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School Plant Management

Organizing the Maintenance Program

by R. N. FINCHUM
Specialist in School Plant Management

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
ARTHUR S. FLEMMING, *Secretary*
Office of Education, LAWRENCE G. DERTHICK, *Commissioner*

Foreword

PRESENT CAPITAL outlay investments in elementary and secondary school buildings, sites, and equipment in the United States are being increased at the rate of about $3 billion annually.

Maintenance and operational services, important aspects of property protection, educational progress, pupil safety, and plant efficiency, are being provided in these facilities at a cost of more than $1 billion a year. This cost may be expected to increase as new facilities are added. School plant management, like other phases of the educational program, faces serious challenges, making it imperative that school officials have some knowledge of the basic principles and procedures involved in school plant care.

This bulletin deals primarily with organizing and developing efficient maintenance programs for school districts. Planned as a companion bulletin, *Administering the Custodial Program* will be concerned with practices and procedures involved in the day-to-day care, or operational services, of school plants.

It is hoped that these bulletins will be useful to those concerned with organizing, developing, improving, and administering school plant maintenance and operational programs.

FRED F. BEACH,
Director, Administration of State and Local School Systems.

E. GLENN FEATHERSTON,
Assistant Commissioner, Division of State and Local School Systems.

Preface

PUBLICATIONS dealing with school plant management frequently devote space to articles on various maintenance problems. In some instances these problems are discussed as segments of broader subject areas; in others, they form the basis of professional magazine articles. In most cases, such discussions are limited in scope, being confined to certain well-defined aspects of the total problem. They are usually scattered among many publications.

School administrators who desire help in organizing or in improving district maintenance programs may not have ready access to these scattered sources of informaion, or if such publications are available, may not have time to search out, study, and analyze the available materials.

The purpose of this bulletin is to bring together, in one document, the collective "know-how" of many people whose experience enables them to give authoritative information on school maintenance programs. The ideas, practices, and suggestions which have been used in this bulletin have been carefully documented as to source.

The author wishes to acknowledge the use of all materials to which reference is made, and to thank those from whom helpful suggestions have been received.

R. N. F.

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CHAPTER I.

Introduction

SCHOOL PLANT operation and maintenance, two closely related areas of school plant management, constitute one of a number of complex problems which confronts public school boards. An essential factor in efficient school administration is a well organized and properly functioning service for the operation and maintenance of the school plant. Operation includes those day-to-day services and activities which are necessary to keep the physical plant open and in a usable condition. Maintenance consists of those services, activities, and procedures which are concerned with preserving, protecting, and keeping buildings, grounds, and equipment in a satisfactory state of repair. It covers a wide range of activities including some repairs, replacements, renovations, and adjustments.

THE PROBLEM

The problem of school plant maintenance begins on the day the school board accepts a building from the contractor and continues throughout the entire life of the building. Experience indicates that in far too many instances school officials fail to recognize this fact. They seem to assume that a new building requires little or no maintenance until it has been in use for several years. It is a mistake, sometimes a costly mistake, for school officials to permit maintenance needs to accumulate before they attempt to develop a planned maintenance program. An adequate school plant maintenance service is vitally important to the pupils, to the educational program, and to the community, because the well-kept school building not only serves as a shelter and a school home for the pupils, but also as a tool of education and frequently, the center of community life. It is essential that school plants be so operated and maintained that they provide optimum service. Adequately planned, well-built school buildings may be so operated and maintained that they fail to provide this service. On

the other hand, average or sometimes mediocre buildings may provide satisfactory service if they are properly operated and maintained.

The public school plant, usually planned and often financed through cooperative community efforts, frequently represents the most substantial as well as the most important community investment. Dedicated to school and community uses and representing a major community interest, the school plant should be so maintained that it merits continued community appreciation and adequate financial support. Good school plant management programs do not "just happen." They must be well planned, manned by competent personnel, given a fair share of the school district revenues, operated to serve the best interests of the pupils, and managed efficiently. When a program is carried on in this manner, it will not be difficult for school officials to justify maintenance costs.

Importance of Maintenance

It has been estimated that the present value of all public elementary and secondary school property in this country was between $28 and $30 billion in 1958–59. Present trends in school construction indicate that approximately $3 billion will be spent for capital outlay in 1959–60. Future classroom requirements will be influenced by such factors as the present backlog of needs, increasing birth rates, normal school plant obsolescence, and population mobility.

Both the existing facilities and those that are to be added from year to year will require adequate maintenance if they are to function satisfactorily as tools of education. The importance of maintaining these facilities lies not only in the necessity for obtaining optimum service from them but also for protecting the district's financial investment in them. It seems axiomatic that expenditures for maintenance accomplish both purposes. Such expenditures make possible a cleaner, healthier, safer school environment, and purchase additional years of usefulness, thus prolonging the interval between replacement dates.

Another significant point is that maintenance, if adequately financed, consumes an important segment of the school dollar. This is demonstrated by the fact that if a planned maintenance program has been followed by the school district, it is generally believed that not less than 5 percent of the district's current operating budget, a figure which seems to have national acceptance, will be required to support an adequate maintenance program.[1] For a new school building it has been suggested that from one-half to 1 percent of the total

[1] Otto K. Fernald. How Many Custodians Do You Need? *School Management*, October 1958, p. 62–68.

plant cost should be allocated annually for its maintenance.[2] For older buildings which have been properly maintained from year to year, some authorities suggest that from 1 to 2 percent of the current replacement cost of a school plant should be budgeted for each year of its maintenance.[3]

Although the recommended minimum expenditure for school plant maintenance is 5 percent of the total annual operating budget for the district, reported data indicate that the school systems of the country spend slightly less for this purpose. A review of the biennial reports on expenditures for all full-time public elementary and secondary day schools in continental United States from 1947–48 through 1955–56 reveals that in only one geographical section of the country—the North Central—have expenditures for maintenance equalled or exceeded recommended amounts, and in this case, for only 2 of the 5 years.

Table 1, page 4, shows the total maintenance costs, the total current operating costs, and the percentage the former is of the latter, covering one year of each biennium from 1947–48 through 1955–56, with States grouped according to four geographic regions. For the five years under consideration, maintenance costs have averaged 4.5 percent of the total current operating costs in 1947–48, 4.6 percent in 1949–50, 4.3 percent in 1951–52, 4.1 percent in 1953–54, and 3.8 percent in 1955–56. This means that maintenance expenditures, as compared with total expenditures, were nearly 1 percent less in 1955–56 than in 1949–50. When one considers that there were not only more buildings but also older buildings in 1955–56 than in 1949–50, it is indicated that less attention is being given to maintenance than formerly. This reasoning seems further justified when one compares total maintenance costs in 1947–48 with those in 1955–56 and total current expenditures in 1947–48 with those in 1955–56. During the first year of this comparison a total of $169,536,000 was spent on maintenance, while nine years later, a total of $319,559,000, a difference of $150,023,000, or an increase of slightly more than 88 percent, was spent for this purpose in continental United States. Total current expenditures, meanwhile, increased from $3,752,460,000 in 1947–48 to $8,251,420,000 in 1955–56, making a difference of $4,498,960,000, or an increase of nearly 120 percent.

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[2] George H. Bush. Maintenance Practices for New School Buildings. *American School and University*, 29th Ed., Vol. 1. New York: American School Publishing Corporation. 1957. p. 274–275.

[3] Paul J. Harris. Supervision of Operation and Maintenance. Association of School Business Officials, *Proceedings* (38th Annual Convention). Kalamazoo, Mich.: The Association. 1952. p. 148–153. C. M. Cornell. Preventive Maintenance of Buildings. *The Nation's Schools*, 56: 104–108, October 1955.

Table 1.—Expenditures for school plant maintenance and total current expenditures for all full-time public elementary and secondary day schools in continental United States, by regions, from 1947–48 through 1955–56 [1]

[One year of each biennium reported in thousands of dollars]

Regions by year	Number of states	Maintenance costs	Percent of total current expenditures	Total current expenditures
1	2	3	4	5
1947–48				
Northeast	9	$44,402	4.3	$1,027,104
North-central	12	57,647	4.9	1,183,000
South [2]	16	40,380	4.2	980,331
West	11	27,107	4.7	582,022
Continental U.S	48	169,536	4.5	3,752,469
1949–50				
Northeast	9	58,348	4.7	1,231,416
North-central	12	71,211	5.1	1,405,982
South	16	48,702	3.9	1,244,240
West	11	35,903	4.6	732,530
Continental U.S	48	214,164	4.6	4,654,169
1951–52				
Northeast	9	59,953	4.0	1,502,957
North-central	12	84,062	5.0	1,695,999
South	16	62,667	4.1	1,513,047
West	11	42,012	4.3	970,343
Continental U.S	48	248,674	4.3	5,682,345
1953–54				
Northeast	9	71,722	4.0	1,776,063
North-central	12	96,201	4.7	2,010,872
South	16	65,891	3.7	1,774,172
West	11	52,057	4.2	1,229,827
Continental U.S	48	284,871	4.1	6,790,933
1955–56				
Northeast	9	80,541	3.7	2,184,121
North-central	12	102,731	4.2	2,435,854
South	16	75,515	3.6	2,120,971
West	11	60,772	4.0	1,510,464
Continental U.S	48	319,559	3.8	8,251,420

[1] *Biennial Survey of Education in the United States*, 1946–48; 1948–50; 1950–52; 1952–54; *1954–56*. Washington: U.S. Government Printing Office. (U.S. Department of Health, Education, and Welfare, Office of Education. Ch. 2.)

[2] The District of Columbia is included with the South throughout this table. Alaska and Hawaii became States after these data were compiled.

In other words, from the beginning to the terminal years of this comparison, total current expenditures increased by 120 percent; maintenance costs by 88 percent, making a difference of 32 percent in the respective increases.

Although this difference would indicate that efforts to maintain school plants have decreased in recent years, there may be other factors which help to explain the difference. Many new school buildings were constructed between the year 1947–48 and the year 1955–56, and it is generally assumed, though not necessarily correctly, that new buildings require little or no maintenance, and for this reason a smaller percentage of the total school costs may have

been allocated for their maintenance and upkeep. Many older buildings, having reached a state of obsolescence, were abandoned during the period, and since maintenance costs for obsolete buildings are generally high, the total amount allocated for maintenance was reduced through the process of abandoning such plants. In addition, other school operating costs, such as expenditures for teachers' salaries, salaries of nonprofessional personnel, fuel, instructional supplies, janitorial supplies, power and electricity, and services provided by expenditures under fixed charges, have increased to such an extent that boards of education absorbed some of these costs out of funds that normally should have been spent on maintenance.

Another way of showing the importance of school plant maintenance is to compare the total average annual *current expenditure* per pupil with the average annual *school plant operation* expenditure per pupil and the average annual *school plant maintenance* expenditure per pupil in continental United States.

Table 2, page 6, shows these data according to type or classification of school districts. That is, rural areas are classified according to the number of school districts—single or multiple—contained in a county, and urban areas are classified according to the size of cities. For convenience, the per pupil expenditure for plant operation and plant maintenance are also shown as percentages of the average annual current expenditure per pupil.

It is of interest to note that rural areas with a single school district have the lowest per pupil expenditure, and cities with a population of 100,000 to 1,000,000 have the highest per pupil expenditure. Cities with a population of 10,000 to 25,000 approximate the general average per capita expenditure for all types of districts. For the country as a whole in 1955–56, the average current expenditure per pupil was $256; for school plant operation, $24.69, or 9.4 percent of current expenditure; for school plant maintenance, $11.39, or 4 percent of current expenditure. (This percentage for plant maintenance is slightly different from the percentage shown for the same year (1955–56) in Table 1, page 4, but the probable explanation is that there have been differences in rounding totals.)

The total expenditure for school plant operation and school plant maintenance for all full-time public elementary and secondary day schools in continental United States during 1955–56, the most recent year for which these data are available, was $1,072,299,000.[4] Repre-

[4] *Biennial Survey of Education in the United States—1954–56.* Washington: U.S. Government Printing Office, 1959. (U.S. Department of Health, Education, and Welfare. Office of Education. Ch. 2, p. 92.)

senting about 13 percent of the current operating budget for that year, this figure seems to indicate that school boards do consider school plant operation and maintenance important.

