Alaska School Facilities Preventive Maintenance & Facility Management Handbook

State of Alaska - Department of Education & Early Development
Finance & Support Services / Facilities

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Background

The primary focus of the original (1997) 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 (DEED) 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 a mere 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 legislation 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 genesis of the preventive maintenance program at DEED and the main factors which came about to justify its existence. It was imperative then, and continues today, that the department and districts collaborate to move all districts beyond a point—real or perceived—of perpetual "breakdown maintenance" and "fix-it" capital expenditure. We must jointly move to integrated, sustainable, best-practice facility care and management. This type of maintenance and facility management is beneficial to the taxpayer, to 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 14.11.100).

> 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;
> (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.

AS 14.11.100

(j) Except as provided in (l) of this section, the state may not allocate money to a municipality for a school construction project under (a)(5), (6), or (7) of this section unless the municipality complies with the requirements of (1) - (5) of this subsection . . . . In approving a project under this subsection, and to the extent required under (a)(8) - (17) of this section, the commissioner shall require . . .

(5) 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;

(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; and

(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 following 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 affect 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. A district requesting capital funding for both school construction and major maintenance projects 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 or AS 14.11.100, 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

(A) the recording of energy consumption for all utilities on a monthly basis for each building; for facilities constructed before 12/15/2004, a district my record energy consumption for utilities on a monthly basis when multiple buildings are served by one utility plant; and

(B) regular evaluation of the effectiveness of and need for commissioning existing buildings;

(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) The department will make a determination of a district's compliance with each element required in (a) of this section, based on evidence of a program acquired by the department, including information gathered by the department during an on-site visit conducted under (f) of this section. The department may change a determination at any time during the year based on new evidence. For purposes of eligibility for an application submitted under AS 14.11.011, on or before June 1, the department will provide preliminary notice of its determination. Districts that are not in full compliance must provide evidence of compliance to

the department 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 will conduct an on-site inspection of school district preventive maintenance and facility management program at least once every five years; however, if the department issues a finding of noncompliance under (e) of this section and the district does not provide adequate evidence of compliance, the department may postpone an onsite visit beyond the five-year period. The department may make additional inspections as it deems necessary. The department may change its determination of compliance based on information obtained during an on-site inspection.

(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.

(h) Notwithstanding (e) and (f) of this section, the department may make a determination of provisional compliance for a district that provides evidence of a plan that meets all required elements identified in (a) of this section but does not provide documentation of adherence to that plan. A determination of provisional compliance will allow a district to be eligible for state aid until a final determination of compliance or non-compliance is provided.

Facility Management Overview

Facility Management as a Strategy

Overview

The preceding Background section summarized the beginnings 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. Since its inception, nearly 100% of Alaska's school districts have achieved compliance in meeting minimum standards. In fact, only a single district out of 53 has not met the state's minimum standards for maintenance and facility management of school facilities at some point. 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, and through the date of this edition, multiple school districts lost certification (some have regained it) and nearly 15 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 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 availability, through integration and district-level 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.

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 operating, maintaining, repairing, and replacing components and systems for optimal results. Such a process addresses facility issues 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. Processes for implementing a comprehensive facility management program are heavily dependent on actionable data and 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 Integration

Whole-building preventive maintenance was the threshold step for Alaska's school districts on the path toward life-cycle, cradle-to-cradle, 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 though an effective facility management program. They all work hand in hand to extend the life of, and renew, 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

Introduction

"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

[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* (https://nces.ed.gov/forum/pub_2005801.asp) and the *Forum Guide to Taking Action with Education Data* (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* (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* (https://nces.ed.gov/forum/pub_2013801.asp).

the life of capital resources, and help decision makers become more transparent and accountable to education stakeholders." [2]

[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 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

Initial commissioning (often abbreviated Cx) occurs as part of the construction project close-out and the handover of an education facility to the owner—be that the city/borough or the school district. "Commissioning ensures that the new building operates as the owner intended and that building staff are prepared to operate and maintain its systems and equipment." [3] The scope of work included in commissioning, along with the entities involved, is a matter of contractual agreement and can vary from project to project. A key feature of any commissioning agreement should be the involvement of those who will be operating and maintaining the facility.

The department recognizes the need for commissioning within the following building systems: mechanical, electrical, controls, bulk fuel, and building envelope. Much of the commissioning effort will be to optimize the inter-relation of components within these systems but there will also be cross-system coordination which is needed such as when occupancy sensors might control both lighting and ventilation systems. Because of this cross-discipline need, utilizing a certified commissioning agent is required on certain school capital projects with state-aid. An updated list of approved commissioning agent certifications is available on the department's publication webpage.

Retro Commissioning

Retro commissioning (RCx), also known as existing building commissioning (EBCx) can generally be expected to yield a positive payback after approximately five years of building operations. It may also be appropriate to conduct retro commissioning at any time on a building which never received initial commissioning. Most energy service companies (ESCOs) make it a practice to include a retro commissioning piece in their energy savings performance contracts. The basis for this is the relatively safe assumption that most, if not all, existing buildings are not performing optimally with respect to their energy performance.

During the portions of the building life-cycle that follow project delivery—i.e., operations, capital asset management—buildings, and building uses, change. Equipment is added, school populations grow and shrink, and space utilization is altered. These and other changes can render previous systems and settings ineffective. For good cause, and often for inappropriate reasons, building control systems are bypassed or overridden by maintenance personnel. Reasons for temporary overrides can be forgotten, resulting in systems operating outside of the original parameters. Retro-commissioning, done well, can account for these building changes and can recalibrate building performance.

Example/Vignette

Initial Commissioning: The School District of Greenville County, South Carolina, decided to undertake a massive building program to replace or renovate over sixty schools district wide. Due to the size of the program, limited maintenance resources within the district, and a long history of taking ownership of new buildings that didn't work, the school district and the program manager decided to fully commission the MEP systems on all of the projects.

An experienced commissioning agent (CxA) was selected to provide the commissioning services. The first task was to help the district achieve consistency in design and ensure conformance with the design guidelines through design reviews at the schematic, design development and construction document phases. Monthly commissioning visits were made to each job site during construction to review the work in progress and to monitor compliance with the contract documents.

The commissioning teams prepared pre-commissioning check lists and functional performance tests for all of the installed equipment. Prior to functional testing the systems were balanced and the test and balance reports were validated through random sampling techniques. After conducting all of the functional testing, the commissioning agents organized all of the owner training which was videotaped for future reference by the District. The final reports were scanned to CDs along with drawings, O&M manuals, T&B reports and shop drawings. The files are loaded on the school district servers so the maintenance data can be accessed by computer from anywhere in the district.

The school district is following this effort up with a performance review designed to yield a repository of lessons learned.

The XYZ School District has completed several state-of-the-art new schools and renovation/additions since 2005 and has several more in the pipeline. On the XXX School project, the district . . . .

Lessons learned include:

Retro Commissioning: DBR Engineering Consultants was hired to perform retro-commissioning for a public school district in Texas. The project was a 396,000 sf high school that was constructed 15 years prior to the project. The scope was limited to the HVAC system and associated controls. The process lasted for five months and included functional testing over a six

week period which identified 155 issues in 17 categories. The estimated energy savings that could be realized by implementing the identified energy conservation measures was 41%. All this even though the school was less than 15 years old and had received good maintenance over that time period.

The XYZ School District has implemented retro commissioning on it XXX School project, the district . . . .

Lessons learned include:

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 components and systems. 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;
- 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 use these reports to better understand their maintenance management program and to track the results generated by 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 is a plethora of computer programs on the market that are specifically designed for such purpose; these are known as 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 on facilities, their maintenance needs, and the organization's maintenance practices.

Early generations of CMMS consisted of software which was locally installed and hosted on district computers. Data storage was also local. Some of these systems were network compatible, making them useful for organizations where access to the system could not be centralized at one location or functional area. With the advent of 'cloud computing', many CMMS service providers developed business models which involved hosting customer facility and maintenance data on their own servers and providing a web-based user interface. Both of these delivery models remain available to organizations with the hosted-data model being prevalent in most Alaska districts. For a peek into history, see the pop-out for how CMMS worked in the 'good old days'.

Historical Management Systems

Modern CMMS have 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 now seems crude, it could possibly still meet minimum requirements of the department for 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—especially one specifically designed for school districts—is measurable and all but mandatory.

