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An exploratory investigation of the facility maintenance program at Sterling Regional High School

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AN EXPLORATORY INVESTIGATION OF THE FACILITY MAINTENANCE PROGRAM AT STERLING REGIONAL HIGH SCHOOL

by
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ABSTRACT

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Dr. Robert W. Kern

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The purpose of the study was to a) determine the effectiveness of the current maintenance program at Sterling High School and to b) make changes in the program to promote staff satisfaction, safety of the environment, and fiscal matters. Administrators and staff members were interviewed regarding the program. A random sample of 100 work orders was analyzed to determine repair time, cost per repair, and percentage of return repairs for each of six maintenance categories, including electrical, plumbing, heating/ventilation/air conditioning (HVAC), fire alarms, other mechanical, and interior. It was determined that the HVAC system required the most repair time, most return repairs, and was the most costly. Changes were made in the computerized documentation systems and work responsibility systems within the maintenance department. Administrators discussed other implications of adopting a similar facility maintenance plan and preventative maintenance program. Continued study is required to determine the cost effectiveness of a preventative maintenance program.

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Chapter 1

Introduction

Focus of the Study

The ability to effectively track and manage the maintenance systems within a facility is vital to the continuity and effectiveness of the facility's programs. Within a school system, clearly defined methods for reporting and completing maintenance needs should result in undisrupted student learning as well as greater ease of instruction and greater staff satisfaction. Maintenance of the environment is vital to the overall productivity of students and staff.

Sterling High School had a facility management and maintenance program in place. However, problems had arisen in meeting the goals of the current program since the ability to track maintenance programs was limited. The district did not have a plan for evaluating the efficiency or efficacy of the maintenance program at the school.

Purpose of the study

The purpose of this research study was to determine the effectiveness of the facility management and preventative maintenance program that was in place. The administration evaluated the current facility preventative maintenance process to determine its effectiveness. During this study, staff evaluated the maintenance program to determine if it had met the operational needs of the school system. Review and modification of current policies and procedures regarding maintenance was undertaken in order to help support the facility plan. A concise and effective program to track maintenance needs and

completion through a more structured chain of command was developed. Modern software packages were reviewed to determine if they would increase the efficiency of the current system while promoting efficiency within the school district.

Definitions

For the purposes of this study, *maintenance* referred to any activities that are required to keep a school building clean, comfortable, and in working order. These activities include, but were not limited to, custodial activities, electrical, plumbing, heating/air conditioning, and general maintenance within the building. For the purposes of this study, this term did not apply to activities that occur outside of the school building, such as upkeep of lawn or athletic fields, repairs to buses, care of parking lots, or any other activities that occur beyond the walls of the school building itself.

The term *maintenance plan* could be described as a process of preserving and supporting physical and mechanical operational systems. The mechanical and physical plant systems must be maintained in order for operations to proceed fluidly. The plan describes procedures for completion of maintenance activities. Implantation of a maintenance plan is the key to the success of the maintenance department in the upkeep of the school and helps to keep the department running smoothly. The maintenance plan can also be part of the *Long Range Facilities Plan (LRFP)* required for submission by the New Jersey Department of Education. An LRFP is typically a five-year plan indicating the physical plant needs and projects planned for the upcoming five years. These plans must be review by the local school board and by a licensed architect. The LRFP guides districts in the required daily maintenance of the school building and helps to plan for any

future changes or capital improvements. If the LRFP is approved by the state, there is state funding available for listed projects that the school district wants to complete.

Sterling staff and administrators also used a term called *the band-aid fix up*. They felt that problems were sometimes resolved by the maintenance staff in the easiest way, but were often not fully repaired or replaced.

Limitations of the Study

This study had several limitations. First, the study was conducted only within one school district; therefore, information received may not be applicable other school districts. Also, the study was limited by the personalities and agendas of the particular participants, including administrators and maintenance staff members. Certain participants may have been more or less willing to provide information for the study or to make changes in systems that are familiar to them in order to effect change within the district. The study was also limited by the amount of time in which the research was able to be undertaken. Certain conclusions were not able to be affirmatively made and required further study over a longer period of time.

Setting of the Study

The Sterling High School District, heretofore referred to simply as "Sterling" or "the district", was the setting for this study. Sterling was a regional school district located in suburban residential community, approximately seven miles southeast of Camden, New Jersey and part of the Philadelphia, Pennsylvania metropolitan area. The district's 4.34 square miles were home to a broad range of ethnic backgrounds. The school received students from five towns, including Magnolia, Stratford, Laurel Springs, Hi-Nella, and Somerdale. A typical adult resident in the district was Caucasian, was employed in a

blue-collar industry, and lived in a household where the median income was approximately $49,000 with an average home value of $99,000. The district serves approximately 1000 students in grades nine through twelve. Demographically, 70% of Sterling's students were Caucasian, 20% were African-American, and 10% were of other races. More males than females attended the school, with a relation of 55% to 45% respectively. Sterling employed approximately 110 staff members, with fifteen members employed within the maintenance department (Sterling High School District, 2003). The maintenance department members participated in the study, as did the administrators within the district, Board of Education members, and teaching staff.

