



Facilities maintenance management practices in large public schools, Texas

Facilities
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Abstract

Purpose – The purpose of this paper is to present previous studies and reports which have shown that most school buildings in the USA suffer from inadequate physical conditions. As American school buildings become “older”, it is essential for every school district to have an effective facilities maintenance management plan of its facilities. Therefore, the main purpose of this study is to identify and analyze how facilities maintenance is planned, managed and carried out by large public schools in the State of Texas, USA.

Design/methodology/approach – Guidelines taken from the literature drove the development of a survey questionnaire, which was sent to 320 school facilities managers from four major metropolitan areas in Texas. Elementary, middle and high schools with enrollments of 750 students or more were selected from the Texas Education Agency’s web site. The responses were received in a secure database established at an online web site, where participants’ identities were kept confidential.

Findings – The overall findings of this research indicate a poor quality of facilities maintenance management practices exists in large public schools in Texas. Nevertheless, the study also found that schools following the guidelines set by the US Department of Education tend to have comparatively more detailed and contemporary information about their facility’s condition. As a result, these schools are able to predict the projected needs of the school, including its maintenance needs.

Originality/value – The results of this study can be adapted and used by any public school that would like to provide high-quality school facilities for healthy and supportive teaching and learning environments.

Keywords Maintenance, Schools, Condition monitoring, Databases

Paper type Research paper

Introduction

In 2000, the National Center for Education Statistics reported that “three-quarters of schools in the US require repairs, renovations, and modernizations” in order to bring the schools to an overall good condition (US Department of Education, 2000). It also concluded that “one in every four buildings reported that at least one type of onsite building was in less than adequate condition.” Aging American school buildings face the growing challenge of maintaining the nation’s education facilities. Routine and unexpected maintenance demands are bound to arise (Sarja, 2002), and hence every educational organization must proactively develop and implement a facilities maintenance plan to deal with these demands.



Previous studies show that facility deficiencies affect teaching and learning performance, student and staff health and safety, and day-to-day building operations (Uline and Tschannen-Moran, 2008; Kennedy, 2007; Mendell and Heath, 2005; Earthman and Lemasters, 1997). This makes it essential for every school to have a plan for effective facilities maintenance management. Facility deficiencies result from numerous causes, including extreme environmental conditions and lack of maintenance funding. According to the US Department of Education (2003a), many facility problems are not due to geography or socio-economic factors; instead, they are related to maintenance staffing level, training, and management practices. This means that a school must have a facilities maintenance program that is planned, managed and carried out effectively.

The main purpose of this study is to identify and analyze how facilities maintenance is planned, managed and carried out by large Texas public schools. To accomplish this the following objectives were established:

- identify how school facilities maintenance is planned;
- identify how the facility condition information is collected and stored;
- identify how effectively the facility inventory data is used for further facilities maintenance planning; and
- identify and analyze the overall maintenance management practices of large public schools in Texas.

The results and the conclusions of this study are presented and discussed in this paper.

Background

The need for maintenance planning

There are about 96,000 schools in the USA governed by approximately 17,000 school districts (US Department of Education, 2003b). In 2006, United States school districts spent an estimated \$25.3 billion on school construction, with 54.1 per cent of that being new construction, and the rest being modernizations (32.9 per cent) and additions (13.0 per cent). For 2007-2009, school construction costs are expected to total nearly \$51.4 billion (Agron, 2007). Based on the report, the national average construction cost for a school ranges from \$16,010 per student (for an elementary school) to \$30,000 per student (for a high school). The Texas Education Agency provides detailed financial information on school districts in the state of Texas: these facilities spent a total of \$3.44 billion in the academic year 2005-2006 for plant maintenance and operation. This represents an expenditure of \$763 per student (Texas Education Agency, 2008), which is approximately 3.7 per cent of the new construction cost.

Li *et al.* (2005) have described the unique learning environment of the twenty-first century learner. As school buildings become older, they face the growing challenge of maintaining the facilities at a level that enables educators to meet this distinctive environment. Construction of new schools definitely helps in upgrading educational facilities and providing better quality of education, but it is equally vital to maintain existing schools to acceptable healthy standards. The physical environment – the school building – is an undeniably integral part of the ecological context of learning (Lackney, 1999).

