



Alaska School Facilities Preventive Maintenance & Facility Management Handbook

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Background

The primary focus of the original and second edition (1999) of the Alaska School Facilities Preventive Maintenance Handbook was to present school districts with a basic outline on how to develop and implement a preventive maintenance program. At that point in history, the Department of Education and Early Development realized that many of the school facilities built following the oil boom of the late 1970s were in poor condition and several were already in dire need of major repairs merely a couple decades after original commissioning. In some cases, it was found that the operational systems for many of these schools were having their life-expectancy curtailed mainly because of maintenance staffing levels, training, and management practices. Even though preventive maintenance was present in some of our school districts, other school districts appeared to be unaware of its existence, or simply did not know how to go about managing their schools with adequate maintenance in a manner which would benefit each school while keeping operational and maintenance costs under control.

As a proposal to address these issues, and as a means to better streamline accountability and efforts in all school districts across the state, state officials focused their attention to ensure school districts had at least minimum standards for preventive maintenance and facility management program. In 1998, new legislations was passed and in 2000 regulations were promulgated to implement minimum criteria for maintenance and facility management if school districts wished to remain eligible for state-aid for school capital projects.

The prime objective of these new standards was to empower school districts to develop functioning preventive maintenance and facility care programs; as a reward for their efforts and demonstrated achievements, the department would then enable eligible school districts to apply for future grants.

This narrative summarizes the birth of the preventive maintenance program and the main factors which came about to justify its existence. It was imperative that the department and districts collaborate to move all districts beyond a point of being stuck in a world of perpetual “breakdown maintenance” where nothing is done until the equipment breaks down. This type of maintenance is detrimental to the taxpayer, maintenance personnel, and to the students and staff in our schools.

Statutory Authority

Alaska Statutes (AS):

- Assign responsibility for preventive maintenance, custodial services and routine maintenance (AS 14.14.090, AS 14.08.111, AS 14.14.060)

AS 14.14.090: In addition to other duties, a school board shall . . .

(10) provide for the development and implementation of a preventive maintenance program for school facilities . . .

AS 14.08.111: A regional school board shall . . .

(8) provide custodial services and routine maintenance of school buildings and facilities;

AS 14.14.060

(f) The borough school board shall provide custodial services and routine maintenance for school buildings and shall appoint, compensate and otherwise control personnel for these purposes. The borough assembly through the borough administrator, shall provide for all major rehabilitation, all construction and major repair of school buildings. The recommendations of the school board shall be considered in carrying out the provisions of this section.

- Define preventive maintenance (AS 14.14.090); and,

AS 14.14.090

(10) . . . in this paragraph, “preventive maintenance” means scheduled maintenance actions that prevent the premature failure or extend the useful life of a facility, or a facility’s systems and components, and that are cost-effective on a life-cycle basis.

- Establish the requirements of a preventive maintenance plan (AS 14.11.011).

AS 14.11.011

(b) For a municipality that is a school district or a regional educational attendance area to be eligible for a grant under this chapter, the district shall submit . . .

(4) evidence acceptable to the department that the district

(A) has a preventive maintenance plan that

(i) includes a computerized maintenance management program, cardex system, or other formal systematic means of tracking the timing and costs associated with planned and completed maintenance activities, including scheduled preventive maintenance;

(ii) addresses energy management for buildings owned or operated by the district;

Statutory Authority

(iii) includes a regular custodial care program for buildings owned or operated by the district;

(iv) includes preventive maintenance training for facility managers and maintenance employees;

(v) includes renewal and replacement schedules for electrical, mechanical, structural, and other components of facilities owned or operated by the district; and

(B) is adequately adhering to the preventive maintenance plan.

Read in their entirety, these statutes establish that preventive maintenance of Alaska schools is solely the responsibility of school districts and that funding for such must be included within the district's operating budget. Some school districts share the duties of maintenance with another agency within the city or borough. The statutes in no way prohibit school districts from acting in conjunction with these associated agencies to effect all or a part of their maintenance program. However, doing so does not relieve the school board of its obligations in the areas of preventive maintenance.

Also, based on this statutory authority, the department's capital improvement project (CIP) application does not allow capital funding for the accomplishment of preventive maintenance **nor for projects caused by lack of it**. A district requesting capital funding from either the school construction fund or major maintenance fund must provide "evidence that the proposed project should be a capital improvement project and not part of a preventive maintenance program, or regular custodial care program." (AS 14.11.011(b)(3))

Regulatory Requirements

Alaska Administrative Code (AAC):

- Provides direction in regulation for development of a school district Preventive Maintenance and Facility Management program and for periodic review by the department that districts are adhering to the plan.

4 AAC 31.013. Preventive maintenance and facility management

(a) For a district to be eligible for state aid under AS 14.11.011 , the district must have a facility management program that addresses the following five elements of facility and maintenance management:

(1) a formal maintenance management program that records maintenance activities on a work order basis, and tracks the timing and cost, including labor and materials, of maintenance activities in sufficient detail to produce reports of planned and completed work;

(2) an energy management plan that includes recording energy consumption for all utilities on a monthly basis for each building; for facilities constructed before 12/15/2004, a district may record energy consumption for utilities on a monthly basis when multiple buildings are served by one utility plant;

(3) a custodial program that includes a schedule of custodial activities for each building based on type of work and scope of effort;

(4) a maintenance training program that specifies training for custodial and maintenance staff and records training received by each person; and

(5) a renewal and replacement schedule that, for each school facility of permanent construction over 1,000 gross square feet, identifies the construction cost of major building systems, including electrical, mechanical, structural and other components; evaluates and establishes the life-expectancy of those systems; compares life-expectancy to the age and condition of the systems; and uses the data to forecast a renewal and replacement year and cost for each system.

(b) Repealed 12/15/2004.

(c) At the request of a chief school administrator, the department will assist a district in implementing a qualifying preventive maintenance program through consultation, on-site reviews, and training.

(d) Repealed 12/15/2004.

(e) On an annual basis, the department shall provide a preliminary notice to each district regarding its compliance with each element required in (a) of this section, based on evidence of a program that was previously provided to the department, or that was gathered by the department during an on-site visit conducted under (f) of this section. On or before June 1, the department will provide its preliminary notice. The department may change a determination of non-compliance at any time during the year based on new evidence. Districts that are not in full compliance must provide evidence of compliance to the department

Regulatory Requirements

by August 1. On or before August 15, the department will notify districts of its final determination regarding compliance. The department will deny a grant application submitted under AS 14.11.011 by a district that has received a final determination from the department that the district is out of compliance with this section.

(f) The department shall conduct on-site inspections of school district preventive maintenance and facility management programs at least once every five years. The department may make additional inspections as it deems necessary. The department may change its determination of compliance based on information obtained during the on-site inspections.

(g) In this section

(1) "district" has the meaning given in AS 14.11.135 ;

(2) "maintenance activities" means all work performed by district staff or contractors on building systems, components, utilities, and site improvements.

Facility Management Overview

Facility Management as a Strategy

Overview

The preceding Background section summarizes the genesis of department-generated preventive maintenance guidance and the following legislation-driven expansion of that narrow facilities care element into a more comprehensive maintenance and facility management requirement. Over the past fifteen years, nearly 100% of Alaska's school districts have achieved compliance in meeting minimum standards. Every school district, with a single exception, has at some point between 2001 and 2016, met the state's minimum standards for maintenance and facility management of school facilities. In August 2002, only six districts met minimum standards. By August 2003, the number was 22. It peaked at 52 school districts in 2008. Disturbingly, since the peak in 2008, two school districts lost certification (and regained it) and an additional 12 school districts have experienced a year or more of provisional compliance where minimum standards are achieved but for which there is not at least 12 months of data demonstrating adherence to the standard. In each of these 14 lapses, it was clear that the measured maintenance, operations, and capital planning areas were not sufficiently integrated into a facility management program so as to remain sustainable through personnel changes or economic shifts in the school district. On a brighter note, some of Alaska's school districts have exceeded the minimum requirements and are operating closer to the forefront of facilities management. Practices and processes such as predictive maintenance to forecast equipment failure, equipment upgrades based on lower life-cycle costs, and managing demand for space are beginning to appear in the department's assessment visits. The Department believes these kinds of results are achievable in every school district, at every level of resource available through integration and local ownership.

Purpose

The purpose for this document is three-fold:

1. To expand department guidance to reflect the full breadth of maintenance and facility management addressed in statute and regulation,
2. To foster greater consistency and sustainability in meeting department requirements by focusing on the integration of operations, maintenance, and capital planning under a Facility Management paradigm, and
3. To offer best-practice insights and meaningful tools to help create facility management programs that exceed minimum requirements.

The structure of this document supports these purposes by addressing each of the five components of maintenance and facility management in three areas: developing, implementing, and sustaining. In addition, where general facility management topics cross one or more of the five mandatory components, these topics are addressed in this Overview section rather than repeatedly in each category. Other pertinent topics and best practices are combined in a section of the publication entitled Additional Considerations. Finally, specific tools and resources are provided as appendices following the narrative documentation.