Significance of the Study

This research study had significance throughout the entire school district, as facility maintenance was completed in a more efficient and successful manner. The use of a more streamlined and efficient preventative maintenance system meant providing all school personnel with greater opportunity to more innovatively and creatively interact in the learning process while using time-on-task in an efficient manner. Other school districts may benefit through the recommendation of modified policies and procedures, chain-of-command planning, and review and use of software systems. This study may be generalized to other school districts and the staff and administration of those districts by providing plans for evaluation and modification of current district maintenance plans.

Relationship of the Study to the ISSLC Standards

This study addressed the ISSLC Standard 1; a school administrator is an educational leader who promotes the success of all students by facilitating the development, articulation, implementation, and stewardship of a vision that is shared and

communicated by the school community. The knowledge standard addressed was 1.a.3.; the administrator has knowledge and understanding of systems. The disposition standard addressed was 1.b.3.; the administrator believes in, values, and is committed to continuous improvement. The performance standard addressed was 1.c.1.; the administrator facilitates and engages in activities ensuring that there is a shared vision (based on relevant demographic and assessment data for student learning) that shapes the programs, plans, and actions for the school. The study also addressed the ISSLC Standard 3; a school administrator is an educational leader who promotes the success of all students by ensuring management of the organization, operation, and resources for a safe, efficient, and effective learning environment. The knowledge standard addressed was 3.a.3.; the administrator has knowledge and understanding of operational procedures for districts and schools, including principles of school law, finance, facilities, and school safety. The disposition standard addressed was 3.b.4.; the administrator believes in, values, and is committed to a safe environment. The performance standard addressed was 3.c.7.; the administrator facilitates and engages in activities ensuring that there is a safe and clean school environment.

Organization of the Study

This study began as a process of collecting data through an organized, on-going process of information gathering as well as analyzing the useful information to achieve a positive outcome. Data gathering took place by interviewing subjects involved in facility maintenance. The primary data gathering techniques were interviewing, observing, and reviewing material. This information was used to support data gained through simple random samples of work orders, memos, emails, and log sheets that were tabulated and

evaluated for effectiveness, productivity, and accuracy. Other participants, such as administrators, Board of Education members, and teaching staff, were interviewed as necessary in regard to satisfaction and current procedures. Resources were identified that offer guidelines for establishment of policies and procedures related to maintenance within a school system. Sterling High School District used these guidelines to implement new procedures that better supported the needs of the school district. The analysis of data was open-ended and action-oriented. Modifications to the organization of the study were made secondary to results of analysis. Analysis was completed on an on-going basis, with data gathering techniques modified and documented as necessary.

All of the previously described study information was formatted into a detailed thesis. Following this introduction, Chapter 2, Review of the Literature, provides a review of the literature related to the study area. Chapter 3, The Design of the Study, provides a discussion of the study design, including more detail regarding data collection and analysis. Chapter 4, Presentation of Research Findings, provides factual information that offers further data to analyze to determine the efficacy of the study. Chapter 5, Conclusions, Implications, and Further Study, discusses final inferences that were drawn from the research and discusses possible options for continued research.

Chapter 2

Review of the Literature

The maintenance of a school building is a daily, year-round task that affects all participants in the everyday life of the school, from students to administrators and from support staff to educators. It only stands to reason that the quality of a school environment could have a great affect upon student learning as well as staff satisfaction. Earthman (2004) noted that there was a great deal of research indicating that student learning was greatly influenced by the conditions of the building in which they spend their time. Each researcher he investigated found that there was a statistically significant difference in the achievement of students in poorly maintained schools versus those in well-maintained schools. Lawrence (2003) reasoned that "students whose schools are comfortable and well-maintained are likely to focus more fully on academic challenges than those who are distracted or depressed by the facility" (p. 11). At the very least, maintenance programs should be able to ensure that students and staff are comfortable within the environment in which they spend a large amount of their day. In Schoolhouse in the Red: An Administrator's Guide to Improving America's School Facilities and Environment, the American Association of School Administrators stated that "overwhelming scientific evidence exists that high quality school facilities are a vital precondition both for student learning and for teaching" (2004, p. 7). The maintenance program should be able to ensure it can meet the basic needs of the staff and students who use the school building. Lawrence (2003) observed that "students dodging leaks

from ceilings, using unsanitary and inadequate bathrooms, attending classes in converted storerooms, and breathing unhealthy air cannot accomplish as much as their peers who attend well-lighted, clean, attractive, and well-furnished schools" (p. 11). The American Association of School Administrators even pointed to growing evidence from the EPA and other organizations that student success and appropriate behavior can be directly correlated to the conditions of the school building (Schoolhouse, 2004). To an observer, the Sterling High School building might appear to be a well-maintained environment. However, further research appeared to be needed to support this observation and to determine if the needs of student and staff were being met.

