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Criteria for design, management and control of maintenance services for buildings

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National foreword

This British Standard is the UK implementation of EN 15331:2011.

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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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Criteria for design, management and control of maintenance services for buildings

Critères pour la conception, la gestion et le contrôle des services de maintenance dans les constructions

Kriterien für Entwicklung, Leitung und Überwachung von Instandhaltungsdienstleistungen von Gebäuden

This European Standard was approved by CEN on 8 July 2011.

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Foreword

This document (EN 15331:2011) has been prepared by Technical Committee CEN/TC 319 “Maintenance”, the secretariat of which is held by UNI.

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of an identical text or by endorsement, at the latest by February 2012, and conflicting national standards shall be withdrawn at the latest by February 2012.

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 CEN/TS 15331:2005.

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

A building presents a challenging set of maintenance related requirements which, although not unique, are not often found together:

— the need to maintain property value of the building over time;

— the possibility that the property may undergo a significant change in its intended use during its service life;

— the number of persons responsible for maintenance and the different type of responsibility (owner, administrator, tenant, users,...);

— its long service life (decades).

Under these conditions, it is difficult to predict with any degree of precision the service life of each component. Budgeting for maintenance, and specifically the scheduling of maintenance interventions, requires the availability and the analysis of feedback data obtained from maintenance activities.

The purpose of building maintenance is to ensure utilisation of the asset by maintaining its value (see 3.3) and initial performance within acceptable limits for its whole service life, as well as promoting technical and regulatory modifications to initial or new technical requirements as selected by the operator or demanded by law.

To achieve this goal, the definition of general criteria to collect data that is essential for maintenance activities and the use of suitable information systems may be used to develop database and management tools to improve the profitability of buildings.

1 Scope

This European Standard specifies the criteria and the general methods that can be used in the planning, management and control of maintenance in buildings and their surrounding area according to the applicable legal requirements, objectives of the owners and users and the required quality of maintenance.

This European Standard applies to the maintenance management of buildings.

For informative purposes, a possible classification of buildings is given in Annex A.

2 Normative references

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

EN 13306:2010, *Maintenance — Maintenance terminology*

EN 13460:2009, *Maintenance — Documents for maintenance*

ISO 6707-1:2004, *Building and civil engineering — Vocabulary — Part 1: General terms*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13306:2010, EN 13460:2009, ISO 6707-1:2004 and the following apply.

3.1
building
construction works that have the provision of shelter for its occupants or contents as one of its main purposes; usually partially or totally enclosed and designed to stand permanently in one place

[ISO 6707-1:2004]

NOTE Including envelope, structural and non structural elements, finishing, fitments, equipment and installations and external works.

3.1.1
maintenance of buildings
combination of all technical, administrative and managerial actions during the lifecycle of a building (or a part of it), intended to retain it, or restore it to, a state in which it can perform the required function

3.2
item
part, component, device, subsystem, functional unit, equipment or system that can be individually described and considered

NOTE A number of items e.g. a population of items or a sample, may itself be considered as an item.

[EN 13306:2010, see 3.1]

3.2.1
system
set of interrelated items considered as a whole for a defined purpose, separated from other items

3.2.2
subsystem
system that is part of a more complex system being considered

3.2.3
component
construction element or functional grouping of several elements considered as part of a single system

3.3
property value
minimum production cost for a building, inclusive of business profit, that assures the compliance with predetermined requirements

3.4
diagnostic
assessment activities aimed at acquiring knowledge of the status and operating conditions of the building and its component parts

3.5
mid and long term budgeting
determination of the general extent of expenses in respect of pre-established objectives; also intended to schedule interventions, and therefore costs and resources, evenly over time if possible

3.6
short term cost budgeting
more specific quantification of expenses compared to the mid and long term budgeting of interventions for a given year, for the purpose of optimising the workload

3.7
corrective maintenance
maintenance carried out after fault recognition and intended to put an item into a state in which it can perform a required function

[EN 13306:2010, see 7.6]

3.8
preventive maintenance
maintenance carried out at predetermined intervals or according to prescribed criteria and intended to reduce the probability of failure or the degradation of the functioning of an item

[EN 13306:2010, see 7.1]

3.9
condition based maintenance
preventive maintenance which includes a combination of condition monitoring and/or inspection and/or testing analysis and ensuring maintenance actions

NOTE The condition monitoring and/or inspection and/or testing may be scheduled, on request or continuous.

[EN 13306:2010, see 7.3]

3.10
opportunity maintenance
preventive maintenance performed in advance of the planned occurrence as a consequence of an unplanned activity which enables it to be performed at reduced cost or with fewer resources

3.11
obsolescence factors
external factors which lead to permanent transition from operability to non-functionality of the building

3.12
instructions for inspection
technical instructions to perform inspection activities on building in order to assess the compliance with specified requirement concerning the function performances of the building or of some selected sub-systems or components

3.13
inspection logbook
collection of inspection records produced during inspection activities

3.14
operation manual
technical instructions to reach a proper item function performance according to its technical specifications and safety conditions

[EN 13460:2009, see 5.2]

3.15
maintenance manual
technical instructions intended to preserve an item in, or restore it to, a state in which it can perform a required function

[EN 13460:2009, see 5.3]

3.16
maintenance plan
structured and documented set of tasks that include the activities, procedures, resources and the time scale required to carry out maintenance

[EN 13306:2010, see 2.5]

3.17
asset register
item basic information, related to technical, contractual, economic, administrative, location and operational aspects, necessary to define it within the company

3.18
down state
state of an item characterized either by a fault, or by a possible inability to perform a required function during preventive maintenance

NOTE 1 This state is related to availability performance.