With the rise and almost universal market penetration of the software-as-service business model, most CMMS include an initial purchase fee (which can include software, hardware, installation, and set-up costs) and an annual service or maintenance fee. While selecting a suitable CMMS to meet the needs of their school district, school officials should be aware there are many options. Most vendors offer modules targeted at specific functions such as space management, fleet management, and inventory management, many of which are neither required by statute or

regulation nor useful to the school district. Marketing personnel within CMMS vendors 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 companies, after a successful marketing push, 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 department's PM State of the State, published annually by June 1 and finalized not later than August 15, includes data on each school district's CMMS tool.

Identification of Facilities, Systems, and Components

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

In order to do so, someone will need to inventory and categorize systems and components maintained by the school district in each of the school facilities that the school district maintains. Vendors and a variety of consultants are willing to perform this task if district personnel are unable to. 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. Part of this data entry will be development of an asset naming convention (see pop-out).

Asset Naming & Equipment IDs

"A little forethought at the start can save a lot of time in the future"

Creating an asset naming convention within your CMMS normally involves both an asset name and an asset ID. Asset names can usually be normal, descriptive text titles (e.g., Generator, Diesel Standby 200KVA Cummins). The problem comes when there are multiple instances of that same asset within the universe of assets managed within the CMMS. An asset ID, on the other hand, is a unique identifier—only one asset has that specific ID. Asset ID's, or equipment tags, are often cryptic combinations of text and numbers that include indicators tying the asset to industry classification systems and types, to particular facilities, to locations within that facility and to the quantity of that particular asset. Asset naming doesn't have to be complex but it must always be consistent and logical. Standardized naming conventions also aid in data reporting and analysis. Come up with a useful naming convention before you go live with your CMMS system because it can be difficult to change later.

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 fire alarm panel, 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 Surveys*, 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.

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 component 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.

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, and author, in the field of facility planning, 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).

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.

Implementing a Maintenance Management 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.

The Need for Sustainability

Revisions to the maintenance plan must occur over the life-cycle of the facility. Other examples driving this change 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. For additional discussion on Sustaining a Maintenance Management Program, see page 23.

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 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. These organizational structures are variations on how best to accomplish the work that is identified in the component needs-based maintenance assessment. This approach to organizational structure—one that examines the necessary maintenance work and builds an organization structure to match—is often overlooked.

Another driver for determining organizational structure is management. This strategy asks the question, "How can the maintenance management resources best be managed?" The expectation is that from good management will follow good maintenance. Most of the management approach structures can be distilled to supporting, or describing, three approaches: centralized, decentralized (or zone maintenance), and hybrid.

Taken together, the combination of organizing personnel to accomplish necessary tasks, and organizing personnel for effective management is most likely to yield a comprehensive maintenance management implementation. There are many resources which can assist a district in implementing an organizational structure. Textbooks have been written and many trade periodicals run at least one if not multiple articles in any calendar year dealing with maintenance organization.

Scheduling and Assigning Work

The heart of any maintenance management program is scheduling and assigning specific maintenance tasks, and tracking the completion of those tasks. In addition, it is best practice to be able to account for all available maintenance hours and to measure time on task and other productivity and utilization metrics. This element of the maintenance management program takes the work items developed for each component and assigns them to the appropriate maintenance craftsperson or team according to the established structure and schedule.

This is accomplished through the CMMS. Once pertinent data is entered into the database system, work orders detailing the scheduled maintenance requirements can be generated and tracked along with all unscheduled work and categories of ancillary work such as training, education support, mail runs, etc. More advanced CMMS programs have an integral query feature which prompts maintenance managers for necessary input and provides industry standards for certain maintenance tasks. It is estimated that there are more than fifty suppliers of maintenance software packages with price variations based on need and capacity. Maintenance magazines and the world-wide-web are good locations to look for these products.

Intentional & Directed

In a roundtable of school maintenance directors, one mentioned an increased awareness of the need to be intentional in the scheduling and management of maintenance efforts. For this district, it appeared that the more workable way to achieve that goal was to bring maintenance scheduling to a more centralized location. For others, site-based management of maintenance is the norm and allows local flexibility in scheduling work. In a site-based organization, the site administrator, or principal, needs to understand the level of importance to be given to scheduled, preventive maintenance.

Most routine maintenance and some preventive and corrective maintenance can be accomplished with very little planning. Often the only planning needed for these is the creation of a work order and assigning/scheduling the work. However, more complex PMs and most corrective

maintenance work requires intentional planning—especially when tools or materials are needed that can't be drawn from common stock. There are also labor considerations. Large corrective maintenance efforts, which can involve component or partial system replacements, often require more than one trade or maintenance skill-set. Understanding these needs and taking action to meet them is the activity of maintenance planning. Large maintenance organizations may find it necessary to establish dedicated planning positions. Where that isn't the case, it's common for a maintenance supervisor or manager to assume that role—sometimes to the detriment of the organization when priorities for time clash.

Planning for complex maintenance work is best approached as a shared task. If there is a need for planning, it's because multiple skills and specialized materials are needed. Even the dedicated planner mentioned earlier isn't a solo performer. That person gathers information from others on factors such as labor projections and material needs in order to develop the plan. In the absence of a dedicated planning function, set up a planning meeting and let the key players share in the task of creating the plan. Reach outside of maintenance to include procurement and business office personnel when materials purchases and logistics are involved. Identify a lead entity to track the plan if it looks like multiple meetings will be needed to develop a successful plan.

Reporting Systems and Feedback

In addition to automating the list of items needing scheduled maintenance, most maintenance management software programs also provide the capability for a computerized building data file. This database of facility requirements can be used to generate a wide variety of accurate reports on matters related to building maintenance and operations and the associated costs. To a certain extent, an integrated maintenance system that incorporates both daily maintenance tasks and long-range planning depends on an automated database of facility information. Effective preventive maintenance programs depend on feedback from maintenance personnel and a reporting/tracking system of costs associated with the preventive maintenance effort. This information is used to maintain the proper balance between preventive maintenance and renewal and replacement efforts (i.e., determining when costs have increased to the extent that preventive maintenance on a system is no longer effective on life-cycle basis).

Through a combination of informal evaluations and formal audits, a reporting system should be established to analyze a district's maintenance system to achieve the most cost-effective maintenance program. In addition to general feedback and reporting, district maintenance programs should undergo periodic evaluations of their effectiveness. This can occur both at the worker's task level and at the maintenance management level. Evaluations can be done either internally or through the use of an outside evaluation team. Maintenance management audits examine the functional program and generally consider the following four factors:

Productivity - the portion of a worker's time that is directly productive.
Performance - how well the individual is working, e.g., is work being completed as planned?
Work Quality - is the individual producing a satisfactory work product?
Priority - effective allocation of available time to the most important tasks. [1]

Though maintenance management audits may look at symptoms of ineffective maintenance at the worker/task level (e.g. number of callbacks, work completed on schedule, etc.), a management audit's focus, as the name implies, is on improvements through better management.

Sustaining a Maintenance Management Program

Introduction

Why do maintenance management programs falter, and even fail, over time in Alaska's school districts? The answers to this question may be many and complex, but one over-arching response may be able to encompass the myriad of reasons. Here it is: Maintenance management practices are not sufficiently integrated in, and indispensable to the district's core operations. This section of the handbook describes some key elements in the building lifecycle, which district leadership should use to weave maintenance management into the essential fabric of the district's operations. They in include: performance metrics, budgeting and staffing, software upgrades, and evaluations, inspections and education.

Performance Metrics

Budgeting and Staffing

Software Upgrades

Evaluations, Inspections, & Education

Energy Management

Developing an Energy Management Program

Introduction

Department regulations for energy management require:

> *(2) an energy management plan that includes*
>
> *(A) the recording of 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; and*
>
> *(B) regular evaluation of the effectiveness of and need for commissioning existing buildings;*

The baseline requirement in *(2)(A)*—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.

Energy Management Plan vs. Policy

An energy management plan is a comprehensive documents 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).

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, roles and responsibilities, etc.), the energy consumption records are specific, and unique to each building. As defined in the regulation, the energy plan needs to include recording energy consumption on a monthly basis for each building. Energy consumption recording must comprise all school district energy utilities such as heating fuel, steam, natural gas, liquid propane (LP) gas, recovered (waste) heat, electricity, wood, and coal. Non-energy utilities such as potable water, wastewater, refuse, etc. can be equally important to track in school districts but are not required under the regulation.