Table 2.—Average expenditure per pupil for total current operation, school plant operation, and school plant maintenance in continental United States, 1955–56 [1]

Type of school district	Average current expenditure per pupil	Average annual expenditure for plant operation		Average annual expenditure for school plant maintenance	
		Per pupil	Percent of total current expenditures	Per pupil	Percent of total current expenditures
1	2	3	4	5	6
Rural					
Single district	$198.00	$11.00	5.5	$6.00	3.2
Multiple district	267.00	21.00	8.8	9.00	3.3
Urban					
100,000–1,000,000 population	322.00	31.86	9.8	17.50	4.7
25,000–100,000 population	275.00	30.37	10.8	15.06	4.8
10,000–25,000 population	251.00	26.89	10.7	10.30	4.0
2,500–10,000 population	268.00	27.02	10.3	10.49	4.0
Average of average	$256.00	$24.09	9.4	$11.39	4.0

[1] *Statistics of Rural Schools: A U.S. Summary, 1955–56.* Washington: U.S. Government Printing Office, 1959. (U.S. Department of Health, Education, and Welfare, Office of Education. Circular No. 565.)
Current Expenditures Per Pupil in Public School Systems: Large Cities, 1955–56. Washington: U.S. Government Printing Office, 1957. (U.S. Department of Health, Education, and Welfare, Office of Education. Circular No. 500.)
Current Expenditures Per Pupil in Public School Systems: Small and Medium Sized Cities, 1955–56. Washington: U.S. Government Printing Office, 1957. (U.S. Department of Health, Education, and Welfare) Office of Education. Circular No. 501.)

Public Concern

During recent years the public has shown great concern about inadequate school facilities. This is attested to by the fact that long-term capital outlay indebtedness for school construction, approved either by popular referendum or by governing bodies which represent the people, now stands at an all-time high in continental United States. Funds obtained through long-term financing plans have been used to construct classrooms in unprecedented numbers, yet it seems probable that classroom shortages will be a continuing problem for several years.

One way to relieve classroom shortages, frequently at much less expense than the cost of new classrooms, is to modernize, rehabilitate, and maintain existing school buildings and thus prolong their life. This is particularly true if the buildings are structurally safe and properly located with respect to the school population to be served. Although many communities seem to show more interest in providing new school facilities than in renovating, modernizing, and utilizing existing plants, there are reasons for this point of view.

Among such reasons are: Most school plants of recent vintage are more appealing and invoke greater community pride than older ones. In many cases, new school facilities are financed through State support plans, local long-term financing, or through a combination of these plans, neither of which may require a great increase in local tax rates. Funds for school plant maintenance are generally limited to State allocations, if any, and to those derived from local current tax levies, a source which would require higher tax rates, if permissible or if not, higher assessments and the same rates on all taxable properties. Either of these requirements would force local taxpayers to contribute additional funds for the maintenance program; and funds spent for maintenance often provide improvements in school facilities that are not always apparent to the public.

Some illustrations of maintenance expenditures of this type are repiping heat and water systems, replacing radiators and heating plants, rewiring for electrical services, and replacing a troublesome roof. Such improvements, expensive though they are, may be known only to those who occupy the building and to a few others; hence the general public, having little information about the desirability of modernizing and renovating older buildings, and seeing little visible evidence of the results of such expenditures, may not be as enthusiastic in support of maintenance as for new construction. In this connection, school plant people frequently complain that maintenance is a "stepchild" of the school district when funds are being allocated for various school services. This complaint is not always without foundation, because school boards are often able to cut appropriations for maintenance without invoking major criticisms such as would be forthcoming if cuts were made in appropriations for other essential school services.

In order to stimulate public interest in, and develop a deep concern for, the significance of school plant maintenance it seems appropriate to suggest that school officials might perform an essential service by publicizing the advantages inherent in a long-range, well-planned, adequately financed maintenance program of the school district.

MAINTENANCE AIMS

The overall objective of maintenance is to keep school facilities in such condition that they will meet the requirements of the educational program. More specifically, maintenance aims include those activities, services, and procedures which help to: (1) Promote health and safety, (2) provide operating economies, (3) prevent time loss, (4) preserve property values, (5) retard deterioration, (6) prevent obsolescence, and (7) develop community pride.

Health and Safety

If school buildings are to be free of conditions which may adversely affect the health and safety of pupils and school employees, they must be kept clean, properly heated (or cooled), ventilated, and lighted. In addition, if noise is a disturbing factor, as it frequently is in buildings where many activities are in progress simultaneously, some method of noise control should be provided.

Unsanitary conditions create many health problems. Respiratory diseases are spread by dust- and germ-laden air; digestive disorders are often brought on by the consumption of food which has been improperly stored, prepared, handled, or served; many other types of communicable diseases and infections may be spread by insects and rodents which are often harbored in unprotected storage areas and on unkept grounds; and many other health hazards may be created by unsanitary, foul-smelling toilet areas. Classrooms that are underheated or overheated and are poorly ventilated do not promote good health. Impaired eyesight and other visual difficulties are frequently caused by poor or improperly controlled artificial and natural lighting. Certain nervous disorders and auditory problems may be brought about by unsatisfactory sonic conditions. The maintenance program and the school plant planning program, if designed to promote health, will give due consideration to these and other health factors.

In addition to providing a school environment which is conducive to good health and to favorable conditions for learning, officials are obligated to maintain safe school facilities. Parents who are required to send their children to school, children who are permitted or compelled to attend, and employees whose work requires them to be on school premises have every right to demand safe buildings, grounds, and equipment. School safety, an all-inclusive term, covers such risks as fire, mechanical, electrical, boilerroom, and maintenance hazards. It is obvious that the full scope of these hazards cannot be discussed in this bulletin, but it is felt that a few pertinent illustrations will indicate the significance of maintenance as a means of eliminating them.

Of all school safety hazards, fire is perhaps the most spectacular. School fires occur at a rate that is alarming, there being an average of 11 school fires every day of every month during the last 3 years.[5] Fortunately, all of these do not cause loss of life, but during the last half century nearly 1,000[6] people have perished because of school

[5] Paul William Kearney. How Fire-Safe Is Your Child's School? *National Parent Teacher.* 54: 10–12, September, 1959.

[6] National Fire Protective Association. *Occupancy Fire Record* (Fire Record Bulletin FR 37-1). Boston, Mass.: The Association. 1957. p. 1–5.

fires. Undoubtedly, some of these have died needlessly. In order to eliminate many fire hazards in schools, school plant planning and maintenance programs need to consider, among other things, the arrangement and design of stair wells and shafts, firewalls for corridors leading to exits, fire-resistive materials for corridor floors and stairs, type and location of exits, segregation of building areas in which fires are most likely to originate, the installation of noncombustible air ducts, the installation of fire protective equipment, and the installation of fire doors.

Another safety hazard concerns the mechanical features of the school plant, which may include: Unprotected outside stairs and entrance platforms; narrow inside stairs; risers that are too high and treads that are too narrow; slippery surfaces for stair treads, ramps, and floors; lack of handrails for stairs and ramps; improperly hung doors; lack of safety glass where needed; absence of panic hardware on outside doors; the existence of open stairwells with low balustrades or none at all; corridors with open radiators and protruding drinking fountains; walkways restricted by wall projections; and shower rooms with slippery floors and uncontrolled hot water valves. Many other examples could be given of unsafe mechanical features of school buildings.

Electrical hazards are particularly noticeable in older school buildings, and their maintenance crews should be on the alert for: Open wiring, knob and cleat jobs; unprotected outlets, metal switch covers, overloaded circuits; switchboxes and panel boards in unprotected wooden cabinets; frayed extension cords draped over nails or pipes; electric motors and other electric appliances without grounds; and absence of pilot lights where needed. These are a few of the hazards that may be found; there are many others. Newer structures are generally wired under the National Electric Code, but even so many precautions need to be taken in dealing with electrical services for these buildings.

Boilerroom hazards, like electrical hazards, are not as noticeable in the newer schools as in the older ones. For example, high-pressure boilers are rarely found in new school buildings, and boilerrooms in new school buildings are generally located so that they are not under, or adjacent to, areas occupied by pupils. Nevertheless, there are certain hazards, even with low-pressure boilers, some of which include: Improper fuel storage, applicable particularly to oil and coal; failure to test safety devices, such as valves, low-water cutoff, high-pressure cutoff, and other types of automatic controls; lack of pressure gage, and unprotected piping; and sometimes pipe runs so laid that they are a danger to traffic.

Maintenance of school facilities is closely related to the effectiveness of the school. No matter how well a structure has been planned and constructed, it is subject to deterioration and if it does not have proper maintenance, safety hazards are bound to increase. Some examples of maintenance hazards include: Highly waxed and polished floors and stair tread; failure to change air filters because of the expense involved; storage of combustibles in spaces not designed for such materials; the use of attic space for storage; insufficient illumination for stairwells and in other areas where falls may occur; improper layout and surfacing of playground areas; poorly planned access roads and service drives for the premises; and the use of flammable curtains in auditoriums. Proper maintenance can either remove these hazards entirely, or at least, minimize them.

Economy of Operation

School buildings deteriorate with age and use. As they age, it becomes increasingly difficult and often more expensive to maintain and operate them in a manner that will provide maximum service and safety. One aim of planned maintenance is to effect operating economies, in some instances, by providing maximum service at no increase in cost, or in others, at reduced cost.

In general, school plant operating economies seem to fall into three categories, namely: Labor, utilities, and supplies and equipment. A few examples in each of these categories will illustrate the significance of planned maintenance in effecting economies in school plant operation.

In many buildings, particularly in older ones, such items as convenient service sinks, adequate and convenient storage for custodial supplies and equipment, suitably located electric service outlets, and hose bibs for both hot and cold water at strategic locations have been overlooked. These conditions can generally be corrected by the maintenance department so that the time consumed by custodians in running to remote parts of the building to obtain tools and supplies and later replacing them can be cut to a minimum. In cleaning operations where labor accounts for 90 percent of the cost,[7] correction of these conditions could save many custodial man-hours during the school year. Another maintenance procedure which has been found to reduce the custodial load to the extent of three full-time employees in a school district whose school population is about 8,000, involved the use of a circulating floor maintenance crew to perform all floor waxing for the district.[8]

[7] How To Reduce Maintenance Costs. *School Management.* 2: 31–34, February 1959.
[8] Richard A. King. Developing Progressive Maintenance. *American School Board Journal.* 136: 55–56, May 1958.

In the category of utilities, proper maintenance may affect economies in the cost of water, fuel, and electricity. For example, a water faucet with a steady drip will waste about 9,000 gallons of water each year; a faucet with a steady stream one-eighth inch in diameter will waste 9,000 gallons of water in 3 days or more than a million gallons a year.[9] In addition, if these faucets are on hot water lines, there is a waste of fuel to heat the water. Replacement of gaskets, or even the faucets themselves, is an inexpensive maintenance procedure which may save many dollars during the course of a school year. Another illustration of operating economy through planned maintenance is provided by the Detroit public schools where proper engineering maintenance and modernization of the heating plants affected an annual saving of about $250,000 on fuel costs for about 300 school buildings.[10] In another case, it was discovered that an airbound boilerroom was creating a waste of fuel by not supplying a sufficient amount of air for proper combustion. Much of the fuel was escaping through the stack in the form of gases. This situation was corrected at small cost by the expedient of admitting more air to the boilerroom.[11]

Electrical services often become expensive because of wasted current. Inefficient fixtures cause current waste; old, inefficient electric motors consume more current and deliver less power than new motors. Color of ceilings affect illumination levels. If the ceilings do not have the proper reflectance factor, or if they are dirty, they decrease the efficiency of electric lights. In addition, electric lights often replace natural illumination because outside windows are not clean. The atmospheric soiling of glass over a month's period will impede the transmission of light by as much as 25 percent.[12] This applies not only to window glass but also to glass fixtures used in connection with electric lights. An adequate maintenance program will provide for the replacement of inefficient fixtures and motors, correct ceiling conditions, and keep windows and light fixtures clean, thus eliminating much waste in the use of electric current.

Other school plant operating economies may be effected through the selection, purchase, and use of maintenance tools and equipment. Such economies may be realized through greater efficiency in work standards, improved quality of results achieved, decreased quantity

[9] Richard Irmiter. The Care and Cleaning of Plumbing Fixtures in School Buildings. *American School Board Journal.* 119: 45-47, July 1949.

[10] John D. L'Hote. Supplying Heat to the Detroit Public Schools. *American School and University.* New York: American School Publishing Co. 29th Ed., Vol. 1. 1957-58. p. 283-284.

[11] David A. Pierce. *Saving Dollars in Building Schools.* New York Reinhold Publishing Corporation. 1959. p. 5-6.

[12] Henry H. Linn. Economies in Plant Operation. *American School and University.* New York: American School Publishing Co. Vol. 17. 1945. p. 281-289.

of materials used, and an improved morale among workers whose feeling of achievement will be much higher than that of personnel without adequate equipment. For example, the purchase of an electric scrubbing-buffing machine and a wet-dry vacuum machine may save enough custodial man-hours during 1 year of usage to more than pay for the equipment. At the same time, better cleaning and polishing results will be shown, and the operators will have more pride in their accomplishment. The installation of pit receptacles at each outside door in school buildings where the grounds are muddy, or likely to become so, may cost a few extra dollars but will save endless hours in floor cleaning operations.