NOTE 2 A down state is sometimes referred to as an internal disabled state.

[EN 13306:2010, see 6.7]

NOTE 3 For buildings the down state, intended as inability to perform the required function, can be seen as a whole down state (complete impossibility to use the building) or a partial down state (the impossibility to use the building is limited to a part of it).

3.19
maintenance concept
interrelationship between the maintenance organization, the splitting of the building into sub-systems and components and the maintenance tasks to be applied for the maintenance of an item

3.20
reliability centred maintenance
method for establishing a scheduled preventive maintenance programme which will efficiently and effectively achieve the inherent reliability and safety levels of equipment and structure

NOTE This definition is different from the definition given in EN 60300-3-11.

4 Basic data and requirements

4.1 General

4.1.1 Introduction

The information required to carry out maintenance should be available either for new constructions and restoration of buildings (maintenance plans issued for construction and updated with “as built documentation”); for existing buildings, if not available, this information should be progressively acquired in a systematic manner and controlled and filed appropriately, to be used for subsequent controls.

Since the complete collection of information requires significant time and costs, the procedure shall be planned in advance and the extent of the collection evaluated on a case-by-case basis.

NOTE The information required should describe the assets as a whole and its adequacy with respect to usability and value. The Asset Register (see 3.17) could also be used to collect the required information.

4.1.2 Preliminary data collection

During preliminary data collection the property to be maintained is to be identified and quantified; the data shall include all documents available and the following information, as a minimum:

— location;

— gross volume and surface area, divided according to intended use (refer to standards if applicable);

— general characteristics of component parts (e.g. position inside the building, drawings, technical data sheet, instructions for maintenance issued by manufacturer,...);

— level of compliance with legal and regulatory requirements (objectives to be attained);

— status of maintenance upgrading in accordance with pre-determined operational specifications;

— external constraints (monumental and environmental, servitudes (e.g. right of way), agreements with public bodies and bordering landowners etc.);

— legal and/or technical documents relating to the installation, operation and maintenance of systems and equipment;

— status of distribution systems and data concerning consumption (energy, water, etc.);

— type and characteristics of services required to ensure operation of the building (premises for doorkeeper and cleaners, heating, etc.).

NOTE The construction company should normally provide this information at the time of delivering the building to the owner (handover). In this case, only the update of this information should be performed by the owner or by organization managing the maintenance services.

4.1.3 Specific collection of information

Detailed information shall be collected, after the preliminary data collection; the collected data shall be accurately identified and its presentation format codified (see Clause 7).

The information categories required may include the following (example list):

a) inventory of buildings and equipment: identification, location and description supported by:

   1) an appropriate coding system for the building complex, individual buildings, technological systems for each building subdivided into technological units, technical elements, component parts and the material of which they are made;

   2) a coding system according to its functional dependences;

b) drawings: sizes, position and layout of the various components;

   NOTE 1 To be reliable, the above information shall refer to the 'as built' status of the building and shall be kept updated during maintenance.

   NOTE 2 For example, these may consist of plans and cross-sections, structural drawings and systems layouts. This process is facilitated if the drawings are computerised.

c) data about maintenance activities already performed (history of the components);

d) assessment of efficiency, functionality and compliance with applicable rules and standards (see 4.2);

e) residual service life, for each component, predicted in accordance with age, quality and conditions of use, and in relation with the service life initially foreseen;

f) technical specifications: especially concerning equipment and building services in order to identify characteristics and 'established operating conditions';

g) repair or replacement costs: for each component, as a basis for a financial assessment of the maintenance plan;

   NOTE 3 The repair cost (i.e. the cost to restore the functionality of a building component) can be estimated with reference to official or regional price list.

h) cost for unavailability and/or down-state: estimate, at least for critical components, costs arising from the down-state of the components or from their inability to provide the services for which they are intended (e.g. costs for liabilities, damages, damage to the corporate image,...);

i) information about critical construction solutions (for example arch vaulting);

j) instruction for inspections, operation manuals and maintenance manuals: experience and recommendations of the builder/manufacturer to be used to develop an appropriate maintenance plan.

4.2 Diagnostic methods and instruments for maintenance

Whenever is possible, maintenance operators should make an appropriate use of diagnostics in managing the buildings subject to the maintenance establishing which type of diagnostic to be used and its physical coverage and duration.

The decisions concerning any maintenance intervention should be based on the results and the information coming from the diagnosis activities.

The effectiveness of the tests and the interpretation of the diagnostic results should be associated with the use of standard methods and instruments to obtain reliable, comparable and traceable results (see Table 1).