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 (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.

The utility consumption records only provide the core data for energy management in a school district. This data needs to be monitored and used to guide energy management processes and to achieve energy use goals. In recognition of this need, subsection *(2)(B)* was added to the minimum requirements for a qualifying energy management program in 2020. This subsection begins to address the additional factors that are needed to develop a more complete, effective energy management program. Such factors include purposes, objectives, goals, procedures, strategies, standards, benchmarks, assessments, education, incentives, and staffing These factors can be grouped into the major categories of: policy, data, objectives, strategies, and measurement.

Energy Policy

A policy or purpose statement regarding a school district's energy management program can be an effective anchor for the program, an important point of reference and statement of commitment. In its informative booklet, *Introduction to Energy Efficiency – A Guide to Managing Energy use in Public and Commercial Facilities*, the Alaska Housing Finance Corporation provides a well-developed framework for crafting an Energy Policy,

> **Energy Policy**
>
> An internal energy policy should state why the organization is committed to conserving energy and/or using it efficiently. Usually in the form of a paragraph, this piece outlines the purpose of the document such as conserving energy in the workplace, using energy more efficiently, reducing costs, reducing emissions, or showing environmental stewardship. Typically, this section also articulates areas of concern such as high and increasing energy costs, community sustainability, etc. (AHFC *Introduction to Energy Efficiency*, p.11).

A school district's energy policy should start at the school board level. The Alaska Association of School Boards (AASB) has developed the following recommended board policy, which can be edited to meet district needs:

BP 3511 ENERGY CONSERVATION

The School Board desires to reduce energy use in the district in order to help conserve natural resources and save money to support other district needs.

The Superintendent or designee shall establish energy use reduction goals, monitor energy consumption and encourage employees and students to conserve resources. The Superintendent or designee shall regularly inspect district facilities and operations and make

> recommendations for maintenance and capital expenditures which may help the district reach its energy consumption goals.
>
> The Superintendent or designee shall establish an energy management program sufficient to meet, at a minimum, the standards needed in order to qualify for state-aid for school capital projects under AS14.11.

An energy policy should answer the 'why' question regarding energy conservation but can also address 'what' and 'how' elements in broad direction-setting statements. In the AASB sample, the initial sentence sets out the purpose of an energy management program while the following paragraphs establish a few key provisions on what kinds of steps will need to be taken to achieve that purpose. These provisions are further developed in the Objectives and Strategies sections of the energy management program.

Energy Data & Information

Information and reliable data is the foundation of an energy management program. Good data provides proof that plan goals are being achieved and draws attention to areas that are lacking. Expanding out from the core information of energy consumption, additional elements and layers of data become important in the process of managing energy. Basic data like overall energy use by month for each building is required to evaluate overall performance, but tracking plan goals is made easier by including more detailed energy use. For example, consider tracking fuel use at each boiler or water heater separate from generators and from other facilities; tracking lighting separate from plug loads and separate from HVAC systems. Other examples are tracking unique features like alternate energy systems separately and measuring hot water flow in addition to total water usage. This level of detail allows setting goals such as reducing lighting energy by 10%, or improving boiler firing sequences, where a single building meter would not provide enough feedback.

Information about the building systems is equally important. Keeping good records of original designs, as-built conditions, and modifications to equipment and control systems is crucial to keep costs down in future renovations or troubleshooting high energy use. Future designers will spend less time figuring out what is there and what the systems are doing if they have access to good records of previous work. Similarly, re-commissioning or retro-commissioning is more cost effective if the commissioning agent does not have to reconstruct the original design intent by reverse-engineering the systems.

Building Automation Systems (BAS) make collection of large amounts of useful data fast and easy. Engineers and researchers prefer too much data over too little; tracking as much as practical is generally recommended. However, even handwritten logs of meter readings or redline markups of original drawings can have great value to the energy management program.

Energy Objectives

The objectives of an energy management program should flow out of the school district's energy policy. When developing these objectives, consider the primary influences on energy use such as building use by various occupants, energy production and transmission, building equipment and systems, and maintenance or custodial activities. While energy management objectives should cover the full spectrum of these, and other, energy use factors, it's helpful to

try and group similar objectives together so that the resulting list of core objectives is in the six to ten range. To help with this, try not to include specific activities such as "enter monthly bills into the energy tracking spreadsheet." That and similar elements will be developed as strategies and actions needed to support the energy objectives.

Here are examples of energy objectives, grouped by overall category, developed by various school districts in their effort to achieve their stated energy policy:

Building Occupants and Users

- Create a sense of responsibility among students, teachers, staff, administrators, parents, and community members.
- Include all building users as part of the energy conservation process.

Data Gathering and Management

- Monitor all energy consumption.
- Track, monitor and report district progress, and identify trends and opportunities for savings.

Operations and Maintenance

- Operate at optimal efficiency and avoid unnecessary costs associated with reactive maintenance practices and procedures.
- Reduce our district's overall environmental impact and provide a healthier and safer educational environment.
- To reduce energy costs by evaluating and choosing appliances and equipment that are more energy efficient.

Existing Building Assessments

- Understand energy use and opportunities for improvements to energy efficiency at all facilities.

New Construction

- Reduce future energy costs in new facility construction and renovation whenever feasible.

Energy Strategies & Actions

Energy objectives can best be attained by developing clear and actionable strategies and identifying specific supporting actions. It's often at this point in the program development that roles and responsibilities are established, and personnel assignments made. That work will be addressed in the following section **Implementing an Energy Management Program**.

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.
- Enter monthly utility records in a software program which is customized to monitor monthly energy usage. (Note: This is a collaborative process which will require close contact in between administrative personnel (e.g. personnel processing utility bills), maintenance personnel (e.g. personnel monitoring fuel consumption), and personnel responsible for the energy management program).
- Determine a benchmark year as the starting point for evaluating the school district's energy management efforts.
- Establish projected consumption and cost data. Projected consumption and cost data will be used to determine future energy upgrades and for budgeting purposes.
- Conduct annual rate review and utility bill analysis.
- Analyze monthly consumption data; track, monitor and review monthly utility bills and investigate and write work orders when consumption is outside of set parameters.
- Obtain and analyze load profiles including the power demand patterns of the highest energy-consuming schools in our district and look for load-shedding and/or load shifting opportunities.

Benchmarks and Measurement

No energy management program is complete without some type of feedback loop regarding effectiveness. Ideally, each energy strategy identified in support of the program's energy objectives would be measurable in some way. This need to measure returns us full-circle to the foundation of a good energy management program—information and data.

Following is an example of a specific energy strategy and its corresponding actions and measurement metrics:

Strategy: Implement water heating set points and guidelines for management.

Actions:

1. Perform PM inspections to identify leaks and check burners, gauges and pumps.
   Standard: 100% of hot water generators/heaters inspected annually; verify with CMMS report.
2. Annually flush water heaters to remove sediment from the system and increase heat transfer efficiency.
   Standard: 100% of water heaters flushed annually; verify with CMMS report.
3. Program water heaters for vacation shut-down to reduce unnecessary heating of water during extended vacation periods.
   Standard: 100% of water heaters programmed; perform annual PM check to ensure no changes occurred.

Measuring effectiveness can build support at all levels for continued implementation and prioritization of energy management programs. The following sample narrative, which was included in a energy program report, would not have been possible without measurement protocols:

Two recent school renewal projects at ABC and XYZ Elementary Schools have been very successful at reducing the utility usage. Both schools have seen a 60% reduction in electrical and natural gas usage/sq.ft. after renovations were completed. The cost/sq.ft. for gas and electric at XYZ decreased from $2.17/sq.ft. to $.69/sq.ft. ABC decreased utilities $2.08 to $.64/sq.ft. We are looking forward to seeing successful reduction comparisons for QRS Elementary School and Student Nutrition for the recent building envelope and heating system upgrades.

Benchmark and measurement elements of the energy management program also become essential elements in sustaining a program over time. This will be discussed in additional detail in the following section **Sustaining an Energy Management Program.**

As described above, there is overlap between the energy management plan and the preventive maintenance management program in regard 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 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.