Avert Plant Shutdown and Time Loss

Another purpose of maintenance is to prevent plant shutdown and time loss, which may be achieved through a program of "preventive maintenance," a plan whose concept is similar to that of "preventive medicine." It operates on the principle that "a stitch in time saves nine," and that it is important to correct minor defects before they reach "epidemic" proportions.

In years prior to the advent of complicated mechanical and service features of school buildings, breakdowns necessitating the closing of schools were rare; but as these features have been added, there is greater opportunity for serious mechanical failures which make it necessary to close schools until repairs are made. Thermostatically controlled steam supply valves, electronically controlled motors for heating plants and ventilating systems, and in some instances sanitary and other service systems involving hydraulics are some examples of the complicated mechanical and service features of many present-day school buildings.

Although emergencies may arise in situations where preventive maintenance is practiced, they are far less frequent when periodic checks of equipment, followed by replacement of defective parts or faulty items, are made. Such periodic inspection makes it possible for the maintenance department to make repairs long in advance of actual breakdowns, thus averting plant shutdown and time loss or discomfort to occupants. In actual practice, it has been found that such repairs and corrections can be made during the summer months when school buildings are unoccupied. This procedure is not only practical but also economical.

Preservation of Property Values

In most communities school properties represent a financial investment which has necessitated heavy local tax levies and often maxi-

mum local effort over a period of several years. Preservation of these property values is an evident aim of maintenance. Adequate school plant operation and maintenance retard deterioration, reduce fire hazards, decrease the need for extensive periodic rehabilitation, and extend the useful lives of buildings and equipment, thus preserving the community's investment in such properties.

Maintenance applies to all parts of a building, to its equipment, and to its grounds. In some building areas, weathering, wear, and tear are more noticeable than in others, and the need for maintenance in these areas is more specific. Timely attention to such details reduce maintenance cost.

On the other hand, deferred maintenance, which may be regarded as maintenance neglect, inevitably leads to more rapid deterioration, results in costly rehabilitation, and often makes early replacement necessary. Some examples of maintenance neglect and its effect on school properties are: Failure to give immediate attention to defective roof flashing may cause serious wall damage; neglected roof leaks may cause decay of structural members, damage to insulation, ceilings, interior finish, and equipment; failure to clean out clogged downspouts or to repair broken gutters may cause serious water seepage into walls and mortar joints and thus damage both outside and inside walls and mar interior finishes; lack of attention to defective electric wiring may result in loss of life and loss of property by fire; and lack of site care may lead to serious soil erosion, cause student accidents, and impose limited usage of valuable outside space.

Correcting Obsolescence

In many communities across the country, there are scores of school buildings which no longer meet the housing requirements of the educational program offered today. In some instances, these communities have either reached or approached the maximum limit of their bonding capacity, and can no longer provide the necessary funds for new school construction. These and other economy-minded communities may be able to decrease their school housing problems by improving conditions in existing buildings. Many of these, lacking some of the elements essential to a good environment for learning but suitably located with respect to school population, are too sound structurally to be abandoned.

Such buildings are generally classified as obsolete, yet in most instances, can be improved to adequately meet today's educational needs in their particular districts. As a maintenance procedure, these improvements can usually be accomplished through a process of modernization, rehabilitation, or remodeling. If it is decided

that these obsolete buildings can remain in use for educational purposes, a complete job of rehabilitation—sometimes referred to as "Comprehensive Renovation"—should be done.

Modernization, a process by which existing plants are adapted to the needs of changing educational and community programs and to newer concepts of pupil services, may include improved science facilities, the installation of fire-resistive stairways, and the replacement of obsolete equipment. This procedure may involve some rehabilitation and remodeling, but is not limited to them.[13]

Rehabilitation, as used here, refers to a general overhauling of a complete building or a major portion thereof. Its purpose is to restore a building to its original state of serviceability or to improve upon it. Rehabilitation may involve renovation, replacement of parts, and remodeling.[14]

Remodeling, which means a change in structure or a major structural improvement of a building, may include: Removal or relocation of partitions, an alteration of roof structure; lowering of ceiling heights, adding structural members for strength, and changes in exterior walls. While modernization and rehabilitation may be included in remodeling, it is not limited to these procedures.[14]

Although architects and engineers usually prefer assignments which call for the designing and planning of complete new buildings rather than the remodeling of old buildings, their services should be secured when old buildings are to be restored and modernized.

Questions concerning comparable costs of modernizing old buildings and of constructing new buildings may be answered by the reported experiences of school systems over the country. These experiences seem to indicate that many buildings now classified as obsolete can be modernized, rehabilitated, or remodeled so that they will meet modern educational requirements at from one-third to two-thirds the cost of comparable new structures.[15]

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[13] N. E. Viles. School Buildings: Remodeling, Rehabilitation, Modernization, and Repair. Washington: U.S. Government Printing Office. 1950. (U.S. Department of Health, Education, and Welfare, Office of Education, Bulletin 1950, No. 17.) p. 2.

[14] Ibid. p. 1.

[15] Harold C. Bauer. Renovation in Fond Du Lac, Wisconsin. *American School and University*. New York: American School Publishing Co. Vol. 25. 1953–54. p. 359–362. William E. Gillis and Harold H. Davis. An Old School Re-Born. *American School Board Journal*, 121: 44–91, October 1950. Harold D. Hynds. Modernization of School Buildings. *1950 Proceedings*, Association of School Business Officials. Kalamazoo, Mich.: The Association. 1950. p. 266–270. Robert A. Nichols III. How We Modernized an Older School. *American School Board Journal*, 136: 48–50, May 1958. John W. Conrad. Modernization of School Buildings in Keokuk, Iowa. *American School Board Journal*, 116: 47–48, March 1948. Stanley Brown. Remodeling an Old Schoolhouse for Efficiency and Economy. *American School Board Journal*, 120: 49–51, February 1950.

Promote Community Pride

Promoting community pride in school facilities through a program of maintenance has greater significance than just "pleasing the public." School officials are well aware of the fact that a clean, well-kept school plant not only contributes to the health, happiness, and character development of the children, but also promotes a favorable community attitude toward the school, develops respect for school property, and thus becomes a factor in its preservation. School principals often assert that inadequate school plant maintenance frequently breeds pupil contempt for the property which is often expressed through misuse of washrooms, littering of premises, and defacing walls, furniture, and equipment, as well as other forms of vandalism. On the other hand, good maintenance generally, but not always, creates an atmosphere where just the opposite is true.

Furthermore, adequate care of valuable school property has implications for public relations as well as for fiscal management. In most communities, it is pleasing to the public to know that officials have preserved public school property through efficient, economical management procedures. This public attitude is often demonstrated by the reasonable financial support accorded the school and by the pride with which its facilities are shown to outsiders.

CHAPTER II

Developing a Maintenance Organization

THE EFFECTIVENESS of school plant maintenance, like other phases of school administration, may well be determined by its administrative and organizational pattern. Adequate planning, trained personnel, and efficient administration are essential if the maintenance program is to achieve its aims. However, in developing an organization for school plant maintenance, it must be remembered that no two school systems are exactly alike in all their elements. Thus, the administrative and organizational patterns of school plant maintenance in different school systems may vary according to a number of modifying circumstances.

The purpose of this chapter is to discuss some of the conditions which should be considered when the district's school plant maintenance program is being developed: (A) Factors affecting the organizational pattern, (B) selection of maintenance personnel, (C) establishing lines of authority, (D) developing personnel policies, and (E) providing inservice training for maintenance employees.

FACTORS AFFECTING THE ORGANIZATIONAL PATTERN

In organizing the school district's maintenance program, officials should give consideration to each of the following factors: (1) Work volume, (2) division of labor, (3) performance standards, and (4) type of maintenance program.

Work Volume

It will be difficult for officials to make an annual determination of the exact amount of work required to keep all school facilities a satisfactory state of repair, but the evaluation of several elements may assist. It is not suggested that these elements should have equal weight in all districts, but local officials might consider them in the light of their respective situation. Among these elements are: (a) Relation of operation policy to maintenance policy, (b) size of the school system, (c) age of buildings and equipment, (d) condition

of buildings, grounds, and equipment, (e) type of materials and finishes, (f) climatic conditions, and (g) building utilization.

Relation of Operational Policy to Maintenance Policy

School plant operation and maintenance, while closely related, may be considered separate fields. It is not always easy, however, to segregate and classify each job as to whether it is an operational or a maintenance function. For example, in some school systems where there is one organization for plant operation and another for plant maintenance, the replacement of a fluorescent or an incandescent lamp may be considered an operational procedure and is done by the custodial staff; while in other systems, this operation may be considered a function of the maintenance department. Some authorities hold that the assignment of minor, routine maintenance duties to custodians, leaving only the major jobs to the maintenance staff, increases employee productivity and decreases labor costs per unit of service. Others argue that operating and maintenance efficiency, as well as morale among all employees, is improved if all operating tasks are performed by custodians and all maintenance work is done by maintenance personnel.

It is not the purpose of this discussion to express preferences for either procedure, but rather to show that if school board policy requires *all* maintenance work to be performed by the maintenance crew, a larger crew and more man-hours will be needed. Furthermore, this plan might preclude the use of members of the custodial force as maintenance personnel during the summer months when extensive maintenance programs are generally undertaken.

In setting up the administrative and organizational pattern for school maintenance and operation, school boards should establish a definite policy with respect to duties assigned to the operational force as well as those assigned to the maintenance department.

Size of School System

Work volume for school plant operation and maintenance will depend largely on the size of the school system. In a large system, it may be expedient to organize the work program so that all phases of school plant operation and school plant maintenance and related services are under one executive officer whose title might be assistant superintendent in charge of buildings and grounds, or director of buildings and grounds. In other systems, it might be more practical to organize two separate departments, one for plant operation and one for plant maintenance, each with a director responsible to the superintendent. In smaller systems it may not be feasible to employ separate personnel for plant operation and for maintenance. In

such cases, there should be great flexibility in duties and training of the custodial staff so that, except in major maintenance tasks, all maintenance work can be done by the custodial staff. Under these circumstances, major maintenance and repair jobs may be contracted to local firms, and the regular custodial employees, together with busdrivers or other qualified school employees who do not have year-round employment, may be converted into summer maintenance crews. If these employees are under local civil service, however, care must be exercised in writing their job specifications.

Age of Buildings and Equipment

The age of buildings and equipment has some bearing on the volume of work involved in district school plant maintenance. All buildings do not deteriorate at the same rate, and unlike the "one-hoss shay" they do not suddenly fall apart, but age does bring deterioration and an increase in maintenance needs.

Certain maintenance requirements in school buildings generally develop at intervals of about 10 years, sometimes referred to as the "cycle of deterioration."[1] During the first 5 years, only minor maintenance and adjustment may be required, but during the fifth or sixth year, more extensive work, such as repainting, recalking, and other types of touchup jobs, may be needed. Then, after 15 to 20 years, buildings may require a new roof or the replacement of other exposed parts. The 25- to 30-year cycle generally represents the end of the useful life of certain mechanical features of the plant, such as the heating and plumbing systems, and hence necessitate their replacement. At about 35 to 40 years, buildings are generally ready for a major overhaul job, such as the replacement of some floors, stair tread, exposed doors and windows, and perhaps the repointing of masonry walls. As buildings age, therefore, more and more attention will be required from the district's maintenance organization if it proposes to do all work by its own staff.

Condition of Buildings, Grounds, and Equipment

In planning an adequate program for school districts where maintenance has been deferred or neglected, the physical condition of buildings, grounds, and equipment will be an important factor in determining the volume of work required of the maintenance staff. If buildings have an accumulation of maintenance needs, if grounds are bare and eroded because of neglect, with little attention given to the repair of furniture and equipment, the volume of work required to place all facilities in a satisfactory state might be staggering. A

[1] N. E. Viles. Maintaining and Replacing Schools. *American School Board Journal.* 139: 23-25, 49. July 1959.

newly organized maintenance force, if not properly directed and skillfully managed, might find itself trying "to move in all directions" at the same time. In order to accomplish the purposes of maintenance within a reasonable period of time, either an unusually heavy work load will have to be carried by each employee, or the maintenance crew will need to be large and versatile.

Type of Building Materials and Finishes

Another factor in determining the volume of maintenance work required for school buildings is the type of materials and quality of finishes used in construction. Many maintenance problems are inherent in low-quality construction materials and finishes, and frequently the low first cost of buildings so constructed represents only a small down payment as compared with total maintenance costs over the life of the buildings.[2]

On the other hand, the use of quality materials and finishes may account for a high construction cost, but may also result in "dividends" for the school system through long-term, low-maintenance costs. High initial cost with long-term low maintenance is considered more economical than low initial cost with long-term high maintenance.[3]

Climatic Conditions

It is generally recognized that in regions which have extremes in temperature, buildings require greater maintenance effort than in milder climates. If there is alternate freezing and thawing, exposed surfaces such as roofs and walls will undergo considerable movement (expansion and contraction), and even though expansion joints have been provided, this movement often results in damage to the exposed parts. Furthermore, in extremely cold climates, maintaining adequate heating facilities constitutes an added burden. In other regions, the ravages of either wind, rain, sun, or excess humidity, or a combination of these elements, may cause additional work loads for maintenance personnel.