The US Department of Education (2003a) stated in its report that:

... the task of caring for these old school buildings... at a level that supports contemporary instructional practices is substantial. At the same time, maintaining the finally tuned workings of new, more technologically advanced facilities also demands considerable expertise and commitment.

Previous studies have found that students are likely to perform better in newer or recently renovated buildings than they do in older ones (Bullock, 2007; O'Neill and Oates, 2001). However, even a new building may suffer from inadequate air circulation, which can lead to indoor air quality (IAQ) problems unless remedied, whereas poor IAQ might affect concentration and student performance (US Environmental Protection Agency, 2008). Older buildings, on the other hand, more frequently face age-related issues such as roof leakage, inefficient energy systems, and other cosmetic problems that can lead to an uncomfortable indoor climate and high utility bills (New Hampshire Department of Education, 2006). These findings emphasize the importance of school buildings being in good physical condition.

Extreme environmental conditions and lack of maintenance funding contribute to building deterioration; however, the US Department of Education (2003a) found that many facility problems are related to maintenance staffing level, training, and management practices. Maintenance planning provides substantial help by providing resourceful information about the facility and the amount of work required. According to Palmer (2006), planning of maintenance activities may free up the work force, whereby the extra labor power can be reallocated to added value activities. Payant and Lewis (2007) conclude that facilities should be kept operable to the standards required by the users. If effective facilities maintenance is not planned, maintenance tends to occur when equipment breaks – typically a more costly arrangement that interrupts building use (Kaiser, 1993). Therefore, Avedesian (1996) suggests that this job is too big and too important to be approached unsystematically.

Short- and long-term planning

Once all maintenance needs have been identified, they must be prioritized, which then forms the basis on which a multi-year maintenance plan is developed. A good maintenance plan soon evolves into a short-term plan and a long-term plan, where identified maintenance projects are placed in order of priority (Stewart, 2007). Chanter and Swallow (2007) describe short-term planning as being more detailed, and conducted when performance analyses of the facility and its components, routine operations, and manpower planning are needed. They also claim that long-term planning can be used for a variety of purposes, such as determining the expenditure required for maintenance over a period of time, planning the expenditure on major repairs and renewal projects depending on available financial resources, and ensuring that their timing has minimum disruptive effects on the organization. In any case, both the short- and long-term maintenance plans should be periodically updated (Allen, 1993).

Effective maintenance is critical to a successful building's operations as poor maintenance leads to more frequent failures, poor utilization of equipment and delayed schedules (Djerdjouri, 2005). Breakdown maintenance postpones repairs and allows damage to accumulate, compounding an organization's problems. Regularly scheduled equipment maintenance not only prevents sudden and unexpected equipment failure, but also reduces the overall life-cycle costs of the building (Rondeau *et al.*, 2006). The

planning process should result in a comprehensive plan that covers all areas of concern. Developing a good plan requires the commitment of everyone involved in the maintenance and operations process, including senior management (Wheeler, 2007). Following are some guidelines suggested by the US Department of Education (2003a) for effective maintenance planning:

- A well-conceived, formulated and written school facilities maintenance plan is an essential component for an effective school program.
- Facilities maintenance planning should be one component of a greater organizational management plan.
- Good facilities maintenance planning includes long- and short-term plans, which demonstrate organizational commitment to facilities maintenance.
- The maintenance plans should be periodically updated.
- It is essential to include stakeholders, school administrators, maintenance and custodial representatives, teachers, parents and students in the maintenance planning process.