Facility Management Overview

With limited availability of capital funding, and community pressure on local funding for public works, it is vitally important for school districts to fully integrate overall facility management into district operations. Facility management is not just a matter of fixing things when they break; it is a comprehensive program of fixing and replacing components before they have a chance to create a crisis or emergency in a school district facility. With a comprehensive facility management program, a school district has tools that will extend the effectiveness of each maintenance and operations dollar so that the maximum amount of funding is made available for the students in the classroom. Tools for implementing a comprehensive facility management program include:

- tracking tools such as work-orders,
- planning tools such as reports, and
- other tools such as active inventory control for custodial and classroom supplies.

Facility Management Overview

Facility Management Integration

Whole-building preventive maintenance was the threshold step for Alaska’s school districts on the path toward life-cycle, cradle-to-grave, sustainable facility management. That was soon followed with requirements that covered operations (custodial, energy management), maintenance (maintenance management, maintenance training), and construction (capital planning). While each of these functional areas can be built up and managed independently, it is their integration that is most likely to ensure sustainability. In the effort to achieve the most value for the facility dollar contributed from all sources—local, state, and federal—operations, maintenance, and construction programs need to be coordinated through an effective facility management program. They all work hand in hand to extend the life of existing facilities. State law provides the basic building blocks for school districts to get the most out of their facilities. Some school districts have exceeded the minimum requirements and are functioning at the forefront of facilities management, integrating processes, practices, and data between functional areas. They are sustaining momentum by using strategic and tactical measures to extend the service life, lower life-cycle costs, and lower occupancy costs.

Building Systems and Components Inventory

Introduction

An accurate inventory of the systems and components in a facility is core knowledge for facility management. The school district’s maintenance management program, custodial program, and capital planning program all depend on this essential data. Energy management programs and maintenance training programs also draw from this information.

Facility Audits and Annual Inspections

Introduction

The implementation phase of both maintenance management and capital planning should establish the practice of regular assessments of facility conditions as part of their programs. Integrating condition data between these two elements of facility management will also assist school districts in sustaining these two programs long-term. One practical integration is making the measurement of performance indicators in each area dependent on data gathered and updated under the other program.

Facilities Budgeting and Funding

Introduction

Budgeting and funding for school facilities includes all elements of facility management—operations, maintenance, and construction. The interface between maintenance management, custodial programs, energy management, and capital planning (renewal) is especially important when considering the costs associated with school facilities.

Data for Informed Decision Making

Facility Management Overview

Introduction

[Forum Guide to Facility Information Management: A Resource for State and Local Education Agencies, 2018, p.15] *Timely access to relevant facilities data is essential to both effective management of school facilities by district officials and appropriate oversight of public investments by a community. Providing the needed information to the public and other decision makers involves:*

- *the development or maintenance of a facilities information system capable of collecting, organizing, storing, analyzing, and reporting relevant, timely, comparable, and accurate facilities data (chapter 2);*
- *the meaningful analysis of available data, including the use of appropriate indicators, indices, measures, and benchmarks (chapter 3);*
- *the collection and frequent updating of a host of clearly defined, comparable data elements that describe school facilities and their funding, operations, maintenance, and use (chapter 4);*
- *the maintenance of data definitions, data standards, quality controls, and operational protocols affecting the collection, analysis, and use of data;¹*
- *the presentation of those data into formats that are reasonably usable by the various stakeholder audiences;² and*
- *timely access to the data in printed public reports or via public websites.³*

School districts and states throughout the country continue to increase their use of facilities data to inform decision making: to manage day-to-day operations, maintenance, and repairs, as well as short-term operational planning, long-term capital planning, and master facilities planning. High-quality facilities data are used to create efficiencies, save money, preserve the life of capital resources, and help decision makers become more transparent and accountable to education stakeholders.

[KPIs and metrics here]

Commissioning: A Special Type of Facility Audit

Introduction

Smart buildings are complex buildings. Many of the leading-edge practices in facility management are dependent on the technology of automated systems. Predictive maintenance is

¹ For more information about ensuring data quality and appropriate data use, see the *Forum Guide to Building a Culture of Quality Data: A School and District Resource* at https://nces.ed.gov/forum/pub_2005801.asp and the *Forum Guide to Taking Action with Education Data* at https://nces.ed.gov/forum/pub_2013801.asp.

² For more information about data presentation, see the *Forum Guide to Data Visualization: A Resource for Education Agencies* at https://nces.ed.gov/forum/pub_2017016.asp.

³ For more information about improving access to education websites, see the *Forum Guide to Ensuring Access to Education Websites* at https://nces.ed.gov/forum/pub_2013801.asp.

Facility Management Overview

often based on digital sensor technology. Energy management depends on sensors, measurements, and electronically controlled mechanical and electrical equipment. Building complexity takes maintenance training requirements to new levels. In response to building complexity, commissioning has evolved from a subtask of other professions and trades to a position of prominence—many would argue its own discipline.

Initial Commissioning

X

Retro Commissioning

X

Example/Vignette

Maintenance Management

Developing a Maintenance Management Program

Introduction

Department regulations for maintenance management require:

(1) a formal maintenance management program that records maintenance activities on a work order basis, and tracks the timing and cost, including labor and materials, of maintenance activities in sufficient detail to produce reports of planned and completed work;

This brief paragraph results in a series of eight documents—seven reports plus samples of varying work orders—that are intended to provide solid evidence of a minimally compliant maintenance management program. School district maintenance managers may be able to develop this level of maintenance plan on an ad-hoc basis with rules of thumb and the knowledge of experienced maintenance technicians. This is especially true for small facilities with a minimal range of surfaces and appurtenances. However, as school facility complexity increases, maintenance management plans are best built from a component-based inventory.

The most common deficiency noted during the department’s certification process, is that maintenance management programs do not track materials associated with maintenance work. All school districts have systems that track labor, but materials tracking, by work order, is often lacking. This does not meet minimum criteria. While there is no question that a well-developed maintenance management program must track labor efforts, materials can be a significant component of maintenance and tracking them by work order is important for measuring the impact of repeated maintenance, or trends on systems.

Compliance with this regulation is demonstrated by providing:

- copies of work orders in various states of completion;
- report total maintenance labor hours collected on work orders by type of work (e.g., scheduled, corrective, operations support, etc.) vs. labor hours available by month for the previous 12 months;
- report scheduled and completed work orders by month for previous 12 months;
- report number of incomplete work orders sorted by age (e.g., 30 days, 60 days, and 90 days, etc.) and status for the previous 12 months (e.g., deferred, awaiting materials, scheduled, etc.);
- report comparison of scheduled maintenance work order hours to unscheduled maintenance work order hours by month for the previous 12 months;
- report monthly trend data for unscheduled work orders showing both hours and numbers of work orders by month for the previous 12 months;
- report planned maintenance activity for the following quarter;

Maintenance Management

- report completed maintenance activity for previous three months including labor and material costs; and
- report preventive maintenance components by building system.

School district officials should be prepared to discuss their maintenance management program and the results from the program.

Maintenance Data Information

In order to have an effective Maintenance Management Program, the first step is to develop a mechanism for collecting information on facility components and systems that will be the subject of the Maintenance Management Program. There are now affordable computer programs on the market that are specifically designed for such purpose; the Computerized Maintenance Management Systems (CMMS). For all intent and purpose, the basic key to any of these programs is the capability to store, retrieve and analyze the information collected.

While selecting a suitable CMMS to meet the needs of their school district, school officials are cautioned about purchasing extra options which are neither required by statute or regulation nor useful to the school district. Marketing companies excel at selling their products, but some companies have hidden fees that are charged after the program is instituted, where school districts find themselves forced to pay extra in order to achieve adequate results. Other marketing companies offer poor customer service which quickly becomes problematic during initial setup. Most of these programs are web-based and consume a good portion of bandwidth during usage. CMMS software should be user-friendly so that it can be implemented with minimal training for all maintenance and custodial personnel as well as school educators. The bottom line is to ask around to other school districts and see what will work best for your organization in order to make an informed decision.

The preceding description of modern CMMS has evolved following the use of 3" X 5" index cards and twelve manila folders (one for each month). One side of the index card contained information about the facility components and systems as well as the services that need to be performed. The back side of the card was used to record the date on which the service was performed, the name of the maintenance or custodial staff, and the cost of materials. Upon task completion, the card was placed in the manila folder assigned to the future month when the task was due. Although this method may be somewhat crude, it can possibly meet the needs of a small school district. The analogy is similar to having accountants using pencils, ledgers, and ten-key adding machines. However, the value of a CMMS specifically designed for school districts is measureable, especially for larger school districts. The bottom line is that good school maintenance costs money, but the long-term return on investment is invaluable. Each district needs to implement a functional maintenance management plan that meets its needs and those mandated by state statutes and regulations.

Record keeping is part of maintenance.

Identification of Facilities, Systems, and Components

Maintenance Management

The second step in developing an effective maintenance management program is to get the information entered into the system.

