



A PRACTICAL GUIDE FOR SCHOOL BUILDINGS MAINTENANCE

Mohamed Abd Elmawgoud Abd Elghaffar

Assistant Professor, Faculty of Engineering, Tanta University, Egypt

Email: mawgoud@gmail.com

ABSTRACT:

This paper's objective is to help school administrators, staff, and community members better understand why and how to develop and implement a facilities maintenance plan. It provides a detailed list of areas, spaces, materials to be maintained as well as a list of defects to be corrected. It also helps plan maintenance activities and evaluate maintenance programs.

The school maintenance program is composed of three components: First, organization, which identify personals in charge and their responsibilities too. Second, inspection, which define the actions to be conducted to prepare a school maintenance plan. Inspection should cover all school building's elements: structure, roofing, building exterior and interior, plumbing system, electrical system, and grounds. Third, maintenance plan, which should ensure that the school building can function at its designed level at all times during its normal lifespan and resist the effects of any natural event as per design.

The paper displays in details each of inspection elements and discusses its maintenance problems and give proposals to solve these problems. It also presents checklists for these inspected components. The papers also discuss the priorities of actions to be taken for preventive maintenance of school buildings. It also presents considerations to plan assessment of maintenance program, and gives some important questions to help assessing building maintenance status.

1-INTRODUCTION:

A school maintenance program is an activity carried out by the school community to extend the life of buildings, furniture and equipment. In order to start a school maintenance program the school building should meet a minimum standard of condition. The school maintenance program should be systematic and pro-active to prevent the unexpected failure. When maintaining a school, we pay not only for bricks and mortar, but also for student and staff well-being. Effective school maintenance protects

capital investment, ensures the health and safety of our children, and supports educational performance^[1].

2-MAINTENANCE PROGRAM:

Good facilities maintenance costs money but unlike many other investments, at the same time facilities maintenance produces savings by: decreasing equipment replacement costs over time, decreasing renovation costs because fewer large-scale repair jobs are needed, and decreasing overhead costs (such as utility bills)

because of increased system efficiency. The maintenance program should be composed of three components: organization, inspection and maintenance plan^[1].

2.1-Organization:

The organizational structure of the school maintenance program should define tasks and vary with the complication of the school community. Avoiding complex structures is suggested. Principals, representatives from parent teacher associations, students, and any other school organizations should be responsible for setting up the school maintenance program. The success of a school maintenance program depends on the school community's ability to be

organized and keep track of all activities included in the program^[1].

A school maintenance organizational structure should include a general coordinator, a fund-raising coordinator, and a responsible team for every area of the school building. The general coordinator is responsible for: scheduling inspection activities, collecting information, preparing a building analysis, and preparing the annual maintenance plan. The fund-raising coordinator plans to raise funds to be used for day to day maintenance and minor repairs carried out by school personnel. It is recommended to assign a team for every area of the school to conduct an inspection on each part of the school building^[2].

Table (1): School maintenance program organizational structure

Name of school:	Date of inspection:
Name of community :	Name of person who filled out the form:
Area	Person Responsible
General Coordinator	
Fund-raising	
Structure team	
Roofing team	
Building exterior team	
Building interior team	
Plumbing team	
Electrical team	
Ground team	
Furniture and equipment team	

2.2-Inspection:

An initial inspection needs to be done to prepare a maintenance plan. The information gathered during the initial school building inspection is the basis for the maintenance program. An analysis report should be prepared in order to summarize the inspection. The preliminary inspection is intended to assist in the evaluation of the overall condition of the school building. The inspection should not be based only on observations of visible condition of the building. It should be a continuous

process in order to update the school maintenance program. If a problem occurs decisions about what curative measure should be made. The inspection starts with simple observations of the inside and outside of the school. Use checklists to determine which items require attention and what action should be taken. The areas of the school building are the following^[3]:

2.2.1-Structure:

The structure of a school building is the group of columns, beams, structural walls,

floors, and roof structure. Over time the building settles and moves creating stresses at joints that cause small cracks to appear. In most cases, this is a normal part of the structure settling in its foundation. However, there are cases where cracks are cause for concern and action. If there is a major structural problem, it should be evaluated by a structural engineer, and the corresponding repairs should be made.

