drain and sewer systems.

The employing authority sets the aims of the cleaning operations, expressed in terms of the end result, necessary to achieve the performance requirements for the drain and sewer system (see EN 752), and develops a strategy to meet these aims. The employing authority also produces a specification for cleaning operations taking account of the aims and the strategy, and including indicators for controlling the quality of the results.

Before commencing cleaning operations, the employing authority should have a thorough knowledge of the drain and sewer system and an assessment of the hydraulic conditions and other relevant factors in order to understand the type and frequency of cleaning necessary (see EN 752). However, it is sometimes necessary to carry out some work in order to obtain this knowledge.

On completion, a report of the cleaning operations is produced, providing information on the works, on any difficulties encountered and any anomalies.

This information is used to improve the management of drain and sewer systems.

1 Scope

This European Standard establishes the general principles for the management and control of operational activities in drain and sewer systems outside buildings and specifies requirements for development and implementation of work programmes, and the selection of techniques.

This European Standard covers the management and control of cleaning.

It is applicable to drain and sewer systems, which operate essentially under gravity, from the point where wastewater leaves a building, roof drainage system, or paved area, to the point where it is discharged into a treatment works or receiving water body. Drains and sewers below buildings are included provided that they do not form part of the drainage system of the building.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 752:2008, *Drain and sewer systems outside buildings*

EN 1829-1:2010, *High pressure water jet machines - Safety requirements - Part 1: Machines*

EN 1829-2:2008, *High-pressure water jet machines - Safety requirements - Part 2: Hoses, hose lines and connectors*

EN 13508-1:2012, *Investigation and assessment of drain and sewer systems outside buildings - Part 1: General Requirements*

EN ISO 14001, *Environmental management systems - Requirements with guidance for use (ISO 14001:2004)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 General

3.1.1
cleaning activities
removal or partial removal of settled deposits, attached deposits, roots and other obstacles from a drain or sewer system

3.1.2
degree of cleaning
extent to which complete removal of deposits is achieved

3.1.3
employing authority
organization that owns or is responsible for the management of a drain or sewer system

3.1.4
removal
extraction of deposits after collecting at the working area or the intentional use of the flow in the drain or sewer to carry the re-entrained solids to a specified point of extraction

3.1.5
self-cleansing
ability of the flow in a drain or sewer to carry away solid particles which would otherwise be deposited in the pipe

[SOURCE: EN 16323: 2014, 2.2.1.13]

3.1.6
supernatant liquor
liquor in a tank lying above the deposited solids

[SOURCE: EN 16323:2014, 2.1.2.16]

3.2 Deposits

3.2.1
attached deposits
material attached to the wall of elements of the drain or sewer system by physical or chemical bonding

3.2.2
settled deposits
material deposited by gravity in the invert or benching of elements of the drain or sewer system

3.3 Cleaning methods

3.3.1
cleaning ball
spherical device, having an indented surface, designed to be carried through a drain or sewer by the flow to facilitate removal of sediments

[SOURCE: EN 752:2008, 3.9]

3.3.2
combined jetting
simultaneous use of high-pressure water jetting equipment together with a suction action, to remove obstructions or sediments from drains or sewers

[SOURCE: EN 16323:2014, 2.2.1.10]

3.3.3
flushing
use of a temporary and substantially increased flow to facilitate the removal of obstructions or sediments from drains or sewers

[SOURCE: EN 16323: 2014, 2.2.1.16]

3.3.4
jetting
use of water under defined conditions of pressure and flow through a nozzle

[SOURCE: EN 16323:2014, 2.2.1.18]

3.3.5
rodding
use of appropriate device on the end of flexible rods to facilitate the removal of obstructions (or sediments) from drains or sewers

[SOURCE: EN 16323: 2014, 2.2.1.11]

3.3.6
scouring plate
device used to clean a drain or sewer by concentrating the flow into a small cross section thereby increasing the flow velocity

3.3.7
winching
use of a device pulled through a drain or sewer to facilitate removal of sediments (or obstructions)

[SOURCE: EN 16323:2014, 2.2.1.12]