In order to do so, affected personnel need to inventory and categorize systems and components maintained by the school district in each of the school facilities that the school district maintains. During the inventory, information such as quantity, type, size, age, condition, manufacturer, model, material specification, location, key parts, part numbers, specialized upkeep requirements (e.g., oil and filter types), and other item-specific data need to be documented. The data collection is time consuming and requires a significant amount of data entry.

[ADDRESS NAMING CONVENTIONS AND EQUIPMENT ID HERE?]

The data collection will reveal systems and components that apply to each of the facilities. School district personnel may add items as necessary to create a complete plan. Many facilities may have multiple system types within a particular category (e.g., roofing, package unit heaters, etc.) as well as multiple components of the same type (e.g., circulating pumps, water closets, toilet partitions, etc.). For each item, and wherever appropriate, a specific preventive maintenance task should be developed. In large school districts, the data collection will reveal similarities amongst systems and components; following these observations, some school districts may elect to standardize as many of their systems and components as possible (e.g., same water closets, light fixtures, etc.), thereby reducing spare parts inventory and training costs, which in turn creates increased productivity and quality of work. Note that standardization may in some cases only be possible during remodel projects or new construction (e.g., boiler replacement / installation, unit heater replacement / installation, etc.); however, simple part replacements may also enable standardization (e.g., energy efficient bulbs, low-flush water closet flushometers, etc.) and save on utility costs.

To assist the school district with executing this task, the department has established a baseline by identifying facility systems and components that should be included in the CMMS. A list of these components is included as Appendix A and should clarify the tasks needing to be done in this section. While thorough, the list is not intended to be exhaustive of every possible component. The list is designed to dovetail with other useful assessment devices such as the Association for Learning Environments International (A4LE) Alaska School Facility Appraisal and the department's Guide for School Facility Condition Survey, as well as other professional facility audit organizations. The list also gives its users a better understanding on how to update Renewal and Replacement (R&R) schedules, a topic which will be discussed later in this guide. A sample of an R&R schedule is included as Appendix B.

Maintenance Management

Determining Present Conditions

While developing the inventory of systems and components described previously, the school district will need to complete an inspection of the components in order to establish their current condition. Following the identification of systems and components in each facility, a detailed inventory is needed to quantify the building components and to establish their current condition. This step includes both an objective process of fact-gathering and a subjective assessment of the current condition. Information such as quantity, type, size, manufacturer, model, material specification, location, key parts, part numbers, and other item-specific data will be documented. A qualified technician or professional will need to make the assessment of current condition. The condition assessment is used to determine both the immediate and future levels of preventive maintenance for the system or component and its end-of-service-life replacement date.

Establishing Appropriate Levels of Maintenance

Preventive maintenance efforts range from visual inspections only to performance testing and analysis; from minor adjustment, cleaning and/or lubrication to complete overhauls; from reconditioning to components replacement.³

School districts that are accredited by the Northwest Association of Schools and Colleges will recall that the accreditation standards include the following:

Standard III - School Plant and Equipment

“13. Inspection(s) of the school plant and equipment **shall** be made each school year by a qualified official and any deficiencies addressed.”⁴

This type of standard is an example of a preventive maintenance requirement at the visual inspection level.

In establishing levels of maintenance, two determinations are needed. The first is to establish a basic life-span for the system or component (e.g., asphalt shingle roofing - 20yrs, oil-fired boiler, 15yrs, drive belt – 3yrs, etc.). The second determination is, “What maintenance activities are needed to ensure that this particular system/component meets or exceeds its life expectancy?”

Answers to the above queries can oftentimes be found in the Operations and Maintenance (O&M) manuals. These manuals are usually turned in shortly after facilities commissioning or major project completion. Manufacturers’ literature, practical experience, test results, and industry averages are some ways to determine both acceptable life cycles and what preventive maintenance work would result in achieving those life expectancies in the most efficient manner; as mentioned previously (i.e., the lowest total life-cycle cost). Alaska presents formidable environmental challenges to our facilities, and the life expectancy of certain systems / components may vary greatly from one region to another, so an informed analysis is necessary.

Maintenance Management

Preparing the Work Items Plan

Once your levels of maintenance have been established, setting the tasks into a workplan is the next step. According to Basil Castaldi, a recognized expert in the field of facility planning and author, four elements make up any preventive maintenance work item.

“In any prescribed maintenance program, the list of tasks to be performed is described in detail. The frequency and nature of the work are clearly stated. The materials to be used are specified in considerable depth and the manner in which the work is to be accomplished is expressed in simple language.”⁵

Consider this further detail of these tasks:

I. The list of tasks to be performed is described in detail.

The detail that accompanies this step is critical and should be as comprehensive as the efforts that were placed in the previous step while identifying facilities, systems, and components. Any maintenance individual who is assigned any of the tasks should be able to determine the location of the equipment, what replacement parts, if any, are needed, what the work entails (e.g. replace air filters), tools and manuals required, estimated time of completion, what Personal Protective Equipment (PPE) should be worn, if any, etc. This task is particularly useful when a new maintenance employee takes over a particular school without having the possibility of shadowing an existing employee.

II. The frequency and nature of the work are clearly stated.

This task is self-explanatory. For instance, a school district may elect to conduct a 30 minute load test for its entire generator fleet at the beginning of each month, with exception to June and July when affected schools are in seasonal shut down. The test will include monitoring and recording all gauges. Another example may be the changing of air handlers filters twice a year, at the beginning of August, and then again at the beginning of February.

III. The materials to be used are specified in considerable depth.

This is another important task, because it avoids the plausibility of maintenance personnel switching various components of a system to a point where functionality and performance are diminished costing the district several operating dollars. For instance, clearly defining a specified nozzle for a fuel burner may enable boilers to maintain peak performance (e.g., hollow, 3.0 gallon per hour, 60 degree angle). Another example could be the adherence to specified air filters, where low-cost air filters may compromise the occupants' environmental safety and well-being (e.g., high capacity pleated filter, MERV 8, Moisture Resistant Die Cut Chipboard, Nominal Height 24 inches, nominal width 24 inches, nominal depth 2 inches).

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IV. The manner in which the work is to be accomplished is expressed in simple language.

The tasks needing attention will be addressed by custodial and maintenance individuals with various educational backgrounds. The best means to ensure understandability across the board is to keep the language simple and direct.

Maintenance Management

Implementing a Preventive Maintenance Program

Introduction

Where the first school board responsibility was to *develop* a preventive maintenance program, the second responsibility is to *implement* a preventive maintenance program. This section offers guidance on carrying out the developed preventive maintenance work plan and establishes the importance of having management reports and a system of feedback from the field in order to implement an effective program.

The basic task of preventive maintenance implementation is to match needs with resources. However, both needs and resources are variables in the facilities management effort. As a result, implementation efforts may occur once to initiate a preventive maintenance program but will also require continuous monitoring of needs and resources to accommodate changes in these variables. For example, the work items assessment of a circulating pump may have indicated an anticipated failure in three years. At the three-year point, a stress test of the pump may indicate no appreciable degradation has occurred. This information may necessitate a revision to the preventive maintenance plan initially implemented. Other examples include the impact of new technologies, improvements to building systems or new tools that reduce repair times. These examples of variables in needs and resources all support the conclusion that implementation requires both an initial and an on-going effort.

Moving from the planning and development phase to implementation and operation almost always involves funding, regardless of the endeavor. Preventive maintenance is no exception. As evidence of the importance of funding in this transition, the portion of the Encyclopedia of Architecture devoted to implementation of a preventive maintenance program is largely a discussion of funding.⁶ Because funding is so critical to the transition, some findings from research concerning maintenance funding and resources are included in the following paragraphs.

Determining Necessary Resources

As previously mentioned, most of the resource requirements result in a need for funds. Determining the level of funding needed for preventive maintenance at a detailed level requires estimating literally thousands of labor and material line items. This method is very time consuming. Other approaches to budgeting for preventive maintenance include establishing a formula based on a percentage of the operating budget or a percentage of building replacement value(s). In California, research showed that:

“If a planned maintenance program is followed, about 5 percent of a district’s operating budget will be required to provide an adequate maintenance program.

In addition to the 5 percent expenditure for the district’s maintenance program, a reserve fund is needed for unanticipated and emergency maintenance expenditures. Another criterion for determining budget requirements is to calculate 2.9 percent of

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the current net building replacement cost or a projected cost based on the square footage of property to be maintained.”⁷

In another budgeting formula, the Encyclopedia of Architecture indicated:

“The cost of preventive maintenance ranges according to the intent of the *plans developed*. To set a budget for this type of work, one may estimate 5% of the present value of the building for preventive maintenance activity. Perhaps 1.5% of the value of the building may be estimated for simpler structures or systems.”⁸

The department’s capital improvement project (CIP) application scoring criteria assigns increased points to school districts based on the percentage of total maintenance expenditures relative to the building replacement value(s). Maximum points are achieved when the percentage is five percent or greater.

One effective strategy for determining the necessary resources is to identify the smallest detailed increments of the preventive maintenance plan and combine them for the aggregate picture. Take each well developed preventive maintenance work item and ask, “What skills (trained personnel), tools, materials (parts etc.), and time are needed to complete this work item?” Once these factors are tabulated and the resource needs are clear, the supporting issues of space for shops, material staging and transportation requirements can be addressed.