Preventative maintenance is one vital key to making certain that the needs of school users can be met. In the Planning Guide for Maintaining School Facilities (2003), published by the United States Department of Education, the authors stated that "a good maintenance program is built on a foundation of preventative maintenance" (Szuba & Young, p. 74). Buchanan (2003) suggested that preventing maintenance problems from happening actually promotes learning and staff satisfaction through reduced environmental disruption. He stated that "in addition to preventing major repairs, good, regular maintenance also helps make systems run more efficiently and economically" (n.p.). The authors of the Planning Guide noted that "because a rigorous preventative maintenance system results in fewer emergency events, it tends to reduce disruptions to the school schedule" (Szuba & Young, p. 75). Planning for maintenance needs is also vital to preventing costly problems that could place the district in a budgetary bind. Though school boards are reluctant to spend money on activities that they may view as unnecessary, they should be made aware that carefully planned preventative maintenance

programs may actually save districts large amounts of money over time. Lawrence (2003) suggested that administrators help school boards to see preventative maintenance as a "good investment" (p.7). Buchanan (2003) goes so far as to suggest that two to four percent of the school building's replacement cost be spent on preventative maintenance on an annual basis.

One phenomenon often encountered in school districts in order to save money and manpower is the practice of deferring maintenance. This can take the form of neglecting to replace needed equipment in a timely fashion or not following a manufacturer's guidelines for equipment maintenance. However, Lawrence (2003) reported that deferring maintenance can be very expensive, with the end result being a deteriorated building that costs the district a substantial amount of money in repairs or renovation. Some buildings become so deteriorated through deferral practices that the construction of a completely new building may be required. Essentially, "problems resulting from deferred maintenance don't go away—they just became more costly to repair" (Lawrence, 2003, p. 8). Though practicing deferred maintenance may initially be used as a cost-saving measure, it can be the most costly maintenance plan over a period of time. In Schoolhouse (2004), the American Association of School Administrators noted that maintenance spending is often one of the first areas cut during budget negotiations, since this often seems less problematic than cutting academic programs. However, taking a proactive approach to maintenance could enable districts to save money over the long-term while ensuring a safe and healthy learning environment (Lawrence, 2003).

In the Planning Guide for Maintaining School Facilities (Szuba & Young, 2003), the authors described a "cutting-edge" approach to school maintenance management known

as "predictive maintenance" (p. 74). This system utilized advanced computer software to predict the maintenance needs of equipment based on factors like age or user demand. Software packages can now be an important part of any maintenance program, especially those employing a more proactive approach like a preventative maintenance or predictive maintenance program. Scheduling of maintenance activities can easily be done using the program. Staff efficiency and time-on-task can be accessed quickly. Computer programs can also assist with facility audits that determine the types of equipment or areas requiring maintenance while establishing a time-line for maintenance (Szuba & Young, Planning Guide, 2003).

Deciding upon the best approach to a maintenance program within a school district begins with evaluation of the current program. Sterling High School had a facility planning and preventative maintenance program in place, but the program had not been updated, evaluated, refined, or retooled in many years. This was due in part to the fact that, three years ago, the district constructed a massive addition to the building which added an addition 45,000 square feet at a cost of approximately $10 million. The "old" school building, which was built in 1962, was still in relatively good shape. However, since a large portion of Sterling's physical plant is over 40 years old, the areas of concern are expensive capital items such as the two boilers, cafeteria equipment, and windows (J. Giambri, personal communication, September 8, 2004).

The district was also concerned with ADA compliance issues in the older parts of the building. The structures and equipment within the school building that require preventative maintenance needed to be identified and systems needed to be set in place concerning maintenance schedules, routines, and responsibilities. While an initial plan

may benefit the district, and more comprehensive plan that included guidelines for periodic reevaluation was needed to determine the success of new planning systems within the department (Szuba & Young, Planning Guide, 2003).