Facility condition auditing

According to the US Department of Education (2000), the average age of the nation's school facilities was 40 years in 1999; however, another report (US Department of Education, 2003b) suggests that age defined by the year a building is built is a poor indicator of its condition, as initial design, quality of construction, and maintenance practices contribute much more to the facility's condition. When the organization knows the condition of the facility, the need for maintenance or repair becomes much clearer. The best way to protect any organization from future liability is to implement an effective facility auditing program (Gilbert, 1999). As facility information is necessary for planning, facility condition assessments should utilize proper methodology, and institutional practices should be able to predict deferred maintenance needs (Rose, 2007). For this, a comprehensive review of the facility's condition is needed. The quality of facilities decisions is only as good as the information on which they are based. Poor building performance and low efficiency can have a major impact on a school's bottom line. Not only do they cause utility costs to significantly increase, but they may lead to occupant discomfort, health problems, and lower productivity (Taival, 2007). The information generated is valuable and provides excellent building data for facility planning, when coupled with enrollment data trends. Any organization's facility presents a moving target, in terms of maintenance; hence, periodic updates of building condition and consciously recording projections is vital (Hamer, 1988).

Data collection and management

The recording of collected data depends on the organization. Various options are available in the market for recording data, from software with electronic pick lists on Palm Pilots to low-end pad and pencil. Following are a few guidelines provided by the US Department of Education (2003a) for collecting facility data:

- Facility audits must be performed regularly.
- If data is collected manually, it should be stored in a computer database.
- Data should be recorded consistently, for benchmarking purposes.

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- Recording images and videotaping sites can be powerful data collection and documentation tools.

Once the large amount of information is assembled, storing that information in an easily accessible manner (retrievable and updatable) becomes vital. Maintenance management is driven by information, and a maintenance department manages this information, to convey its ability and reliability. Bacalu (2007) states that: “proper document management can significantly enhance the effectiveness of a maintenance organization.” Deciding how to systematically store and manage the volume of data collected during inspections is also important in the planning stage. Failure to do this may make it difficult for the staff to use the inspection information and thus, they will derive little value from it (Avedesian, 1996).

Negligent facilities maintenance planning can cause major problems. Large capital investment may be misspent when buildings and equipment deteriorate or warranties become invalidated. Since school facilities are primarily financed by the public, it is important to adequately invest those public funds. Furthermore, failing to maintain school facilities might also discourage future public investment in the education system.

Research methods

Based on the guidelines of the US Department of Education (2003a, b), a questionnaire was developed in which 14 questions were asked (see the Appendix). To identify maintenance planning practices, questions were asked regarding long- and short-range planning, and the importance of facilities maintenance in the school. To identify facility audit practices, questions were asked regarding schools’ facility condition assessment program, and the regular practice for storing recorded data. Questions were also asked about schools’ practices in using the facility condition data for future planning.

The population for the present study is composed of public elementary, middle and high schools in the cities of Houston, Dallas, Austin and San Antonio, Texas, USA. Texas is the second most populated state in the USA, with over 23.5 million residents, out of which 4.53 million were enrolled in public elementary and secondary schools in the fall of 2005 (US Department of Education, 2008a). In terms of total expenditure for public elementary and secondary education, Texas ranks number 3 in the nation, following the states of California and New York, with an annual expenditure of approximately \$42.2 billion in the academic year 2005-2006 (US Department of Education, 2008b). When looking at the total expenditure on facilities acquisition and construction, Texas ranks number 2 with \$5.78 billion a year, following California. The same ranking applies for operations and maintenance in elementary and secondary education, where Texas was reported as having a total expenditure of \$3.88 billion in the academic year 2005-2006, following the state of California (US Department of Education, 2008b).

The four cities selected for this study comprise the four largest metropolitan areas in the state, having a significant number of schools in them. There are approximately 1,000 public schools with regular instruction in these cities, not including alternative, juvenile justice, budgeted and discipline instruction type schools. For the purposes of the study, public elementary, middle, and high schools with enrollments of 750 or more students were selected from each above-mentioned city for the survey. For this study it is assumed that, as enrollment of the school increases, the size of the school facility also

increases. The list of schools was generated from the Texas Education Agency's web site; the schools selected for the survey have contact information of the facilities maintenance/plant manager or the principal available on their web site. According to the US Department of Education (2003a), facilities issues arise in new schools and old schools, as both types of schools require equal expertise and commitment to maintenance. Therefore, the actual service life of the buildings was not considered as a factor in the data collection.