Table 1 — Types, objectives and methods of building assessment (example of levels that could be used during the data collection process)

Type of assessment	Objectives	Methods and procedures for examination	Types of evaluation
General diagnostic or pre-diagnostic	Objective description of any abnormality, malfunctions or degradation General information on condition of building	Inspection (e.g. visual inspection) Check lists Information from previous inspections Simple portable instruments	Qualitative
In-depth diagnostic	Thorough examination of the actual status and its interpretation Collection of sufficient information for detailed design of work to be undertaken	Non destructive tests Destructive instrumental tests (sampling from building and laboratory tests) Analytical methods (diagnostic documents, malfunction chart, fault trees, etc.) Expert systems	Qualitative and quantitative

The data collected and analysed shall be included in the documents (or in an equivalent electronic system) accompanying the inspection documentation (either instructions and logbook); these should provide for the following data:

a) technical or identification data: this section contains information on: the position within the building, the functions required, the types of service provided, the performance specifications, the physical and functional relationship with other components, the installation and operation characteristics;

b) diagnostic data: this section contains information on the methods and instruments to be used to analyse the malfunctioning or unexpected deterioration as well as their evaluation criteria;

c) actual state data: this section contains the interpretation of the actual state of the building or of its parts (sub-systems, components,....), all technical and financial information on the interventions carried out and indications of remedies or corrective action to be adopted.

There shall be one of these data record for each technical element or component, in accordance with the appropriate breakdown structure, accompanied by drawings and information to ensure prompt identification.

NOTE The information contained in the diagnostic and measurement data are an integral part of the feedback (see Clause 10).

A specific plan for the assessment is to be prepared. This plan shall consider the objectives to be attained, operating conditions, times for implementation and cost of the intervention.

For large real estate, sampling techniques shall be used for the general assessment. Buildings are then to be grouped by homogeneous classes, according to age, intended use, location, main characteristics and type of construction. However, care must be taken to ensure that the sample selected is truly representative of the whole real estate.

With respect to the results of the general assessment and the effects of possible hazardous situations or down states, the critical components shall be identified and submitted to an in-depth analysis using structured methods such as Reliability Centred Maintenance.

Assessment planning shall be periodically reviewed according to needs.

5 Building and maintenance strategy

5.1 General

Building management should be conceived and developed according to EN ISO 9001 with due consideration to the objectives in terms of user's requirements and their achievement through the building operations. Maintenance services provided by third parties should be supplied within the framework of a quality management system.

See Figure 1 for the relationship between building strategies and maintenance.

NOTE Analytical techniques (for example, Reliability Centred Maintenance) could be used to support the definition of maintenance strategies.

5.2 Building strategy

A building strategy shall determine the applicable required service and performance specifications for each building (see 5.3). This will also include a strategy to ensure protection of the property value of the building, whenever applicable.

The building strategy should be reviewed at specified regular intervals and whenever there is a significant change in the service or performance requirements; this will ensure that the strategy remains current and meaningful.

5.3 Maintenance policy

In accordance with the objectives of the building strategy and with the applicable legal requirements, the maintenance policy shall establish the service level to be provided by the inspection and maintenance services.

It shall also define – if possible with the support of diagnostic tools – the objectives, the maintenance strategies and the intervention priorities to be considered when establishing the maintenance plan (see Clause 6).

An effective maintenance policy shall optimise cost, according to actual financial resources; the policy shall identify maintenance costs and verify their compatibility with expected results and established priorities, in accordance with the building strategy and within the limits of the financial plan.

The policy shall consider, whenever possible, obsolescence factors that may influence the services and performance that have to be provided by the building to its users or to other interested parties.

The objective and targets shall be presented qualitatively and – as far as possible – quantitatively, defining quality standards (i.e. the "building quality" to be assured by means of maintenance) and service levels (characteristics and frequency of interventions and methods of providing/executing maintenance).

5.4 Maintenance strategies/maintenance types

5.4.1 Corrective maintenance

A corrective maintenance strategy shall only be adopted when it is not feasible - for economical or technical reasons - to adopt preventive measures and when the degraded state (i.e. the state in which the ability to provide the required function is reduced, but within defined limits of acceptability; see EN 13306) is acceptable, involving components that are not part of critical or safety systems. Corrective maintenance normally refers to unexpected malfunctions.

The general maintenance strategy of a building is composed of the different sub-strategies for the components of the building. Preventive maintenance may be necessary for critical sub-system (e.g. elevators, fire fighting systems, structures...) and corrective maintenance may be sufficient for less-critical sub-systems (e.g., depending on specific building requirements, windows, plaster, painting...).

NOTE Emergency interventions and those related to malfunctions cannot be scheduled. However, based on feedback information, this strategy can provide data for service logistics (signal and alarm systems, warehouse, technical resource management).

5.4.2 Preventive maintenance

5.4.2.1 Predetermined maintenance

A preventive maintenance plan shall be developed for sub-systems and components of the building. This shall take account of all the collected data (see Clause 10) and manufacturers' instructions. The plan shall allow – by means of a detailed definition of tasks and resources (manpower, materials, machines,...) – for budget definition and for the identification of the periods of down state (time during which the service will be unavailable to the user or system).