Fine cracks often appear in concrete floors, these are not cause for alarm. Most school building have concrete floors which are not part of the foundation, but are constructed separately. This is called a floating slab as it rests on a bed of gravel or sand, and moves slightly with changes in the bed. That floating motion creates a hairline crack. The crack often appears where a sump or steel column is located. Hairline cracks in a ground floor slab are common, and generally not serious. But there are exceptions: if the cracks are more than

1/4" wide; if they are getting larger, or if water is seeping through the cracks. This is the time to consult with a structural engineer^[4].

Special attention should be paid to these aspects:

- Deform in columns, beams, structural walls, floors, and roof structure
- Decaying in wood structural components
- Rusting of metal structural components

Wood and metal structural components need repainting on a regular basis. Wood cracks should be sealed with caulk prior to painting. Under the base of the wood column decay is likely to occur since wood will absorb water at the ends. The roof's structural support system holds the roof in place. The purlins, rafters, and wall plates should be free from rot and insect infestation. The drive screws should be fixed into solid material, and the wall plates should be secure to the walls by bolts.

Table (2): School building structure inspection list

Name of school:		Date of inspection:		
Name of community:		Name of person who filled out the form:		
Component	Conditions		Remarks	Location
	Choose one.			
Identify the specific item accordingly with a description. Leave blank if the item does not exist.	Satisfactory	Not Satisfactory	If unsatisfactory, describe the problem	Where is the unsatisfactory component located in the school building?
Columns				
Beams				
Structural walls				
Ground floor				
Upper floor				
Roof structure				
Stairs				
General Remarks:				

2.2.2-Roofing:

Roofs protect buildings from rain, sun, and wind. In a pitched roof, sheets should be well-secured and not corroded. The ridge cap should be strongly fixed to the roof sheet. In flat roofs rainwater can be impounded on. They require a final covering to provide protection from the sun, wind and rain.

Flashing is used in roofing systems to help seal out water. It is installed where two sections of roof come together, or where something penetrates through the roof line such a vent pipe. Good maintenance of roofs includes an examination of the flashing.

Gutters need to be kept clean. Blocked gutters cause water problems into the school

building. Also they should be examined for leaks. Gutter brackets should not be broken or rusted. Down-spout pipes should be undamaged. The rainwater should flow through the gutters and into the down-spouts. Never allow water from down-spout to pour directly on a roof below. Connect upper storey down spouts to lower level gutters^[3].

2.2.3-Building Exterior:

The school building’s exterior needs a periodic maintenance to protect the materials. The greatest threats of the school building’s

exterior are water, wind, sun, and in coastal areas, saltpeter. A visual inspection is required to check conditions of the exterior walls and covering. It is important to look for peeling paint, missing mortar between masonry, cracks, mold growing on walls, and bushes and shrubs touching the building’s exterior. The exterior walls should be kept clean and free of debris. Leaves and plant materials should be raked away from the walls so that any water drains away. A semiannual cleaning is an important step in the maintenance process.

Table (3): School building roofing inspection list

Name of school:		Date of inspection:		
Name of community :		Name of person who filled out the form:		
Identify the specific item accordingly with a description. Leave blank if the item does not exist .	Choose one.		If unsatisfactory, describe the problem.	Where is the unsatisfactory component located in the school building?
	Satisfactory	Not Satisfactory		
Roof covering				
Flashing				
Gutters				
Down-spouts				
Flat roof protection				
Other				
General Remarks:				

In exterior brick, concrete block, or any masonry walls, the basic concerns are cracking and water intrusion. Water can erode the mortar. If there are cracks, there are more openings for water to enter. If there is a pale film on the masonry, this is called efflorescence and is the result of dried mineral salts. If there is mortar falling out of the joints, it’s time for a restore process. Fresh mortar has to be put into those open joints. Over time, problems may spate the wainscot. The paint over the wainscot may peel due to moisture. The joint between the masonry portion of the exterior and any other material such as wood or metal trim on doors and window frames should be carefully checked. Because the materials are dissimilar, they have different rates and characteristics of expansion and contraction. Wood siding

products are all vulnerable to water. Two simple rules apply to maintaining wood exteriors:

- 1-The wood must be kept coated with a protective film of paint or stain.
- 2-All joints and openings must be caulked to prevent water intrusion.