While starting with the most detailed information and building up yields a comprehensive assessment of necessary resources, broad and systematic thinking is required to arrive at the necessary organizational structure with which to accomplish the preventive maintenance program.

Determining Organizational Structure

The structure and organization of the preventive maintenance program must be in place before effective scheduling of work can occur. Some operations and maintenance organizations establish a cross-disciplined preventive maintenance work center whose main task is to inspect various systems and components (usually dynamic equipment) and write maintenance work orders. Following the inspection, more traditional work centers such as plumbing, sheet metal, etc. are assigned the actual work tasks. Other maintenance organizations are oriented almost completely to preventive maintenance tasks with major crafts taking responsibility for components and systems within their respective areas. In this model, a small multi-disciplined workcenter handles routine maintenance and emergency repairs and, in some cases, minor improvement work.

Maintenance Management

Sustaining a Maintenance Management Program

Introduction

[This is where we will discuss any maintenance management elements that respond to the cradle-to-grave/cradle-to-cradle life cycle of a building.].

Energy Management

Developing an Energy Management Program

Introduction

Department regulations for energy management require:

(2) an energy management plan that includes recording energy consumption for all utilities on a monthly basis for each building; for facilities constructed before December 15, 2004, a district may record energy consumption for utilities on a monthly basis when multiple buildings are served by one utility plant;

This baseline requirement—the recording of energy consumption—is deceptively simple. However, because the two categorical requirements—all utilities and all buildings—are comprehensive in nature, the complexity of record keeping multiplies quickly. Not only does the math of buildings x utilities result in many data points, the variety of utilities used varies from building to building as does the variety of delivery methods for those utilities. School district energy program managers will be challenged if they attempt to develop this level of energy plan on an ad-hoc basis without data tracking tools. However, as school facility complexity increases, energy plans, like maintenance programs, must be built from a facility-specific inventory.

The most common deficiency noted during the department’s certification process is that energy programs are not tracking all types of utilities used or are not doing tracking using a monthly metric. This does not meet minimum criteria. While there is no question that a well-developed energy management program should include districtwide information (e.g., goals, standards, organizational structure, staffing, etc.), the energy consumption records are unique to each building.

The utility consumption records are just the beginning of the planning needed to develop a complete, effective energy management program. Other planning factors include: expectations/goals, staffing, schedules, equipment, safety, and supplies.

An energy management plan is a comprehensive document that “...maps out internal maintenance schedules, equipment logs, and keeps equipment manuals and buildings drawings on hand for reference. Unlike an energy policy, the energy management plan is regularly updated, typically on an annual basis. It is used to document recent achievements, changes in performance, and shifting priorities.” (AHFC White Paper, p.8)

As described above, there is overlap between the energy management plan and the preventive maintenance management program in regards to maintenance schedules. Although maintenance personnel involvement is critical, a successful energy management plan also necessitates everyone’s participation, from school board members to students. The energy plan should incorporate what measures are selected to optimize resource utilization while minimizing costs and expenses. Most importantly, the plan should utilize data gathering to benchmark whether or not efforts are paying dividends; to do so, many school districts set objectives (e.g., reduce fuel consumption by 15% within the next 12 months; reduce electric consumption by 10% within the

Energy Management

next 12 months). The plan should be simple and clearly define everyone's tasks in support of the plan. School districts who have effective energy management plans usually assign its execution to a responsible individual with access to top-level administrators. In such manner, school board members can receive updates from their energy plan manager on a regular basis (e.g. monthly, quarterly, or bi-annually) and determine how well the plan is working. Officials may then review issues that could be faltering the plan objectives or need to attention.

Here are examples of measures taken by various school districts in their effort to mitigate energy consumption:

- Energy monitoring via automated remote reporting;
- Turn off electrical appliances at the end of each day (e.g., lights, smart boards, computers, monitors, speakers, televisions, stereos, copy machines, kitchen hoods, etc.);
- Utilize minimal corridor night lighting during non-occupancy;
- Report all utility malfunctions immediately to maintenance personnel (e.g., oil / gas/ water leaks, lights no longer shutting off automatically, etc.);
- Shut down boilers, refrigerators, and freezers during summer;
- Turn down the heat during non-occupancy periods (also known as night setback), including holiday breaks;
- Install occupant sensor lighting;
- Install low-flow flush flushometers for water closet / urinals;
- Shut down the school at 5:00 p.m. one night a week;
- Optimize Heating Ventilation and Air Conditioning (HVAC) systems (e.g. replace air filters, tune-up boilers twice a year, ensure fans are not continuously running in manual override mode, ensure air louvers are operational, etc.);
- Replace antiquated lighting systems with more efficient ones (e.g. replace T-12 fixtures with T-8; replace Tungsten filament bulbs with high efficiency Light-Emitting Diode (LED) bulbs);
- Install provisional arctic porticos during cold season;
- Reward schools that decrease energy use (e.g., free movie night at the gym); and
- Enlist/appoint an 'energy champion' and ensure someone is comparing and using the information.

As defined in the regulation, the energy plan also needs to record energy consumption on a monthly basis for each building. Energy consumption recording must comprise all school district utilities such as heating fuel, steam, natural gas, Liquid Propane Gas (LGP), waste heat, electricity, wood, coal, potable water, waste water, refuse, etc.

As noted, the regulation makes exception for buildings built before December 15, 2004. In such case, for instance, if a large fuel tank supplying multiple facilities was built prior to this date

Energy Management

(e.g., school, teacher housings, and generator shed all feeding off one main fuel line), it is permissible to record the monthly utility readings for the entire distribution system. The same goes for electrical meters. However, any school built after this date must have individualized means to record each of its utilities (e.g., oil meter, waste heat meter, electric meter, etc.); the daisy-chaining of numerous buildings off one utility meter is no longer permitted.

Compliance with this regulation is demonstrated by providing:

- Written copy of the energy management plan; and
- Utility report recording energy consumption for all utilities, on a monthly basis, for each building for the previous 12 months.

School district officials should also be prepared to discuss their energy management plan and the results gained from the plan.

Energy Management

Implementing an Energy Management Plan

Introduction

[This is where we will discuss any energy management implementation steps; how to put a plan into action.]

Energy Management

Sustaining an Energy Management Plan

Introduction

[This is where we will discuss any maintenance management elements that respond to the cradle-to-grave/cradle-to-cradle life cycle of a building.].

Custodial Program

Developing a Custodial Program

Introduction

Department regulations for custodial programs require:

(3) a custodial program that includes a schedule of custodial activities for each building based on type of work and scope of effort;

This baseline requirement—a schedule of custodial tasks for each building based on the type of work needed (i.e., the activity needed for each surface or equipment item) and the level of effort (i.e., the frequency of care for each type of work)—represents a significant planning effort. School district custodial program managers may be able to develop this level of custodial plan on an ad-hoc basis with rules of thumb and the knowledge of experienced custodians. This is especially true for small facilities with a minimal range of surfaces and appurtenances. However, as school facility complexity increases, custodial plans, like maintenance programs, are best built from a component-based inventory.

The most common deficiency noted during the department’s certification process is that custodial programs are not building-specific but rather are a one-size-fits-all program written for the entire school district. This does not meet minimum criteria. While there is no question that a well-developed custodial program should include districtwide information (e.g., goals, standards, organizational structure, staffing, etc.), the schedule of custodial activities is unique to each building.

The schedule of custodial activities is just the beginning of the planning needed to develop a complete and effective custodial program. Other planning factors include: expectations/goals, staffing, schedules, equipment, safety, and supplies.

Leadership

The custodial program is a tool, customized to individual school districts, designed to guide custodial personnel in the execution of their work. ***“The first step toward establishing an effective custodial program is to determine the district’s expectations of its custodial services. This requires input from both the school board (who ultimately will fund the program) and the building administration (who will live with the results of the program).”***¹

[NCES/ALASBO *Planning Guide for Maintaining School Facilities*, 2003, p.82]

This is often developed as a vision statement. If this vision is absent, it falls to the Facility Manager to elicit it in order to make proper plans. Often, suitable statements from which to plan can be found in board policy. One common, and helpful, step in establishing and communicating a vision is to provide a mission

Sample Vision Statement

It is our vision to provide the highest level of customer service satisfaction of any school district in Alaska by being innovative, flexible, and competitive with a can-do attitude.

Sample Mission Statement

"The mission of the XYZ School District Custodial Team is to provide an attractive, healthy, and safe, working and learning environment to facilitate greatness in our staff and students."

Custodial Program

statement. These two elements, vision and mission, can serve as the basis of a custodial plan or program. The mission statement should be supported by goals and objectives. It is imperative that custodial program staff know what is expected of them. For example, will custodians do light maintenance? To whom do custodians report? Are custodians responsible for event set-up such as equipment and furniture?