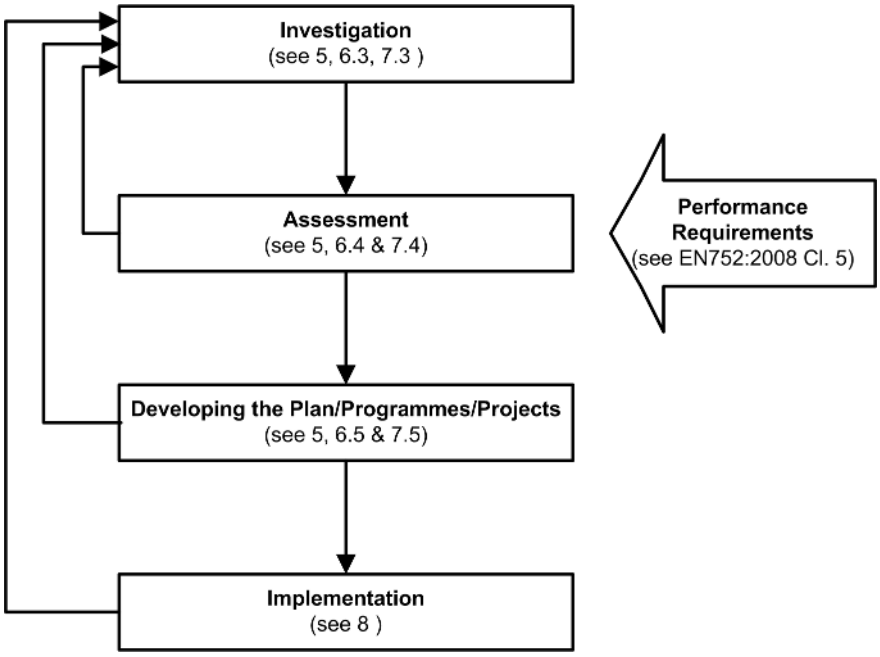
4 General

EN 752:2008, Clause 6, outlines the process for preparation and implementation of an integrated drain and sewer system management plan which includes, at a strategic level, plans for the rehabilitation and maintenance of the drain and sewer system. The amount of detail in these plans in the integrated drain and sewer system plan can vary. A maintenance plan should include a cleaning plan where cleaning activities are necessary.

Cleaning activities in drains and sewers can be carried out pro-actively, to prevent problems occurring or to clean a drain or sewer before particular operations (e.g. an inspection or renovation work) or reactively in response to problems that have occurred.

The requirements for pro-active cleaning can be identified through a rehabilitation plan, a maintenance plan involving periodic monitoring or as part of an integrated sewer system management plan in accordance with EN 752. Consideration shall also be given to the feasibility of preventing deposition of sediments for example by rehabilitation of the sewer.

This European Standard sets out a process for implementing the cleaning activities in the integrated drain and sewer system management plan. The process is based on a staged application of the process outlined in Figure 1.



NOTE Based on EN 752:2008, Figure 5.

Figure 1 — Integrated Sewer System Management Process

The integrated sewer system management process is applied successively to develop a cleaning programme based on the integrated sewer system management plan. The programme outlines a series of discrete projects to implement the plan. Following this, the integrated sewer system management process is then used to produce a detailed specification for each of these projects in the programme. Finally, following the implementation of each project, the cleaning programme and the integrated sewer system management plan are reviewed and updated where necessary. The performance requirements should be in accordance with EN 752:2008, 5.2.

At each stage further investigation and assessment is carried out in accordance with EN 13508-1.

This staged process is summarized in full in Figure 2. The extent and detail of these stages should be determined by the characteristics of the individual systems. According to the specific local conditions, stages may be consolidated or, if they are not necessary, omitted.