Implementing an Energy Management Program

Introduction

The school board has *developed* an energy management program based on policy, objectives, and strategies; benchmarks have been established—now what? The responsibility that follows is to *implement* the energy management program. In a nutshell, implementation involves two essential steps: 1) committing resources, and 2) taking action. This section offers guidance on carrying out the developed energy management plan and establishes the importance of leadership; the key resources of knowledge, time, and funds; and, finally, executing an action plan.

Leadership

One of the more important components to implementing an energy management plan is simply to commit to the plan. Although—to a degree—energy management plan *development* can be accomplished at the school board-level by defining policy and identifying objectives, energy management implementation must be launched at multiple levels of leadership in the school district's structure. School district officials who engage their entire organization while committing to a cross-discipline team approach often reap optimal benefits. Cross-discipline leadership includes leaders in education delivery (i.e., the classroom), student leaders, leaders in facility operations and maintenance, custodial leaders, and leaders in school administration. More so than in any of the other four key areas of facilities and maintenance management, energy management program implementation only happens well when building users and building operators cooperate together in doing their part.

And finally, it is important for the leadership team to recognize all achievements made so that momentum is kept through the entire organization.

Resourcing the Plan

In multiple years of assessing school district energy management programs, the department has found that the resources needed are generally scaleable to the complexity of the district's operations. Said another way, whether a district serves a small student population and only has a few facilities that consume energy, or whether a district has thousands of students and hundreds of energy-consuming facilities, the resources of personnel, time, and funds are sufficient for a well performing energy management program. Large districts envy the simplicity of a few buildings with basic systems found in small districts, while small district crave the seemingly endless supply of resources and specialists available to large districts.

Knowledge

The cross-discipline leadership team needs to cover the energy program's necessary scope of knowledge. However, not every energy leader needs to know the number of BTU in a gallon of heating fuel or a chord of wood. Facilities and technical leaders may not need the skills to lead and inspire a room full of students, or a building full of instructional staff, on practical methods for energy conservation. A classroom instructor in an urban school may never need to know where their school's fuel tank is located much less how to measure its contents. Conversely for a

teacher, who also serves as the school administrator, in a remote location, this knowledge is indispensable. Within the *knowledge* element of resourcing are actions to provide training and raise awareness through communicating with stakeholders. When implementing the energy management program, identify the necessary elements of knowledge, and match that knowledge up with the personnel on the cross-discipline energy management team. The following bullet points will provide a good starting point for the elements of knowledge that are needed[4]:

- [see the glossary of the AHFC *Introduction to Energy Efficiency*] OR
- Management skills
    - Organizational and leadership skills
    - Change management skills
    - Contract management
- Financial and accounting skills
    - Risk management
    - Economics of energy management
    - Financing options, alternative financing
- Energy management knowledge
    - Energy fundamentals
    - Energy optimization fundamentals
- Technical knowledge
    - Mechanical and electrical engineering principles
    - Facility and industrial processes
    - Operation and maintenance practices and requirements
    - Awareness and understanding of new and existing technologies
    - Building automation and interoperability
    - Instrumentation and controls
    - Commissioning principles
    - Recommissioning
- Other knowledge and skill areas
    - Communication and interpersonal skills
    - Energy procurement
    - Performance contracting
    - Implementation costs
    - Product and service procurement

Time

There is no doubt that labor hours are needed to implement an energy management program and labor hours equals personnel. When implementing an energy management program, identify and assign needed tasks to appropriate personnel.

[4] *Source: Global Superior Energy Performance Partnership Report – 2013*

One way to wrap the preceding two resources together, knowledge and time, to implement an energy management program is to engage a person to serve as the district's Energy Champion. See the paragraph below for more information.

Funds

The final element that must be brought to the implementation step is funding. Primarily this will be tied to securing the necessary knowledge and personnel required to execute the program, to manage its daily, weekly, monthly, and annual cycles.

Executing the Plan

The development of the energy management program will inform the elements of the action plan. The creation of an action plan is a necessary tool which will act as a blueprint to guide and monitor the systematic approach to improved environmental performance. The action plan needs to focus on the scope and scale of goals, targets, roles, and resources. To promote success, the plan should be accepted by all areas of the facility that it addresses.

At this point in time, the next step is to implement the action plan. This step begins by raising awareness, building capacity, motivating staff, and tracking and monitoring progress. Continual feedback on successes achieved can help motivate stakeholders to continually improve.

Provide a brief list here of examples of effective feedback to stakeholders.

There also needs to be a means to assess the plan's performance. Regular evaluations of baseline objectives based on gathered data collection will reveal new opportunities to improve performance.

Goals need to be set to improve performance. The overall objectives should aim to reduce energy usage while maintaining adequate environmental controls. The development of effective goals will help govern possible future improvements.

A periodic progress evaluation of the energy management program will keep everyone informed on improvements made toward goal objectives. This is also a great time to review the action plan itself and to identify any efficiency measures that should be modified or added.

An Energy Champion

The responsibility of an energy champion is to advocate energy efficiency throughout a school district and encourage co-workers to adopt 'efficient' practices in both the workplace and in their everyday lives.

Typical characteristics of an energy champion include:

- The ability to create, drive, and promote internal awareness campaigns.
- Be knowledgeable and up to date on the latest environmental policies and regulations.

- Demonstrating a willingness to challenge others on their behavior.
- Displaying a passion for the environment.
- Leading by example within the workplace.

School districts with dedicated energy champions experience more robust performances in the implementation of their energy management program and in the execution of their energy management plan.

Incentives

Incentives can also play an important role as part of the energy management plan. Incentives can vary from tax credits, rebates, savings programs, etc. In some districts, energy savings are given back to stakeholders to help pay for student activities, etc.

Reporting & Feedback

The reporting of energy consumption reports if one of the primary evaluative tools that can help evaluate the overall performance of the energy management plan. Accurate and consistent data collection is a necessity. There's an expression that "people who don't value energy efficiency keep forgetting the numbers."

Notwithstanding the importance of energy consumption, the need to provide stakeholders with regular feedbacks on the performance of the district's energy management program can prove just as critical. Our most successful organizations keep all their stakeholders well informed as a key component to the overall success of the energy programs execution. This goes back to the team approach discussed previously.

Sustaining an Energy Management Plan

Introduction

Historically, school district energy management programs have existed at the opposite extremes of sustainment. By far, failure to meet the provisions of a certified energy management program is the leading cause of school district non-certification for Preventive Maintenance and Facility Management. At the same time, the department regularly encounters school districts that have a laser-like focus on managing energy cost and consumption—districts that initiate and sustain these programs without any encouragement from external sources. With the possible exception of custodial programs—whose results are regularly on display for all to see and critique—energy management programs offer the most intrinsic value to districts, and increasingly one of the most immediate values.

This section examines this somewhat confounding dichotomy by uncovering the most common pitfalls to a sustainable program and offers a focused solution, though one with many layers.

Common Pitfalls

Personnel Changes

Program is Not Internalized

Lack of Clarity on Requirements

Lack of Organizational Commitment

A fundamental aspect of an organization's energy management effectiveness is their commitment. While bottom-up support may influence executive management for a time as evidenced by demands for employee parking, break and office appointments, employee-driven calls for improved energy management are not effective. Managers approve employee perks often with an eye toward maintaining or increasing productivity. Energy management has no such recognized link.

To make executive management appreciate the importance of energy, its importance to the organization must be presented. In today's business world, no organization can function without adequate energy input. Improving energy management is crucial to increased profitability, decreased dependence on non-sustainable resources and reduced environmental impact. Too often energy is treated as a crisis problem that can be fixed and forgotten while core business issues require constant attention. This is unfortunate because energy management requires constant attention to be effective. Once energy is removed from a primary focus of attention, the organization will slip back into unsound management practices.

Insufficient Resources

Energy, as any other managed area, requires a commitment of resources to be effective. Resources are required to cover the cost of command and control (oversight) as well as the cost of energy management projects. In most organizations capital resources are reserved for core functions, and energy management is relegated to secondary status. This means that not only are there no funds for energy projects, but the resources to manage energy do not exist.

To effectively manage energy resources, its importance within the organization must be made visible and demonstrated by making energy a core value and delegating manpower, capital resources, and commitment.