NOTE With respect to civil components, preventive maintenance is applicable mainly to finishing work (painting, varnishing, covering, etc.). Long life components require estimates only for mid and long-term planning or scheduling. Preventive maintenance also includes some cleaning operations (such as façades, roofs, terraces, outlets, drainpipes, grids, sewers, etc.).

5.4.2.2 Condition based maintenance

Long life components or other components that have been identified as critical (e.g. for their functions or their technology) are to be checked periodically in accordance with a pre-established inspection plan; subsequent interventions will be determined by the condition of the item revealed by the inspection activity.

5.4.2.3 Opportunity maintenance

Maintenance plans (see Clause 6) shall identify maintenance activities that may be performed – by means of the definition of an adequate tolerance on maintenance intervals – concurrently with other activities, leading to: financial savings, decreased maintenance time, reduced down-state time, less problems for the users.

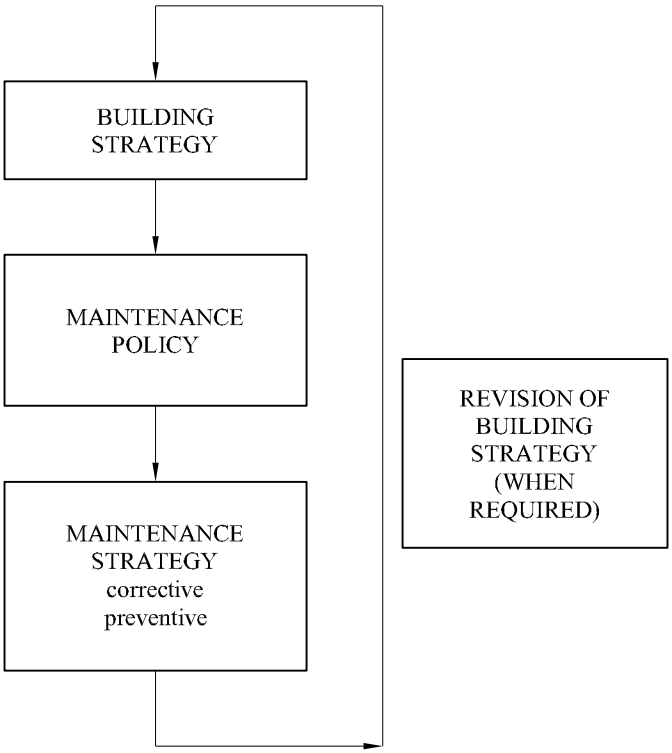

Figure 1 — Relationship between Building strategies and Maintenance

6 Maintenance plan

6.1 General

The maintenance plan is the main management tool for maintenance activities; it schedules interventions over time, identifying and allocating necessary resources for implementation of strategies predetermined by the owner of the property taking into account also the user's needs.

The aim is to optimise the overall availability of the building and its individual component parts by determining the type of maintenance to be undertaken and the frequency of interventions. To this aim, the maintenance concept should be defined considering:

— the decomposition of the building into sub-system, components and items with the definition of a technical hierarchy (building breakdown structure);

— the criticality analysis of the building and of its sub-system and component within the building breakdown structure;

— the comparison of the criticality analysis with the building strategy previously defined;

— the definition of the maintenance tasks to be performed for each sub-system or component;

— the available resources for maintenance (maintenance organization and maintenance support).

A commonly used approach for optimising maintenance is the Reliability Centred Maintenance method, which can be used to identify, in a structured manner, tasks that achieve the overall building objectives (see Annex C).

The maintenance plan shall be updated based on the feedback data received or according to need.

NOTE Considering the importance of preventing hazards, loss or damage, the fact that the information on the maintenance status is often insufficient and that it is difficult to predict the service life of a component with sufficient accuracy, inspection of the assets and management of feedback information are particularly important for quality management.

6.2 Preparation of the plan

The maintenance plan is structured according to the breakdown of the building assumed during the collection of information. The plan shall define:

— the combination of the best strategies to be applied according to the analysis described in 6.1;

— methods of periodic inspections, with frequency established according to the importance of the operation and the consequences (risks, problems) resulting from malfunctioning;

— schedule of interventions and inspections;

— methods for the execution of interventions with the associated safety plan (selection of material, work equipment, etc.);

— operators assigned to maintenance activities;

— criteria for measuring and monitoring activities;

— maintenance budget (see 6.3) compared to general budget.

6.3 Budgeting

Maintenance budget shall be developed as follows (see Annex B for information purpose only):

— short term budget, to determine the costs for the interventions required within the year;

— mid and long term budget, to verify the economic effectiveness of the maintenance policy adopted.

Costs shall consider all the required resources (professional and consulting fees, labour, material, equipment, etc.).

NOTE Short-term budget should determine the costs on the base of agreed price lists, on an historical basis or on an analysis of market prices for each item. Individual prices for mid- and long-term budget may be determined on the basis of cost-indexes and discounting-back models. These models allow for interpretation of cost indexes, grouped according to the methods used in developing the plan, into average yearly maintenance costs.