The manual entitled Maintenance and Operations Administrative Guidelines for School Districts and Community Colleges (n.d.), the authors stated that "a qualified and diverse staff is the cornerstone of any maintenance organization" (p. 87). Through the years, Sterling had been able to maintain maintenance and custodial personnel with little turnover, which Lawrence (2003) stated is not always common in such departments, since personnel are often required to perform more work without the reward of greater earnings. The disadvantage of a low turnover rate is that the employees within the department have not had the opportunity to experience other maintenance settings in other school districts or similar facilities. The personnel within the department generally lacked the knowledge base to be innovative and proactive in order to learn and initiate new programs that may result in greater cost saving while increasing employee efficiency. In addition, Sterling did not have a clearly established chain-of-command program concerning administrative and supervisory responsibilities. In the Maintenance and Operations Administrative Guidelines (2004), the Florida Department of Education emphasized the need for an established hierarchy within a district, but also recognized the value of continued modification of the organizational plan given the differing and constantly-changing maintenance functions within a school system. The document stated that the need for continued modification of the organization of the department means "accurately defining the overall scope of work required to adequately maintain a facility" (p.25). It appeared that the most basic and essential task involved in establishing an

effective maintenance program lies in constantly understanding and identifying any and all equipment and/or structures that will require service. The department can then begin to go forward to establish appropriate procedures for all maintenance needs within the building.

A clearly established work order system was one of the main areas of need within the Sterling maintenance department (J. Giambri, personal communication, September 8, 2004). It was additionally important that clear guidelines for the maintenance system be instrumented in order to meet the mandates issued by the State of New Jersey, since each school within the state is required to establish a maintenance system (American Association of School Administrators, 2004). While the Planning Guide (Szuba & Young, 2003) suggested that some policies and procedures, such as those for scheduling of work or tracking work orders, can easily be done using a system of index cards or files, Sterling's department had few established guidelines for receipt, performance, and reporting of completed work orders or other maintenance tasks. Many sites have instituted the practice of creating manuals as a reference for completion of school maintenance activities. Continued use of a "breakdown maintenance" (Szuba & Young, Planning Guide, 2003, p. 74) system with no guidelines for performance procedures and documentation continues to lead to greater use of manpower and cost. "Breakdown maintenance" can actually lead to a debt within the maintenance department due to a build up of repair costs. The American Association of School Administrators (Schoolhouse, 2004) stated that this type of system can lead to many unforeseen but related problems. For instance, when repairs are delayed on a leaky roof, damage can actually be done to "plumbing and electrical systems, ceiling tiles, walls, floors, and

furniture", which will lead to even more cost that may have been unplanned (p.22). The authors of the Planning Guide (Szuba & Young, 2003) noted that "an effective work order system is a good tool for identifying, monitoring, and projecting future maintenance needs" (p. 124). A clearly established work order system can serve as the basis for the evaluation of the success of newly established procedures within the maintenance department.

The Planning Guide (Szuba & Young, 2003) noted that those affected by a newly established maintenance program (students, the school board, staff) should certainly expect that the program will produce results that generate "clean, orderly, safe, cost-effective, and instructionally supportive school facility that enhances the educational experience of all students" (p. 124). The goal of this research study was to provide Sterling with a facility plan that can meet this expectation.

Chapter 3

Design of the Study

Research Design

Sterling High School was selected as the primary site for research, with the school's administrators, Board of Education, and staff members as the primary population. While the entire maintenance staff was involved, the research design for this study specifically addressed the concern for constant, consistent, and concise information which was used to evaluate the current facilities maintenance program. The design of this research was structured as action-oriented research, which would allow the plan to be a process of collecting, analyzing, and reporting data. The design provided for open-ended research which could be flexible while allowing new data to be introduced into the process from time to time.

To begin the study, Sterling's administrators and maintenance staff were interviewed regarding their perceptions of the maintenance program. These participants were able to identify areas for focus of the study, including areas of the facility in most need of improvement. These participants were also able to help identify areas of the facility in most need of consistent inspection for the maintenance needs of that area. With these identified problems in mind, the facility was toured with the maintenance manager, with notes kept regarding visual inspection and verbal accounts from the manager regarding ongoing issues for improvement.

Following the inspection, all previous data related to various areas of the Sterling High School Maintenance Department was reviewed. Certain areas were carefully checked, such as electrical, plumbing, fire, security and heat, air conditioning, and ventilation along with all other internal and external physical structures of the school.

Focus of Research Instrumentation

Specific instruments were not designed for the study, but essentially all of the instruments utilized for tracking maintenance efforts in the district were reviewed with precise research logs maintained. Modifications were made as necessary and reviewed with appropriate users in order to effect change that was documented and implemented to determine the impact on efficiency, satisfaction, and comprehensiveness of maintenance efforts. General research related to the current systems in place within the district was collected as well as those that were utilized in the previous years to determine effectiveness of these systems for possible inclusion, in part or whole, in a new maintenance program.