Therefore, in the periodic check look for peeling paint, or stains that have worn so thin that the wood grain is exposed and raised. Also look for open joints, where water can penetrate. Action should be taken before wood rot sets in because if that occurs, the only course may be to tear off the rotted section and install new materials, which is always more expensive.

Typically, the maximum time interval for repainting and applying waterproofing is seven to ten years for wood plank siding. For other

wood materials, it is much less. Exterior plywood must be checked each year and may need more frequent treatment. Particle board will need touch-up every year to avoid warping. Exposed edges of wood are the points where water is most likely to penetrate. Those edges should be well sealed with paint and caulk.

If there are metal frames, doors, windows, and railings, protective paint is required to avoid rust and deterioration. Wood doors, windows, railings and posts should be sanded and painted. Door and window hinges should be oiled at least annually^[4].

2.2.4-Building Interior:

Maintenance of interior masonry walls usually is minimal unless cracks appear. The horizontal crack is the most serious because it indicates great pressure against the wall from the outside. A vertical crack, or stair step one, is caused by differential stress along the base of the wall. It may result from simple settlement. If

there is a hairline crack where the walls join other elements, just resealing and repainting ought to do the trick.

Windows should open and close easily. The operators on louvered windows should work properly. Glass windows should be completed, fitting the sheet of glass into the window frame.

Many interior doors are hollow-core. They are light and easily punched having a hole in one. Sometimes a door starts to stick at a corner. This is due to settlement of the building. If it is not serious, the door can be removed and the sticking edge planed down to relieve the problem. If the door is sticking, it could be out of rack, which indicates a more complex problem involving the school building's structural system. The ceiling may drop due to panels loosening, or if it has plaster, the plaster coats may be pulling away from the lath. It may also be structural, such as an overloading of a ceiling. Or it could be a water leakage problem^[4].

Table (4) : School building exterior inspection list

Name of school:		Date of inspection:		
Name of community :		Name of person who filled out the form:		
Identify the specific item accordingly with a description. Leave blank if the item does not exist .	Choose one.		If unsatisfactory, describe the problem.	Where is the unsatisfactory component located in the school building?
	Satisfactory	Not Satisfactory		
Exterior walls				
Exterior windows				
Exterior doors				
Corridor railings and posts				
Other				
General Remarks:				

Table (5) : School building interior inspection list

Name of school:		Date of inspection:		
Name of community :		Name of person who filled out the form:		
Identify the specific item accordingly with the description. Leave blank if the item does not exist .	Choose one.		If unsatisfactory, describe the problem.	Where is the unsatisfactory component located in the school building?
	Satisfactory	Not Satisfactory		
Floor covering				
Interior walls				
Ceiling				
Interior doors				
Interior windows				
Window glazing				
Other				
General Remarks:				

2.2.5-Plumbing System:

Most of a school's plumbing has five major parts: water supply, water storage, fixtures, waste collection, and septic system. Water is provided either by a public system or a private well, and the water storage could be underground or elevated. From there the distribution enters the school building through the pipes. Next, there is waste collection. At each fixture (lavatory, sink, washbasin, shower, drinking fountain, urinal, and toilet) there will be a connection to waste collection piping. Waste water pipe leads to either a major public sewer line or a septic treatment system. Waste collection piping also has vents to get sewer gas into the atmosphere, and provide air into the system to help it work.

Plumbing leaks can be a bigger problem as it is out of sight, behind the walls and under the floor. If a water pipe ruptures the water supply should be temporary turned off. Where the water service pipe enters the school, there will be a main shut-off valve. Most plumbing fixtures have shut-off valves mounted on them, which can be used to isolate the fixture. One of the biggest problems is a break in the water entry pipe due to settlement in the ground. This

requires excavating the trench and repairing the pipe. Some schools may have entry pipes made of lead, which raise concerns about possible lead poisoning. Replacing the service entry pipe with another material is the best solution. Water storage tanks should be inspected every year, and cleaned if necessary. In flush tanks, the flapper valve at the bottom should close off the opening where the water flows from the tank into the bowl. If water still runs, the situation can usually be corrected by adjusting one or the other. If a simple adjustment does not work, the inner mechanism in the tank may have to be replaced^[5].