The web site filtered schools by city and school type. From each city, the top 26-27 schools listed under elementary, middle and high schools with enrollments of 750 or more were selected. The sample population consisted of 320 schools, with 80 schools from each city. Participation in the study was voluntary, with no monetary benefits distributed to the participants. The responses were received in a secure database established at an online web site. Providing the school's name was optional, however, 80.6 per cent of the respondents made this information available. In the data analyses, the researcher omitted the school's names to protect confidentiality.

Findings

Of the 320 public schools contacted, 72 responses were collected, reflecting a response rate of 22.5 per cent. Respondents reported holding position titles of plant managers, facilities managers, maintenance managers, and chief maintenance engineers. Yet, since all respondents reported being responsible for the performance of the built environment, they can be considered as the facilities manager in charge at that school, regardless of their position title. In any case, only one response was collected from each school surveyed. Respondents to the survey represented schools with enrollments ranging from 779 to 3,289 students. The participation distribution is summarized in Table I. The responses were benchmarked with suggested guidelines from the US Department of Education (2003a) in the *Planning Guide for Maintaining School Facilities* and the literature.

Statistical T-tests were conducted on the responses received, after categorizing them by the city in which the school is located. Given the small sample size, no significant statistical difference was observed for any of the four cities on any of the questions asked, meaning that the distribution of results is homogeneous and consistent among the responses collected. As a result, the analyses presented in this paper were conducted on the responses as being from one group, representing school facilities in the state of Texas, rather than by city of residence.

Table I.
Distribution of
participants, by city

City	Number of responses
Austin	17
Dallas	19
Houston	22
San Antonio	14
Total	72

Facility maintenance plans

According to the US Department of Education (2003a), a well-conceived, formulated and written school facilities maintenance plan is an essential component of an effective school program. This also reflects a school's degree of systematic maintenance planning. In addition, facilities maintenance planning should be one component of a greater organizational management plan. As such, it reflects the fact that school planners understand the utmost importance of facilities maintenance as it affects teaching and learning. As seen in Table II, 33.3 per cent of the schools' maintenance officials are not aware of such practices and approximately 3 per cent do not have a written plan for facility improvement. Yet, 86.1 per cent of school officials acknowledge the importance of facilities maintenance planning as a part of their overall organizational plan.

As per the US Department of Education (2003a), it is essential to include stakeholders (independent school district representatives), school administrators, maintenance and custodial representatives, teachers, parents and students in the maintenance planning process. Table III shows that school administrators, maintenance representatives, and stakeholders are involved with long-range planning, whereas only 56.9 per cent of the schools include teachers, and less than 30 per cent of the schools are apt to include students and parents. With short-range maintenance planning, the picture is even worse: only maintenance representatives and school administrators are included in the process. Teachers and stakeholders are very seldom, students are rarely, and parents are never included in the process of short-range maintenance planning. Since teachers and students are the most important users of the school facility, their inclusion in planning is necessary as their comfort level for teaching and learning is very important. Nevertheless, in short-term maintenance planning faculty and student input needs to be organized in order to be

Response	Does your school have a written facilities maintenance plan that guides your planning? (%)	Is facilities maintenance planning a component of overall organizational planning? (%)
Yes	63.9	86.1
No	2.8	0.0
I do not know	33.3	13.9

Table II.
Participants' responses to questions about facilities maintenance planning

Response	Group involved in long-range planning (%)	Group involved in short-range planning (%)
School administrators	94.4	94.4
Facilities/maintenance/custodial representatives	91.7	100.0
Teachers	56.9	25.4
Parents	22.2	0.0
Students	26.4	4.2
Stakeholders	79.2	28.2
No planning is done	9.7	0.0

Table III.
Groups involved in short- and long-range planning

consistent and objective; a good Computerized Maintenance Management System (CMMS) software input interfaces can achieve this with minimal training.

The long-range planning for most of the schools (83.3 per cent) typically spans from 3 to 5 years (Table IV). Long-term planning needs to be updated periodically to meet the changing state of the facility and its condition (Allen, 1993), but clearly, about 28 per cent of the schools do not update their long-range plans. Approximately, 10 per cent of the schools do not have a long-range plan in place, and 18 per cent of the schools do not update their long-range plan, in spite of having one. It is crucial to update long-range maintenance plans (2-7 years duration), as facility conditions change rapidly. For short-term planning the US Department of Education (2003a) indicates that a plan should be updated on a quarterly basis for routine operation and maintenance, manpower distribution, etc. This is practiced by only 18.3 per cent of the schools (Table IV), whereas for 81.7 per cent of the facilities, short-range planning typically spans between six months and a year.