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[2] A. W. Eckert. Constructing School Buildings with Materials that will Minimize Future Maintenance. *1953 Proceedings*, Association of School Business Officials. Kalamazoo, Mich.: The Association. 1953. p. 111–115.

[3] John Hunter, Jr. Expediting Maintenance through School Design. *American School Board Journal*, 136: 47–48, January 1958. Ernest O. Fox. School Building Design, Construction, Supervision, and Materials in Relation to Future Maintenance. *1953 Proceedings*, Association of School Business Officials. Kalamazoo, Mich.: The Association. 1953. p. 88–93. Norman J. Aaron. Constructing School Buildings with Materials That Will Minimize Future Maintenance. *1953 Proceedings*, Association of School Business Officials. Kalamazoo, Mich.: The Association. 1953. p. 106–110.

Building Utilization

Another factor involved in determining maintenance work volume is the extent to which school buildings are used. When building utilization is confined to regular day school groups, only normal wear and tear may be expected; but if regular school groups and/or outside groups are permitted, or are encouraged, to use these buildings after school hours, the wear and tear may be expected to increase by an appreciable amount, depending on group sizes, hours of use, and supervision.

A fairly recent study [4] surveyed 220 school systems with respect to practices and policies concerning the after-school use of buildings. The findings indicate that: Almost 100 percent of these systems permit after-school use of buildings by both school groups and out-of-school groups; more than 75 percent positively encourage after-school use by school groups, and 51 percent positively encourage such use by nonschool groups; and 81 percent make no charge to school groups, while 11 percent make no charge to nonschool groups.

These findings seem to indicate that after-school use of buildings by both school and nonschool groups is not only prevalent but also encouraged. Where the practice is extensive, additional man-hours are required to maintain floors, stairs, lighting, hardware, furniture and equipment, and other parts of the school plant affected by such additional use.

Division of Labor

The division of labor according to tasks, or the degree of work specialization, is a second factor in determining the type of maintenance organization for a school district. Although organization of the maintenance staff into permanent work crews on the basis of rigid areas of specialization is not recommended by some authorities,[5] others feel that job overlapping can be avoided only when job responsibilities are carefully understood and defined.[6]

Since no two school systems are alike, it seems inadvisable to suggest that one particular plan of organization will fit all situations. Local conditions that apply to school plant maintenance should be evaluated before a decision is reached as to the type of maintenance organization the district should have. However, it seems pertinent

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[4] Lynn B. Davis. After-School Use of Buildings. *1953 Proceedings*, Association of School Business Officials. Kalamazoo, Mich.: The Association, 1953. p. 142–157.

[5] *Operation and Maintenance Handbook*. New York: State Education Department, Bureau of Field Services, 1955. p. 68.

[6] N. L. George. Some Principles for the Organization and Operation of a Central School Shop Service. *American School Board Journal*, 120: 41-92, February 1950.

to suggest that, regardless of the type of maintenance organization, the district should secure competent people for all jobs and especially skilled people for special jobs.

Performance Standards

The organizational pattern of the school plant maintenance program may be affected by the performance standards required of personnel. If these standards are to be on a high level, there must be an organization whose responsible head will direct and coordinate all work to effect an easy flow of effective and efficient services in the best interest of the schools. On the other hand, sloppy work, "buck passing," and shirking of responsibility, often tolerated in some communities because the labor cost seems low, may require little or no organization, but may be more expensive than quality work performed in greater quantity by competent mechanics at higher wages.[7]

Type of Maintenance Programs

The type of maintenance program conducted by the school district is another factor which may condition its maintenance organizational pattern. There is no one best type of program for all school districts, but Viles [8] suggests that most districts follow some phases of the following: (a) All maintenance may be done by the school maintenance staff; (b) all maintenance may be done by contract; (c) staff and contract maintenance may be intermingled; (d) most maintenance may be done by the staff, but local journeymen may be used on special jobs; and (e) maintenance staff intermingled with summer and other assistance from regular custodians. It seems obvious that all of these plans will not require the same organizational pattern.

SELECTION OF MAINTENANCE PERSONNEL

After officials have decided on the type of maintenance program and organization they wish to establish in their school districts, they should then select competent personnel to meet the requirements of the program. These requirements are largely determined by: (1) Size of staff needed, (2) types of skills required, and (3) personal characteristics desired.

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[7] Henry H. Linn. Developing a School Plant Maintenance Program. *Planning for School Plant Insurance, Maintenance, and Operation.* (Educational Bulletin, Vol. XXVI, No. 2.) Frankfort, Ky.: State Department of Education, 1958. p. 174–184.

[8] N. E. Viles. op. cit., p. 25.

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Size of Staff

The maintenance staff includes laborers, semiskilled workers, skilled mechanics, office personnel, foremen, supervisors, and the program director. In planning a maintenance program, a school system may determine the exact personnel requirements by "trial and error," but a number of factors, if used together and not separately, may be of value in making this determination. These include: (a) Annual man-hours required by crafts; (b) experiences of similar systems with respect to staff size and costs; (c) ratio of maintenance costs to plant and equipment value; (d) ratio of maintenance costs to current operating costs; and (e) ratio of supervisors to workers.[8a]

Man-Hours by Crafts

School systems which have kept records on man-hour requirements should have little difficulty in determining the total number of annual man-hours required for each craft. In the absence of such previous records it will be necessary for the district to make a careful inspection of all its school facilities to determine maintenance needs, which can be recorded and then analyzed as to type. When this has been done, estimates of costs and annual man-hours by crafts can be established.

Experiences of Similar School Systems

A comparison of experience of similar systems may be of value in determining the size of the district's maintenance force. School systems to be studied should be carefully selected on the basis of comparable criteria, such as: Elementary and secondary enrollments; number and type of elementary and secondary school buildings, total number of classrooms; number and capacity of auditoriums, number and size of gymnasiums, shops, and special areas; number of professional personnel, district population, true valuation of all district property; number of full- and part-time maintenance employees by trades, a breakdown of the current and the preceeding year's maintenance costs, including all contract maintenance; and the type of maintenance program conducted by the district.

Ratio of Maintenance Costs to Plant and Equipment Value

The school district's annual budget for maintenance should represent from 1 to 2 percent of the current replacement cost of its school facilities. In some districts where maintenance has been neglected, this amount may have to be increased for an adequate maintenance program. In other districts where maintenance needs have been met

[8a] Adapted from *Operation and Maintenance Handbook*. New York State Education Department. op. cit., p. 69.

from year to year, or where most buildings are new and hence have higher replacement value, 1 percent of the current replacement cost of school facilities may be adequate. For purposes of illustration, suppose that the maintenance needs of a particular district are such that 2 percent of the replacement cost of its facilities will be required for maintenance and that the replacement value of its facilities is $10 million. In this case, the annual maintenance budget will be $200,000.

When the amount of money for maintenance has thus been determined, consideration can be given to the size of the district's maintenance force. It is generally recognized that the costs of labor will consume a minimum of 80 percent of the maintenance budget.[9]

If this percentage is applied to a total maintenance budget of $200,000, the result will be $160,000, the amount that can be allocated for salaries of maintenance personnel. Then, if an inventory has been made of maintenance needs and broken down into man-hours by crafts, it will not be difficult for the director of maintenance to apply the local wage factor and thereby determine the number of full- and part-time employees the district can hire.

Ratio of Maintenance Costs to Current Operating Costs

As has been previously indicated, the school district's maintenance budget should be no less than 5 percent of its current operating budget. On this basis, suppose that a district's current operating budget is such that $100,000 should be allocated to maintenance. If salaries and wages of maintenance personnel account for 80 percent of maintenance costs, the amount that can be earmarked for wages and salaries is $80,000. By applying to this amount the local wage factor and the number of man-hours required by crafts, the maintenance director can determine staff size by work areas.

Ratio of Supervisors to Maintenance Employees

Size of the school district, local conditions, maintenance funds, and staff size are important factors in determining district policy and procedure for efficient supervision of maintenance personnel. Certain industry management studies have been instrumental in developing the "span of control" concept which emphasizes that both management and work efficiency are improved if: Not more than 5 supervisory subordinates report to 1 chief; not less than 5 nor more than 10 craftsmen report to 1 craft foreman; not less than 8 nor more than 15 semiskilled craftsmen report to 1 detail foreman; and not less than

[9] Walter C. Hawkins. Preventive School Maintenance Program. *American School and University*. New York: American School Publishing Co. Vol. 21, 1949, p. 304-305.

10 nor more than 20 laborers report to 1 work foreman. Furthermore, in computing workload, idle or standby time should not exceed 5 percent of the hours required to meet normal peak loads. In smaller school systems where there is only 1 supervisor with 2 or 3 craftsmen under his direction there is no problem with respect to supervisor-worker ratio. But in larger systems where there are many employees for each craft, this ratio becomes an important factor in the development of an efficient maintenance program.

Types of Skills Required

In smaller school systems it may not be feasible, even if financially possible, to employ a full complement of maintenance personnel with at least one skilled craftsman for each area of work. Most small districts, desiring to accomplish as much work as possible with a minimum maintenance force, seek men who have a multiciplicity of skills. One such employee might possess skills in carpentry, painting, roofing, hardware, and furniture repair work; another might be skilled in pipefitting and plumbing, metalwork, and electrical work; and another qualified to do a number of other types of maintenance work. Substantial tasks which require a high degree of specialization may be let out to contract under competitive bid procedures.

On the other hand, medium- and large-size school systems may find it economical to employ one or more men who are particularly skilled in each of the following areas: Painting, masonry, carpentry and cabinetmaking, electrical, pipefitting and plumbing, plastering; heating and ventilation, sheet metal; furniture repair, landscaping and grounds maintenance, glazing; and various types of shop and machine work. The number of employees required for each of these crafts will depend largely upon the size of the school district, the type of buildings and equipment, and the extent to which maintenance work is contracted.

Personal Characteristics

An effective, well-managed, economically operated school maintenance program can be more readily developed if school officials will remember that it is better to keep inefficient, unqualified workers out of the system by the process of "selection" than to eliminate them later by the process of "separation."

In selecting maintenance personnel, school officials should consider such personal characteristics as: (a) Age, (b) health and physical fitness, (c) character, habits, and responsibility, and (d) training and experience.

Age

It is generally recognized that the most satisfactory age for original employment of school plant personnel is between 25 and 40 years.[10] If an employee is too young, he may not command the respect of administrative and maintenance personnel; if too old, he may be slow, inefficient, and physically unable to do the job. The development of an efficient maintenance department may well be conditioned by the selection of personnel who are young enough to do a full day's work and old enough to exercise good judgment.

Health and Physical Fitness

If an individual has all other required qualifications but has physical defects, does not possess good health, and has low physical vigor, he should not be employed to do maintenance work. Physical deficiencies such as absence of limbs, hearing and speech difficulties, failing eyesight, hypertension, emotional instability, and lack of agility are handicaps which contribute to accidents, cause an unnecessary drain on the energy of fellow workers, and produce unsatisfactory work standards, inefficiency, and low morale among other personnel.

Character, Habits, and Responsibility

Unimpeachable character, approved habits, and a sense of responsibility are personal characteristics which should not be overlooked by officials when they select school plant maintenance personnel. Individuals whose conduct, reputation, and habits are questionable often fail to accept responsibilities, are not receptive to suggestions for improvement, frequently shirk their responsibilities, and sometimes demoralize their associates. Although these traits are not always discernible, officials may be able to spot undesirable candidates by reviewing their employment records, by investigating their interest in civic, church, and fraternal affairs, by analyzing their philosophy of life, and by observing their home conditions.[11]

Training and Experience

If high standards and efficient methods of work are to be achieved, it is imperative that maintenance employees have some training and experience in the areas of work to which they are assigned. In some cases, this training and experience may have been obtained from other areas than school plant maintenance. If secured from the

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[10] Charles Everand Reeves. The Employment and Organization of School Plant Personnel. *American School Board Journal*, 121 : 37, December 1950.

[11] George H. Bush. Qualifications, Preparatory, and In-Service Training of Plant Operation Employees. *1950 Proceedings*. Association of School Business Officials. Kalamazoo, Mich., The Association, 1950. p. 160–166.

building construction field or from trade schools, it may be quite valuable. In other cases, it may not be possible for officials to secure men with appropriate experience. In this event, the district should select only those men who are willing to serve a period of apprenticeship, at lower wages than are paid skilled craftsmen during this period of appropriate training for their work.