The waste collection system consists of large pipes that gather the used water from all fixtures and transport it to a treatment system. If the toilet or any other fixture rocks when used, it should be tightened to prevent leakage so preventive maintenance requires a periodic look under lavatories and sinks. Other common problems are blockages. Paper or other objects can become stuck in the waste line, to clean the obstruction, a special auger, has to be used. Septic tanks should be inspected every year, cleaned and flushed out at least every four years.

Table (6): School building plumbing inspection list

Name of school:		Date of inspection:		
Name of community :		Name of person who filled out the form:		
Identify the specific item accordingly with a description. Leave blank if the item does not exist .	Choose one		If unsatisfactory, describe the problem.	Where is the unsatisfactory component located in the school building?
	Satisfactory	Not Satisfactory		
Water Supply				
Water Store				
Fixtures				
Waste collection				
Septic Tank				
Other				
General Remarks:				

2.2.6-Electrical System:

The school's electrical system consists of the electrical panel box where power lines bring electricity, and branch lines (circuits) which take electrical power to other parts of the school. In most school buildings there are two lines, each brings 110 volts into the school. Smaller circuits, those for lights, outlets and most other equipment, use 110 volts. Heavier equipment will need 220 volts. A third main line called the neutral, sometimes called the ground conductor, carries electricity back out of the school, to the transformer. There is also one more main wire, the grounding wire. This wire runs from the connection at the neutral to a metal rod buried in the earth. The electrical panel box will contain either fuses or circuit breakers. They prevent over heat and possible fire as they blows when heat reaches a preset level. If this happens, there should be faulty equipments that have to be repaired or replaced. Once the cause is determined and solved, reset the circuit breaker, or replace the fuse. If there is a circuit breaker in the school, there is a simple maintenance task to be performed every six to 12 months. One by one, turn off the circuit breaker and turn it back on^[6].

2.2.7-Grounds:

Sidewalks are typically concrete, but a walkway may be concrete, asphalt, brick, stone, or even wood. Good maintenance means keeping a watchful eye for conditions that may cause tripping hazards or water drainage toward the school building. Driveways and parking lots are typically built of asphalt, concrete or gravel. Gravel driveways often develop ruts regarding may be needed in addition to more gravel. Concrete is a durable material, but it may start to crack as the ground under the driveway shifts slightly. Asphalt driveways may experience sinking, but asphalt can be patched. When severely deteriorated, an asphalt driveway can have a new topcoat added, provided that the additional coating does not create a problem to the school building. The driveway elevation should be below the school building floor so that rain will drain away from the school building. Particular attention should be paid to the direction of the water flow in heavy rain. If either a sidewalk, walkway, courtyard, driveway, or parking lot is tilted toward the school building, forcing water toward it, then a flood proofing technique is required to stop flood-water from entering the school building^[4].

Table (7): School building electrical system inspection list

Name of school:		Date of inspection:		
Name of community :		Name of person who filled out the form:		
Identify the specific item accordingly with a description. Leave blank if the item does not exist .	Choose one		If unsatisfactory, describe the problem.	Where is the unsatisfactory component located in the school building?
	Satisfactory	Not Satisfactory		
Service entrance cable				
Main panel box				
Circuits and conductors				
Outlets and switches				
Interior lighting (lamps and bulbs)				
Exterior lighting				
Electrical equipments				
Other				
General Remarks:				

Table (8): School building grounds inspection list

Name of school:		Date of inspection:		
Name of community :		Name of person who filled out the form:		
Identify the specific item accordingly with a description. Leave blank if the item does not exist .	Choose one		If unsatisfactory, describe the problem.	Where is the unsatisfactory component located in the school building?
	Satisfactory	Not Satisfactory		
Courtyard				
Sidewalks and walkways				
Parking lot and driveway				
Retaining walls				
Gardens				
Fencing				
Other				
General Remarks:				

Retaining walls deteriorate because of excessive pressure due to water accumulation. Conditions can be improved by excavating a trench behind the retaining wall and filling it with coarse gravel. Drain holes through the wall will be able to relieve the water pressure. Retaining walls sometimes suffer from the root pressure or from general movement of top soil down the slope. Normally these conditions require rebuilding the retaining wall. Gardens should be watered and fertilized frequently to cultivate a lovely landscape. Flower and plant beds should be cleaned, plants pruned, hedged trimmed, and grass cut in a regular basis^[4].