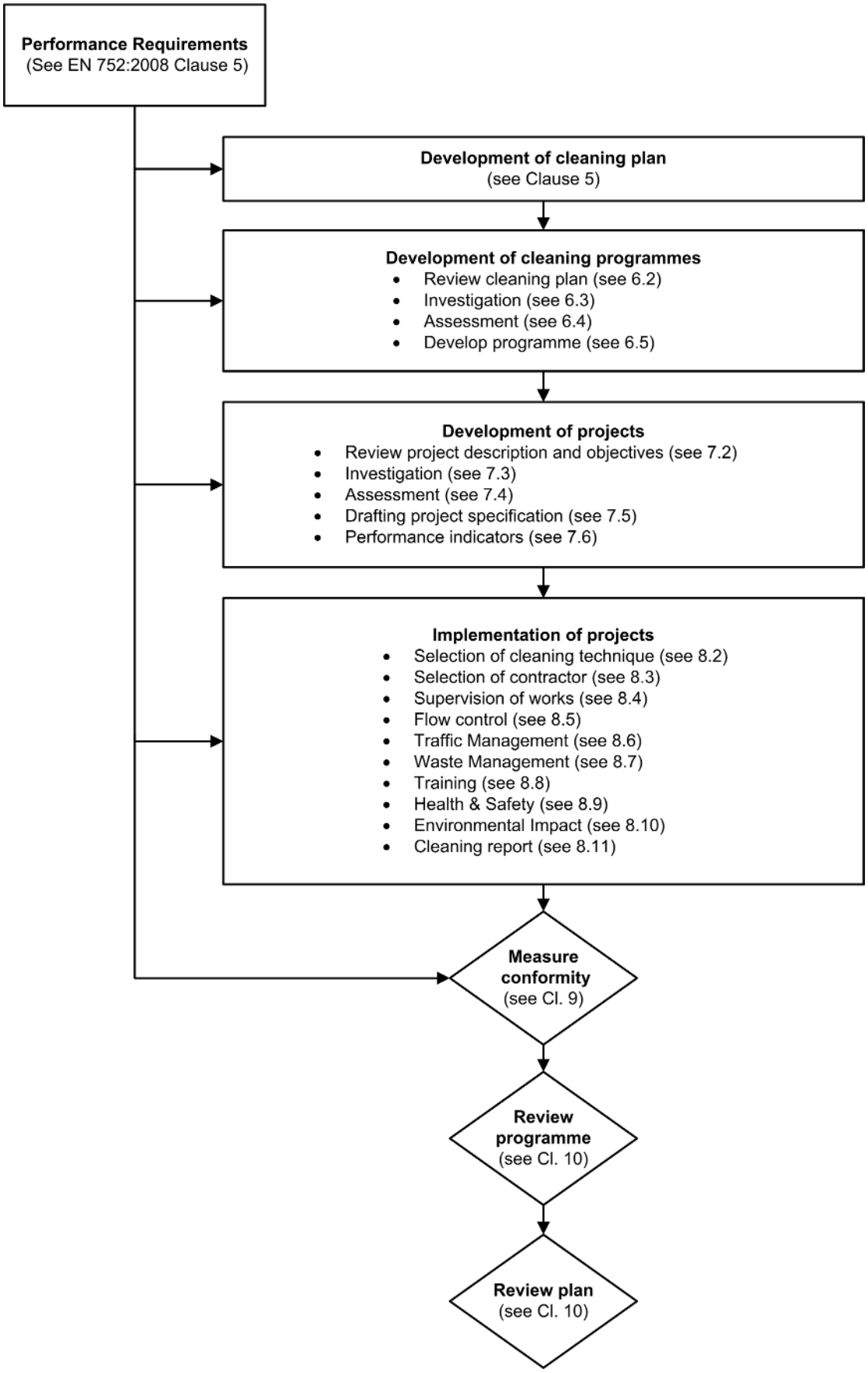


Figure 2 — Summary of the sewer cleaning management and control process

5 Cleaning plan

5.1 Introduction

An integrated sewer system management plan prepared in accordance with EN 752:2008, Clause 6, includes:

— new development plan;

— rehabilitation plan;

— operational plan;

— maintenance plan.

Cleaning activities are one aspect of the maintenance plan, as part of an integrated sewer system management plan. A maintenance plan, dealing with cleaning activities should be in place for the drain and sewer system prior to carrying out major programmes of sewer cleaning. However, this is not always possible if works are required urgently (e.g. in response to a sewer failure).

It is not necessary for the plan to include detailed descriptions of the solutions. It may include only general descriptions of the approaches to be taken.

5.2 Cleaning aims

The principal aims of carrying out cleaning work can include:

a) Pro-active cleaning

— to ensure that the performance of the drain or sewer system is acceptable;

— to prolong the operational life and maintain the value of the asset;

— to control septicity to reduce associated odour, health and potential corrosion problems;

— to limit polluting discharges into receiving water bodies;

— to enable inspection or renovation of the drain or sewer system;

— to optimize the effectiveness of key components of the system at critical times (e.g. prior to heavy rain seasons, busy periods in tourist sites);

— to facilitate inspection.

b) Reactive cleaning

— to remove a blockage in order to restore the flow;

— to restore the function of the drain or sewer system;

— to remove sediments in order to reduce septicity and odour problems.

The nature of the aim can determine the degree of cleaning necessary.

6 Preparation of cleaning programme

6.1 Introduction

The starting point for the preparation of the cleaning programme is the maintenance plan produced in accordance with EN 752:2008, Clause 6, and the performance requirements produced in accordance with EN 752:2008, Clause 5.

The maintenance plan does not generally contain the necessary detail to proceed directly to the production of the cleaning specification. The cleaning programme defines a series of projects, in line with the integrated sewer system management plan, to ensure that the drain and sewer system meets the performance requirements. The cleaning programme should define the objectives for each project in sufficient detail so that a project specification can then be produced in accordance with Clause 7.

The preparation of the cleaning programme involves:

a) review of the cleaning plan (see 6.2) to ensure it is still current and to establish what further investigation is required to develop the programme;

b) further investigation (see 6.3) to provide the information necessary for the more detailed assessment;

c) more detailed assessment (see 6.4) to identify further detail of the performance deficiencies that the programme needs to address;

d) develop the programme (see 6.5) setting the scope and objectives for each of the projects.

All stages of the preparation of the cleaning programme shall take account of the health and safety principles set out in EN 752:2008, Clause 7.

6.2 Review of the cleaning plan

A review should be undertaken of the cleaning aspects of the maintenance plan within the integrated sewer system management plan. This should include:

a) ensuring the performance requirements used in the preparation of the integrated sewer system management plan are still current;

b) checking that any assumptions regarding projected timescales included in the plan for new developments or other changes to the sewer system are still valid;

c) identifying where further investigation and assessment is required in order to develop the programme of works.

If there have been any changes then the plan should be updated.

6.3 Investigation

The investigation of the drain and sewer system shall be carried out in accordance with EN 752:2008, Clause 6, and EN 13508-1:2012, Clause 5.

The location of the sections of drains and sewers where proactive cleaning is to be carried out and the assessment of the cleaning frequencies shall be based on:

a) an understanding of the characteristics and structural condition of the drain and sewer system;

b) an analysis of its performance;

c) a review of the available information which may include the performance of similar systems elsewhere.

The different sections of the sewer shall be described according to the information collected in order to optimize the cleaning programme.

The scope of the investigations necessary to produce the cleaning programme will depend on the extent of the investigations carried out during the preparation of the integrated sewer system management plan. A review should be undertaken of the information available. The review should include:

d) inventory data

   1) type of effluent (wastewater, surface water, combined sewage or specific effluents);

   2) sewer characteristics (shape, size, slope, depth, material, etc.), presence and characteristics of combined sewer overflows and other ancillaries;

   3) characteristics of the location of the sewer (e.g. aquifer protection zones, ground water level, trees, proximity of receiving water bodies);

e) condition information from inspection reports (e.g. visual inspection reports, CCTV reports, sediment measurements);

f) data on flows from measurements or the results of hydraulic models;

g) records of past cleaning (e.g. location of areas of persistent operational problems); and

h) performance data (e.g. flooding, sewer blockages, collapses, odours, septicity problems, premature operation of combined sewer overflows, etc.).