Custodial Activities

“Within school districts, custodial operations should reflect the needs of individual facility types, i.e., elementary schools, middle schools, high schools, technical schools, and ancillary buildings. Each type of facility requires a number of basic custodial services in support of the educational process; however, the requirements for middle and secondary/technical schools may be greatly expanded due to their size, complexity, and use patterns.” [Florida DOE *Maintenance and Operations Administrative Guidelines for School Districts and Community Colleges*, 2010, pg 49]

As mentioned in the introduction, the most complete custodial plan is based on a component inventory, a quantification, of building elements and equipment requiring custodial services. In order to streamline this effort, a good place to begin is with a list of custodial tasks. These can be developed from industry guidelines, samples from other school districts, or internal documents such as custodial job descriptions or existing checklists. Consider the following as a sample list which, on the left, covers a variety of custodial tasks pertinent to the common areas in a school:

Sweep/clean exterior walkways to 10ft from entries/exits	<i>Quantity of exterior walkways</i>
Vacuum entries/exits and/or wet-mop entries/exits	<i>Type/quantity of entry flooring</i>
Clean glazing (doors & sidelites) at all entry/exits, inside and out	<i>Quantity of glass at entries; height of glass at entries</i>
Vacuum all carpeted corridors	<i>Quantity of carpet in corridors</i>
Dry mop all hard surface corridors	<i>Quantity of hard surface in corridors</i>
Wet mop all hard surface corridors	<i>Quantity of hard surface in corridors</i>
Extract soiled areas on carpets	<i>N/A; as needed</i>
Remove stains and marks from hard surface floors	<i>N/A; as needed</i>
Clean all drinking fountains	<i>Quantity of drinking fountains</i>
Clean glazing at interior windows, window walls, displays	<i>Quantity of interior glazing</i>
Dust all equipment, sills, trims and hard surface furnishings	<i>Density of dusting surfaces per SF</i>

On the right side of the table are the associated building elements that would need to be inventoried in order to develop a custodial schedule for the building that was based on the type and frequency of custodial activity. An added benefit of having this component and quantity based inventory is the ability to use industry standards to develop staffing requirements. For example, if the inventory of glass in the facility totaled 350sf, and that amount needed daily

Custodial Program

cleaning, an industry standard of 525sf/hour would yield 40 minutes of direct cleaning time for that activity. The combination of all tasks would provide data for determining custodial FTEs needed for the facility.

In developing custodial activities, don't forget the plethora of non-cleaning related duties. These might include: recycling, snow removal, events and set-ups, relamping, pest control, mail pickup/delivery, supplies inventory/stocking, direct visitors, record keeping, and training.

Standards of Cleanliness

When developing the custodial program based on custodial activities—and especially when developing time based standards for the activity—the standard of cleanliness must be considered. In other words, how clean is clean? The Association of Physical Plant Administrators (APPA) has developed a widely recognized, and adopted, standard consisting of 5 levels, each with descriptive narratives. Under this standard, the target for most school spaces would be Level II “Ordinary Tidiness”. A number of other industry and trade associations also have cleanliness standards that can be adopted and/or modified. Once adopted, these should be integrated into custodial program documents and schedules.

Procedures. Cleaning procedures by function (e.g., empty waste receptacle, clean chalkboard, etc.), to include scheduling (e.g., daily, weekly, etc.) in each area of the building. This description is usually relatively broad and should include location, task at hand, and frequency for all areas of the building:

Methods and procedures. This depiction should give ample details on how to get the job done effectively. For instance, marker boards may require a specific solution to clean their surfaces; mirrors may require a specific cloth. The instructions should also warn personnel as to what not to do, such as using a particular solution on a specific surface. Gymnasium floors and countertops have been ruined while using the wrong cleaning agents. The following subjects should be covered at length in the custodial program:

Safety

Personnel Safety. Custodial personnel are exposed to a variety of health hazards such as chemicals, blood-borne pathogens, toxic substances, electrical shocks, trip and falls, etc. It is important that these employees be informed and trained on how to protect themselves and to conduct their work in the safest possible environment. The custodial program should include:

- when / how to use Personal Protective Equipment (PPE);
- how to deal with Hazardous Materials (HazMat) including Sharps and bio waste; and
- awareness of location and use of Material Safety Data Sheet (MSDS) and the “Right to Know.”

Custodial Program

Equipment Needs

Care of cleaning equipment and use. The cleaning equipment must be stowed, maintained and operated properly. Custodial personnel should be well-versed and familiar on how to care for all of their equipment, including:

- buffers;
- personnel lifts;
- ladders;
- carts;
- mop buckets and presses;
- dust mops;
- wet mops;
- push brooms and corn brooms;
- vacuum cleaners;
- carpet extractors, etc.
- entrance, lobbies, and corridors;
- classrooms and laboratories;
- offices, lounges, and conference rooms;
- restrooms, locker rooms, showers and dressing areas;
- cafeterias and lunch areas; and
- gymnasiums and multipurpose rooms, etc.

Products

Selection and listing of school district prescribed cleaners. The list should be inclusive of all cleaners, as well as a brief description on use (e.g., spray cleaner; shower foam, etc.) and methodology (e.g., daily, on most hard surface; per manufacturer's instructions, etc.). The following are examples that could be included in the custodial program:

- all-purpose cleaner
- all-purpose degreaser
- glass cleaner;
- disinfectant;
- absorbing deodorant;
- scale and lime remover;
- mar and spray paint remover;
- gum remover aerosol;
- shower descaler;
- stainless steel cleaner;
- septic enzymes, etc.

Custodial Program

As in the case for the Preventive Maintenance program, the custodial program will be utilized by custodial individuals with various educational backgrounds. The best means to ensure effective communication is to keep the language simple and direct. If custodial personnel do not read English, the program should be translated in order to achieve proper results.

A good custodial program should also include random inspections. A list of *Standard for Clean Classroom* can be found in Appendix G. By using the standard, strong points and weaknesses can be identified, giving custodians an appraisal of what is getting done properly, and what needs to be improved upon.

Another important tool for the custodial workforce is the *Master Custodial Schedule*. (see Appendix H). A customized schedule should be displayed in each custodian's workplace. The schedule should indicate what tasks need done daily, weekly, monthly, annually, and as needed.

Custodial Program

Implementing a Custodial Program

Implementation of a custodial program requires gathering and deploying resources you have identified in the planning stage.

Custodial Program

Sustaining a Custodial Program

[This is where we will discuss any maintenance management elements that respond to the cradle-to-grave/cradle-to-cradle life cycle of a building.]

Maintenance Training

Developing a Maintenance and Custodial Training Program

Introduction

Department regulations for maintenance training require:

(4) a maintenance training program that specifies training for custodial and maintenance staff and records training received by each person;

The intention of statute and regulation is that there should be a program of continuous training for maintenance personnel, custodians, and their managers as part of ensuring maintained state financed facilities. Training in facility systems and operations assist a facility in reaching its expected life and insures the continued effectiveness of an educational facility as designed. This maintenance training is separate from the training mandated and provided by a school district's human resources (HR) department. It is specific to facility maintenance and custodial operations. The previously mentioned HR training is important; however, it is not a substitute for mandated training under these statutes and regulations.

Definition: Custodian
"one that guards and protects or maintains"

A good training program, as part of an efficient maintenance program, interacts with all other aspects of the program: maintenance management, energy management, custodial, and capital planning. No part of a preventive maintenance program operates in a vacuum. Good custodial is actually one part of a balanced maintenance program and it will be included under the term "maintenance training" in this section.

Planning

The first thing to contemplate when developing a maintenance training program is, what are is being maintained? This is where coordination with maintenance management and capital planning is important. Start with a list of school district facilities and assets, including O&M manuals and scheduled preventive maintenance items. Once the list is compiled of equipment, finishes, and other assets that school district personnel need training on, a school district can begin to plan. Training should include initial new hire training, training on new equipment and finishes, periodic re-training, and training review. Also, an essential part of a training program is recording who was trained and on what subject the training was on. Efficient training records list all types of training over the year and the personnel who attended each one, and separately list each individual and each of the training that person received. One convenient way of recording this is through the maintenance management work order system.

HELPFUL HINT

Standardize to reduce training and inventory costs

Working with capital planning and maintenance to develop school district standards for materials and components will simplify operations, minimize variation of inventory parts, and reduce the makes and models of equipment needing training.

Maintenance Training

Having “training” as an available work order sub-group makes sorting efficient. Assigning a work order to each individual attending a training session and having those individuals code their time to that work order allows easy sorting by training or by individual. This method also captures hours and costs of training. This is not the only method of recording. There are other personnel management programs available for recording training. Just make sure that it shows facility-mandated training versus HR training. A paper record is not recommended, as this is less useful for long-term tracking of personnel training.

Maintenance Training

Implementing a Maintenance and Custodial Training Program

Introduction

Once maintenance and O&M requirements have been established, a school district can decide what and how much training is required and set in place its training program. Some things to consider are identifying fundamental training elements for new employees, and what items may require annual training versus every few years. Formulate how training will be conducted, as well as when, where, and by whom. See below for some factors to consider as you develop your program.

New Hires

After basic orientation of the duties expected of the assigned position, additional training should be planned depending on the position or craft.