Facility condition assessment

Hamer (1988) and the US Department of Education (2003a) suggest that the data collected by a Facility Condition Assessment (FCA) should be used for short- and long-range planning, routine operation and maintenance, establishing benchmarks for measuring equipment and component's service life, and preventive maintenance. This is not the case for most of the schools (see Table V). Although all of the schools use this information for routine operation and maintenance, less than half of the schools use the FCA for establishing benchmarks and for long-term facility planning.

Table IV.
Span of facilities
maintenance plans and
updates

Response	Span of long-range plan (%)	How often is the long-range plan updated? (%)	Span of short-range plan (%)
1 month	-	-	4.2
3 months	-	-	14.1
6 months	-	1.4	56.3
1 year	-	41.7	25.4
2 years	2.8	29.1	-
3 years	45.8	0.0	-
5 years	37.5	-	-
7 years	4.2	-	-
N/A	9.7	27.8	0.0

Table V.
Uses of facility condition
assessments

Purpose	Percentage
Routine operation and maintenance	100.0
Short-term facilities planning	87.5
Preventive maintenance	51.4
Long-term facilities planning	47.2
Establishing benchmarks for measuring equipment/component's service life	31.9

According to the US Department of Education (2003a), facility audits must be performed regularly, e.g. annually. The condition of a building and its components change as they age; hence it is important to keep the information up-to-date. When the organization knows the condition of their facility, the need for maintenance or repair becomes much clearer. It was found that 30.5 per cent of the schools conduct audits once every three to five years. This is a very long period, as facility conditions change rapidly and the importance of current building condition information is vital for facilities maintenance planning.

Facility inventory data

The next questions addressed recording and storing the FCA data. Recording and storing the condition data is significant since this information helps policymakers reach decisions about school buildings, which in turn, provide a better learning environment for students (Stewart, 2007). Hence, incomplete or inaccurate information will only discourage effective decision making for facilities planning and improvement. To record data accurately, assessors should use standard checklists and forms (US Department of Education, 2003a). Deciding how to systematically store and manage the volume of data collected during inspections is also important in the planning stage. Failure to do this may make it difficult for the staff to use the inspection information and thus, it will offer little value. Facilities data is so valuable that it should be regarded as an organizational asset and should be stored in a computer database that is strong and flexible enough for data import, export and updates (US Department of Education, 2003a). Of the schools, 62.5 per cent record data using standard checklists and forms, while 54.2 per cent of the schools store that data in computers. Recording data on blank papers, as practiced by 36.1 per cent of the schools, is not the best practice, since the data can be inaccurate, as it is not directed by standard checklists. Storing data in paper files, practiced by 41.7 per cent of the schools, is also not recommended by the US Department of Education (2003a). This not only takes considerable storage space, it also makes it difficult to share the information with other facility planners. If the data stored in paper files is not organized, then retrieving particular information in a timely manner becomes almost impossible.

The next question dealt with the type of information that the facility inventory database contains. As mentioned earlier, it is very important to have complete information on a building's condition and its components, in order for planners to plan facilities maintenance. As per Hamer (1988), the database should contain information about physical space resources, historical data, current and projected needs, staff, equipment and space requirements, fixed assets inventory (furniture inventory), and cost and schedule information. The survey found that most of the schools have detailed information on physical space resources (space/occupancy inventory) (94.4 per cent), fixed asset inventory (furniture and equipment) (91.7 per cent), and historical data and current needs (staff, equipment, and space requirements) (90.3 per cent). Nevertheless, what many schools lack is information on projected needs, and cost and schedule information, where only 30.6 per cent and 13.9 per cent of the schools, respectively, store this information in their database.

The last question was on the respondents' estimate of how much inventory data on the school facility's condition, and its components, they think they have available. While 47.3 per cent of the schools have inventory databases of 75 per cent or less, only

11.1 per cent of the respondents answered that they have an inventory database of 91 per cent or more.