Where there is insufficient information available to plan the cleaning programme, a programme of investigations shall be carried out to obtain the necessary information.

An example report form is given in Annex A.

Investigations should be carried out where further information is needed in order to produce the cleaning programme.

Examples can include:

— further inspection in parts of the system where the original assessment was based only on sample inspections;

— the use of an appropriate sewer flow simulation model;

— more detailed studies of the impact of any discharges on receiving waters bodies.

Details of investigation techniques for drains and sewers are described in EN 13508-1.

6.4 Assessment

The assessment should identify the location of those components of the drains and sewer system where proactive or reactive cleaning is to be carried out. This shall be based on:

a) the effect of the deposits on the performance of the system;

b) the sources of such deposits;

c) the typology of the drain or sewer;

d) the nature of the effluent.

The performance of the drain or sewer systems shall be assessed in accordance with EN 13508-1:2012, Clause 6, using the results of the investigation (see 6.3). The assessments carried out during the preparation of the integrated sewer system management plan should be reviewed and updated in the light of any new information identified during the investigations. The performance at each planning horizon shall be compared to the performance requirements to identify the needs for cleaning.

Where inspection is used to determine the current levels of sediment, the effect of the movement of sediment in dunes, leaving some parts of the pipe clear while other localized parts of the sewer have significant deposits, should be considered. However, localized sediments may also indicate the presence of an obstacle.

The typology of drains and sewers can be identified as:

— type 1: drains and sewers which are self-cleansing, where proactive cleaning is exceptional;

— type 2: drains and sewers which are not completely self-cleansing, where proactive cleaning could be beneficial, the cleaning frequencies depending on the rate of sediment accumulation;

— type 3: drains and sewers with localized problems, which require frequent cleaning.

The typology can change over time.

Other elements of the sewer system, for example sewer connections, gullies, silt traps, inverted siphons, pumping stations can also require cleaning.

This analysis is carried out using available information including the results of the specific investigations carried out to develop the programme (see 6.3).

The results of the assessment should be checked with the assessment made during the production of the integrated sewer system management plan and if there are significant differences the plan should be reviewed to ensure that it is still valid.

6.5 Develop the programme

6.5.1 Introduction

The cleaning programme comprises a number of projects which together shall meet the objectives. Where cleaning forms part of the integrated sewer system management plan, a cleaning programme should be developed. The cleaning programme should define the scope and objectives of each project in the programme and the phasing of the projects including the relationship to any external constraints such as budgets, and interactions with other programmes. The programme shall take account of the safety principles in EN 752:2008, Clause 7. The potential of education to improve user behaviour or enforcement of permits for industrial wastewater should be considered.

A cleaning programme shall:

— identify optimum frequencies for pro-active cleaning operations;

— maintain or reduce the number of reactive cleaning operations to an acceptable level.

6.5.2 Specification of objectives

The cleaning objectives should be established in accordance with the cleaning aim. These should be expressed as a performance requirement, for example:

a) to remove settled and/or attached deposits to a prescribed amount, (for example remove completely or to a maximum depth); or

b) to restore the flow capacity in a pipe to the design capacity; or

c) to limit the build-up of sediments to a prescribed level; or

d) to limit the deposits to existing levels (maintaining a balance in the sediment movement); or

e) to limit the build-up of deposits so that flooding is limited to prescribed frequencies; or

f) to remove sufficient deposits to avoid blockages; or

g) to remove sufficient sediments to allow an inspection to take place or to facilitate renovation or repair;

h) to remove bio-films (for example from rising mains to reduce septicity, or from heat exchangers).

6.5.3 Develop options

There are a number of possible cleaning approaches, these include the following:

— periodic cleaning (cleaning according to fixed time intervals);

— monitored periodic cleaning (cleaning according to time interval, the subsequent time interval is updated according to the depth of deposits prior to previous cleaning);

— planned inspection (by CCTV or other method) and cleaning (inspection at intervals in order to determine when deposits have reached a threshold level for cleaning);

— specific cleaning before other works such as CCTV inspection, rehabilitation operations, etc.;

— reactive cleaning - in those sections of drains and sewers which are normally self-cleansing;

— enforcement action – enforcing discharge permits or discharge regulations to prevent discharge of unsuitable materials into the drain or sewer system.

Where frequent cleaning is required, or where the consequences of sediment accumulation are severe, consideration should be given to the feasibility of carrying out rehabilitation works to prevent the accumulation of sediments.

6.5.4 Assess technical feasibility of solutions

The options developed in 6.5.2 should first be assessed to establish the extent to which they will meet the cleaning objectives and minimum performance requirements, and whether it would be feasible to implement them, for example the feasibility of increasing capacity by sewer cleaning.

All options that meet the minimum performance requirements and that are technically feasible to implement should be taken forward to the next stage.

6.5.5 Select optimum solution

The selection of the most appropriate option shall then take account of a wide range of costs and benefits of each of the options. These should take account of the extent (if any) to which any option would result in the system achieving more than the minimum performance requirements or providing additional capacity beyond that currently anticipated.

Criteria for assessing the costs and benefits of different options in order to select the optimum solution are given in EN 752:2008, 6.4.3.

6.5.6 Producing the programme

The programme should specify:

a) the cleaning objectives (see 6.5.2);

b) the approach to be adopted (see 6.5.3);

c) location and length of the sewers to be cleaned or inspected;

d) nature of the deposits anticipated to be removed (for example intruding roots, sediments, obstacles).