Sample and Sampling Technique

Following initial interviews and examination of the facility, the first step for gathering information for analysis was to identify the efficacy of the tracking systems used for work performance within the department. Information gathered for analysis was gained through simple random sampling of the work order requests, memo, emails, and all log sheets which were tabulated and evaluated for effectiveness, productivity, response time, and accuracy. The total sample size was 100 work orders over a seven-month time span. This sample was generated by accessing the current maintenance software called Altiris. The sample utilized encompassed information over the 2004 school year, dating from

June to December 2004. Because the current facility maintenance program was not well-defined, the ability to gather this written information was limited at times. As a supplement to this information, related equipment documentation and inspection reports which may have been completed by outside contracted professionals were sampled and checked for accuracy and compliance. Interior and exterior tours of the school facilities related to certain work orders or other documentation may have been necessary and were conducted on a weekly basis. Interview with appropriate parties, such as the superintendent, school business administrator, teachers, or maintenance staff was conducted regarding specific written requests as a means to determine follow-through and satisfaction with maintenance efforts.

Data Collection Approach

The primary methods used in the information gathering process were personal interviews, site inspections, and review of all mandatory documentation. Personal interviews were conducted on an ongoing basis with all necessary participants as questions arose regarding previously developed policies or procedures. Site inspections were also conducted regularly as a review of documentation and follow-up regarding interview information. All mandatory documentation required by the various regulatory agencies was reviewed, including federal, state, and local agencies. Other documentation was examined, including facilities maintenance log books, work order request log books, the previous year's purchase orders for the maintenance department, and staff employment records. Employment records were valuable in determining the department's staffing patterns over the course of the previous year. Research logs were kept throughout the interview/inspection/documentation review process in order to track the outcomes of

previous maintenance operations. The internal computer-assisted help desk system called "Altiris" was also reviewed with outcome logs completed as well. The intern was also able to examine the outside contractors' work performance reports from the previous year.

Following collection of written information previously reviewed, final interviews were conducted with appropriate parties. The data collection approach was both a fact finding analysis as well as an information gathering process. Data gathering took place by reviewing all documentation related to the school's maintenance department. The information gathered was used to determine the need for changes in the facilities maintenance department of the school. The information gathered was both paper- driven as well a computer access-driven since the school districted utilizes a software system with numerous records. Staff performance of tasks and carry out of the work order system was observed and evaluated, from initiation of the work order to the completion of said order. Various materials and software packages were reviewed, some of which were already in use within the maintenance department. The current policy and procedure manual of the district was examined, which was available via the school district website. All recent equipment documentation and inspection reports which are done by outside contracted professionals were checked. Numerous interior and exterior tours of the school facilities were completed.

Data Analysis Plan

The data collected was evaluated and divided into different segments of the physical plant operation requirements: electrical; plumbing; heating, cooling and ventilation (HVAC); fire alarm/suppression systems; other mechanical systems; and interior: walls,

floors, and ceilings. The aforementioned data was organized by taking the divided sections and evaluating them in three areas: speed of response and resolution of problem; time, materials, and staff required to complete tasks; and all costs associated with the resolving and rectifying the problem. The analysis of the data was open-ended and action-oriented. Analysis techniques were modified and documented on an ever-changing basis. Changes were made as necessary to the current programs and procedures utilized within the maintenance department in order to evaluate the effect of such changes on productivity, completeness, and accuracy of work, and satisfaction regarding maintenance actions.

Chapter 4

Presentation of Research Findings

The initial research study questions were carefully discussed with Sterling's administrators and maintenance staff. The staff was interviewed and asked to give their perceptions of the maintenance program. These participants were able to identify areas for focus of the study, including areas in which the facility's maintenance department was most requested for assistance. These participants were also able to assist in identifying areas of the facility in most need of consistent attention, inspection, and repair. All specific identified problems given the maintenance department by the Sterling staff were deciphered, coded, and documented on an ongoing basis for facility improvement purposes as well as for the reduction of future costly expense.

The initial interviews with Sterling staff indicated that, in past practice, most areas of concern were dealt with using a laissez-faire approach. Interestingly, this approach was taken not by the business administrator, but by the previous maintenance director. The Sterling staff interviews indicated that the work order process and follow-up on numerous items were handled with mediocrity, with poor standards upheld for performance and follow-through. It appeared that the Sterling staff was pleased to have the work orders addressed and fixed, but they never felt confident that they were done completely nor professionally. The Sterling staff and administrators felt that the maintenance staff fixed and repaired with what they called the "band-aid fix up". The term "band aid" means that the problem was resolved for the time being, but was not totally repaired or replaced. The

goal of the previous maintenance leadership was to get projects completed in the easiest way, which often required the least amount of time and the least of amount of expense. However, having to complete projects numerous times could actually strain manpower over the long-term. The business administrator recognized that the Sterling staff lacked confidence in the maintenance department because of the lack of leadership. As a result, the business administrator had to take more of a leadership role in making sure all projects were completed, further straining his time secondary to the multiple roles and responsibilities already required of him. The Sterling staff felt that the lack of a proactive approach and little follow-up by the maintenance department leadership led to apprehensiveness and reduced confidence from the Sterling staff about the maintenance staff's ability to get projects done correctly. The most interesting finding during the interview process was that the maintenance staff actually wanted to be more proactive and develop a formalized facility maintenance program as well a preventative maintenance program. They also saw the need for an ongoing professional training process for all members of the maintenance staff.