Custodians

If custodians in the school district are only responsible for cleaning, a closer title would be janitor, then initial training in cleaning procedures and expectations are expected. Custodians are also the first level of eyes-on for the maintenance program. They need to be trained on inspecting and observations and how to initiate a work order based on any conditions requiring maintenance. If they are expected to perform some light maintenance, closer to the definition of a custodian, then there needs to be additional training. For some school districts the additional training is performed by maintenance mechanics. A work order is initiated with a new hire for training in mechanical, electrical, or other trade. The assigned mechanic performs the training (e.g. filter changing, flushometers, etc.) and the time is recorded.

Maintenance Technicians

Facility maintenance will be very new for many maintenance mechanics, even for journeymen. Most of these technicians have a background in construction, performing repairs in a facility environment is not the same. Add in the complexity of being in an educational facility with administration, teachers, and students, it can be a lot to adjust to. Initial training should include the work order system (including asset numbering), procedures for working in a school. A very successful way many school districts use for this training is to have new people initially assigned to the preventive maintenance team. The extent of time varies from one turn of facilities to a set time like six months. This orients the person to all facilities and locations of

HELPFUL HINT

Train the Trainers

Example:

Custodians are tasked with replacing flushometers on the toilets. Have a maintenance technician train the lead custodian for a facility. When he is competent, have that person train the other custodians in the school under the technician's supervision. This will insure work is able to be performed onsite and the lead custodian has better retention of the skill. This will save time and money by not having a centrally based technician travelling to the facility.

Maintenance Training

components, operations in an active educational facility and how to perform work orders, close work orders, and create new work orders.

Continuous Training

After maintenance management has assembled the list of maintenance training needs, decide if an item requires annual, semi-annual, or periodic training. Setting a schedule for the training that avoids interfering with normal maintenance duties will help learning. One method is to have an annual in-service for employees just prior to a new school year. Depending on the size a school district, a strategy can be to have two days with half of the personnel on each day. This helps to keep the numbers manageable and maintains a maintenance personnel presence in the facilities. This becomes a good time for many training sessions with some hands-on training. Balance quantity of training with quality and avoid over-load. If an in-service is not possible or desired, the school district will need to arrange for the proper training either by going to each facility or having some version of a distributed gathering.

Periodic Training

At times, a training need becomes apparent that is outside of normally scheduled training. This could be from the maintenance supervisor(s) seeing repetition of work orders for the same issue or periodic inspections by preventive maintenance staff or building personnel of conditions that need to be addressed. The training program should have built in allowances for investigating issues and arranging for appropriate training.

Opportunity Training

Shadowing a contracted maintenance technician or craftsman can provide another training opportunity for school district maintenance personnel. These visits may occur during regular inspections or as a result of a failed component.

Maintenance Training

Sustaining a Maintenance and Custodial Training Program

Introduction

As time passes, finishes and assets are replaced. A good training program must be agile -- ready for changes and to develop or update training as required. One way to stay ahead of the curve is to maintain contact with capital planning. As facilities are being planned for construction or renovation, be prepared to discuss specific items in the plan and what training each may require. Identify whether the items are part of the school district's standards and can be included as part of the normal training plan.

As part of project planning, ensure that adequate factory training is included in the project. This should be true factory-level training and not just an orientation showing where it is and how it works. Training should include all facets of maintenance including a list of recommended parts to keep on hand. For items like building automation and fire alarm systems, training should be full maintenance and programming to the level of a certified technician. This project-specific training is required if the project is funded or reimbursed through AS 14.11 state aid. Training requirements should be incorporated in the project's bid documents. Take this training as a time to refresh your long-term staff and as new training for recently added staff.

Part of sustaining a training program is to set a schedule for training that works into the foreseeable future. Review individual training histories and be ready to incorporate training that may be missing. A good time for this is during personnel annual reviews. Review any new items that will require a change in training.

A school district training plan should contain or perform the following:

- A written training plan that has training for new staff, annual training, and how the need for periodic training is addressed;
- Produce at any time the scheduled maintenance training for the next year;
- Produce and review an individual's training history;
- Produce and review the prior year's training activity and attendance; and
- An efficient training program can track training on the maintenance work order system to able to track training costs and individual training time.

HELPFUL HINT

Let technology and the force make training easier and less expensive

Use videos from **YouTube** to assist in training. Many manufacturers and some individuals have posted videos of maintenance procedures. Keep a library, or create a playlist, for training and refresher courses.

Use **mobile video chat** program apps to use smartphones or tablets to communicate when performing maintenance.

Use the school's **distance learning assets** for training across the district when face-to-face is not required.

Capital Planning

Developing a Capital Planning Program

Introduction

Department regulations for capital planning require:

(5) a renewal and replacement schedule that, for each school facility of permanent construction over 1,000 gross square feet, identifies the construction cost of major building systems, including electrical, mechanical, structural and other components; evaluates and establishes the life-expectancy of those systems; compares life-expectancy to the age and condition of the systems; and uses the data to forecast a renewal and replacement year and cost for each system.

Capital planning is managing renewal and replacement plus so much more. A school district cannot efficiently maintain their facilities only through capital planning alone, nor can a school district manage their facilities properly without capital planning. Capital planning is, as the name implies, planning for future capital needs. But, in order to plan for those needs, the owner needs to identify the capital components, establish an expected life of the components, track repairs, maintenance, upgrades performed during the life, establish protocols for inspections during the life, modify the life expectancy based on condition and plan for the eventual replacement or rehabilitation of the component. Capital planning does not happen in a vacuum. The identification and scheduling of maintenance is performed through maintenance management. If it can have an effect on energy efficiency, then tracking performance is important. Many items involve custodial operations -- from being the on-site eyes to possibly changing filters or general cleaning. And finally, the proper training on maintaining the component has a large impact on whether the component meets, or possibly exceeds, the expected life. Below are steps and discussion on how to plan a school district's capital planning program, how to implement it, and how to sustain it into the future.

Planning

The first step in establishing a capital planning program is to identify what items the school district intends to include in its plan. Statute says electrical, mechanical, structural, and other components of facilities owned or operated by the school district; in other words, the physical buildings and grounds. This is the minimum to satisfy state statute, but a program that properly serves the school district should also include items like vehicles, grounds equipment, and other capitalized equipment. The planning part of the process is the most important part of establishing a capital planning program and needs to be thorough in the items to include. Under "grounds", is playground equipment included by components: play structures, swings, free standing slides, etc.? Should it also include paving and other hard surfaces? In mechanical, boilers and fans are obvious items, but consider pumps, VAV boxes, day tanks, expansion tanks, etc. As a school district begins planning it needs to establish the criteria of what a capital component is and what is not.

The next step in establishing the program is uniquely identifying a component from others in order to track its condition and work already performed. The identifying asset number for a

Capital Planning

particular object should be assigned in the maintenance management program. Some parts of the identifying number and the record keeping of the item should be able to include and sort by the following items that are important to capital planning:

1. Location (facility, room, etc.);
2. Date placed in service;
3. Make, model;
4. Life expectancy, date of replacement, and date of review;
5. Estimated cost of replacement;
6. All work orders including repairs, PM inspections. Include descriptions and costs; and
7. Date removed from service and identifier of replacement.

There is much more information that a good maintenance program should have available, but these elements are critical for effective capital planning. The first is obvious, recording what school a component is associated with, additionally, identifying a specific room is helpful to physically locate the component; sorting by school also assists in evaluating capital needs by facility. Date in service and a component's make and model helps to establish expected life and when a school district can anticipate future needs. Date of review is when school district personnel begin to review the history of repairs and preventive maintenance inspections to possibly adjust the date of replacement. The date of replacement shows that it is no longer in service and including the new component identifier tracks what replaced the item.

Capital Planning

Implementing a Capital Planning Program

Introduction

Now that all of the capital components and equipment have been identified, tagged, and put into the maintenance management program, the day-to-day (or year-to-year) part begins. As the components start to reach their expected life, capital planning begins to review the records of repairs and inspections and makes adjustments to the replacement schedule. An example of the flow of information and decision making is as follows:

Boiler 001 at school ABC was installed with the construction of the school in 1990. Part of its O&M information is that it is expected to be replaced at 30 years and reviews to begin at 25 years. In 2015, the maintenance program puts the boiler on the review list and capital planning begins review. As part of the review, capital planning reviews the scheduled inspections performed twice a year and the scheduled cleaning, maintenance, and tuning performed once a year. Also reviewed are all repair work orders for scope of repairs, frequency, and costs. The boiler condition is discussed with the boiler technician(s) and maintenance manager. After discussion, it is decided whether the replacement should be done sooner, at the scheduled date, or if the boiler is in a condition that its useful life can be extended. At the same time the cost of replacement is adjusted to reflect the current cost of replacement. Review is performed again at 27 years.

If an asset is not performing well and does not appear to be able to meet its expected life, the technicians doing repairs and inspections can request an earlier review of the asset. The process of review starts and, if needed, a new replacement date is assigned and planned for.