7 Preparation of the project specification

7.1 Introduction

The project specification shall contain all the information, including any drawings, necessary to carry out the project.

The starting point for the preparation of the project specification is the project description and project objectives in the sewer cleaning programme produced in accordance with Clause 6 and the performance requirements produced in accordance with the EN 752:2008, Clause 5.

Further information is still likely to be required to carry out the detailed design and produce the specification.

The preparation of the project specification involves:

— review of the project description and project objectives;

— further investigation;

— further assessment (if necessary);

— producing the project specification.

All stages of the preparation of the project specification shall take account of the health and safety principles set out in EN 752:2008, Clause 7.

7.2 Review of the project description and project objectives

The project description and objectives as set out in the sewer cleaning programme should be reviewed to ensure it is still current. Any related new developments or other utility works should be reviewed. Where there have been any changes in the nature or the timing of other works which might impact on the project or its phasing the programme should be revised.

The information available should be reviewed to determine what further investigations are necessary in order to produce the project specification.

7.3 Investigation

An investigation should be carried out to determine the following:

— the extent of the deposits or obstructions including deposits in lateral connections to the sewer;

— the nature of the deposits expected (e.g. grease, sand);

— whether the deposits are the cause (wholly or partially) of any reported performance problems;

— the amount of deposits which need to be removed to restore acceptable performance having regard to the likely rate of re-deposition following cleaning;

— the structural condition of the drain or sewer and the type of material;

— other information that could affect the feasibility of sewer cleaning work.

The investigation should be carried out using the existing data available. Further investigation can be necessary.

7.4 Assessment

EN 13508-1 gives guidance on the assessment of existing drain and sewer systems. The assessment should be sufficiently detailed to allow decisions to be taken on the solutions for the project.

Following the completion of the assessment, the project objectives should be reviewed to ensure that they are still valid.

7.5 Drafting the project specification

7.5.1 Prepare detailed options

Options should be developed for the pipeline lengths to be cleaned and the amount of deposit that need to be removed. The feasibility of these options should be evaluated taking into account:

a) the nature of the deposits or obstacles to be removed;

b) the size of the drain or sewer;

c) the range of water depths and the flow regimes within the drain or sewer;

d) restrictions on the access, including

   1) traffic restrictions,

   2) the availability of suitable manholes or inspection chambers,

   3) the need for off-road vehicles and their suitability to the site conditions,

   4) the weight of the vehicle and the risk of the damage to the drain or sewer,

   5) land ownership;

e) the structural condition and the type of material of the drain or sewer and its susceptibility to deterioration due to damage through cleaning;

f) the extent to which they meet the cleaning aims;

g) the risk the sewer cleaning method will contribute to early CSO operation or flooding.

7.5.2 Select optimal solution

The options found to be technically feasible should be compared to identify the optimal solution in accordance with the procedure described in EN 752:2008, 6.4.3.

7.5.3 Prepare project specification

For the selected option, a description of the works shall be produced to provide all the information necessary for the cleaning activities.

The information provided in the project specification can include:

a) the objective of the cleaning;

b) the location and extent of the section to be cleaned (e.g. drawing);

c) the location of the access points (e.g. manholes or inspection chambers) and the distance between them;

d) restrictions on access to the site of the manhole or inspection chamber (e.g. traffic restrictions, the need for off road vehicles, land ownership etc.);

e) restriction on access into or within the manhole or inspection chamber (e.g. the need for special lifting equipment or diameter of the manhole or inspection chamber);

f) the depth of the manhole or inspection chamber;

g) the type of deposits expected;

h) the size of the drain or sewer;

i) any known hazards (including hazards from trade effluents, drop pipes, automatic flushing devices etc.);

j) the water depth and flows in the drain or sewer in various conditions;

k) environmental restrictions such as noise, odours, etc.;

l) whether there is danger of a direct spill from the sewer into a receiving water body;

m) traffic management requirements;

n) restrictions on working methods;

o) restrictions on temporary stopping where this could cause flooding or pollution;

p) the locations of pumping installations or other structures which could be adversely affected by cleaning operations;

q) whether and where deposits are to be removed from the drain or sewer;

r) restrictions on the disposal of deposits and supernatant liquor (see 8.7);

s) water supply points (location, the nature of that supply and number);

t) welfare facilities required on site for the use of operatives engaged on the cleaning works;

u) information available in relation to the waste material to be removed by the cleaning work;

v) the anticipated volumes of material, if known, to be removed as part of the cleaning operation;

w) public safety issues that could arise from the works.

7.6 Performance indicators

7.6.1 Introduction

Performance indicators should be selected to determine whether the project has

a) been carried out in accordance with the project specification, and

b) achieved the objectives set out in the sewer cleaning programme or project.

For each site, it is advisable to adapt the indicator to show without ambiguity whether the required performance has been achieved. A performance indicator should be clearly defined, simple and easy to use. It should be based on measurable parameters such as the depth of deposits (where the location can be visually inspected), the mass or volume of the material removed. Performance indicators should be used to measure conformity of the completed project (see Clause 9).

In certain cases, statistical indicators of the amount of material removed can be used. It could therefore be possible to allow, for example, a predetermined number of obstructions per unit length, as a satisfactory degree of cleaning.