ESTABLISHING LINES OF AUTHORITY

Lines of authority for supervisory control of all school employees—professional and nonprofessional—should be so well established and so clearly defined that the employees understand their relationships. Of fundamental importance is the concept that all employees are members of a team working together to provide the very best opportunities obtainable for child development. The duties of each group of employees are different, yet all members should seek to create an environment in which the learning process may be carried on in the most efficient manner. This team concept can be implemented by the supervision of personnel and by the coordination of work schedules.

Supervision

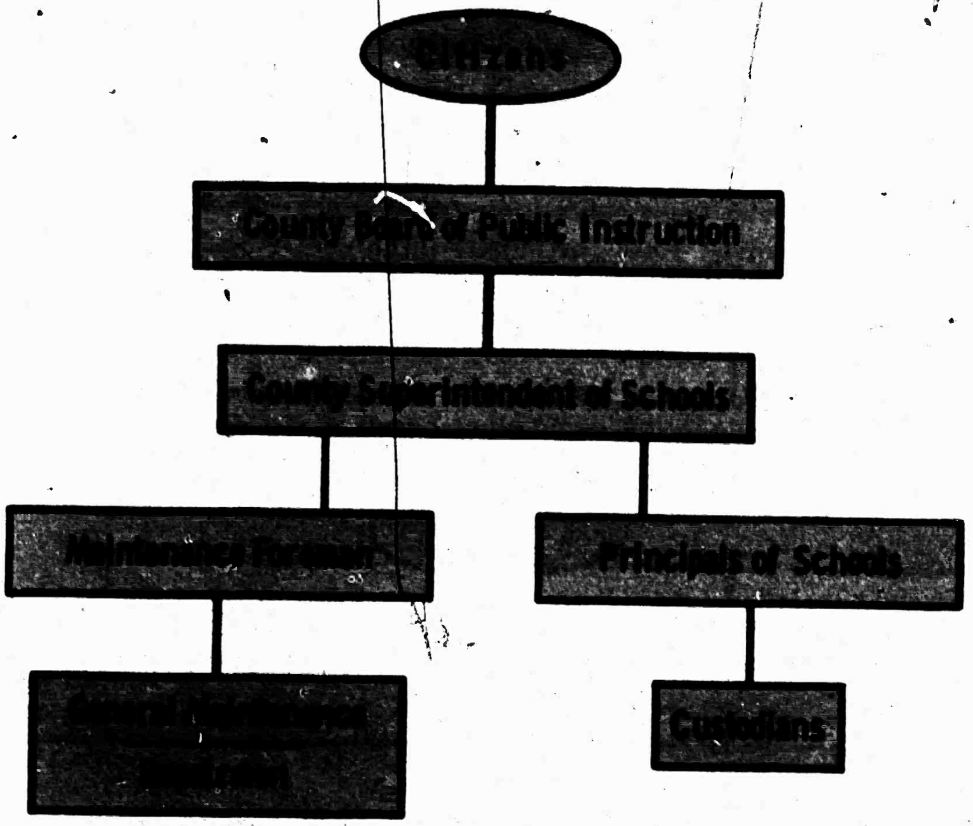
Experience shows that good supervision is as helpful to noninstructional employees as it is to the teaching staff.[12] Quality of work, performance levels, employee moral, personnel relations, and job performance techniques can be improved by proper supervision of maintenance personnel. These are important if school facilities are to make a proper contribution to the educational endeavor.

Maintenance supervisory problems encountered in small school districts are much the same as those in larger districts, but size of the district is a factor which often determines the manner in which supervision is handled. Regardless of school district size, however, supervision of school plant operation and maintenance activities must be concerned with such problems as: Inspecting the plant and its equipment; overseeing repair work and alterations; certifying maintenance bills; preparing specifications for materials and supplies used in operating and maintaining school plants; evaluating the work of maintenance employees; preparing job analyses, and having general custody of school plants.

In smaller districts, the superintendent or the business manager generally assumes responsibility for the direct supervision of school plant employees. In larger districts where adequate personnel are available, separate maintenance and operating staff organization are

[12] Alonzo D. Brainard. Good Supervision Means Good Maintenance. *Nation's Schools*, 55: 88. September 1956.

Chart 1.—Organization of school plant maintenance in typical small county (under 25 plants), state of Florida



frequently established, and in such cases, different procedures are required for successful supervision.

Tokheim,[12] in a recent study of school plant operation and maintenance in Florida school systems, reported that the superintendent of schools is in charge of both operation and maintenance in 25 counties. In 9 counties, these services are under the direction of a maintenance supervisor; in 10 counties, operation is separate from maintenance, with a separate supervisor in charge of each. In the remaining 23 counties, both maintenance and operation are under the supervision of the superintendent of schools and a supervisor of maintenance, or there is no county maintenance program, maintenance being left to the individual communities under the direction of the school principal. Tokheim has developed flow charts showing lines of authority for typical small, medium, and large Florida counties. Chart 1, page 27, represents small systems having less than

[12] *School Plant Operation and Maintenance Programs in Florida Counties.* Florida State Department of Education. Tallahassee: The Department. 1959.

25 buildings; chart 2 below is for medium-sized systems having from 25 to 50 school plants; and chart 3, page 29, indicates the line of authority for typical large systems.

Coordination

Adequate supervision alone will not insure cooperation and coordination between maintenance and plant operation personnel, on the one hand, and instructional and other professional personnel, on the other. If the team concept in education is to be fully implemented, all involved must participate intelligently and without friction. It is generally recognized that each individual does his work best when he is happy in that work and has a cordial relationship

Chart 2.—Organization of school plant maintenance in typical medium county (25 to 50 plants), state of Florida

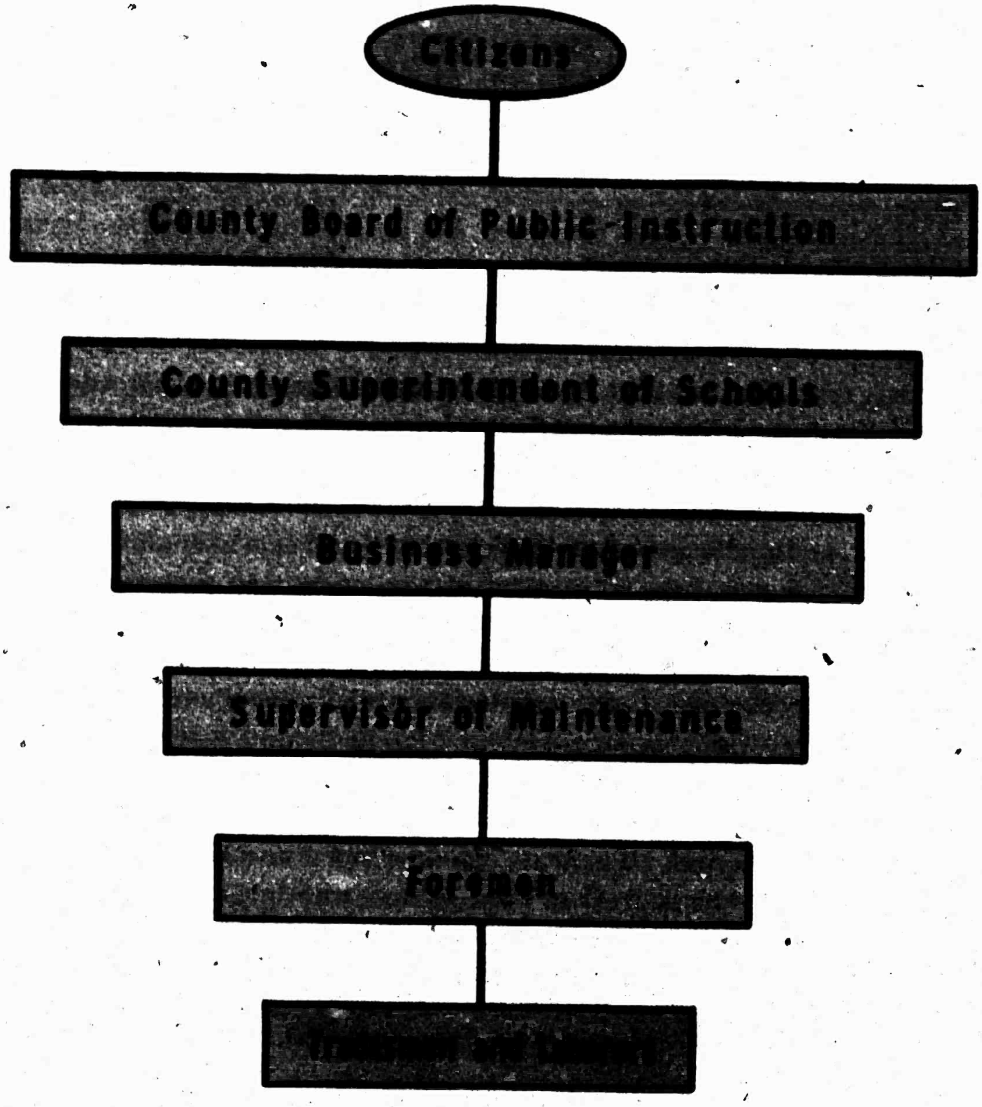
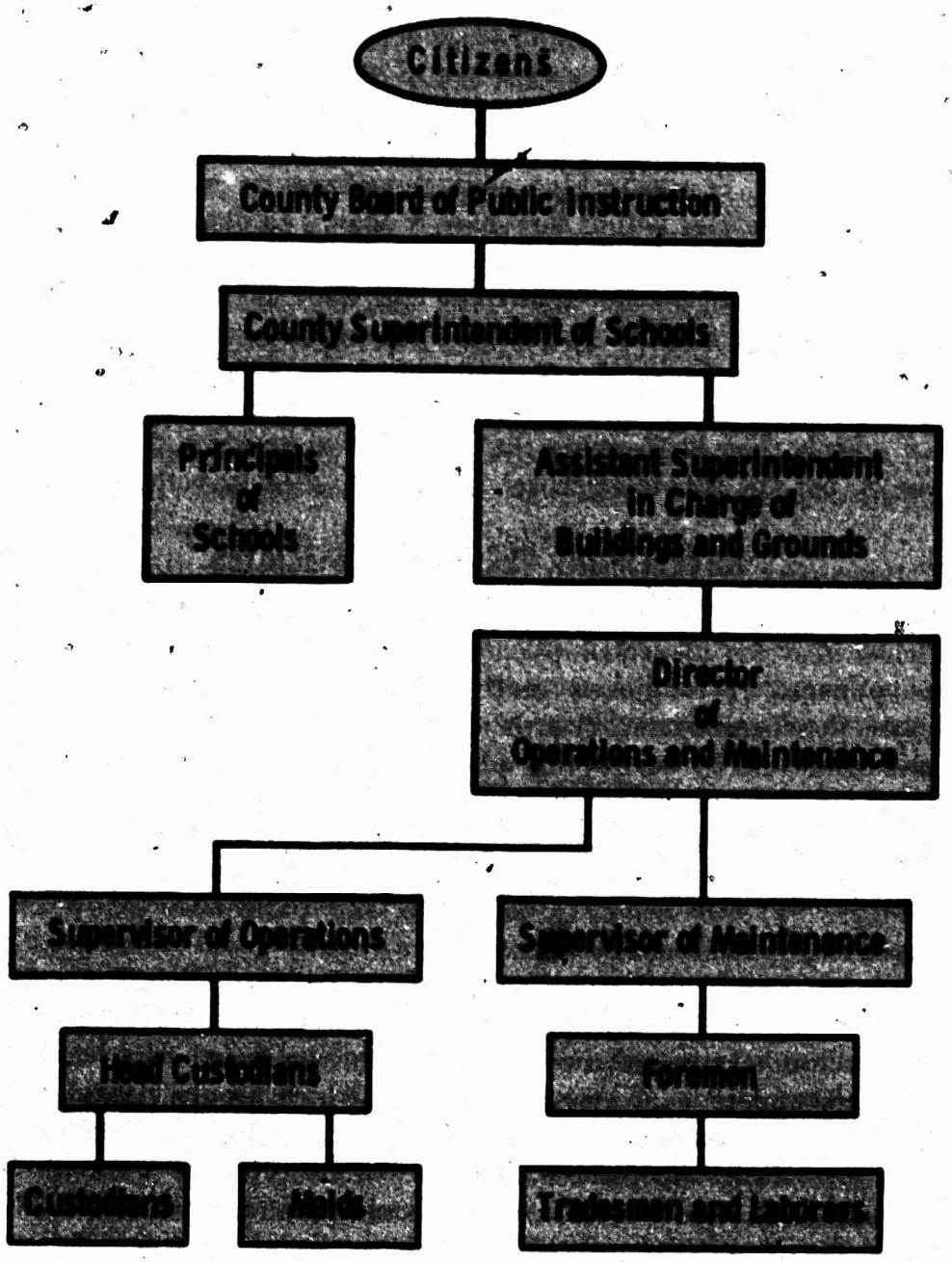


Chart 3.—Organization of school plant maintenance in typical large county (over 50 plants), state of Florida



with his associates. This relationship can be established if maintenance work is coordinated with plant operation and with instruction.