After all scheduled reviews are performed, a report is produced by facility that shows replacement needs for the next six years and the expected costs. The person(s) deciding on the final six-year capital improvement plan review the replacement report and put together projects for the plan that may combine related items or stand alone as a single project. In the example above, all three boilers are scheduled for replacement and one project is put forward for boiler replacements; it may include other equipment reaching replacement age, like pumps, expansion tanks, etc.

Capital Planning

Sustaining a Capital Planning Program

Introduction

As a school district's capital planning program matures, there will be upgrades, component replacements, new facilities, and maybe facilities being removed from the school district. Planning the process of managing the data for these instances will help to smoothly update the system. One challenge is when an asset is transferred from one facility to another. This is usually capitalized equipment that can be easily moved like vehicles, grounds equipment, or educational equipment such as smartboards. Scheduled PM inspections should catch that the equipment is not where it should be per the asset record. Once the asset is located, it can be reassigned in the record or returned.

Another situation is where an asset has reached its end of useful life and is not of a value to be considered a capital improvement project. An example would be a replacement of a heat circulation pump with a value of a few thousand dollars plus labor. When writing a work order for replacement, either to be performed in-house or by contractor, it is best to assign the new asset number in the work order and order both the pump and asset tag. When the work is complete, the out-of-service date is registered with the old asset and a placed-in-service date is registered to the new asset. The O&M manuals can be electronically made part of the new asset's file and the preventive maintenance schedule can be initiated.

HELPFUL HINT

Involve consultants in the asset replacement strategy

During design identify assets being replaced and assign the new asset numbers and include them in the equipment schedules. Example:

BOILERS

ID	Old asset Number	New Asset Number	Manufacturer/Model	In Service
B-1	03MC02OB01	03MC02OB03	Wiel-Mclain Model 886	6/02/1990
B-2	03MC02OB02	03MC02OB04	Wiel-Mclain Model 886	8/21/2018

This shows that the asset being retired is identified and the new asset number is assigned. For new construction, only the new asset number is shown.

When a large project replaces many assets, it is best to start early in planning and design stages to coordinate asset replacement strategies. At this point involving the consultants, the maintenance management, and capital planning will make the process smoother. Capital planning and the consultants identify which assets are being replaced and maintenance management assigns the new asset numbers and prepares the old assets for retirement in the system. As the project begins, the contractor submits documents on the proposed replacement/new assets. During submittal review, if the submittal is approved, maintenance management inputs data on make/model, preventive maintenance schedule, maintenance parts, and expected life from the submittal documentation. When O&M manuals are provided electronically, the manuals can be attached to the asset file in the CMMS.

Capital Planning

Capital asset management is not a stand-alone operation. It takes coordination with maintenance management, maintenance technicians, maintenance managers, and the committee that creates and reviews capital improvements.

[BELOW ARE POTENTIAL AREAS OF CONTENT UNDER CONSIDERATION]

TOOLS -

1. Six-year plan: Department has basic template for use in documenting project priority, category, name/scope and cost.
2. DEED provides a basic spreadsheet tool (the Renewal and Replacement Schedule) to assist school districts in capital planning. It identifies 26 systems, calculates basic life expectancies, and estimates costs based on facility value (typically insurance appraisal value). Discussion of the plan should also include identification of funding sources. Projects anticipated to be funded with state aid will have a school district match component; what is the intended funding stream for the school district portion of the project costs? If all projects in first year of the six-year plan were to receive funding, will the school district be able to provide its required match?
3. TIPS for presenting to the school board or capital planning committee.
Not helpful to only have “emergent districtwide” projects. (In “compliance” area of Preventive Maintenance Handbook, note that application scores may be marked down in “capital planning” if no specific out-years projects are identified.)
4. STATUTES
Specific statute, AS 14.08.101(7), requiring school board approval of six-year plan.

Additional Considerations

Managing Contracted Staff and Privatized Activities

[Content to be developed.]

Evaluating Your Maintenance Program

[Content to be developed.]

Environmental Safety

[Content to be developed.]

—remain as good as new for as long as practicable?”

Portable Devices in the Maintenance Work Flow

[Content to be developed.]

Electronic Operations & Maintenance Manuals

[Content to be developed.]

Notes

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Appendix A

Sample Systems and Components Inventory List

Foundation and Substructure

- Footings
- Foundation walls
- Slab/beams on grade
- Piling/Posts
 - thermopiles
- Reinforcing
- Connectors
- Waterproofing
- Insulation
- Underdrains

Superstructure

- Columns
- Beams
- Rigid frames
- Floor structure
 - joists
 - deck/slab/sheathing
 - ramps
- Roof structure
 - trusses
 - deck/slab/sheathing
- Monolithic bearing walls
- Stairs and railings
- Structural bracing
- Welds/connectors

Exterior Wall Systems

- Wall construction
- Cladding/sheathing
- Doors
 - frame
 - door unit
 - hardware
- Glazing systems
 - frame
 - glazing
 - hardware
 - curtain walls
 - storefronts
- Balcony walls/railings
- Louvers and screens
- Expansion/seismic joints
- Insulation
- Protective coating
- Sealants

Roof Systems

- Roofing
- Insulation
- Paving and ballast
- Curbs/supports
- Expansion/seismic joints
- Drains, gutters and d.s.
- Drywells
- Flashing and trim
- Fasteners
- Snow stops
- Roof openings

Interior Construction

- Fixed partitions
- Demountable partitions
- Retractable partitions
- Doors
 - frame
 - door unit
 - hardware
- Glazing systems
 - frame
 - glazing
 - storefronts/entrances
- Interior finishes
 - carpet
 - resilient tile/sheet
 - ceramic/clay tile
 - terrazzo
 - paint
 - vinyl/fabric wall cover
 - wood
 - metal panels
- Ceiling system
 - suspension grid
 - acoustical units
 - soffits (metal/gyp.)

Specialties

- Toilet partitions
- Display boards
- Projection screens
- Display cases
- Lockers
- Flag poles

Appendix A

Sample Systems and Components Inventory List

Conveying Systems

- Elevators
- Moving stairs/walks
- Dumbwaiters
- Pneumatic tube
- Lifts(material/personnel)

Heating Systems

- Boilers
- Furnaces
- Burners
- Fuel tanks & distribution
- Heat transfer equipment
 - heat exchangers
 - coils
- Terminal/package units
- Fin tubes/radiators
- Heating accessories
 - dampers/draft control
 - breeching and ductwork
 - stacks
 - insulation
 - piping
 - valves

Air Handling Systems

- Air handling units
- Unit ventilators
- Fans
- Inlets/outlets
- Ducting systems
 - dampers
 - filters
 - mixing boxes
 - sound attenuators
- Humidifiers
- Dust collection systems

Cooling Systems

- Condensing units
- Compressors
- Heat exchangers
- Packaged A/C units
- Chillers
- Absorption units

Mechanical Controls

- Compressors
- Pneumatic valves/levers
- Pneumatic tubing
- Electronic controls

Plumbing Systems

- Cold water piping
- Water heater
- Hot water piping
- Pumps
 - sewage lift
 - water booster
 - circulating
 - sump
- Valves and traps
- Insulation
- Plumbing fixtures
 - sinks and faucets
 - toilets/urinals
 - coolers/drinking fountains
 - exterior hose bibs
- Waste vents
- Waste piping
- Septic tanks

Fire Protection/Suppression Systems

- Sprinkler piping
- Backflow preventers
- Sprinkler heads
- Fire extinguishers
- Fire hose system
- Standpipe connection
- Fire pumps
- Grease hood extinguisher

Power Generation and Transmission

- Generators
- Engines/turbines
- Transfer switches
- Transformers
- Service wiring
- Substation
- Switchgear
- Bus ducting
- Overcurrent protection

Appendix A

Sample Systems and Components Inventory List

Power Distribution Systems

- Main distribution panel
- Wiring
- Conduits
- Raceway
- Cable trays
- Distribution panels
- Electrical receptacles
- Circuit breakers
- Baseboard heaters
- Motors/fans
- Heat trace

Lighting Systems

- Fixtures
 - fluorescent fixtures
 - incandescent fixtures
 - HID fixtures
- Wiring
- Lighting panels
- Emergency lighting
- Standby lighting
- Exterior lighting

Signal Systems

- Computer data
- Public address
- Television
- Telephone
- Clock system
- Satellite delivery system
- Fire alarms
- Fire door hold-opens
- Security alarm/devices

Landscaping Systems

- Irrigation
- Tree/shrub plantings
- Flower bed plantings
- Turf/lawn
- Walks/plazas

Playfields and Playground Systems

- Football fields
- Baseball/softball fields
- Hard surface courts
- Hockey/skating rinks
- Playdecks
- Swings
- Climbing toys
- Safety mats
- Gravel and containment
- Markings/painting

Vehicular Systems

- Parking lots
- Roads/drives
- Curbs
- Fire lanes

Site Utilities

- Fuel tanks
- Fuel distribution piping
- Storm drainage
- Fire hydrant systems
- Electrical power
- Pole-mounted lighting

Equipment

- Furnishings
 - classroom furniture
 - seating
 - rugs and mats
- Fixtures
 - window treatments
 - artwork
 - vending
- Equipment
 - waste handling
 - loading dock
 - parking equipment
 - postal
 - food service
 - woodworking shop
 - auto/engine shop
- Special construction
 - vaults
 - swimming pools
 - acoustical enclosures
 - raised computer flooring