7 Information systems

7.1 General

As for other systems, the management of building maintenance shall be supported by information systems appropriate to the complexity of the activity carried out.

See Figures 2 and 3.

7.2 Maintenance information system

Management procedures could be computerised according to the size and complexity of the real estate property – using specific methods suitable for maintenance activities - to facilitate planning, implementation operation and control.

The structure of the information systems shall:

a) be appropriate to the diverse nature of the data related to the building (e.g. drawings at different scales, pictures, data sheet, manuals...);

b) have the ability to adapt to the changing of standards and regulations as these often require existing data to be modified, aggregated or broken down, for technical, administrative or fiscal reasons.

Information system shall also allow for:

— effective management of the plan in terms of preparation, updating, modification and optimization;

— issue of documents required to start the activities (work orders, requests for interventions, etc.);

— collection and analysis of feedback data.

NOTE Complete computerisation of the maintenance information system may also allow for monitoring of the operational conditions of components and should ensure compliance with company procedures, thus facilitating implementation of a quality management system.

7.3 General characteristics

The information system shall have the following capabilities, as a minimum:

— possibility of providing a breakdown of the property (to be achieved through a hierarchical process of subdivision on several clearly identifiable levels) into individual items subject to maintenance;

— ability to define basic maintenance activities, accurately identifying the resources required for each, such as labour, material, equipment and associated costs;

— ability to group the information into short term plans, identifying required activities and resources;

— ability to provide feedback data to develop a historical and statistical basis for a review of the results (such as reliability analysis, failure modes analysis, cost analysis, etc.) and to allow for modification of starting hypothesis used for planning and scheduling.

7.4 Functions

The main areas of information systems (planning, management and control) require the development of appropriate information modules, such as:

a) inventory, containing specific technical, functional, economic and dimensional data for all the building components;

b) work-list, containing information on work methods, means and resources required, frequency of works, costs and times of execution;

c) maintenance plan, containing information on frequency, procedures, operators, technical specifications and cost of maintenance intervention, for each component;

d) scheduling and resource management, containing allocation and organisation of technical and financial resources;

e) requests for interventions, containing requests for unscheduled interventions required because of malfunction or obsolescence;

NOTE 1 This function is sensitive as it interacts in technical, economical and organisational terms with planned activities.

f) notes/work orders, containing administrative authorisations for intervention and work instructions to operators;

NOTE 2 Completion of the forms required for acquisition of feedback data and work permits monitoring of work status, containing information on interventions already completed or to be completed.

g) monitoring of spare parts;

h) expense reports containing details useful for cost control;

i) historical log listing works completed;

j) inspection record (surveillance/monitoring), containing functional and physical conditions of technical elements;

k) periodic inspections required by applicable laws and regulations (statutory inspections and/or maintenance);

l) analysis of reliability and failures containing feedback data to be processed for modelling component reliability over time.

Through the use of these modules, the system shall provide a continuous assessment of the maintenance plan, using feedback data acquired from individual work orders, reports of execution and financial statements.