The next step in the study was to randomly select 100 work orders from June to December 2004. The work orders were downloaded from the district's computer program called Altiris. Any paperwork that was necessary in deciphering the work orders was researched and compiled. Other paperwork may have included contractor reports, purchase orders, and other documents that were necessary to gain a full understanding of the work that was completed. The work orders were then classified into six different. categories by the type of work completed. These categories included electrical, plumbing, heating/ventilation/air conditioning (HVAC), fire alarms, other mechanical, and interior,

which included issues regarding floors, walls, and ceilings. The total repair time for each job was calculated and averaged for each category. The cost per repair and number of return repairs were also calculated and averaged. The calculation of costs associated with materials was completed by reviewing all related purchase orders for supplies that had to be purchased to complete the work order request. Materials that were in-stock at the facility were also calculated into expense if necessary. These materials may have consisted of items such as expendable tools, nails, glue, tape, and other items. The results of the work order analysis are provided in Table 1.

Table 1

100 Work Orders over a Seven-month Time Period, June to December 2004

Area	Number of Work Orders	Repair Time (Days)	Cost Per Repair (Dollars)	Return Repairs (Percentage)
Electrical	14	3	$215	15
Plumbing	12	2	$225	25
HVAC	27	2	$375	65
Fire/Alarms	11	1	$185	25
Other Mechanical	13	4	$225	40
Interior	23	2	$120	15

Note. The average dollar amount includes the hourly rate of the contractor or internal maintenance staff personnel as well as the costs of materials.

Following analysis of the work orders, it was clear that the HVAC system generated the most work orders. The HVAC system was also the most costly to repair and generated the highest number of return repairs as well. The focus of the study was

modified after this analysis to concentrate on the needs within the HVAC system. Because this area seemed to be most problematic to the district, it was determined that if new policies and procedures could be put in place to reduce the problems with the HVAC system, the other areas could also be managed according to new policies generated regarding this system.

The expenses regarding the HVAC system were analyzed as a first step. The district had an electrician and a plumber on staff in the maintenance department, which was a benefit with regard to reducing expenses. However, these professionals were sometimes not able to fully fix problems within the HVAC system, necessitating the assistance of outside contractors. The expense of the hourly contractor consistently exceeded the internal hourly maintenance staff hourly rate. Problems within the HVAC system generated the most need for the use of outside contractors (versus other areas such as electrical or plumbing), which further increased the expenses for this area. Additionally, the parts that were often order for repairs were more costly than parts or supplies that were ordered for repair of other areas. Return repairs were often necessary because of multiple part or supply orders. For instance, rather than ordering and repairing new filters for an entire wing within the facility, only those that required maintenance at the time were ordered and repaired. There was no foresight regarding repairs that might be necessary or prudent.

As a direct result of complaints from staff regarding the work order system, particularly the HVAC system, Sterling administrators decided to make a change in the position of maintenance director. This change took effect in July 2004. Interestingly, when the work orders for the HVAC system were analyzed, it was clear that many of the

work orders had been generated in the month of June, with most of the follow-up and return repair activities completed in the proceeding months. This may have been partly due to the fact that the air conditioning system was in greatest use during the month of June that year. However, it was clear from many of the work order issues that the previous maintenance director had not been proactive in directing the work of the members of the maintenance department regarding the HVAC system. He had apparently let many of the issues with the HVAC system compound themselves until costly repairs were necessary. There were tracking systems in place for staff or outside contractors to review on all the HVAC systems. There were other areas within the building that utilized log sheets regarding maintenance, but this was very inconsistent. The department's tracking systems for work completion or effectiveness were either minimal or absent. There were no calendars or reminder systems. Modern computerized systems for monitoring and tracking work were either not utilized or were underutilized. Part of the reason that some areas were not checked more carefully was the lack of leadership knowledge base. Additionally, the maintenance staff did not regularly receive lists of jobs to perform on a daily basis. Often staff members were left to individually decide which jobs to complete. Sometimes this would mean that a staff member would document responsibility for a job but then would forget or overlook follow-through on the job. Management would often not follow up on job completion. Other times, staff members did not document completed work, which led to redundancy.