Schotland [14] suggests two methods by which maintenance may be coordinated with other phases of the school program: (a) The physical approach, which envisions the use of committees whose members represent all available resources of administration, instruction, design, construction, maintenance, and operation in planning school buildings, and in establishing such procedures as will inherently eliminate difficulties before they have a chance to develop; and (b) the human approach, which attempts to improve the attitudes and the behavior of all people involved so that their day-to-day relations and experiences may be made smoother, happier, more satisfying, and productive of good for the school system. Obviously, the first of these approaches is more applicable in planning and maintaining new schools than in planning the maintenance program for existing schools, but the second approach may be applied in both instances.

DEVELOPING PERSONNEL POLICIES

The successful operation of schools, increasingly dependent upon efficient services of school plant employees, may be more readily accomplished if conditions contribute to a high level of morale among these employees. Boards of education can do much to insure these conditions by developing, adopting, and enforcing definite personnel policies. Some considerations in developing such policies are: (1) Job application, review, and appointment procedures; (2) probation, promotion, and salary schedules; (3) work hours, tenure, and holidays; (4) sick leave, annual leave, and insurance; (5) retirement and miscellaneous benefits.

Job Application, Review, and Appointment Procedures

An administrative official designated by the board of education should formulate a job classification plan which groups positions of similar duties and responsibilities, assigns job titles, and describes desired levels of competence for the various types of work to be performed. In addition, this officer should prepare a suitable application form, to be completed by each applicant with the desired information and returned for review.

The reviewing officer should set up a separate file for each applicant. After all applications have been received and filed, a thorough investigation of previous work records, habits, character, and atti-

[14] Joseph Schotland. Coordinate Maintenance and Plant Operations With Instruction Department. *1952 Proceedings.* Association of School Business Officials. Kalamazoo: The Association. 1952. p. 109–116.

tudes should be made. This investigation may be conducted by correspondence or by telephone, but since forthright statements about an applicant are more freely given in conversation than in writing, some authorities recommend the exclusive use of the telephone.[15] However, if investigation by correspondence is preferred, good results may be obtained if carefully prepared rating sheets are submitted to respondents. It is often less difficult and generally more fruitful for respondents to evaluate certain designated characteristics of an applicant by placing a check (✓) in the appropriate column opposite each characteristic to be rated than to write letters.

After these investigations have been completed, all applicants should be interviewed, given a competitive written examination, and required to take a performance test. The interview may reveal certain traits, characteristics, and attitudes not previously shown; the written examination will determine ability to read, write, and follow instructions; and the performance test will show proficiency, or lack of it, in the specific skills required in the position.

Using data obtained from the above procedures, the administrative officer should prepare an eligibility list, from which selections can be made according to ratings received. This procedure will permit the school district to secure capable workers, and will often eliminate undue pressure on school officials to employ undesirable personnel.

Probation and Promotion

Regardless of the process of selecting maintenance personnel, sound policy seems to dictate that new employees should be required to serve a probationary period of not less than 6 months nor more than 1 year before being placed on permanent status. During this period, they will have an opportunity to demonstrate their competence, secure approval of fellow workers, and establish rapport with the organization. At the same time, new employees who fail to make satisfactory progress in jobs to which they have been assigned can be transferred to other jobs to which they are more suited, or be discharged, at the discretion of the board or employment officer.

On the other hand, personnel who have successfully completed probationary periods and have been placed on permanent status should be considered for promotion when job vacancies create promotional opportunities. Although seniority and "agreeableness" may be given some weight in establishing promotional policies, prime factors in determining such policies, particularly on levels involving management, should be competency, merit, suitability, and aptitude.

[15] Lowell D. Jackson. Selecting School Custodians and Maintenance Men. *American School Board Journal*. 130: 34, June 1955.

Salary Scales

School boards should place all nonprofessional employees on a definite salary schedule. Each position classification should have a basic beginning salary with from 3 to 5 automatic increments, at equal time intervals, eventually to reach a maximum for the particular classification. In communities where periodic collective bargaining, or some other method, is used to establish wage scales, it may be expedient for boards of education to accept these rates as appropriate for school employees rather than attempt to establish their own salary scales. This procedure may eliminate labor disputes and improve worker morale.

Whatever method is used to establish wage and salary scales for nonprofessional employees, it should be remembered that the beginning salary paid to them will largely determine whether the school system is to secure maintenance personnel with satisfactory qualifications. High wages and salaries generally attract people with high qualifications; low wages and salaries, those with low qualifications. Over the years, the school district will be able to secure quality maintenance services if it is willing and able to pay satisfactory wages for such services.

Work Hours

In industrial and other types of employment, a 5-day, 40-hour week is now standard practice. Fairness to school plant employees seems to make it imperative that they be assigned a work week of no more than 40 hours. If it should be necessary for maintenance personnel to work in excess of the regular 40 hours, or on holidays or Sundays, they should receive the same consideration with respect to overtime wages as comparable workers in local industries. This may take the form of additional pay or an adjustment in allowance for time off, either on an equivalent or a premium basis. School board policies should carefully define *regular* and *overtime* hours and should specify the rate of remuneration, or adjustments for time off, in terms of hours, such as flat rate, one and one-half, or double time for overtime, for holiday and Sunday work. If board policy with respect to overtime is specifically spelled out, employees know what to expect when they accept employment, and from this standpoint, will have no grounds for complaint, dissatisfaction, or failure to comply with work orders when they are issued.

Tenure

School plant personnel who have successfully passed their period of probation should be placed on a tenure status that will give them

a feeling of security in their positions as long as their work, habits, and attitudes merit retention in the system. In school districts where all school employees must be elected on an annual basis, competent school plant people should be re-elected without having to reapply for their jobs. This procedure adds stability to the maintenance organization, provides incentive for individuals to improve their efficiency, and helps to remove such positions from the reach of those who would use pressure on boards of education to secure them.

Holidays

In order to avoid any question on the part of either labor or management with regard to holidays, boards of education should have a written policy which stipulates the specific holidays for which employees are to be paid. If it becomes necessary for any employee to work on any designated holiday, this policy should designate the extra pay involved, if any, or provision should be made for other time off, either in equivalent hours or on a premium basis. The number of holidays allowed nonprofessional employees should be no less than the number of days allowed professional employees, provided each group is paid for the same number of months each year.

Sick Leave

Nonprofessional employees, like other people, have various illnesses. When ill, an employee should not be expected to work, and when the illness is of reasonable duration, he should not be required to forfeit his wages while recuperating. Boards of education should adopt a definite written sick leave policy which will protect the school district from abuse and the employee from wage loss. Such a policy is advantageous to both the district and the employee. The employee who is ill, but continues to work, exposes other employees to possible communicable diseases, and prolongs the period of his own illness. He seriously impairs his own efficiency, and may cause accidents to himself and others, thus creating possible district liability for these accidents.

A sick leave policy which grants one sick leave day per month with pay, with provisions for a minimum of 36 cumulative unused sick leave days, is considered reasonable for nonprofessional employees. However, as a protection against possible abuse, the written sick leave policy should specifically state that the board of education may require a doctor's written certification to an illness after a specified minimum period of absence, depending on the wishes of individual boards.

Annual Leave

School board policy governing annual leave with pay should be fair and equitable for all school employees. If professional employees are given vacation allowances, nonprofessional employees should be given similar consideration. However, many nonprofessional employees, like many teachers, are not employed on a full year basis. In some systems certain employees, such as clerks, bus drivers, food service workers, custodians, and, occasionally, teachers, are transferred to other types of school-connected work during the summer vacation periods; in other systems, they are laid off without pay during the summer months. Since there are variations in the number of months such employees work per year, vacation allowances for them will also vary.

In school systems where full-time, nonprofessional employees are allowed vacations with pay, an allowance of 2 weeks seems to be the general practice. Fairness to personnel who are employed only 9 or 10 months during the year dictates that they should be allowed paid vacations in the same ratio as full-time employees. For example, the worker who is employed for 10 months should be allowed ten-twelfths as many days as employees who are on a 12-month basis. Other variations in vacation pay allowances may be necessary in order to be fair to all concerned. For example, some school systems recognize and reward long periods of faithful service by somewhat longer vacation periods to employees who qualify. In any event, board policy should carefully define and explain all situations with respect to paid vacation plans.

Insurance

Another area of personnel management requiring definite school board policy is that of insurance protection for school employees. In States whose statutes do not specifically prohibit the expenditure of school funds for social insurance, boards should decide whether or not to purchase such insurance, and if so, what kinds, in what amounts, and who is to pay the cost. If the cost is to be paid jointly by the board and the employee, board policy should specify whether the coverage is to be required of all employees or to be on a voluntary basis.

Whatever method of payment is used, board policy should be clear on such points as board obligations, employee obligations, salary deductions, if any, and benefits accruing to employees. It is well to remember that if the board pays all or any part of the costs of such insurance, these costs are not only a direct but are also a continuing, contingent liability to the school district.

If school districts participate in social insurance programs, coverage is generally confined to one or more of such types as: Workmen's compensation, or some form of health and accident insurance; group life; group hospitalization and medical service; and employee liability.

Egly,[16] in a recent study of fringe benefits for classified employees of school districts of 100,000 population or greater, reports that most fringe benefits are granted by school districts of 500,000 to 1,000,000 population, located in the West. Of the 94 school districts reported in this study, 72 percent provide workmen's compensation, with 87 percent of these paying the total cost; nearly 12 percent provide hospital, medical, and surgical insurance, with 54 percent of these paying the total cost; 85 percent provide life insurance, with 25 percent of these paying the total cost; and 86 percent permit payroll deductions for health and accident insurance.

While these and other types of fringe benefits for school maintenance personnel may not be considered essential by some school officials, competition from industry, where such benefits are often freely given, may force school districts to grant them in order to secure competent people. Furthermore, in States where school district immunity for liability has been waived, workmen's compensation insurance, whether required by State law or not, seems essential for the protection of the school district as well as the protection of district employees and their families.

Retirement

If school boards adopt retirement plans and contribute funds to help provide retirement income for school personnel, whether professional or nonprofessional, written policies should be carefully formulated to cover many phases of the program, such as: Contributions, retirement age, monthly benefits, death benefits, rights of survivors, and disposition of any residue funds from employee contributions upon the death of the retiree.

There are arguments for and against the designation of specific ages for compulsory retirement, but if school boards adopt policies establishing compulsory retirement ages, they have an obligation to assure those concerned of some means of livelihood after retirement. This assurance may be provided through a local retirement plan, a State plan, the Federal Social Security plan, or a combination of two or more of these, depending on State and Federal statutes, local

[16] Edgar C. Egly. Fringe Benefits for Classified Employees of School Districts in the United States of 100,000 Population or Greater. *1958 Proceedings.* Association of School Business Officials. Evanston, Ill., The Association, 1958. p. 138-142.

conditions, cost to the employee and to the board, and maximum benefits to retirees.

Available evidence indicates that school boards are giving attention to regulations concerning retirement when they develop policy manuals. In an analysis of 60 school board policy manuals representing 17 States, White [17] found that nearly 70 percent of the districts have board policies relating to retirement, usually covering both professional and nonprofessional personnel. These range from the adoption of policies similar to Federal regulations on retirement through a variety of local plans, some with optional and some with compulsory retirement ages, with most specifying the percentage of an employee's salary that must be contributed to the retirement fund.

Miscellaneous Benefits

In addition to the foregoing types of employee benefits, the written policies should also cover numerous other situations which affect management-employee relationships. While not intended as an all-inclusive list of such situations, the following merit board consideration:

Bereavement leave with pay, if allowed, should be defined so that there will be no misunderstanding as to the number of days allowed or as to deceased relatives on whose account such leaves may be granted.

Christmas shopping, for school employees' whose work hours conflict with the business hours of local retail stores, may necessitate some time off by such employees. If board policy permits Christmas shopping during work hours, a time limit should be specified.

Coffee breaks, if allowed for other employee groups, should be permitted for school plant personnel, and if permitted should be limited to not more than one-half hour each day.

Court attendance, if done as a civic duty, should cause no loss of salary, but board policy should make it clear that any fees received should be counted as a part of the regular salary, not in addition to it.

Dental and medical visits, if not included in sick leave allowed, should be permitted on an emergency basis without salary loss, but board policy should be so clear that this privilege cannot be abused.