Overall maintenance management practices

According to the US Department of Education (2003a), an FCA should use all three of the following criteria: implementing visual inspection, using adequate tools, and recording facility condition images. If performing all three is considered an “ideal assessment,” the survey found out that 25 per cent (18 schools) of the sample reaches this level. For this group of schools, the survey found that 88.9 per cent of them conduct an FCA once every two years, or more frequently. The facility condition data in these schools is used more effectively and for wide-ranging purposes: 100.0 per cent of the schools use this data for short-term facility planning and for their routine operation and maintenance planning, 83.3 per cent of the schools use it for long-term facility planning, 72.2 per cent of the schools use it to plan their preventive maintenance, and 66.7 per cent of the schools use it for establishing benchmarks. All of these categories show better use of the data, compared to the numbers given in Table V. Therefore, these schools have better information from the FCA findings, and hence, they are in a position to make better decisions related to facilities maintenance planning. For the same group of schools it was also found that their inventory contains: physical space resources, fixed asset inventory, and historical data and current needs (in 100.0 per cent of the schools), projected needs (in 72.2 per cent of the schools), and cost and schedule information (in 33.3 per cent of the schools). All these categories reached higher percentages for this group than for the entire sample population. This shows that “ideal assessment” practices can provide more detailed information about school facilities and their projected needs. Finally, concerning the amount of information stored in the database, it was found that 94.4 per cent of these schools have 76 per cent or more of their information stored, compared to only 52.8 per cent in the entire sample population.

Conclusions

Following is a summary of the results of the study:

- Properly implemented facilities maintenance planning should be one component of a greater organizational management plan. Yet, only 64 per cent of the schools have a well conceived maintenance plan that guides facility improvement.
- Since teachers and students are the most important users of the school facility, their inclusion in planning is necessary. Yet, 43 per cent of the schools do not include teachers and 75 per cent of them do not include students in their maintenance planning.
- Long-term planning needs to be updated periodically to meet the changing state of the facility and its condition. Notably, 90 per cent of schools have a long-range plan, and 72 per cent of the schools update that plan periodically.
- Only 25 per cent of the schools conduct “ideal assessment,” a practice providing more accurate and adequate information about the facility condition, which may result in better decisions for facilities maintenance planning.
- A total of 31 per cent of the schools conduct an FCA once every three to five years. This is a very long period, as facility condition changes constantly, and

the importance of this information is vital for maintenance planning decision-making.

- Less than 50 per cent of the schools use the FCA findings for long-term planning and for establishing benchmarks for building components' service life. Only 51 per cent of the schools use this information for preventive maintenance. However, when a school practices "ideal assessment," it has more information in its database, and it is in a much better position to plan for facility needs by using that information for short- and long-range planning, planning preventive maintenance, and establishing benchmarks for components' and equipments' service life. Another aspect of using FCA data and information systems is planning, or budgeting for future renewal of key building systems. It takes discipline by executive administration staff to do this and not divert funds over time to other short-term and less strategically important expenditures.
- Schools that practice "ideal assessment" have comparatively more detailed and up-to-date information about their facility's condition. Hence, these schools are able to predict the projected needs of the school, as well as its maintenance.

This study was undertaken to evaluate the facilities maintenance management practices in large public schools in Texas. It was found that, although the majority of the schools considered maintenance planning to be an important part of the overall organizational plan, most of them do not have adequate information about their facility's condition, which is essential for planning. The review of literature revealed that for effective facilities maintenance planning, up-to-date and detailed facility condition information is critical. The majority of the schools lack this information because their practice for collecting facility condition information is inadequate. The data collected in this study reveals that those schools that conduct a building condition assessment, as recommended by the US Department of Education, have a facilities maintenance management practice that contributes to the well-being of the school. These 25 per cent of schools are able to gather more detailed and up-to-date information about the condition of their school facility and its components; therefore, they are able to further use this detailed information for proactive activities like long-term planning, benchmarking components, and preventive maintenance. The significance of this study follows: although the sample size was small and it included only 72 responses, it still identifies a link between the extent to which facilities maintenance management is implemented in public schools and the outcomes of implementing these practices, in terms of their ability to develop and maintain proactive facilities maintenance management programs.