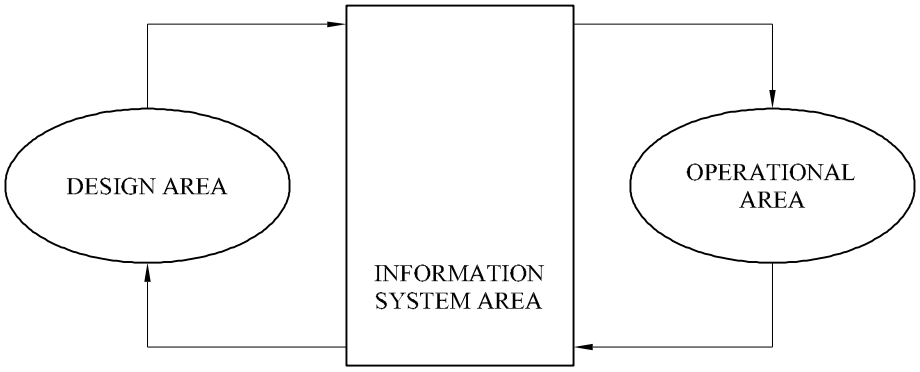

Figure 2 — Organisational Maintenance System – Areas

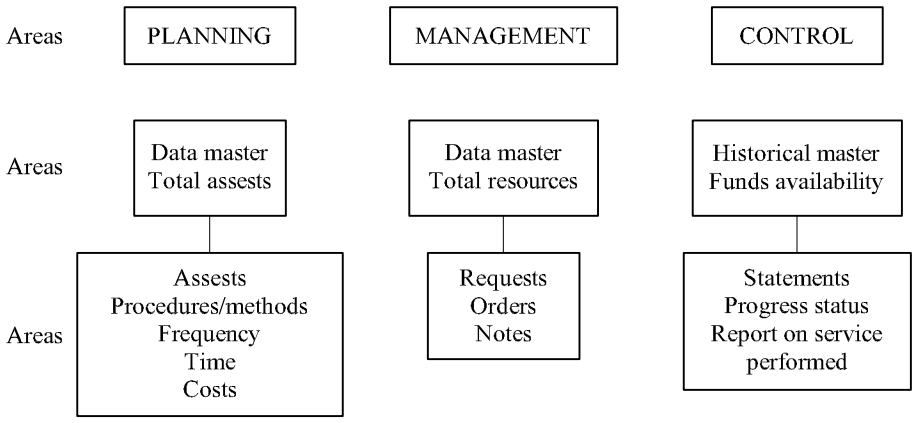

Figure 3 — Building Maintenance Information System - Principal Modules

8 Operational management of maintenance services

8.1 General

The resources (for example: financial resources, human resources, material, facilities and tools...) shall be planned and managed with sufficient flexibility to ensure maintenance activities are conducted in an efficient manner both from the technical and economical aspects (see Figure 4).

8.2 Financial resources

The information collected and the planning of interventions shall allow for a correct and reliable determination of funds required and their distribution over time (cash-flow).

8.3 Human resources

Human resources shall be identified in terms of skills required and required work load.

NOTE The definition of human resources may differ according to whether the resources are internal or external to the company that manages the property and/or the maintenance.

With respect to human resources, the professional contributions of architects and engineers, consultant, site supervisors and inspectors in the execution of a project are also to be considered, as well as other experts (e.g. specialists in mechanical, electrical or structural work) required to draft technical reports.

8.4 Material

If the time required to purchase “short term life” material and components (especially for equipment components) is a critical factor (e.g. for sub-system or component that are related with safety matters, with environmental matters, with the continuity of production...), an accurate planning of spare parts shall also be carried out.

Normally purchasing requirements shall be assessed according to the following criteria:

— difficulty due to the location of the buildings;

— market availability;

— procurement costs;

— possible end of production of specific material and components.

8.5 Support equipment and inspection

The analysis of the maintenance plan shall allow for determination of the equipment required to carry out interventions and inspections. Maintenance management organization shall ensure that operators have the necessary equipment and that these are fully functional.

NOTE The equipment is usually of common use.

Special equipment, such as instrumental diagnosis tools or special lifting devices, may be hired or the work assigned to specialised contractors.

8.6 Programs and schedules

Work orders foreseen in the maintenance plan and unplanned work orders shall be accompanied by supporting documents for operational organisation, supervision and monitoring; calendar based (e.g. daily, weekly and/or monthly) scheduling of activities to be performed shall be designated by specific type of work (for example civil, mechanical, electrical, instrumentation, etc.) or by functional or geographic areas.

The documents shall contain at least the following information:

— dates for execution of each intervention;

— location of the intervention;

— resources required;

— itinerary recommended to the individual teams;

— availability of material in stock (quantity and location);

— safety plan requirements;

— work permits and administrative authorisations;

— responsible contact person.

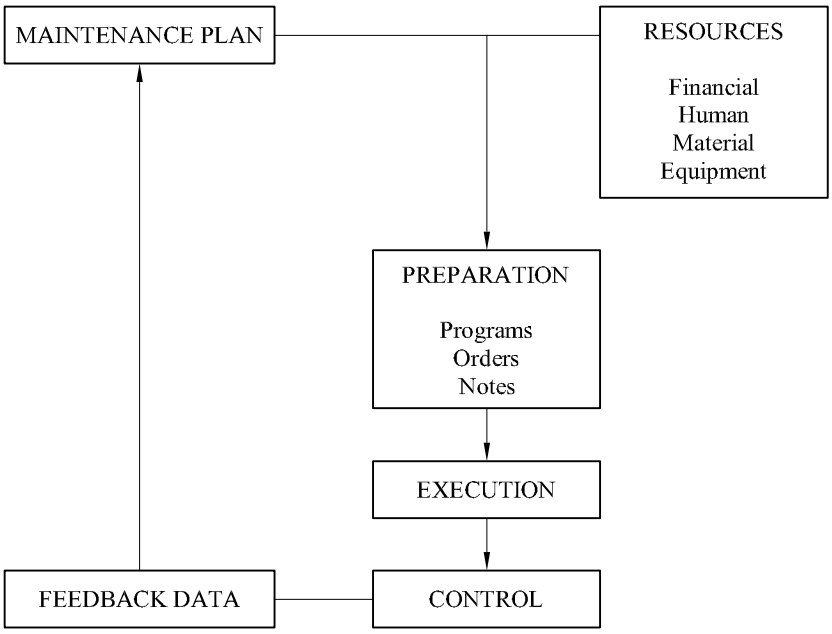

Figure 4 — Maintenance Operational Management Flow - Diagram

9 Monitoring

9.1 Technical monitoring

Corrective maintenance, when performed with high frequency and low cost interventions, shall be monitored by a plan based on sampling and spot-checking. The spot check shall consider the characteristics of the building, the criticality of the item that has been subject to corrective maintenance, the subjects who carry out the activity and the complexity and dimension of the activity.

Condition based maintenance - that often in building maintenance can be characterised by numerically limited interventions but of high cost - shall be subject to periodic inspections (during work and upon completion), by second and/or third parties.