The next phase of the study entailed reviewing the computer system used in the maintenance department as well as other computerized systems that were currently available. After careful evaluation of the various software packages available, it was clear

that the current system in place was best suited for the maintenance program. However, the current software packages which were being used contained a tremendous amount of information which was not being used to the fullest potential. All data gathered from the current maintenance software package was compiled in order to evaluate the value, completeness, and accuracy of said software. It was determined that under-utilization of the maintenance software package and a lack of foundational training were the main areas of weakness with in the use of the current computerized system within the department. The district required consistency of training with the maintenance staff that would enable each member of the department to follow standard protocol regarding access and documentation using the computer system.

Working closely with the new maintenance director, a clear plan for maintenance staff was put into place. This plan was initially used for issues regarding the HVAC system but was easily adapted for the other areas of school maintenance. Meetings were held with the new maintenance director to establish procedures regarding the work of the maintenance staff. It was determined that each member of the staff would receive daily lists regarding the work to be completed that day. These lists would be formatted in checklist style. A master log of all necessary work would be kept using Altiris. At the end of each work day, each staff member would return his list with updates made on a daily basis to the master log. These updates could be made by the director or by staff members themselves. Training meetings were provided for all staff members regarding the access of Altiris and the importance of follow through regarding documentation.

The greatest discovery made during the course of the study of the HVAC system revealed a lack of progressive preventative maintenance for the system. Failure to avoid

and progressively pursue problems with the system had actually caused a significant mold problem in the building. The maintenance department was not following manufacturer protocols regarding replacement of items such as filters, pumps, and other parts. The system was not regularly checked for small leaks or other areas of damage. The mechanical design of an HVAC chiller system in a 40-year-old school that was not initially designed with air conditioning also contributed and magnified the problems. The lack of professional technical skill within the maintenance department and the lack of professional knowledge on the part of managers and administrators essentially caused a domino effect in the HVAC system of the school.

The next course of action was to compile a list of maintenance items that could be completed on a regular basis to prolong the life of the HVAC system. This type of time line would assist in planning for future work and would assist in placing orders for materials and equipment, as the maintenance director would have knowledge regarding when to have back up equipment or other supplies available. Meetings with the maintenance director generated a preventative maintenance list for the HVAC system, which was easily broken down into responsibilities to be conducted on a monthly basis. This maintenance list was easily entered into the Altiris system and could be incorporated into daily job lists for the maintenance staff. For instance, if the preventative maintenance item for the HVAC system for that month was replacing all filters within the 200 wing of the building, staff members working in the 200 wing could add that responsibility to their daily responsibility list. This preventative maintenance procedure could be easily adapted for the other maintenance category areas (electrical, plumbing, fire alarms, other

maintenance, and interior) and is being completed on an ongoing basis with regard to these areas.

Following review of the district's policies and procedures manual for the department, it was determined that some policies were effective and used by the maintenance staff while others were not being followed. Some policies reflected current standards while others were out-of-date. Also, it was clear that the training, education, and knowledge of the maintenance staff regarding the formal policies and procedures of the department was lacking. The current policies were readjusted in a draft format so that trial periods of the new processes could be evaluated based on performance. This included policies regarding documentation of work and preventative maintenance activities. The drafts of the new policies were developed and formalized by using data for the current maintenance software service. Recommendations from the school administration and maintenance staff were incorporated. Plans were developed for the implementation of new district polices and procedures and more formalized staff education. The need for a more formalized plan for the maintenance of the school building was recognized and changes were initiated. These changes continue to occur on a continual basis regarding the different areas of the school and are updated as necessary.

Chapter 5

Conclusions, Implications, and Further Study

Conclusions

The study required the administration to evaluate the current facility maintenance program to determine its effectiveness. It was clear as a result of the study that the Sterling High School District greatly benefited from a formalized maintenance plan, especially in regard to the HVAC system. Procedures for maintaining this system were not productive, efficient, or cost effective and were clearly not meeting the operational needs of the district. Concluding this study required new policies for the HVAC system to help to reduce costs and return repair visits over a period of time. Because of ongoing difficulties with the HVAC system and mold issues, the administration determined that the chiller must be replaced, at a cost of $135,000. Though this was a significant cost to the district, administrators and Board members felt more confident in justifying such an expense since a preventative maintenance program was in place that would follow manufacturer's recommendations to help prolong the life of the chiller. As a result of the study, Sterling had a clearly defined method for reporting and completing maintenance activities with regard to the HVAC system. The program was generalized to other systems within the school on an ongoing basis.

The research findings indicated better satisfaction and improved performance evaluations in the maintenance department since the new preventative maintenance program started. Documentation systems that were put into place were more organized

and easily maintained by the maintenance department. The revised documentation systems provided a better continuum of communication between the internal maintenance department and the outside contractors. The result was a more proactive department that planned ahead for possible issues related to the school building and physical plan.