Today, maintaining American school facilities has become a mounting challenge for school authorities. The US Department of Education has claimed that poor building conditions are mainly due to poor maintenance staffing levels and management practices by school maintenance departments. As facility conditions directly impact teaching and learning, it is very important for school districts to provide a healthy learning experience for quality education. For this, facility planners need to plan school maintenance efficiently and effectively, but the findings of this research reflect the poor quality of facilities management practices in large public schools in Texas. The study population was limited to school facilities in the state of Texas; therefore, the authors believe that inference cannot be made to school systems in other states or countries,

since they were not sampled and there is no statistical justification for doing so. Nevertheless, while the researchers will not infer from it, other states with large investment in public schools may use the concepts discussed in this paper in assessing, evaluating, and improving their facility maintenance management practices. The results of this study can also be used by any public school whose mission is to provide high-quality school facilities for healthy and supportive teaching and learning experiences.

Based on the findings of this study, future research can be conducted in several directions. For example, the impact of the school type (elementary, middle, and high school) on facilities maintenance could be studied. As the users of high schools tend to be less friendly to the building/property, and typically more aggressive toward the school facility premature failure, maintaining such a facility would be a greater challenge for the maintenance department. A different study could be conducted on analyzing the challenges faced by facilities maintenance departments in maintaining older school facilities to acceptable standards.

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Appendix. The survey questionnaire

- (1) Does your school have a written facility maintenance plan that guides your planning for facility improvement?
 - Yes
 - No
 - I do not know
- (2) Is facility maintenance planning a component of overall organizational planning?
 - Yes
 - No
 - I do not know
- (3) The long range planning for school's facility maintenance includes which of the following groups? (select all that are applicable)
 - School administrators
 - Facilities/maintenance/custodial representatives
 - Teachers
 - Parents
 - Students
 - Stakeholders
 - I do not know
- (4) Long range facility maintenance planning typically spans for:
 - 2 years
 - 3 years
 - 5 years
 - 7 years
 - No long range planning is done
- (5) How often are they updated?
 - 6 months
 - 1 year
 - 2 years
 - 3 years
 - Not applicable
- (6) The short range planning for school facility maintenance includes which of the following groups? (select all that are applicable)
 - School administrators
 - Facilities/maintenance/custodial representatives
 - Teachers
 - Parents
 - Students
 - Stakeholders
 - I do not know

- (7) Short range facility maintenance planning typically spans for:
- 1 month
 - 3 months
 - 6 months
 - 1 year
 - More than 1 year
 - Not applicable
- (8) Facility condition assessment and survey inspection is typically done by: (select all that are applicable)
- Visual inspection
 - Use of hand tools, meters, sensors, etc.
 - Use of building assessment and inspection software
 - Recording video and images of building condition and components
 - Not done
- (9) Facility condition assessment is typically done:
- Once in six months
 - Once in a year
 - Once in two years
 - Once in three to five years
 - Not done
- (10) Facility condition assessment is:
- Recorded using standard checklists and forms
 - Recorded by writing assessment on blank papers
 - Not done
- (11) How is the condition assessment data stored?
- In computer (e.g. MS excel, word, note pad, etc.)
 - In paper file
 - Use of assessment software
 - Not applicable
- (12) The facility condition findings are used for: (select all that are applicable):
- Short term facility planning
 - Long term facility planning
 - Routine operations and maintenance
 - Establishing benchmarks for measuring equipment/component's life
 - Preventive maintenance
 - Not applicable
- (13) How detailed inventory data of the school facility condition and its components do you think you have?
- 0%-10%
 - 11%-25%
 - 26%-50%

- 51%-75%
- 76%-90%
- 91%-100%

- (14) What does your facility inventory database contain? (select all that are applicable)
- Physical space resources (space/occupancy inventory)
 - Historical data and current needs (staff, equipment and space requirements)
 - Projected needs
 - Fixed assets inventory (furniture and equipment)
 - Cost and schedule information
 - No database available

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