2.3-School Maintenance Plan:

A school maintenance plan should ensure that the school building can function at its designed level at all times during normal life of the school and resist the effects of an extreme natural event like hurricanes, floods, and earthquakes, provided that the original design, construction, and materials were satisfactory for these demands. The maintenance of the school building is a daily activity of the institution and its personnel. It is an important factor in the delivery of education. In assessing the priority of school maintenance requirements, the following characteristics should be considered^[5]:

- Obvious safety issues including structural or fire hazards, and matters affecting mobility and personal safety;
- A decrease in the performance, functionality or usability of the space or facility;
- The potential damaging consequence to other building elements such as a leaking roof on ceilings, walls, floors and equipment; and, to a lesser extent,
- Appearance or aesthetics, depending on location or visibility.

Each fault is assessed and reviewed, then allocated a priority based on the condition of the item and its impact on the functionality of the space. The following categories of works are considered urgent: minor building repairs following damage by storm, clearing of sewer blockages, toilet exhaust fan repair where the only means of ventilation is mechanical, water supply failure or fire service repairs, repair or replacement of small hot-water units where these are the only source of hot water, gas leak, power failure adaptation, fluorescent lighting repairs resulting from burnt-out ballasts catching fire, vandal damage, repair of external broken glass, pest eradication, and master key replacement.

3-EVALUATING MAINTENANCE PROGRAMS:

One other vital component of adequate school facilities maintenance is periodic evaluation to assess the success of these efforts at a program level. Program success can be evaluated relative to program objectives. In other words, measuring “success” means answering the question: Are we reaching our goals and objectives? It is fair to expect the maintenance program to yield results of clean, orderly, safe, cost-effective, and instructionally supportive school facilities that enhance the educational experience of all students^[7].

3.1-Considerations When Planning Program Evaluations:

The types of information needed to evaluate the program’s effectiveness include:

Physical inspections: Records of physical inspections are good evaluative material. To care for buildings and grounds, staff must observe and assess their condition on a regular basis. Inspections should be both visual and operational, and should result in work orders for items requiring service or repair.

Work order systems: An effective work order system, is a good tool for identifying, monitoring, and projecting future maintenance needs. All maintenance work should be recorded on work orders, which then provide valuable quantitative information for evaluations.

User feedback/customer satisfaction surveys: There are many ways to gather information from users/customers, including collecting satisfaction surveys.

Audits: Performance audits, commissioning, and annual reviews of accomplishments provide

important data for the facility plan and evaluation.

Alternative resources: Maintenance and operations manuals, vendor expertise, warranties, and other resources can be sources of benchmarking data or evaluation standards.

Regulatory activities: Trained staff or contractors must be assigned to determine whether applicable public safety and environmental regulations are followed. These staff must be responsible for documenting inspection activities and reports, notifying appropriate oversight organizations of deficiencies, developing strategies for remedying deficiencies, and verifying compliance to applicable laws and regulations. Documentation of these activities can be used in program evaluation^[7].

3.2-Collecting Data to Inform a Comprehensive Evaluation:

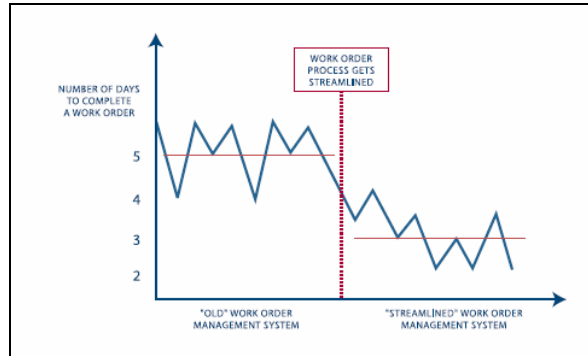
Before assessing maintenance improvements, it is necessary to identify the baseline against which progress will be measured. In other words, will the organization compare its current status against its previous status, against peer organizations, or relative to commonly accepted norms and best-practice standards?