Appendix B

Anticipated Life Expectancies (Renewal Schedule)

System Life and Cost Data Sheet

	System Life Expect
Site Improvements	25
Site Utilities	40
Foundation/Substruct.	50
Superstructure	50
Exterior Wall System	25
Exterior Windows	30
Exterior Doors	20
Roof Systems	20
Interior Partitions	50
Interior Doors	30
Interior Floor Finishes	15
Interior Wall Finishes	25
Interior Ceiling Finishes	25
Specialties	40
Conveying Systems	40
Plumbing piping	30
Plumbing Fixtures	30
Fire Protect./Suppres.	30
HVAC Distribution	40
HVAC Equipment	30
HVAC Controls	20
Electrical Serv./Gen.	40
Electrical Distribution	50
Electrical Lighting	25
Special Electrical	15
Equip and Furnishings	25

Appendix C

Facility Funding Formulas

[To Be Developed]

Appendix D

Checklists

District Preventative Maintenance Program Review

District:

Review Year:

Site Visit Date:

Item	Requirement	Approved	Comments
Maintenance Management			
A1	Provide copies of work orders of varying types and status.	☐	
A2	Report: Total maintenance labor hours collected on work orders by type of work (scheduled, corrective, operations support, etc.) vs. labor hours available—by month for previous 12 months.	☐	
A3	Report: Scheduled and completed work orders—by month for previous 12 months.	☐	
A4	Report: Number of incomplete work orders sorted by age (30, 60, 90 days, etc.) and status (deferred, awaiting materials, scheduled, etc.)—by month for the previous 12 months.	☐	
A5	Report: Comparison of scheduled maintenance work order hours to unscheduled maintenance work order hours—by month for previous 12 months.	☐	
A6	Report: Monthly trend data for unscheduled work orders showing both hours and numbers of work orders—by month for the previous 12 months.	☐	
A7	Report: Planned maintenance activity report—by facility for next 3 months.	☐	
A8	Report: Completed maintenance activity (work orders) including labor and material costs—by facility for previous 3 months.	☐	
Energy Management			
B1	Provide a written energy management plan.	☐	
B2	Reports: Consumption data for each building, each utility [e.g., fuel oil, electricity, natural gas, LPG, water, etc.]—by month for the previous 12 months.	☐	
Custodial Program			
C1	Provide a written custodial plan that is building-specific and describes both the frequency (schedule) and level of custodial care for each facility.	☐	
Maintenance Training			
D1	Provide a schedule of planned training for both custodial and maintenance personnel—for the current or upcoming school year.	☐	
D2	Provide a record of training describing type and duration of training—by individual for current school year.	☐	
Renewal and Replacement (R&R) Schedules			
E1	Provide a Renewal/Replacement Schedule (detailed to at least EED's 26 systems) for each permanent building over 1000sf.	☐	
E2	Provide information that supports that the data in the R&R schedules was developed based on system condition assessments.	☐	
Fixed Asset Inventory System (FAIS)			
F1	Report: Report of fixed asset, date acquired, location and estimated period of service.	☐	

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Appendix D

Checklists

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Page 1

(a) For a district to be eligible for state aid under AS 14.11.011, the chief school administrator of the district must certify, on a form provided by the department, that the district has, and is in compliance with, a facility management program that addresses the following five elements of facility management, including maintenance management:

(1) a maintenance management program that is a formal system that records maintenance activities on a work order basis and tracks the timing and costs, including labor and materials, of maintenance activities in sufficient detail to produce reports of planned and completed work;

Mandatory

- ☐ Show that your system for can recording all maintenance activities on a work order basis and how a work order is handled from its creation to completion?
- ☐ Show your maintenance personnel performed no activities this week or this month not recorded on a work order?
- ☐ Show a record of your work orders that track all of your maintenance activities according to typical categories such as preventive, routine, emergency and operations?
- ☐ Generate a report of your planned maintenance activity for the next quarter that shows the timing (i.e., schedule) and anticipated costs, including labor and materials, of that work?
- ☐ Produce a report covering the previous three months of all maintenance activities and their costs, including labor and materials broken out by typical maintenance categories such as preventive, routine, emergency and operations?
- ☐ Show a report of planned versus completed maintenance activity for each facility by work order?

Best Practice

- ☐ Show that assets are identified for tracking purposes to the component level?
- ☐ Demonstrate how the data collected is used in the day-to-day management program?

(2) an energy management plan that includes recording energy consumption for all utilities on a monthly basis for each building;

Mandatory

- ☐ Produce a monthly record of energy consumption for each utility by building?
- ☐ Demonstrate that each building over 1000 square feet is separately measured each month.
- ☐ (If this is not practical at every site, tell what you do instead.)

Appendix D

Checklists

4 AAC 31.013 PREVENTIVE MAINTENANCE AND FACILITY MANAGEMENT COMPLIANCE TEST

Page 1

Best Practice

- ☐ Show comparison of energy consumption in each building over multi-year period.
- ☐ Identify causes of increased or decrease energy consumption.

(3) a custodial program that includes a schedule of custodial activities for each building based on type of work and scope of effort;

Mandatory

- ☐ Produce a copy of your written custodial plan at each site showing a schedule of custodial activities?
- ☐ Show that your plan for each building includes the type of work (i.e., the activity needed for each surface or equipment item) and the scope of effort (i.e., the frequency of care for each type of work)?

Best Practice

- ☐ Demonstrate the district's plan has been made available to all custodial staff, principals, and management personnel?
- ☐ Demonstrate how the plan transfers to custodial work being done at the site?
- ☐ Show that the program has included in a scope of effort the quantity (e.g., square feet of carpet, number of toilet fixtures, etc.)?
- ☐ Custodial plan shows areas of each custodians responsibility.

(4) a maintenance training program that specifies training for custodial and maintenance staff and records training received by each person; and

Mandatory

- ☐ Show a written training plan or training schedule that addresses annual training goals?
- ☐ Produce a schedule of planned training for the coming year?
- ☐ Produce a record of training activities by individual custodian and maintenance staff?
- ☐ Show training records for last year?

Best Practice

- ☐ Track maintenance training through work orders on CMMS?

Appendix D

Checklists

4 AAC 31.013 PREVENTIVE MAINTENANCE AND FACILITY MANAGEMENT COMPLIANCE TEST

Page 1

(5) a renewal and placement schedule that, for each school facility of permanent construction over 1,000 gross square feet, identifies the construction cost of major building systems, including electrical, mechanical, structural and other components; evaluates and establishes the life-expectancy of those systems; compares life-expectancy to the age and condition of the systems; and uses the data to forecast a renewal and replacement year and cost for each system.

Mandatory

- ☐ Provide a Renewal & Replacement (R&R) Schedule for each permanent building over 1000 square feet in size?
- ☐ Demonstrate that major building systems are identified at least at the level of the 26 systems used on the DEED renewal and replacement schedule?
- ☐ Show information that supports the data in the R&R schedule was developed based on on-site assessments?

Best Practice

- ☐ Show how these schedules are being used by the district to formulate capital plans?
- ☐ Show, for buildings with major additions of different ages, that separate R&R schedules have been created?
- ☐ Demonstrate that the R&R schedules are updated each year?
- ☐ Provide a site-by-site or districtwide forecast of renewal cost by fiscal year?

Appendix E

Definitions

Component

A part of a system in the school facility.

Component Repair or Replacement

The unscheduled repair or replacement of faulty components, materials, or products caused by factors beyond the control of maintenance personnel.

Custodial Care

The day to day and periodic cleaning, painting, and replacement of disposable supplies to maintain the facility in safe, clean and orderly condition.

Deferred Maintenance

Custodial care, routine maintenance, or preventive maintenance that is postponed for lack of funds, resources, or other reasons.

Major Maintenance

Facility renewal that requires major repair or rehabilitation to protect the structure and correct building code deficiencies, and shall exceed \$25,000 per project, per site. It must be demonstrated, using evidence acceptable to the department that (1) the school district has adhered to its regular preventive, routine and/or custodial maintenance schedule for the identified project request, and (2) preventive maintenance is no longer cost effective.

Preventive Maintenance

The regularly scheduled activities that carry out the diagnostic and corrective actions necessary to prevent premature failure or maximize or extend the useful life of a facility and/or its components. It involves a planned and implemented program of inspection, servicing, testing and replacement of systems and components that is cost effective on a life-cycle basis.

Renewal or Replacement

A scheduled and anticipated systematic upgrading of a facility system or component to rehabilitate it to a renewed functioning standard.

System(s)

An assembly of components created to perform specific functions in a school facility, such as a roof system, mechanical system or electrical system.

Note: The above definitions are those adopted by the Bond Reimbursement and Grant Review Committee 4-18-97.

Appendix F

Bibliography of Maintenance Publications

[To Be Developed]

Appendix G

Standard for a Clean Classroom

[To Be Developed]

Appendix H

Master Custodial Schedule

[To Be Developed]