Employee association meetings, if planned and conducted during work hours for the purpose of improving morale and efficiency, may justify absence from work with no loss of pay. Board policy should establish the conditions for attendance at such meetings in the interest of the school district.

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[17] Alpheus L. White. *Characteristics of School Board Policy Manuals.* Washington: U.S. Government Printing Office, 1959. (U.S. Department of Health, Education, and Welfare, Office of Education, Bulletin 1959, No. 14.) p. 24.

Illness of family, like bereavement, is an emergency which upsets and disturbs the work schedule of employees from time to time. Liberal board policies with respect to serious illnesses may accomplish more "good will" than many other employee benefits.

Personnel counseling may be of such importance in solving personal and family problems that boards may wish to provide such service to all employees.

School attendance, like association and inservice training meetings, should improve employee efficiency. If school boards wish to permit school attendance for this purpose during work hours without loss of pay, policies should specify the maximum amount of time allowed, the types of courses employees may pursue, and whether or not salary increments may be expected after the satisfactory completion of certain courses.

Termination allowance, if allowed for any employee who loses his job through no fault of his own, such as the elimination of a position, should be commensurate with the period of employment and the job classification held.

Time off to vote may be immensely important to employees whose work hours conflict with their precinct voting hours. Board policy should not overlook opportunities for the promotion of good citizenship by permitting such workers to vote without being docked for lost time.

Work improvement suggestions by employees may often lead to savings in time and in cost for certain operations. It might be financially advantageous to school districts if boards of education would adopt a policy of rewarding employees who make worthwhile work improvement suggestions.

PROVIDING INSERVICE TRAINING

The techniques and procedures for performing the tasks undertaken by the school district's maintenance crew must be learned by its members either before or after being employed by the school district. Inservice training programs that help qualify maintenance personnel to do their jobs more efficiently will make them more valuable to the district. It has been said that, "The question is not whether a district can afford to pay for the formal training of its maintenance men, but whether the district can afford not to pay for such training."[18] In one way or another, the district will pay for this training, either through formal class and apprenticeship meth-

[18] N. E. Viles. A Maintenance Training Program in Action. *1950 Proceedings*, Association of School Business Officials. Kalamazoo, Mich.: The Association, 1950. p. 384.

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ods, or through long periods of poor service, during which workers learn by mistakes.

In providing inservice training programs for maintenance personnel, school officials need to consider: (1) Types of training programs, (2) areas of instruction, (3) instructional personnel, and (4) methods of instruction.

Types of Training Programs

The type and scope of the maintenance training program will be conditioned by the number of participants, the types of skills required, the organizational pattern of the maintenance department, the availability of instructional materials, and by other local conditions. As a general rule, however, inservice instructional programs are confined to: (a) Apprenticeship programs, (b) discussion groups, (c) formal training schools, (d) State department of education programs, and (e) college, university, or technical school courses, either on or off campus.

Apprenticeship Training

The apprenticeship type of training for maintenance personnel may follow a variety of patterns, depending upon the size of the school system and other local conditions. One pattern which may be administered successfully in any school system, regardless of size, provides for the assignment of inexperienced men to a skilled craftsman who gives them on-the-job instruction in his particular craft. This type of instruction may continue for as many months as necessary for the trainees to master the essentials of the trade. As these men gain experience and know-how, they are given more and more responsible tasks, and after demonstrating satisfactory performance in their particular trades, are classified as skilled craftsmen.

Another pattern of apprenticeship training, perhaps more adaptable to large than to small school systems, is that of designating a formal training center or shop where skilled workmen instruct and direct small groups of trainees in particular crafts. This type of instruction is continued until trainees have sufficient mastery of their crafts to assume some job responsibilities under appropriate supervision. At this point, they may be called assistant plumbers, electricians, or whatever their craft designation may be. After they have had sufficient experience and the required training in their particular fields, they are classified as assistants to master craftsmen, and finally as master craftsmen.

Discussion Groups

Another means of providing inservice training for maintenance personnel is through the organization of small groups of men who are assembled periodically during the year for a week or more to study various maintenance problems and procedures. In organizing these discussion groups, it seems desirable to select the most proficient employees as group leaders, with outsiders being brought in to serve as resource people as needs arise. Some authorities indicate that participation in these group discussions should be optional with the workers, and should be related to classification, salary, and promotion.[19] The purpose of this procedure is to stimulate greater worker interest.

Formal Training Schools

The Minneapolis School for Janitor-Engineers, which has been in operation since 1919, is probably the most widely known training school of this type in the country. It employs instructors who have no other duties than those of teaching janitor-engineers. Classes meet in facilities that are especially adapted to this type of instruction and are conducted a specified number of hours each week during the entire year. A course, which consists of units of instruction, may continue for 3 or more years.

Formal maintenance and custodial training schools of this nature may be economically feasible only for large school systems where the number of maintenance and custodial personnel employed justify the expenditure of funds for full-time teaching personnel. However, if two or more small school districts cooperate in a joint venture of this kind, it might be operated economically and successfully.

State Department of Education Training Programs

School plant services provided local school systems by the 50 State departments of education vary from minor degrees of State control over financing, planning, constructing, and operating school buildings (through cooperative training schools for school plant personnel sponsored jointly by the State and the local school districts) to more specific types of services. While 11 States provide consultative and advisory services in the area of school plant maintenance and operation, only 2 or 3 of these assist local school systems in developing inservice training programs for custodial and maintenance personnel.[20] In States where this assistance is given, leadership is pro-

[19] Sidney M. Bliss. How To Inaugurate In-Service Training of Non-Teaching Personnel. *American School Board Journal*, 120: 41-42, March 1950.

[20] N. E. Viles *and* Ray L. Hamon. *State School Plant Services.* Washington: U.S. Government Printing Office. 1956. (U.S. Department of Health, Education, and Welfare, Office of Education, Misc. No. 26.) p. 4-23.

vided by a staff member of the school plant-planning section of the department of education. This staff member generally has the title of Supervisor of Maintenance or Supervisor of Maintenance and Custodial Services.

In States where this service is, or can be, provided, there should be a definite pattern for the operation of training schools for custodial and maintenance personnel. One such pattern takes into consideration travel distances, overnight lodging, and conveniences for participants. The local school system may or may not pay the expenses of its trainees, since schools are held at locations where most participants can return home overnight, or the facilities of colleges and universities, including dormitories, may be used at nominal cost. Study areas should be predetermined on the basis of the interests of participants. Instruction may be handled by State department personnel, representatives of various manufacturing firms, local school employees whose competencies are recognized, engineers, architects, or any other specialists whose services may be available. The expenses of such personnel, including salaries, if any, may be borne by the State department of education, by the participating school systems, or jointly by the State department of education and the participating systems.

Under another pattern of State-conducted training programs, participants are assembled at a central location in the State for a specified period of time at least once each year. Facilities of colleges and universities are often used for this purpose, but they may be available only at times when such colleges or universities are not in regular or summer sessions. Other mechanics and details for this type program may be arranged in a fashion similar to those previously described.

College, University, or Technical School Courses

During the past several years, numerous colleges, universities, and technical schools have conducted resident and extension courses for school custodial and maintenance employees. Resident courses, generally offered during the summer months, run from 2 days to several weeks, with daily sessions of 6 to 8 hours. Instruction in various phases of custodial-maintenance services is given by specialists who are brought to the institution for class lectures, discussions, demonstrations, and laboratory work. In most instances, credit may be earned for the successful completion of each course, but this is optional.

Extension courses, usually conducted in the evenings at various school centers over the State, consist of lectures, discussions, audio-

visual presentations, demonstrations, trainee participation in the performance of certain tasks, and panel presentations. These courses may be either intensive or extensive with respect to time allotment and scope. If intensive, a course may be conducted for 1 or 2 weeks, with daily evening sessions of 2 or 3 hours, each session covering one or more areas of instruction. If extensive, a course may continue for an entire year, with daily or weekly evening sessions of 2 or 3 hours, each session covering limited areas of instruction. Local conditions may require variations in these plans.

Enrollees in resident courses may come from almost any locality in the country, while extension course enrollees are often limited to employees of the particular school system where instruction is being offered, or to this and neighboring school districts. However, extension courses often provide training opportunities for many who could not afford to attend resident courses.

In some instances, sponsoring institutions bear most, if not all, costs involved in operating training schools for school plant personnel. In other cases, operating funds are derived from tuition fees which may be paid either by the participants themselves or by their school boards.

Areas of Instruction

Such factors as size of the school system, number of school plant employees, and types of work to be performed will determine the areas in which instruction should be offered in a maintenance training program. In small systems where custodial employees do all except contract maintenance, special training should be given in areas where their work is to be performed. In larger systems with separate maintenance and custodial crews, training programs may enable personnel to move from one work category to another, or instruction may be limited to the improvement of skills within particular work areas.

The work areas most frequently handled by the school district maintenance department, and the types of training include:

Painting.—Types of paint, methods of application, and principles of color conditioning.

Plumbing.—Valves, fixtures, piping and pipefitting, hot-water tanks, showers, and sewage lines, including methods of repair and replacement.

Heating and ventilating.—Care of boilers, radiators, traps, converters, temperature and safety control devices, unit heaters, dampers, stokers, gas and oil burners; instruction in temperature control, air movement, and other elements relating to thermal environment.

Electrical services.—Instruction in the care, repair, and replacement of electrical equipment, including motors, wiring, switches, service panels, and light fixtures.

Any other work areas not performed by contract maintenance should also be given consideration in the training program, and regardless of areas covered, safety, both for employees and other building occupants, should be stressed in all areas.

Instructional Personnel

Instructional personnel for maintenance training schools, regardless of program sponsorship, should be experts in their respective fields and practical in their methods of instruction. In most sections of the country, competent instructors may be obtained from: (a) Manufacturing concerns, (b) professional sources, and (c) industry.

Manufacturing Concerns

Some manufacturers of school building materials, school furniture and equipment, and operating supplies will furnish skilled personnel, often without charge, to train maintenance employees in techniques of maintenance, methods of use, and other details in connection with particular products, but they should not attempt to "sell" their products. Most companies, realizing that consumer satisfaction is important, are willing to spend much time and money on research that will improve their products and thus create greater consumer demand for them. The findings of such research may not be available to the general public, but may be used by company representatives as resource instructional material for maintenance schools.

Professional Sources

Professionally trained instructional personnel for maintenance schools may be secured from a number of sources. Architects and engineers from architectural and engineering offices are often available to most school districts. College, university, and technical school professors who teach courses in school plant management, in mechanical, electrical, and chemical engineering may be employed to give instruction in areas of their particular specialty. State department of education school plant specialists may render invaluable service as directors and instructors in maintenance schools. Professionally trained maintenance personnel from the sponsoring school system, or from nearby districts, often make exceptionally good instructors for maintenance schools.

Industry

Many large industries employ maintenance specialists to keep their buildings, equipment, and other properties in a satisfactory state of repair. These specialists may be prevailed upon to transfer "industrial know-how" in maintenance to school plant employees through instruction.

Methods of Instruction

Maintenance school teaching-procedures, techniques, and training methods should help school plant employees become more efficient in their work, lead to quality performance, develop pride in accomplishment, and should improve operation and maintenance services to the school district. Methods of instruction often depend upon teacher ingenuity, types of tasks to be mastered, instructional materials available, and the amount of time allotted to instruction. Some situations may require the demonstration method, where students watch others perform tasks which they themselves must learn to perform. The job sheet method, successfully used in various aspects of vocational education, may be adapted to situations where learners must analyze the various steps in a given task. Other and more common methods of presentation include the lecture, the question and answer, round table and panel discussions, and audiovisual presentations or various combinations of these methods. Regardless of method or methods used, however, an abundance of printed materials, such as books, guides, charts, diagrams, slides, drawings, and pictures should be used in order to make the program more effective.

CHAPTER III

Programing Maintenance Needs

THE PRECEDING CHAPTER has been devoted to a discussion of some of the factors involved in personnel management as they relate to the total problem of developing a maintenance organization for a public school district.

The purpose of the present chapter is to propose and discuss some guidelines which may be used in programing the maintenance needs of a school district. It is recognized that no single formula will be adequate to cover all phases of maintenance program planning for all districts. There are, however, certain common denominators which may be used to determine maintenance needs for each district. These include: (A) Establishing needs as to location; (B) developing maintenance schedules; and (C) determining maintenance shop and equipment requirements.

ESTABLISHING NEEDS AS TO LOCATION

It is not possible for the school district maintenance organization to develop a well-planned, efficient, low-cost maintenance program unless the specific needs at each school location are known. These needs may be revealed through: (1) Long-range planning, (2) routine inspections and periodic checks, (3) community suggestions, and (4) emergency requests.