Implications

Only the short-term achievements of the new preventative maintenance program were able to be evaluated. The short-term results showed that the impact of the new preventative maintenance program was two-fold. First, the satisfaction of the school district employees as related to the requests for maintenance assistance rose dramatically. The staff appreciated that their requests were heard and resolved with a communication system that was both accurate and timely. Second, the speed of the response in resolving building problems was doubled because staff responded quickly and the planning process, such as having parts and materials already in stock at the school, reduced waiting time. The short-term information gathered showed improved lines of communication which consequently improved quality of service and began to reduce unexpected maintenance repair expenses.

The most apparent change that was noted as a direct result of alterations made over the course of the study was a higher level of job satisfaction as noted by members of the maintenance department. Personal interviews were completed with members of the maintenance department. The staff overwhelmingly indicated that the new system, with their input, required more time and effort during the development stage than anticipated but the staff identified many immediate results. All members reported feeling more productive and useful with a more clear and concise list of responsibilities to be

completed each day. The administration and teaching staff noted an improvement in response time regarding problems and generally felt that problems were fixed more readily. They also noted more success with fixing problems with fewer visits. The teaching staff noted less disruption within their classroom for maintenance issues, which translated into increased focus and learning for their students. Staff members generally felt more confident in contacting the maintenance department to address problems both large and small.

Professional Growth

The intern was able to grow as a leader during the study through the ISSLC standards addressed. This study addressed the ISSLC Standard 1; a school administrator is an educational leader who promotes the success of all students by facilitating the development, articulation, implementation, and stewardship of a vision that is shared and communicated by the school community. The intern identified the concern of staff and administrators for the safety and comfort of the students in regard to the maintenance program. The intern initiated changes in the maintenance department that had long been a goal of the school community. The knowledge standard addressed was 1.a.3.; the administrator has knowledge and understanding of systems. With a background in management of maintenance systems, the intern implemented new policies and procedures that made a positive impact on the school community. The disposition standard addressed was 1.b.3.; the administrator believes in, values, and is committed to continuous improvement. The intern identified the need for further study regarding cost effectiveness, staff productivity, and staff education. The intern committed to continuing to make positive changes in the performance of the maintenance department that would

ensure the success of the students, teachers, administrators, and other staff members that must use the school building each day. The performance standard addressed was 1.c.1.; the administrator facilitates and engages in activities ensuring that there is a shared vision (based on relevant demographic and assessment data for student learning) that shapes the programs, plans, and actions for the school. The intern identified the need to interview and receive feedback from all parties that might be affected by the study rather than making changes based on simple observation or other factors. When all parties affected by possible changes were involved in decision-making, the new program was more readily accepted and utilized. The intern grew as a leader according to Standard 1 by recognizing the importance of shared ideas and goals through understanding the value in the opinions and views of many for the betterment of the school community.

The study also addressed the ISSLC Standard 3; a school administrator is an educational leader who promotes the success of all students by ensuring management of the organization, operation, and resources for a safe, efficient, and effective learning environment. The intern identified the HVAC system as the area of greatest need within the school building that could affect the safety, health, and comfort of the students. The intern addressed ongoing issues within the maintenance department that had affected the effectiveness of the learning environment. The knowledge standard addressed was 3.a.3.; the administrator has knowledge and understanding of operational procedures for districts and schools, including principles of school law, finance, facilities, and school safety. The intern gained greater understanding of the importance of facility management in relation to the efficiency of a school system. The disposition standard addressed was 3.b.4.; the administrator believes in, values, and is committed to a safe environment. The intern

identified the importance of a safe and healthy school environment in helping students to learn. The performance standard addressed was 3.c.7.; the administrator facilitates and engages in activities ensuring that there is a safe and clean school environment. The intern made changes in the maintenance program that elicited changes in the health and safety within the school environment. The intern recognized the need for clear and concise maintenance programs to ensure the success of the school and the students. The intern became aware of the need for ongoing management of the maintenance department to ensure that programs initiated through the study could be applied to all areas of school facility management.

Further Study

The preventative maintenance program will need to be studied to determine if problems could actually be identified proactively with foresight rather than waiting until large expenses were incurred. It appeared that preventing issues by following manufacturer's recommendations for equipment maintenance would eliminate large expenses generated by breakdown of larger, more costly parts. Continued monitoring of expenses is required to determine the cost-effectiveness of preventative maintenance.

The new plan was only formally implemented with regard to the HVAC system. It was slowly being implemented across all systems within the district. Further study is needed to determine if using the program with regard to other areas within the school would result in generalized ongoing improvements. Continued study will be needed to determine if the high level of staff satisfaction would continue as the program was initiated across all maintenance areas. Further study will also necessary to identify if the new programs put in place would result in undisrupted student learning as well as greater

ease of instruction and greater staff satisfaction. The study generally provided evidence that, at Sterling, the maintenance of the environment was very important in contributing to the overall productivity and satisfaction of students and staff.

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