7.6.2 Indicators for the assessment of the work quality

The results required either immediately after cleaning has taken place, or on a continuing basis, shall be clearly described in the specification, to ensure that the cleaning objectives are achieved.

Performance indicators should be selected in relation to each of the cleaning objectives.

Examples of indicators can include:

— re-establishing free flow following reactive cleaning;

— number of complaints concerning odours, blockages, flooding or pollution from a sewer length after pro-active cleaning;

— measurement of sediment depths at a sample of sections which were cleaned;

— percentage of sediment depth compared to the diameter of the drain.

7.6.3 Indicators for the assessment of the effectiveness of the project or programme

Examples of indicators can include:

— percentage of the total length of drain or sewer cleaned pro-actively per year;

— percentage of the total length of drain or sewer cleaned reactively per year;

— number of emergency cleaning operations carried out per kilometre of sewer each year;

— number of complaints concerning odours, blockages, flooding or pollution from a sewer length after pro-active cleaning;

— volume or weight of sediments removed per kilometre of sewer cleaned.

8 Implementation of projects

8.1 Introduction

The implementation of the project shall be carried out in accordance with the principles set out in EN 752:2008, Clause 11. Personnel carrying out the work shall have appropriate training in accordance with EN 752:2008, Clause 13.

The cleaning work should generally be carried out in such a manner that coarse material and debris is not allowed to discharge into the downstream sewer system. In some cases, it is possible to remove deposits at the wastewater treatment plant or other appropriate location. Deposits shall be removed from the drain or sewer system.

Where all the drains or sewers in an area are being cleaned, work should generally start with those sewers near the head of the system and continue downstream.

Where a supply of water is required, measures shall be taken to avoid contamination of any drinking water supply and to avoid unacceptable impact of the pressure supplied to other users. Where high pressure water jetting cleaning methods are to be employed the use of equipment capable of recycling the supernatant liquor decanted from the deposits removed should be considered. In addition, the use of non-potable water sources should also be considered.

Where unexpected pollutants are found, the cleaning work should be stopped, and arrangements made to avoid dispersing the pollution. The employer will be informed to agree what to do next.

Information on cleaning methods is given in Annex B.

8.2 Select cleaning technique

When selecting the cleaning method and equipment the following considerations should be taken into account:

a) the nature of the deposits or obstacles to be removed;

b) the shape, size and depth of the drain or sewer;

c) the range water depths and the flow regimes within the drain and sewer;

d) the distance from the manhole or inspection chamber to the furthest point to be cleaned;

e) restrictions on the access to the manhole or inspection chamber, including traffic restrictions, the need for off-road vehicles, land ownership;

f) whether access is available from the downstream manhole or inspection chamber;

g) whether the access from the manhole or inspection chamber to the furthest point to be cleaned is only through plain (straight) pipe or whether it is through bends or an interceptor trap;

h) the type of material used in the construction of the drain or sewer and its susceptibility to damage through cleaning;

i) the structural condition of the drain or sewer and its susceptibility to deterioration due to damage through cleaning;

j) environmental criteria such as noise, odours, the risk of discharge to the environment, etc.

Further information on the different cleaning methods available is given in Annex B.

8.3 Selection of contractor

The work can be carried out directly by the employing authority (e.g. the owner or operator of the system) or by a contractor.

The Public Procurement Directive (Directive 2004/18/EC [2]) can apply to the selection of contractors.

The selection of a contractor should take into account a number of factors including:

a) the qualifications of the contractor, including:

   1) technical competence and experience;

   2) availability of adequate equipment and personnel;

   3) health and safety procedures;

   4) quality management systems in place;

   5) environmental management systems;

   6) financial stability;

   7) licence to work in the country.

b) price.

c) waste management capabilities.

d) The impact of the proposed method of working including:

   1) the proposed resources, including:

      i) personnel (including management);

      ii) equipment;

      iii) materials.

   2) the management of risks including minimizing:

      i) risks to the health and safety of operatives on site and of the public;

      ii) environmental risks.

   3) contract strategy – e.g. a single management contractor with subcontractors, or division of the work between different contracts.

   4) social disruption – the disruption to local residents and other members of the public.

8.4 Supervision of the works

Supervision of the contractor by the employing authority or their representative should include the following:

a) ensuring that the contracting company has adequate internal management procedures;

b) competency of the contractor's supervisors and license (if required);

c) compliance of the works with the specification;

d) checking the adequacy of resources and methods of working;

e) the verification of health and safety compliance;

f) progress of the works in accordance with the project specification;

g) reporting, auditing and documentation of test procedures, test results and performance indicators;

h) valuation of works and approval of payments;

i) certification of the satisfactory completion of the works;

j) ensuring that records of the works are produced;

k) monitoring the volumes and type of material removed from the sewer or drain including checking that soil from around the pipe is not entering the system.

In addition the contractor shall supervise the works themselves, including:

l) checking the adequacy of resources and methods of working;

m) progress of the works in accordance with the project specification;

n) reporting the volumes and type of material removed from the sewer or drain;

o) dealing with unforeseen incidents;

p) cost control;

q) health and safety coordination (the Temporary and Mobile Sites Directive (Directive 92/57/EEC [1]) can apply).

8.5 Flow control

Where work is being carried out in existing drain and sewer systems, consideration should be given to measures to control the flow where necessary. The need for such measures will depend on the method used and can include:

a) use of temporary stoppers to control the flow for short periods;

b) use of temporary pumps in association with temporary stoppers to pump the flow past the works;

c) temporary diversion of the flow.