In graph (1) Although the amount of time it takes for the actual work to be accomplished has not changed, two significant time-saving approaches have been adopted:

1) The number of people handling the work order has been cut, and 2) The parts and materials procurement system has been linked to the work order system. This type of streamlining not only increases efficiency with respect to getting work accomplished, but also decreases unnecessary administrative costs.

Sources of information about the condition of school facilities and the impact of a facility maintenance program include: number of work orders completed, changes in maintenance costs, major incident reviews (e.g., number of school shutdowns, safety events, etc.), customer

feedback, visual inspections by supervisors and managers, comprehensive management audits, performance audits, facility report cards or other summaries, trend analysis, external audits, weekly foreman's meetings, staff turnover rates, and public opinion¹⁷¹.



Graph (1): Shows the number of days it took for a work order to get completed in a school district before and after the process was streamlined

3.3-Examples of Good Evaluation Questions:

Maintenance planners have learned to ask some very good evaluation questions, some of which are listed below. The list illustrates the types of questions that facilities maintenance planners can ask to meet the information needs of their evaluation efforts¹⁷¹.

3.3.1-Work Orders:

Does the work order system account for all maintenance staff time and materials?

Does the work order system produce the history of all maintenance activities at each site?

Does the work order system track all purchases, storage, and installation?

Does the work order system document all preventive maintenance activities?

Is priority recognition available to differentiate between emergency, routine, and preventive maintenance?

3.3.2-Needs Assessment:

Does the needs assessment include a mechanism for collecting input from users?

Does the needs assessment include data from the work order system?

Are stakeholders (e.g., maintenance staff, educators, users) included in needs assessment and planning activities?

Does the needs assessment include information from the work order system?

Does the needs assessment include information from site and equipment inspections?

Does the needs assessment include data from performance and systems audits?

3.3.3-Site Inspections:

Are inspectors adequately trained for their task?

Are there clear standards for inspections?

Are inspections conducted with both property needs and maintenance capacity in mind?

3.3.4-Data Management Systems:

Does the data management system document the current status of the major systems and components in every school building?

Does the data management system document the capital and maintenance needs of every school building?

Does the data management system document the short- and long-term needs of the district?

3.3.5-Budgeting:

Does the budget request reflect the needs of the annual facility plan?

Are there both short- and long-term budget objectives?

Are maintenance staffs involved in developing the budget?

Does the annual budget reflect the inevitability of unplanned emergency maintenance issues?

Are there contingency plans in the budget?

Are industry standards used to estimate costs?

3.3.6- Staffing:

Does the personnel policy include maintenance and contracted staff?

Do job descriptions reflect the identified needs of the organization?

Do job descriptions outline the necessary qualifications to perform the work?

Does the organizational chart accurately define reporting responsibilities?

Are training opportunities available and relevant to the duties of the staff?

Are all trades people fully licensed for their work?

Are cost-benefit analyses conducted to determine staff/contracting needs?

Are staff performance evaluations performed on a regular schedule?

Do data force staff performance evaluations?

Are staff accomplishments reviewed and documented on an annual base?

4-CONCLUSIONS:

Conclusions derived from the paper can be summarized as follows:

- Priorities of school maintenance are directed towards actions concerning natural hazardous including damages of storm, earthquakes, etc. For preventive maintenance, sewage pipes unblocking, ventilation fans, water supply problems, fire services repair, gas leakage, power failure, and external glass damage are of great importance.
- Evaluation of maintenance process depends on determination of a target baseline to compare the new situation with. The baseline could be current condition, similar organizations, or standard conditions.

5-RECOMMENDATIONS:

- Organizations, institutes, and governments should encourage specialists of evaluation methods of maintenance process to perform further investigations to overcome maintenance problems and improve its quality.
- More efforts are to be exerted to convince the public and increase their awareness of the importance of keeping our maintenance products environmentally-friendly.