Statements, operator's declaration of conformity, and certifications issued by other parties shall be systematically collected and preserved so that it is always readily available.

9.2 Financial monitoring

Financial control shall be based on the budget associated with the maintenance plan.

NOTE 1 Maintenance cost control is a crucial factor in the success of the maintenance plan in terms of efficiency and respect of the budget.

Final cost accounting of maintenance activities shall be prompt and accurate in order to allow for comparison with budgeted costs in due time.

NOTE 2 Simple accounting data is not always sufficient to correctly evaluate technical requirements and maintenance performance (e.g. it is fundamental to have a log of the working hours of labour required, subdivided by discipline and it is important to monitor the status of works that extends beyond the accounting period).

The information collected during maintenance works shall be formulated in a manner that allows for an analysis of maintenance costs by:

— item, to determine optimal maintenance activities by frequency and organisation,

— functional system, to assess the relationship between costs and services,

— maintenance strategy adopted.

The data processing of the above parameters shall provide the total cost of maintenance, or breakdown of costs by item and by type of intervention. Costs by item allow for an assessment of the reliability of the item and the evaluation of opportunities to improve maintenance strategies.

9.3 Performance monitoring

The performance of the building or of its sub-systems shall be checked periodically with reference to the defined technical specifications and according to the criteria specified in the maintenance and inspection manuals according to the maintenance strategy. The performance monitoring is essential in order to have an evaluation of the effectiveness over time of the maintenance planning.

10 Feedback data

Feedback data is essential for all maintenance plans. The technical and financial information acquired through experience (details on failures, type and frequency, costs and methods of intervention) leads to increasingly reliable forecasts.

Maintenance reports shall contain feedback data in a form appropriate to subsequent processing (see 7.2). The feedback data are intended to be used by at least two organizations: the owner of the building and the public authorities (according to laws and regulations).

This processing is intended to obtain a continuous improvement of maintenance plans (see Figure 5) by means of the analyses of:

— defects[1)] and abnormalities,

— useful life, reliability and availability of critical systems and MTBF/MRT[2)] of components, through an analysis of the mode and frequency of item failures, and

— the effectiveness of corrections made.

NOTE The abovementioned analysis can be performed in various ways depending on the dimension and complexity of the building.

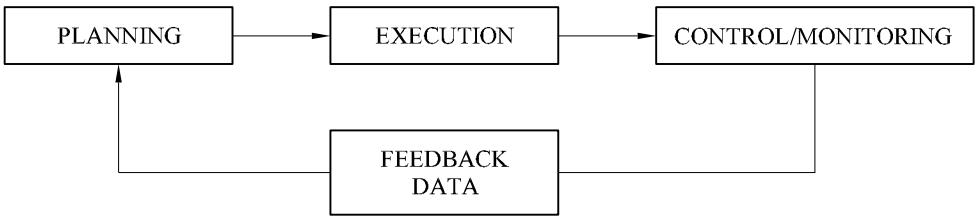

Figure 5 — Feedback data

1) Defect: non-fulfilment of a requirement related to an intended or specified use (EN ISO 9000:2005, *Quality management systems — Fundamentals and vocabulary*).

2) MTBF: mean time between failures: mathematical expectation of the time between failures. MRT: mean repair time: Mathematical expectation of the repair time (EN 13306:2010, *Maintenance — Maintenance terminology*).

Annex A
(informative)

Building classification as per Eurostat "Classification of Types of Construction" (CC) (1996)

Code	Label
1	Buildings
11	Residential buildings
111	One-dwelling buildings
1110	One-dwelling buildings
112	Two- and more dwelling buildings
1121	Two-dwelling buildings
1122	Three- and more dwelling buildings
113	Residences for communities
1130	Residences for communities
12	Non-residential buildings
121	Hotels and similar buildings
1211	Hotel buildings
1212	Other short-stay accommodation buildings
122	Office buildings
1220	Office buildings
123	Wholesale and retail trade buildings
1230	Wholesale and retail trade buildings
124	Traffic and communication buildings
1241	Communication buildings, stations, terminals and associated buildings
1242	Garage buildings
125	Industrial buildings and warehouses
1251	Industrial buildings
1252	Reservoirs, silos and warehouses
126	Public entertainment, education, hospital or institutional care buildings
1261	Public entertainment buildings
1262	Museums and libraries
1263	School, university and research buildings
1264	Hospital or institutional care buildings
1265	Sports halls
127	Other non-residential buildings
1271	Non-residential farm buildings
1272	Buildings used as places of worship and for religious activities
1273	Historic or protected monuments
1274	Other buildings not elsewhere classified

Annex B
(informative)