The selection of the appropriate approach will depend on the frequency and magnitude of expected flows, having regard to the expected weather and other factors.

8.6 Traffic management

Where works are carried out in roads, the effect of the works on the traffic should be considered and measures taken to limit the impact; for example by local traffic control measures such as temporary traffic signals, or installation of traffic diversions via alternative routes. Consideration should be given to providing road users, local residents and businesses etc. advance notification of the cleaning works.

8.7 Waste management

Measures should be taken to minimize the impact of wastes from the cleaning works. The waste management approach should be in accordance with the following hierarchy:

a) measures should be taken to minimize the amount of waste produced for example by dewatering;

b) where waste is produced measures should be taken to recycle as much of the waste as practicable;

c) where it is not possible to recycle the waste, consideration should be given to the use of the waste for energy recovery;

d) where none of the options is possible, the disposal of the waste should take account of the environmental impact.

Where possible, deposits should be recycled in accordance with the principles of sustainability.

Any of these disposal methods can include treatment of the waste.

Inappropriate disposal of deposits can cause environmental damage and endanger public health, and the disposal of deposits can be subject to national legislation. Any restrictions on the disposal of the deposits shall be defined in the contract.

8.8 Training

Training requirements for work in drain and sewer systems are described in EN 752:2008, Clause 13.

Training requirements essentially depend on chosen techniques and materials.

The contractor shall ensure that personnel working on the site are adequately trained in respect of the particular cleaning method used.

Personnel at all levels taking part in sewer cleaning activities shall be made aware of all specific risks of such activity (see also 8.1).

8.9 Health and safety

The works shall be carried out in accordance with the health and safety principles described in EN 752:2008, Clause 7. Further guidance on health and safety is given in EN 752:2008, Annex D. In addition to the hazards generally associated with work in drains and sewers there are some special hazards associated with some of the equipment used for sewer cleaning. High-pressure water jetting machines shall comply with the requirements of EN 1829-1 and EN 1829-2.

The main part of the sewer cleaning operations comprises work on drains and sewers and in confined spaces. In addition, there can be hazards related to the specific cleaning method.

The contractor shall identify the health and safety risks associated with the proposed cleaning works and provide the necessary mitigation of those risks.

Drain and sewer cleaning sites are frequently close to traffic.

8.10 Environmental impact

The environmental impact shall be taken into account. Environmental management procedures are described in EN ISO 14001.

It is the contractor's responsibility to ensure on the site the control of the risks of environment pollution or disturbance it may generate during its activity.

As far as cleaning is concerned, the following types of impact shall be taken into consideration:

a) impact on surface receiving water bodies or groundwater:

   1) pollution of groundwater by accidental discharge of polluting agents;

   2) discharge of wastewater from the site;

   3) discharge of polluted or sediment laden surface water from the site.

b) impact on site:

   1) contamination by spray or spillage;

   2) impact of vehicles used for cleaning.

c) impact on air:

   1) emission of gas and polluting particles by site equipment;

   2) dust generated by the work;

   3) toxic emissions (e.g. Volatile Organic Carbons);

   4) odour and aerosols.

d) impact of noise:

   1) noise emissions from site equipment.

e) impact of site waste:

   1) sorting of site waste;

   2) handling of deposits removed;

   3) procedure for handling and disposal of contaminated soil and waste materials.

f) social impact:

   1) tidiness and cleanliness on public or private property;

   2) restrictions on access to property;

   3) ecological damage.

8.11 Cleaning report

A report shall be submitted by the contractor to the client on completion of the cleaning work. This is the first control of sewer cleaning work and it should contain details of the work carried out including:

— the location, date and time of the work;

— the name of the contractor and the operative;

— an estimate of the state of the sewer before the work commenced;

— the cleaning techniques used;

— the type and amount of deposits removed;

— documentation of the waste management arrangements for the deposits removed (the Waste Framework Directive (Directive 2008/98/EC [3]) can apply); and

— any information concerning the state of the sewer after cleaning.

An example of a cleaning report form is included in Annex A.

9 Measurement of conformity

9.1 Measuring conformity with the project specification

9.1.1 Measuring conformity

The methods to be used to measure the conformity shall be stated in the contract. Examples include the following:

— visual inspection of sediment depths at manholes or inspection chambers;

— visual inspection of the sediment in the drains or sewers, directly or by CCTV see EN 13508-1:2012, 5.8.3;

— sonar inspection of the drain or sewer.

The specification shall also state whether these are to be applied on all locations or to a sample. Where sampling is to be used the sampling method and the method of statistical analysis shall be described.

Visual inspection of the sewer is particularly important where tree roots or other obstacles are being removed.

9.1.2 Non-conformities

When non-conformities are found, these shall be rectified as required in the contract.

After a cleaning operation has been completed and the non-conformities have been rectified the completion of the cleaning work can be agreed by the employing authority or its representative.

9.2 Post project appraisal

Following the completion of each project, the upgraded system should be assessed using performance indicators (see 7.6) and other measurements to establish whether the objectives of the project, as set out in the cleaning programme, have been achieved. Any lessons learned from the project should be considered in relation to future cleaning works.