Narrow Focus

In most cases the responsibility for energy management is centralized in a single functional area, such as engineering or maintenance. Employing a narrow focus limits the range of opportunities identified and fails to consider how an opportunity identified in one functional area may impact a different department. While the organization's technical expertise may exist primarily in one departmental area, energy opportunities are not limited to technological improvements and can include improved purchasing, operating practices, and maintenance. Widening the focus and participation in energy management will yield measurable improvement in the results.

Shifting Priorities

Effective management requires a sustained commitment to achieve measurable results. Too often, energy management is a passing fancy. When shortages occur or prices spike unexpectedly, energy becomes the crisis de jour and receives the full attention of the organization. Then when market conditions change, energy management is once again relegated to a minor concern. Because energy is used every day, it must be managed every day.

Employing a crisis approach to energy, or any other organizational concern, produces no sustained improvement and often results in resentment as organizational priorities are constantly changed. Effective management of energy requires a stable, committed staff to provide command and control, collect and analyze energy data, and implement energy management projects. A firm commitment to energy management must be demonstrated by providing adequate resources, and following a carefully planned strategy.

Lack of Energy Data

When the authority for energy is spread across an organization no one is responsible for its management, and no one has accurate data regarding the consumption, cost, and organizational energy efficiency. To achieve proper management, data on usage, demand, utility rates, average price, marginal price, and energy consumption per unit of output must be available and used to influence organizational decisions. Someone in the organization must be assigned responsibility to collect, analyze and report energy cost, consumption and efficiency information.

Results Not Sustained

Sustaining the effort in energy management faces the same concerns as shifting priorities described above. Too often, energy problems are handled with a crisis approach. After the perceived crisis passes or is superseded by other concerns, the effort devoted to managing energy is removed and placed elsewhere. Sustaining energy management efforts and results can only be achieved by instituting a recognized, stable management that defines a structure for managing energy within the organization.

Sustainability Solution(s)

Previously, this document established two principles for sustaining any maintenance or facility management program: 1) by integrating it with other operational practices of the organization, and 2) by making it sufficiently "visible" so that its absence will be missed (see pages 6-7). These strategies are as powerful in the area of energy management as in any other of the five core practices.

Integration

Visibility

Retro-Commissioning

" Building systems go out of tune, much like automobiles. In order to improve the EUI [Energy Use Index], which is similar to the miles per gallon in a car, building systems need to be re-commissioned every three to five years. "

Alaska Housing Finance Corporation. *White Paper on Energy Use in Alaska's Public Facilities*. November 7, 2012; p. 5.

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, master schedules, organizational structure, staffing, etc.), the specific 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, procedures, equipment, safety, and supplies.

Leadership

The custodial program is a tool, unique to each school district, customized to individual school facilities, 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)."***[l] [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.

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."

One common, and helpful, step in establishing and communicating a vision is to provide a mission 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?

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 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:

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

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 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, re-lamping, pest control, mail pickup/delivery, supplies inventory/stocking, directing 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."

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.

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 developing the custodial program is the *Master Custodial Schedule*. (see Appendix H). There are generally three elements considered when developing master custodial schedules: 1) service or task, 2) frequency, and 3) space use/type or location. In some master schedules, service/task and use/location are blended to help reduce duplication. Frequency of care, the element normally in the most prominent position in the schedule, is the backbone of the schedule. The most commonly used frequencies are: daily, weekly, monthly, annually, and as-needed. However, some plans add the additional frequencies of: nightly (if a day/night operation is used), semi-weekly, quarterly, semi-annually. Selecting appropriate frequencies is a balance of simplicity and effectiveness and should be indexed to the program's adopted Standard of Cleanliness. The format or organization of any particular custodial master schedule focuses on one of the three elements discussed previously. One focused on frequency will generally list daily tasks, followed by weekly tasks, then monthly, and so on. Types of tasks (e.g., vacuuming, or restocking) and space/locations (e.g., gymnasium, restroom) will be listed adjacent to each other as long as their frequency is the same. These are often presented as a matrix. A schedule focused on use/location will organize the schedule by areas or room types and list all the necessary tasks for that area and state the frequency as a suffix to each task. These types of schedules are most often presented in a 'paragraph' style. A third type focuses on stating

the essential tasks one time and then aligning those tasks to the applicable use/location in a matrix. In this last type, frequency is presented with symbols which are defined in a legend. All three structures have their positives and negatives. The sample *Master Custodial Schedule* (Appendix H) uses the space-use/location focus. This tool is also available on the department's Facilities web page as a spreadsheet file.

A customized schedule, one edited to include the specific needs of the facility, should be developed from the master custodial schedule. Once developed, it should be displayed in each custodian's workplace. This, and other ideas are more fully developed in the following section, **Implementing a Custodial Program**.

Implementing a Custodial Program

Introduction

At this point, the school board has *developed* a custodial management program based on policy, cleaning standards, and equipment; staffing requirements have been established—now what? The responsibility that follows is to *implement* the custodial management program. Implementation of a custodial program requires gathering and deploying resources you have identified in the planning stage. This section offers guidance on carrying out the developed custodial management plan and establishes the importance of resourcing the plan with of knowledge, funds, staffing, and equipment; and, finally, executing an action plan.

Resourcing the Plan

In multiple years of assessing school district custodial management programs, the department has found that the resources needed are . . ..

Knowledge

Funds

A key element that must be brought to the implementation step is funding. Primarily this will be tied to securing the necessary knowledge and personnel required to execute the program, to manage its daily, weekly, monthly, and annual cycles.

Staffing

There is no doubt that labor hours are needed to implement a custodial program and labor hours equals personnel. When implementing a custodial program, identify and assign needed tasks to appropriate personnel.

> Call out here to identify challenges of securing staff.

Equipment

Executing the Plan

The development of the custodial program will inform the elements of the action plan. The creation of an action plan is a necessary tool which will act as a blueprint to guide and monitor the systematic approach to improved school health and cleanliness. The action plan needs to focus on the scope and scale of goals, targets, roles, and resources. To promote success, the plan should be accepted by all areas of the facility that it addresses.

At this point in time, the next step is to implement the action plan. This step begins by raising awareness, building capacity, motivating staff, and tracking and monitoring progress. Continual feedback on successes achieved can help motivate stakeholders to continually improve.

> Provide a brief list here of examples of effective feedback to stakeholders.

A periodic progress evaluation of the custodial program will keep everyone informed on improvements made toward goal objectives. This is also a great time to review the action plan itself and to identify any efficiency measures that should be modified or added.

Reporting & Feedback

The implementation of a formal custodial performance feedback look is one of the primary evaluative tools that can help evaluate the overall performance of the custodial program. Include a variety of stakeholders to gather this input and strive to make it objective, non-personal, and non-threatening.

Evaluation Sample #1

Evaluation Sample #2

Sustaining a Custodial Program

Introduction

Previously, this document established two principles for sustaining any maintenance or facility management program: 1) by integrating it with other operational practices of the organization, and 2) by making it sufficiently "visible" so that its absence will be missed (see pages 6-7). Nowhere do these elements come so naturally to the forefront as in the area of custodial care. The year 2020 will likely be a benchmark for years to come on the integration of custodial programs into the core mission of schools. The heightened awareness of custodial protocols on occupant safety in the midst of the Covid-19 pandemic brought the facility professional responsible for this area to a seat at the leadership team table. So ingrained was a district's custodial program into school operations that schools literally could not open without an effective care and cleaning protocol against the virus that caused Covid-19. With regard to visibility, the custodial program, has always enjoyed the benefit of front-and-center awareness of all school users—whether students, staff, or the public. While these users may routinely bypass great custodial care without a thought or reaction, not so where that care is lacking. Unlike other facility programs, the custodial program is always on display; it's absence is nearly impossible to miss. This ensures a measure of sustainability.

Performance Metrics

Budgeting and Staffing

Evaluations, Inspections, & Education

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 "

There are two common problems found when evaluating districts maintenance training programs. The first is that there are many cases of no planning being done. This is usually due to not establishing a training plan with set dates and schedules to perform training. Without a plan, training is forgotten or put off until another time. The second issue is that increased HR training has begun to encroach on maintenance training. Even when there is a scheduled day, or days, of training, the non-maintenance training utilizes this time due to its convenience.

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 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.

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.

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 the first level of eyes-on for the maintenance program. They need to be trained on inspections 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 additional training should be provided. 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 how to operate the work order system (including asset numbering) and procedures for working in a school. A very successful method 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 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.