Example of the formulation and inclusion into budget of a maintenance plan

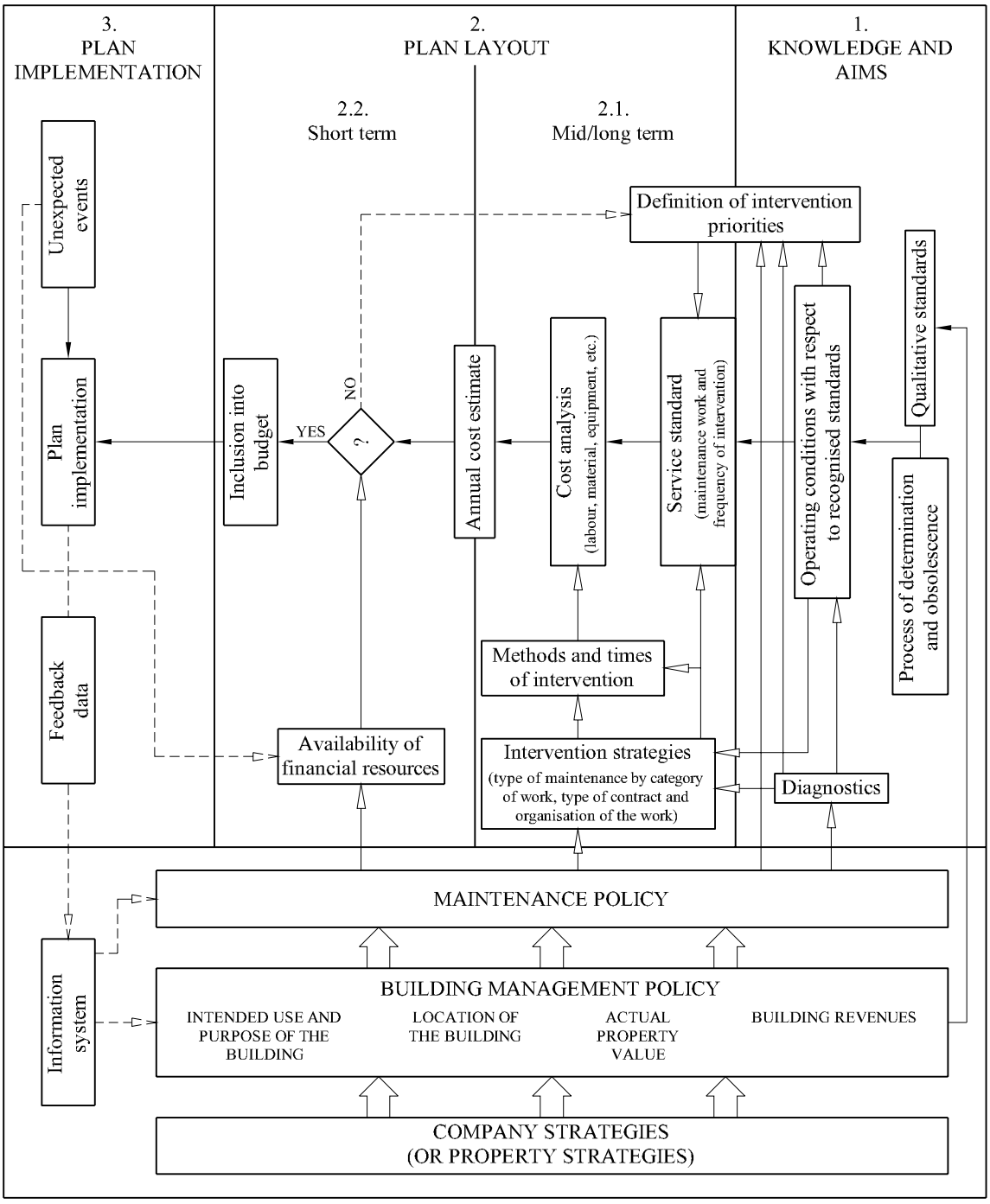

Figure B.1 — Example of the formulation and inclusion of a Maintenance plan into a Budget

Annex C
(informative)

Outline of the Reliability Centred Maintenance method

Reliability Centred Maintenance (RCM) is a method to identify the failure management policies that should be implemented to efficiently and effectively achieve the required safety, availability and economy of operation for all types of equipment including buildings. The method is fully described in EN 60300-3-11 and includes guidance on analysis in all relevant phases of the lifecycle, collection of appropriate data and continuous improvement of the maintenance plan using these data.

RCM provides a decision process to identify applicable and effective preventive maintenance requirements or management actions for equipment in accordance with the safety, operational and economic consequences of identifiable failures, and the degradation mechanism, responsible for those failures. The end result of working through the process is a judgement as to the necessity of performing a maintenance task or design alternatives to effect improvements.

The basic steps of an RCM programme are as follows:

a) initiation and planning;

b) functional failure analysis;

c) task selection;

d) implementation;

e) continuous improvement.

All tasks are based on safety in respect of personnel and environment, and on operational or economic concerns. However, it should be noted that the criteria considered will depend on the nature of the equipment or building under study and its application. For example, a production facility will be required to be economically viable, and may be sensitive to strict safety and environmental considerations, whereas office accommodation may have less stringent safety, economic and environmental criteria.

Successful application of RCM requires a good understanding of the equipment and structure, the operational environment, operating context and the associated systems, together with the possible failures and their consequences. Greatest benefit can be achieved through targeting of the analysis to where failures would have serious safety, environmental, economic or operational effects.

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