A review of the cleaning plan shall be carried out by following the evolution of general quality indicators and efficiency indicators for the applied strategy, using for example the reporting data from reactive or pro-active cleaning operations as statistical parameters.

Examples of general and efficiency indicators are given in 7.6.3.

The review of the cleaning plan can lead to the improvement of the former strategy or the determining of a new strategy, and, thus, provides feedback for continuous improvement.

The cleaning strategy should be specified with consideration of operational experience and should be continuously reviewed and updated with information from earlier cleaning.

10 Review of programme and plan

A review of the cleaning plan shall be carried out by following the evolution of general quality indicators and efficiency indicators for the applied strategy, using for example the reporting data from reactive or pro-active cleaning operations as statistical parameters.

Examples of general and efficiency indicators are given in 7.6.3.

The review of the cleaning plan can lead to the improvement of the former strategy or the determining of a new strategy, and, thus, provides feedback for continuous improvement.

The cleaning strategy should be specified with consideration of operational experience and should be continuously reviewed and updated with information from earlier cleaning.

Annex A
(informative)

Example of cleaning report form

SEWER CLEANING DAILY REPORT FORM

Sheet .. of ..

Contractor:

Date:

Operative:

Time of arrival

Site:

Time of departure

Location	Start manhole Ref	Finish manhole Ref	Sewer length [m]	Sewer size [mm]	Sewer type	Technique used	Depth of deposits before [mm]	Type of deposits	Depth of deposits after [mm]	Length cleaned [m]	Direction of cleaning [Upstream or Downstream]	Waste management Reference	Comments

Annex B
(informative)

Cleaning methods

B.1 General

Techniques for cleaning drains and sewers include the following. This list is not exhaustive. Work on sewers is potentially hazardous, and health and safety should also be considered (see 6.3).

B.2 Jetting

This technique can be used for removal of obstacles, and settled and attached deposits. Work should be carried out wherever possible from a downstream manhole or inspection chamber. Pressures should be limited to avoid damage to the fabric of the pipe. Maximum safe working pressures to avoid damage will vary according to the material of the pipe, the condition of the pipe and the type of nozzle.

Water jetting units can be broadly classified on the basis of the pressure used and the rate of water delivered. Typically, there are two families of jetting units; the first using lower pressures and delivering higher flow rates of water, the second using higher pressures delivering lower flow rates of water. Experience is needed to select the most appropriate unit.

Care should be taken when introducing the nozzle into the pipe as the nozzle can cause impact damage to the pipe when the pressure is started. The nozzle should be kept moving at all times in order to limit the potential for damage to the fabric of the drain or sewer. The rewind rate of the jetting hose for sediment removal should be typically 100 mm to 200 mm per second.

The nozzle should be selected which:

— is appropriate for the nature of the deposits being removed;

— minimizes the risk of damage to the fabric of the drain or sewer;

— maximizes the effectiveness of removal of the deposits.

Where water for cleaning is taken from the public supply, national or local regulations can apply.

B.3 Jetting with suction

Combined water jetting delivering higher flow rates of water with suction to remove deposits from the sewer.

Where this equipment is incorporated in a single vehicle this is termed combined jetting. This combination sometimes includes re-circulation of water allowing higher flow rates of water to be used.

This technique can be used for removal of settled or attached deposits.

B.4 Winching

This involves pulling a tool by means of a cable between two adjacent manholes. Measures should also be taken to minimize the risk of damage to the drain or sewer system. The type of the tool selected should relate to the nature of the deposits. The size of the initial tool selected should generally be small. The size of tool should then be increased successively to the maximum for the size of pipe. The tension on the cable should be monitored for any undue force. The direction of working is generally two-way.

B.5 Rodding

This involves pushing a tool through a drain or sewer on the end of a flexible rod. It is generally only suitable for pipes less than DN 250 and less than 2 m deep and for removal of blockages. The type of tool selected should relate to the nature of the deposits. Total removal of debris from the drain or sewer line is not generally possible and some material is likely to remain in the line. In addition, some debris may also pass into the downstream system.

B.6 Remote controlled equipment

A variety of remotely controlled equipment is available including:

— chain flails;

— mechanical root cutters;

— robotic controlled high-pressure water cutters.

The equipment chosen should be appropriate for the type of deposits being removed and the pipe material.

B.7 Flushing

Flushing involves temporarily placing a gate dam, or flushing valve across the flow upstream of the length to be cleaned in order to retain a significant volume of flow which is then released to create a large wave. Care should be taken to ensure that there are no personnel in the sewers downstream. This is suitable for cleaning loose deposits in sewers. The loosened deposits are generally retained in the drain or sewer system.

B.8 Cleaning balls/scouring plates

In this method, a gate or ball slightly smaller than the size of the drain or sewer is allowed to move down the drain or sewer. The increased flow velocity as the flow passes the moving obstruction loosens the sediments and moves them downstream. Cleaning balls are generally fluted to maximize the localized turbulence to release the deposits. It is not generally possible to remove the loosened deposits from the sewer.

B.9 Manual or mechanical excavation

Manual or mechanical excavation is also possible in larger drains or sewers, and is generally used where other methods of cleaning are not practicable. Due to the potential health and safety risks, the use of methods involving operations personnel entering the sewer should be minimized.

Mechanical excavation can be using small excavators or purpose made vehicles that push or sweep the sediments forward to a collection point. Where mechanical excavation is used, the equipment should be protected to minimize the risk of explosions.

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