REFERENCES:

- 1-<http://www.epa.gov/iaq/schools/performance.html>
- 2-<http://www.appa.org/pdffiles/AllCustodialAnalysis.pdf>
- 3-ASHER, Stephen M. Let's Fix It, A repair and maintenance manual for BHN/CED/BNTF buildings, The Caribbean Development Bank and The United States Agency for International Development.
- 4-AYSAN, Yasemin, CLAYTON, Andrew, CORY, Alistar, DAVIS, Ian, and SANDERSON, David. Developing Building for Safety Programs, The Oxford Center for Disaster Studies 1995.
- 5-REYNOLDS, Henry. Building Analysis Report, Home Tech Information Systems, Inc., 1995.
- 6-CARTER, Charles B. Home Maintenance ... Tips for Busy People, Home Tech Information Systems, Inc.
- 7-Planning Guide For Maintenance School Facilities, School Facilities Maintenance Task Force National Forum on Education Statistics and the Association of School Business Officials International (ASBO®), the National Center for Education Statistics and the National Cooperative Education Statistics System, February 2003.

دليل عملي لصيانة مباني المدارس

محمد عبد الموجود عبد الغفار

قسم الهندسة المعمارية - كلية الهندسة - جامعة طنطا

يتكون برنامج صيانة المدارس من ثلاثة عناصر:

- 1- الإدارة التي تحدد المسؤوليات والأعضاء ممن يتابعون عمليات الصيانة والمتابعة.
- 2- عملية الفحص التي تحدد الإجراءات اللازمة لإعداد خطة الصيانة الخاصة بالمدرسة، يجب أن يغطي الفحص جميع عناصر المبنى (هيكل إنشائي - أسقف - حوائط داخلية وخارجية - نظام الصرف الصحي - الكهرباء - الحدائق والممرات).

3- خطة الصيانة التي يجب أن تحقق قيام المبنى بداء وظيفته بكفاءة خلال عمره الافتراضي، ويتحمل العوامل الطبيعية التي صمم لمقاومتها. تقدم الورقة البحثية شرحاً تفصيلياً للعناصر المبنى التي يجب فحصها وتحلل مشاكلها وتضع الحلول للتغلب عليها.

وتتضمن الاعتبارات التخطيطية لتقييم برنامج الصيانة النقاط الآتية: الفحص المادي لهيكل المبنى داخليا وخارجيا لملاحظة أي أعطال أو أضرار، منظومة أوامر العمل لتحديد وملاحظة وتوقع احتياجات الصيانة، الاستعانة بآراء المستخدمين لتحديد مدى الرضي عن مستوى عناصر المبنى، الفحص الدوري، مصادر المعلومات من الكتلوجات وشهادات الضمان، والاستعانة بالخبراء لتحديد المطابقة الأمنية والبيئية.

وتستعرض الورقة البحثية عملية تقييم برنامج الصيانة، يعتمد التقييم على وضع خط أساس لقياس مدى التقدم والانجاز الذي حققته الصيانة، قد يكون هذا الأساس الحالة الحالية أو حالة المؤسسات المشابهة أو المقارنة بالمقاييس الحالية. ويعتمد التقييم على ملاحظة عدد وأوامر العمل الكاملة، التغيير في قيمة تكلفة الصيانة، عدد الحوادث والأعطال الخطيرة التي وقعت، رد فعل المستخدمين، الفحص البصري، فحص الأداء، وتقارير المؤسسات، تحليل الاتجاه، وأخيراً الرأي العام.

ويقدم البحث بعض الأسئلة الهامة للمساعدة في تقييم حالة مبني المدرسة تتعلق بأوامر العمل، تحديد الاحتياجات، فحص الموقع، نظام إدارة البيانات، التمويل، وتقييم العاملين.

حققت الدراسة النتائج التالية: تكون أولوية أعمال الصيانة بمبني المدرسة في الأعمال المتعلقة بالأضرار الناجمة من العواصف والأخطار البيئية الأخرى، الحفاظ على عمل شبكة الصرف بكفاءة، معالجة أعطال الإمداد بالمياه والكهرباء وتسرب الغاز، وإصلاح خدمات الحريق.

ويوصي البحث بأن تشجع توجيه المؤسسات والمعاهد والحكومات المختصين بتقييم عمليات الصيانة ببذل الكثير من الجهد للتغلب على مشكلات الصيانة وتحسين جودتها، وضرورة إقناع العامة إلي ضرورة المحافظة على واستخدام المواد صديقة البيئة في عمليات الصيانة.