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.

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.

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 programing 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.

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.

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.

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.*

Of the five maintenance and facility management criteria outlined in regulation, the capital planning requirement is the longest; it uses the most words. In practice, however, it's been demonstrated that a single, relatively simple spreadsheet—for each facility—can accomplish all of the required elements. Most districts utilize the department-developed Renewal and Replacement Schedule spreadsheet file to document their capital planning efforts. Many districts, especially those being served by the Southeast Regional Resource Center (SERRC), have added functions to the department's basic tool. Two of those include: multiple linked worksheets to account for different ages and renewal cycles, and data updates following the completion of capital projects. That said, capital planning is so much more than simply managing renewal and replacement spreadsheets.

The most common deficiency in capital planning seen by the department during its site assessments is its lack of use. The required data can be produced but there is a starkly apparent lack of its relevance to district processes. While there is evidence that every district is doing some amount of capital renewal, little of it springs from, or is even related to, a cohesive plan. The impact of available capital planning data on district six-year CIP plans is noticeably absent. Moving from data to a program, from develop to implement is a challenge for districts of every size. Exacerbating the issue is value question, "What good does it do?" When there are economic issues that limit resources for capital renewal and deferred maintenance, it's not uncommon to develop the attitude that capital planning is efforts are wasted. This can prove to be shortsighted if and when funding becomes available and districts find themselves not in position for available funding. Even in times of lean funding, a capital renewal plan with prioritized needs based on data and metrics from a robust capital planning program can be of great value to building owners.

Planning

A school district cannot efficiently maintain their facilities through capital planning alone, nor can a school district manage and maintain 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-span of the components, track repairs and maintenance performed during the life of the components, establish protocols for condition assessment of components, modify the life

expectancy based on condition, and plan for the eventual replacement or rehabilitation of the component.

The first step in establishing a capital planning program is to identify what items the school district intends to include in its plan. Statute indicates 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 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.

Implementing a Capital Planning Program

Introduction

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.

Once 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 for each 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.

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	06/02/1990
B-2	03MC02OB02	03MC02OB04	Wiel-Mclain Model 886	08/21/2018

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

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.]

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Appendices

Appendix A

Sample Systems and Components Inventory List

The below listing aligns with the building system and component structure utilized in the department's *Guide for School Facility Condition Surveys*.

Vehicular Surfaces
- Parking lots
- Roads/drives
- Curbs/gutters
- Signage

Pedestrian Surfaces
- Walkways
- Plazas
- Boardwalks

Elevated Decks, Stairs & Ramps
- Elevated Boardwalks
- Elevated Playdecks
- Stairs/railings
- Ramps

Site Walls
- Retaining walls
- Decorative walls

Landscaping & Irrigation
- Turf/Lawn
- Planting/Beds
- Mulch
- Boulders
- Irrigation and controls

Fencing and Gates
- Posts
- Fencing
- Gates
- Vehicle Gates
- Bollards/Staples

Site Furnishings & Equipment
- Benches/tables
- Signs
- Flagpoles
- Planters
- Waste receptacles
- Bike racks

Playgrounds & Playfields
- Playgrounds
- Sports fields
- Hard surface courts
- Ice Rinks
- Playdecks
- Play structures
- Fall protection
- Markings/paintings

Other Site Improvements
- Sledding hills
- Snowmelt systems
- Water features

Freestanding Shelters
- Foundations
- Superstructure
- Enclosure
- Electrical components

Attached Shelters
- Foundations
- Superstructure
- Enclosure
- Electrical components

Support Buildings
- Foundations
- Superstructure
- Enclosure
- Mechanical components
- Electrical components

Water System
- Wells
- Tanks
- Pumps
- Piping/valves
- Treatment system

Sanitary Sewer
- Tanks
- Lift Stations/pumps
- Piping/valves
- Treatment system

Storm Water
- Piping
- Culverts
- Swales
- Catchments
- Fencing
- Treatment system

Fuel Systems
- Foundations
- Tanks
- Piping/valves
- Containment
- Fencing

Heating/Cooling Piping & Utilidors
- Piping
- Valves
- Insulation,
- Utilidors
- Vaults

Electrical Service & Distribution
- Poles
- Transformers
- Switchgear
- Conduit
- Feeders

Data/Comm Service & Distribution
- Conduit
- Cable/wiring
- Satellite dishes
- Foundations
- Equipment

Lighting & Equipment
- Poles
- Fixtures
- Devices
- Panels
- Conduit/feeders

Security Systems
- Poles
- Devices
- Conduit
- Cable

Continuous & Column Footings
- Reinforcement
- Concrete
- Insulation

Foundation Walls & Treatment
- Reinforcement
- Concrete
- Dampproofing
- Insulation

Foundation Drainage
- Pipe
- Geotextile

Structural & Nonstructural Slabs
- Reinforcement
- Concrete
- Joints
- Finish

Trench, Pit, and Pad
- Reinforcement
- Concrete
- Embedments

Underslab Elements
- Vapor barrier
- Insulation
- Pipe
- Geotextile

Piling & Pile Cap
- Pile
- Thermopile
- Pile caps

Caissons
- Piers
- Pile caps

Grade Beams
- Reinforcement
- Concrete
- Insulation

Arctic Foundation Systems
- Thermosyphons
- Refrigeration
- Insulation

Other Special Foundations
- Underpinning
- Vibro-replacement

Lower & Main Floors
- Beams
- Joists
- Decking
- Topping
- Soffit
- Insulation
- Coatings

Upper Floors
- Columns
- Beams
- Joists
- Decking
- Topping
- Coatings

Ramps
- Columns
- Beams
- Joists
- Decking
- Topping
- Coatings

Pitched Roofs
- Columns
- Beams
- Rafters
- Trusses
- Decking
- Bracing

Flat Roofs
- Columns
- Beams
- Rafters
- Trusses
- Decking
- Bracing

Special Roofs
- Pneumatic structures
- Domes

Stair Structure
- Columns
- Landings
- Stringers
- Treads
- Risers
- Toppings

Stair Railings
- Guardrail
- Railing
- Balusters
- Supports
- Coatings

Ladders & Steps
- Ladders
- Steps
- Coatings

Exterior Walls
- Framing
- Sheathing
- Insulation
- Siding
- Vapor/Air barriers
- Vents

Fascias & Soffits
- Framing
- Sheathing
- Insulation
- Siding
- Vapor/Air barriers
- Vents

Curtainwalls & Non-bearing Walls
- Framing
- Mullions/Rails
- Connectors
- Insulation
- Siding
- Barriers
- Interior substrate

Windows
- Frames
- Glazing
- Exterior sills
- Flashings
- Coatings/sealants
- Vandal-proofing

Storefronts
- Framing
- Glazing
- Flashings
- Closures/sealants

Structural Window Walls
- Columns
- Frames,
- Glazing
- Exterior sills
- Flashings
- Closures/sealants

Translucent Panels
- Panel assembly
- Exterior sills
- Flashings

Personnel Doors
- Frames
- Doors
- Lites
- Latch assembly
- Openers
- Thresholds
- Flashings
- Finish

Special Doors
- Frames
- Doors
- Openers
- Lock assembly
- Flashing
- Finish

Louvers, Screens & Shading Devices
- Louvers
- Screens
- Trellis
- Shades/shelfs

Balcony Elements
- Walls
- Grills
- Guardrails
- Handrails

Other Exterior Accessories
- Signage
- Decorations

Pitched Roofing
- Underlayment/barriers
- Roofing
- Flashing
- VTR assembly
- Insulation
- Fascia

Gutters & Downspouts
- Gutters
- Membranes
- Downspouts
- Hangers

Flat Roofing
- Underlayment/barriers
- Roofing
- Flashing
- VTR assembly
- Insulation
- Copings

Roof Drains & Piping
- Drains
- Scuppers
- Leaders
- Insulation

Skylights
- Fixed/operable Skylights
- Curbs
- Flashing
- Hardware

Roof Hatches
- Hatches
- Curbs
- Flashing
- Hardware

Roof Decks, Walls & Railings
- Decking/paving
- Protection
- Supports
- Walls
- Railings

Other Roof Accessories
- Snow guards
- Tie-offs
- Pipe supports

Fixed Partitions
- Framing
- Substrates/sheathing
- Blocking
- Insulation

Soffits & Ceilings
- Framing
- Substrates/sheathing
- Blocking
- Insulation

Operable Partitions
- Partition
- Support structure
- Factory finishes

Demountable Partitions
- Partition
- Support structure
- Factory finishes

Glazed Partitions
- Frames
- Glazing
- Glass block
- Trims

Railings & Screens
- Railing assemblies
- Visual screens

Personnel Doors
- Frames
- Doors
- Integral lites
- Hardware
- Trims
- Finish

Special Doors
- Frames
- Doors
- Hardware
- Finish

Windows & Sidelites
- Frame
- Glazing
- Stops

Access Floors
- Framing/stands
- Floor panels
- Factory finishes

Platforms & Stages
- Framing
- Sheathing/panels
- Accessories

Floor Finishes
- Finish material
- Trims
- Wall base
- Transitions

Wall Finishes
- Finish material
- Trims

Ceiling Finishes
- Framing/supports
- Finish material
- Trim

Other Finishes
- Finish material
- Transitions

Interior Specialties
- Toilet partitions/accessories
- Lockers
- Boards
- Protective Guards
- Signage

Casework/Millwork
- Cabinets
- Cubbies
- Wardrobes
- Counters
- Display case
- Trim

Seating
- Framing
- Finish
- Accessories

Window Coverings
- Drapes
- Blinds
- Blackout shades

Passenger Elevator
- Cab
- Rails
- Machinery
- Appurtenances

Lifts & Other Conveyors
- Cab/enclosure
- Rails
- Machinery
- Appurtenances

Elevators & Lifts
- Cab/enclosure
- Rails
- Machinery
- Appurtenances

Hoists & Cranes
- Structure/rails
- Hoist/crane
- Appurtenances

Other Systems
- Structure/rails
- Enclosure
- Appurtenances

Plumbing Fixtures
- Fixture
- Rough-in
- Valves/stops
- Mounts
- Trims

Plumbing Piping
- Pipe
- Fittings
- Hangers
- Insulation

Plumbing Equipment
- Pumps
- Tanks
- Traps
- Hot water generators
- Treatment

Waste & Vent Piping
- Pipe
- Fittings
- Cleanouts
- Supports
- Insulation

Special Systems
- Equipment
- Piping
- Fittings

Heating Equipment
- Boilers
- Furnaces
- Burners
- Flue
- Expansion tank
- Media

Heating Distribution Systems
- Pipe
- Fittings
- Valves
- Pumps
- Insulation
- Strainers

Ventilation Equipment
- Air handling units
- Supply/Return fans
- Exhaust fans
- Coils
- VAVs
- Terminal units

Ventilation Distribution Systems
- Ducting
- Insulation
- Diffusers
- Damper/Silencers

Cooling Equipment
- Air Conditioning units
- Make-up units
- Coils
- Refrigerant

Cooling Distribution Systems
- Pipe
- Fittings
- Valves
- Gauges
- Insulation

Heat Recovery System
- Heat Recovery units
- Fans

Control Systems
- Head End
- Direct Digital Control points
- Wiring
- Sensors
- Gauges

Riser & Equipment
- Riser
- Backflow device
- Headers
- Valves

Sprinklers & Piping
- Pipe
- Fittings
- Heads
- Hangers/Bracing

Special Suppression Systems
- Tanks
- Valves
- Piping
- Controls

Fuel Supply (Gas & Oil)
- Tanks
- Valves
- Piping
- Controls

Dust Collection Systems
- Tank
- Stand
- Fans
- Ducting
- Controls

Compressed Air & Vacuum Systems
- Tanks
- Mounts
- Fans
- Ducting
- Controls
- Outlets

Other Special Mechanical Systems
- Equipment
- Piping/ducting
- Grills

Main Distribution Panels & Switchgear
- Main Distribution Panel enclosure
- Disconnect
- CT Enclosure
- Bus
- Fuses

Panels & Motor Control Centers
- Switchboards
- Panelboards
- Motor control centers

Transformers
- Transformer

Conduit & Feeders
- Conduit
- Hangers/supports
- Fittings
- Wires

Lighting Fixtures
- Interior Fixtures
- Building Mounted Fixtures
- Exit/emergency
- Trims

Lighting Controls
- Control Panel
- Switches
- Occupancy sensors

Conduit & Wiring
- Conduit
- Fittings
- Wiring

Devices & Connections
- Outlets
- Disconnects
- Sensors/timers
- Motor connections

Conduit & Wiring
- Conduit
- Fittings
- Wiring

Fire Alarms
- Devices
- Panels
- Conduit
- Wiring

Data & Communications
- Equipment
- Devices/connections
- Conduit/tray
- Wiring

Security Systems
- Headend
- Detectors
- Closed circuit television
- Access control
- Conduit/tray
- Wiring

Clock Systems
- Clocks
- Controls
- Conduit/tray
- Wiring

Intercom Systems
- Headend
- Interties
- Speakers
- Wiring

Other Special Systems
- Equipment
- Devices
- Conduit/tray
- Wiring

Power Generation & Distribution
- Generators
- Switchgear
- Panels
- Conduit
- Feeders

Electrical Heating Systems
- Baseboards
- Unit Heaters
- Radiator
- Radiant Heat
- Controls

Grounding Systems
- Grounding
- Lightning Protection

Food Service and Kitchen Equipment
- Cooking Equipment
- Refer/Freezer
- Tables/counters

Athletic Equipment
- Basketball goals
- Inserts
- Ropes
- Bars
- Mat hoists

Career & Technology Equipment
- Woodworking
- Metal/welding
- Small engine
- Robotics

Science Equipment
- Casework
- Equipment

Library Equipment
- Stacks
- Shelves
- Desks
- Chairs

Theater Equipment
- Lighting
- Rigging
- Sound system
- Curtains

Art Equipment
- Kilns
- Sinks

Loading Dock Equipment
- Bumpers
- Levelers

Other Equipment
- OT/PT

Fixed Furnishings
- Classroom
- Administration
- Workrooms
- Assembly

Mats
- Mats
- Grates

Other Furnishings
- Window shades

Packaged Utility Modules
- Foundation
- Superstructure
- Enclosure
- Mechanical
- Electrical

Swimming Pool
- Foundation
- Superstructure
- Enclosure
- Mechanical
- Electrical

Greenhouse
- Foundation
- Framing
- Panels
- Mechanical
- Electrical

Appendix B

Anticipated Life Expectancies (Renewal Schedule)

System	System Life Expectancy (Years)
Site Improvements	25
Site Utilities	40
Foundation/Substructure	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 Protection/Suppression	30
HVAC Distribution	40
HVAC Equipment	30
HVAC Controls	20
Electrical Service/Generation	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 Preventive 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, electricity, recovered heat, ~~water~~biomass, etc.]—by month for the previous 12 months.	☐	
B3	Provide support of annual evaluation of need and effectiveness of retro-commissioning for required facilities.	☐	
	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 DEED'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.	☐	

4 AAC 31.013 PREVENTIVE MAINTENANCE AND FACILITY MANAGEMENT COMPLIANCE TEST

(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

(a) the 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; and

(b) regular evaluation of the effectiveness of and need for commissioning existing buildings;

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.)
- ☐ Demonstrate tracking and updating of which facilities are required to be evaluated for retro-commissioning?
- ☐ Provide a worksheet or other method of annual evaluation of need for retro-commissioning required facilities?

Best Practice

- ☐ Show comparison of energy consumption in each building over multi-year period.
- ☐ Identify causes of increased or decreased energy consumption?
- ☐ Demonstrate the development of energy efficiency measures (EEMs) based on consumption analysis?
- ☐ Tracking implementation of EEMs and then accomplishing appropriate measurement and verification?

(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 custodian's 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?

(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

Building System(s)

An assembly of components created to perform specific functions in a facility (ref. DEED *CostFormat* for descriptions of 11 standard building systems).

Capital Renewal or Replacement

A scheduled and anticipated systematic upgrading or replacement of a building system or component, anticipated based on life-expectancy, to establish its ability to function for a new life cycle—typically at least five years.

Commissioning

A systematic process of testing buildings systems to ensure that a building performs in accordance with the design intent, contract documents, and the owner's operational needs. Retro-commissioning is commissioning of building systems that occurs on a facility that has never been commissioned, or occurs after an initial commissioning, to recalibrate building performance to ensure optimal systems performance.

Component

An item within a building system that provides a function distinct from other elements in that system.

Corrective Maintenance

Unscheduled maintenance or repair in response to system or component failures that are accomplished at an operational level.

Custodial Care

The day to day and periodic cleaning of building surfaces and fixtures needed to maintain a facility in safe, clean, and orderly condition; includes the replacement of disposable supplies and building items.

Deferred Maintenance

Maintenance or capital renewal that is postponed for lack of funds, resources, or other reasons.

Energy Audit and Assessment

An assessment of a building that review current energy consumption and identifies energy efficiency measures that you can conduct to make the building more energy efficient.

Energy Benchmarking

Measuring building energy performance against its own past performance or against other buildings with a similar function/use.

Energy Consumption Monitoring

Measuring, recording, and tracking use of energy utilities by a building. Required to be done on a monthly basis.

Energy Efficiency Measures

Upgrades, retrofits, or repairs of systems or software or a practice that, when implemented, results in reduced energy use while maintaining the same or higher level of service.

Major Maintenance

Facility renewal that requires major repair or rehabilitation to protect the structure, correct building code deficiencies, or achieve an operating cost savings, and shall exceed $50,000 per project, per site. It must be demonstrated, using evidence acceptable to the department that (1) the 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. Programs shall contain the elements defined in AS 14.11.011(b)(4) and 4 AAC 31.013 to be eligible for funding.

Routine Maintenance

Light maintenance and inspection tasks performed at regular intervals (daily, weekly, monthly, etc.). Differentiated from preventive maintenance by level of complexity, specialized skill, and duration of effort.

Note: The above definitions are those adopted by the Bond Reimbursement and Grant Review Committee April 20, 2022.

Appendix F

Bibliography of Maintenance Publications

[To Be Developed]

Appendix G

Standard for a Clean Classroom

[To Be Developed]

Appendix H

Master Custodial Schedule

The Department of Education and Early Development, Facilities has developed a template master custodial schedule to assist school district in implementing a Custodial Program in compliance with 4 AAC 31.013. This template provides a comprehensive list of Space Types with their respective custodial tasks and frequencies identified. Edit the list to match any specific education related facility. Frequency of tasks to be performed are suggested and can be modified to meet district objectives.

The template's room-based cleaning list can also be adapted to other organizational models such as schedule-based, or a hybrid approach in which repetitive space-cleaning tasks are summarized in a Cleaning Processes section of the district's custodial guidelines. Examples of these would be: Dusting, Vacuuming, Disinfecting, Window Cleaning, etc. The assumption would be that these tasks would occur in all spaces. Spaces needing specialized cleaning, such as Gymnasiums or Bi-cultural/Bilingual, would continue to be broken out for additional attention.

An excel version of the template is available from the department.

Acronyms
AN = As Needed
SA = Semi-annual
Q = Quarterly
BW = Bi-weekly

Category A – Instructional or Resource (Sample Space)

Art Classroom

Task	Frequency
Dust ceiling/wall perimeter	Weekly
Dust all ceiling mounted light fixtures, projectors, etc.	Weekly
Vacuum all vents and diffusers	Weekly
Dust non-wet-area horizontal surfaces (furniture, trim, sills)	Daily
Clean and disinfect table tops	Daily
Spot clean vertical and horizontal hard surfaces	Weekly
Clean/wipe down countertops	Daily
Clean sinks and faucets	Daily
Clean equipment surfaces (pottery wheel, kiln, racks, easles)	Daily
Empty pencil sharpeners	Daily
Clean window glass on doors/sidelights	Daily
Empty trash receptacles and replace liners	Daily
Vacuum, mop/spot clean and disinfect all hard-surface floors	Daily
Strip and wax all hard-surface flooring	Semi-annual
Clean and disinfect all waste receptacles	Weekly
Clean shades or blinds	Monthly

Task	Frequency
Clean marker boards	As Needed
Replace lamps/bulbs	As Needed
[Other]	
Ceramics/Kiln	
Dust ceiling/wall perimeter	Weekly
Dust all ceiling mounted light fixtures	Weekly
Mop floor	Daily
Spot clean walls hard surfaces	Weekly
Clean equipment surfaces (pottery wheels, kiln, etc.)	Weekly
[Other]	

Category B – Support Teaching (Sample Space)

Teacher Breakroom

Task	Frequency
Dust ceiling/wall perimeter	Weekly
Dust all ceiling mounted light fixtures, projectors, etc.	Weekly
Vacuum all vents and diffusers	Weekly
Dust all horizontal surfaces (furniture, counters, trim, sills)	Daily
Clean and disinfect table tops	Daily
Spot clean vertical and horizontal hard surfaces	Weekly; As Needed
Clean sinks and faucets	Daily
Clean appliances surfaces (range, microwave, refrigerator)	Daily; As Needed
Remove and clean behind around appliances	Annually
Clean window glass on doors/sidelights	Daily
Empty trash receptacles and replace liners	Daily
Vacuum all carpeted floors and area rugs	Daily
Spot clean small marks and stains on carpets and area rugs	Weekly
Extraction cleaning carpeted floors and area rugs	Semi-annual
Vacuum, mop/spot clean and disinfect all hard-surface floors	Daily
Strip and wax all hard-surface flooring	Semi-annual
Clean and disinfect all waste receptacles	Weekly
Clean shades or blinds	Monthly
Clean marker boards	As Needed
Replace lamps/bulbs	As Needed
[Other]	
Restroom	
Mop and disinfect floor using enzymatic cleaner	Daily
Clean and disinfect mirrors	Daily
Clean and disinfect lavatory	Daily
Clean and disinfect toilet	Daily
Check & replenish hand soap, paper towel, & tissue supplies	Daily
Clean exterior of all dispensers (tissue, soap, etc.)	Daily
Check that all fixtures are functioning properly	Daily

Task	Frequency
Clean and disinfect wall surfaces	Weekly
Clean and disinfect all waste receptacles	Weekly
Clean and disinfect exposed plumbing piping and valves	Weekly
[Other]	

Category C – General Support (Sample Space)

Nurse/Clinic Space

Task	Frequency
Dust ceiling/wall perimeter	Weekly
Dust all ceiling mounted light fixtures, projectors, etc.	Weekly
Vacuum all vents and diffusers	Weekly
Dust all horizontal surfaces (furniture, counters, trim, sills)	Daily
Clean and disinfect equipment (cots, apparatus)	Daily
Spot clean vertical and horizontal hard surfaces	Weekly; As Needed
Clean sinks and faucets	Daily
Clean appliances surfaces (range, microwave, refrigerator)	Daily; As Needed
Remove and clean behind around appliances	Annually
Clean window glass on doors/sidelights	Daily
Empty trash receptacles and replace liners	Daily
Vacuum, mop/spot clean and disinfect all hard-surface floors	Daily
Strip and wax all hard-surface flooring	Semi-annual
Clean and disinfect all waste receptacles	Weekly
Clean shades or blinds	Monthly
Clean marker boards	As Needed
Replace lamps/bulbs	As Needed
[Other]	
Restroom	
Mop and disinfect floor using enzymatic cleaner	Daily
Clean and disinfect mirrors	Daily
Clean and disinfect lavatory	Daily
Clean and disinfect toilet	Daily
Check & replenish hand soap, paper towel, & tissue supplies	Daily
Clean exterior of all dispensers (tissue, soap, etc.)	Daily
Check that all fixtures are functioning properly	Daily
Clean and disinfect wall surfaces	Weekly
Clean and disinfect all waste receptacles	Weekly
Clean and disinfect exposed plumbing piping and valves	Weekly
[Other]	

Category D – Supplementary (Sample Space)

Mechanical/Electrical (M/E)

Task	Frequency
Dust ceiling/wall perimeter	Weekly
Dust all ceiling mounted light fixtures, etc.	Weekly
Vacuum all vents and diffusers	Weekly
Dust all horizontal surfaces (furniture, counters, trim, sills)	Daily
Clean window glass on doors/sidelights	Daily
Empty trash receptacles and replace liners	Daily
Sweep, mop/spot clean and disinfect all hard-surface floors	Daily
Strip and wax all hard-surface flooring	Semi-annual
Clean and disinfect all waste receptacles	Weekly
[Other]	