Long-Range Planning

The first step in long-range planning for maintenance involves the collection of factual data on all buildings, grounds, and equipment in the school system. This can be accomplished by conducting a building maintenance survey. The director of buildings and grounds and the maintenance supervisor, or other officials responsible for the district's maintenance program, should direct the survey so that comparable procedures will be used throughout the district. Except for the survey director and his assistant, personnel of the survey team may change for each building, with the principal,

selected teachers, the custodians, and 1 or 2 technically trained members from the local community serving as members of the survey team for the particular building. An analysis of the maintenance needs of a school plant requires a wide, practical knowledge of school building construction. The director of buildings and grounds, the maintenance supervisor, and the technically trained members of the team can supply this knowledge, while the principal, teachers, and custodians—those who actually work and live in the building—can direct attention to maintenance needs about which they have knowledge.

The survey team should inspect every part of the school plant, including grounds and equipment, and every maintenance requirement should be listed, giving the estimated cost of each. Priority ratings should be assigned to each need, with most urgent needs being given first priority; those that will prolong the life of the building and equipment, second; and those that are otherwise desirable, third.[1]

When all buildings of the district have been surveyed, all maintenance needs with respect to priority, costs, and location can be tabulated for further study and evaluation. This evaluation may disclose that all items having first priority cannot be handled during the first year of the program. If so, those considered less urgent may have to be deferred until a later date. Regardless of how much maintenance can be accomplished during the first year, however, the framework for long range programing of maintenance work will have been laid.

Routine Inspections and Periodic Checks

Once a complete, comprehensive maintenance survey has been made, the maintenance needs of a school district can be kept current by routine inspections and periodic checks. These inspections can and should be made by the school principal and his custodians. The principal should be particularly alert for conditions affecting the health and safety of students and teachers; custodians should inspect hardware, glass, lights, mechanical and electrical systems, furniture and equipment, and various types of controls. Needs that are discovered by these routine inspections, if not of an emergency nature, may be reported to the maintenance department on a daily, weekly, or monthly basis, depending upon the degree of urgency and the reporting procedures of the local system.

Periodic checks of all electric motors, starter control equipment, heating and ventilating systems, water heaters, instructional equip-

[1] Harry F. Walton. Surveying and Programming Maintenance Needs. *1952 Proceedings.* Association of School Business Officials. Kalamazoo, Mich.: The Association, 1952. p. 102–109.

ment, and many other phases of the school plant should be made by maintenance specialists. These checks should be made at least once annually,[2] preferably during the summer vacation period when there is ample time and less possibility of interfering with school activities. In addition to periodic checks by school maintenance personnel, certain parts of the school plant may need periodic checks by architects, engineers, boiler inspectors, and representatives of insurance companies or their rating bureaus. The services of architects and engineers will be required if there is any question concerning building safety; the services of professional boiler inspectors are frequently required by State statutes, and are often provided by insurance companies; other insurance representatives, or officials of rating bureaus, inspect school properties for the purpose of establishing—or changing—insurance rates. In any event, all building defects discovered and subsequently reported by any of these inspectors become maintenance needs which should be corrected by the school district.

Community Suggestions

In many school districts, school maintenance programs are not organized, staffed, and administered in such a way that the needs of each school can be determined by the maintenance staff. In such districts, there may be some progressive communities where parent-teacher associations, civic clubs, community improvement leagues, and other organizations become interested in, and devote attention to, various aspects of the school program.[3] The improvement of school facilities is often one area in which keen interest is manifested. This interest may be promoted by special school plant improvement committees composed of representatives of the various community organizations.

These committees, working cooperatively with school principals, inspect and evaluate school facilities, usually on an annual basis. If such annual inspections reveal maintenance needs, they are itemized, cost estimates are made, and school boards are requested to provide funds to meet them. Furthermore, the use of funds raised by local groups to supplement those provided by their boards for maintenance purposes is not without precedent.

Although this plan may be successful to the extent that it provides adequate maintenance for some schools, it is not normally recom-

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[2] Graham R. Miller. Program for Preventive Maintenance. *American School and University*. New York: American School Publishing Co. Vol. 26, 1954–55, p. 458–459.

[3] James F. Rochester. Efficient Programming of Maintenance Work. *1953 Proceedings*. Association of School Business Officials. Kalamazoo, Mich.: The Association, 1953, p. 130–133.

mended as a maintenance procedure because certain communities, lacking leadership may not receive their fair share of system-wide maintenance funds.

Emergency Requests

Even though long-range planning, routine inspections and periodic checks, and community suggestions may have established school district maintenance needs as to location and estimated cost, unforeseen situations often arise, which demand immediate attention. These emergency needs include building and equipment damage caused by fire, vandalism, and storms; heating plant failure; frozen water lines; breakdown of, or overloading, sewage disposal systems in rural areas; and other failures created by fortuitous circumstances. Such needs are reported to the maintenance department by the school principal or by the school custodian, and regardless of priority ratings of previously listed maintenance needs, take precedent over all others.

DEVELOPING A MAINTENANCE SCHEDULE

A well-planned maintenance program must be flexible enough to cope with the unexpected, specific enough to utilize to best advantage the time and skills of all employees, and broad enough to cover all maintenance categories. Each major maintenance activity should be timed to become a part of a long-range, master schedule, with the work so arranged that it is fairly distributed among the maintenance crews. In order to do this, it will be necessary to keep a running, master list of all maintenance tasks and repair jobs that are to be done. Each job may be given a tentative starting and completion date, with the various items of work being cooperatively assigned to members of the maintenance staff.

The development of a master schedule will involve an analysis of maintenance needs as to types, of which five are generally recognized. These are: (1) Recurring, (2) periodic, (3) replacement, (4) emergency, and (5) improvement.

Recurring Maintenance

The term "recurring maintenance" refers to school maintenance tasks and jobs which should be performed one or more times each year. These may be performed by the regular custodial staff or by the maintenance department, depending on local policy. If assigned to the maintenance department, such work should be on a scheduled basis.

Examples of recurring maintenance tasks include such things as floor and furniture care, certain cleaning operations, some types of

lawn and grounds maintenance, and specialized care of mechanical and heating equipment.

The frequency with which certain floor maintenance tasks are to be performed depends upon the number of students and the amount of traffic, the type of floors and floor covering, and the condition of playgrounds and other areas surrounding school buildings. Corridors and other areas where there is consistent, heavy traffic may need to be waxed weekly. Classroom floors may need to be washed and waxed twice each year, once before school opens and again during the Christmas holidays. Wood floors in certain building areas may need to be stripped, given two coats of sealer or varnish, and waxed once each year; gymnasium floors and indoor play courts, if of wood, may need to be scrubbed, have lines repainted, given two coats of varnish or "gym" finish, and waxed once each year, either during the summer months or other holiday periods. Students' desks and chairs may need to be washed, with some sanded and varnished as needed, during the summer.

In general, light fixtures, helix or stack switches on oil burners, and interior glass surfaces should be cleaned once each month; exterior glass, at least twice a year; and all painted interior classroom and corridor walls should be cleaned once each year.[4]

Lawn and grounds maintenance includes thorough and frequent cleaning, weeding, seeding, fertilizing, spraying, erosion control and pest control. It also includes, at less frequent intervals, pruning and trimming ornamental shrubbery, removing and replacing diseased shrubs and plants, and maintaining equipment used in lawn care. In addition, roads, driveways, walkways, and footpaths must be kept in good and safe condition, free from grass, weeds, and debris. If there are trees on the school site, it may be necessary, on occasion, to remove dead and diseased timber, both standing and fallen, in order to keep the grounds safe and aesthetically pleasing.[5] In colder climates where there is heavy snowfall, maintenance crews and the custodial personnel may have to operate as a team to remove snow from steps, walks, and driveways.

Mechanical and heating equipment, like other essential elements of the school plant, require constant vigilance and frequent maintenance, some of which is of a specialized nature. Water pumps, vacuum pumps, and other types of motor-driven equipment may need oiling once each week; heating and hot water boilers should be blown

[4] David A. Pierce. *Saving Dollars in Building Schools.* New York: Reinhold Publishing Corporation, 1959, p. 88.

[5] H. S. Conover. *Grounds Maintenance Handbook.* New York: F. W. Dodge Corporation, 1958, p. 1–5. J. Roy Leevy. Landscaping the School Site. *American School Board Journal,* 130: 55–98, April 1955.

down at least twice each year, once during the summer and again during the Christmas holidays; and ventilating systems may require frequent adjustment and attention.

In school districts where these recurring tasks are assigned to maintenance, scheduling has been accomplished in a variety of ways. Some districts use special floor maintenance crews which rotate from building to building, taking care of individual building floor needs on a recurring cycle of from 5 to 8 weeks. The size of each crew will depend upon the tasks to be performed; the number of crews, upon the size of the school district and other factors previously mentioned. These crews are equipped with all tools and facilities needed, and are transported from school to school in a panel delivery truck. As a general rule, work is performed between the hours of 3:30 p.m., or the dismissal hour, and midnight.[6]

The plan is reputed to be highly satisfactory both from the standpoint of efficiency and economy. It is efficient in that personnel become more skilled by doing one type of work than by performing a variety of tasks; it provides more consistent and uniform maintenance of floors; and it improves the efficiency of regular custodians by relieving them of an onerous, time-consuming task. The plan is economical in that it reduces the number of custodians needed, increases the life of asphalt tile beyond ordinary expectations, and requires less wax, thus reducing wax bills.[7]

In some school districts, the floor maintenance crew is augmented during the summer months by members of the regular custodial force. Such crews then increase the scope of their work to include cleaning walls and woodwork and washing light fixtures, interior glass, and windows.

Other recurring maintenance jobs, such as furniture care, cleaning operations, lawn and grounds maintenance, and specialized care of mechanical and heating equipment, can be similarly scheduled for work crews in each of these categories on a rotating basis.

As another plan of scheduling recurring maintenance work, the director of maintenance may develop a master list of items and repair jobs, assigning a tentative starting and completion date for each, and designating the person or persons who are to do the work. This plan will enable the supervisor to inspect the work in progress and/or the complete job.

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[6] Buven E. Tucker. Operations of a Floor Maintenance Crew. *American School and University*. New York: American School Publishing Co. Vol. 27, 1955–56, p. 432.

[7] Richard A. King. Developing Progressive Maintenance. *American School Board Journal*, 136: 55–65, May 1958. J. E. Crews. A Floor Maintenance System. *American School and University*. New York: American School Publishing Co. Vol. 26, 1954–55, p. 460.

Another scheduling device involves the use of a Job Ticket Board in the central maintenance office. This requires the use of a Job Ticket for each job, each ticket being pegged to a special notice board until the job has been completed, after which a completed work order form, together with appropriate records, is filed with the director of maintenance.[8]

Modification of these plans, or the development of others to fit local situations, may be found practical in many school districts.

Periodic Maintenance

Periodic maintenance refers to those jobs and tasks which may need attention less frequently than recurring maintenance jobs. In general they include repair and renovation items which follow cycles of from 3 to 5 years, such as: (A) Exterior and interior painting, and roof repair; (B) repair of window shades, blinds and curtains; (C) weatherproofing windows, doors, and walls; (D) repairing heating plants, and cleaning septic tanks.

Exterior and Interior Painting

One of the major costs in a preventive maintenance program is that of repainting exteriors and redecorating interiors of school buildings. Exterior and interior painting are essentially two types of maintenance operations. The primary purpose of exterior painting is to protect exposed surfaces and the secondary, to improve appearances. Interior painting is done to increase light reflection, improve appearances, and incidentally preserve surfaces.

Schedules for repainting school buildings vary greatly from region to region, climatic and weather conditions affecting the desirable frequency of repainting. In some localities where smoke fumes are heavy, or where there is an excessive amount of deterioration from salt or spray, or from blowing sand, exterior and interior painted surfaces may survive for shorter periods of time than in other localities. Except under extreme conditions such as these, there is a need generally to schedule outside painting every 3 to 5 years; inside surfaces, at intervals of 5 years.[9]

Little can be done to prolong the life of outside paint other than using quality products and expert workmanship. In addition, two methods have been used by various school systems to prolong the interval between interior paint jobs.

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[8] *School Business Management Handbook: Operation and Maintenance.* The State Education Department, Bureau of Field and Financial Services. Albany, N.Y.: The Department, 1955. p. 75.

[9] Nathan M. Patterson. Long-Range Maintenance and Yearly Maintenance. *1957 Proceedings.* Association of School Business Officials. Evanston, Ill.: The Association, 1958. p. 103–107.

One of these methods, used in the Muscogee County School District, Columbus, Ga., involves the adoption of a "scheme" or a "standard" for all interior painting for the entire school district—a system-wide color scheme, subject to no change except on a long-term basis. However, schemes for small or special interior areas may be changed as required, with little or no noticeable effect on the program. It has been reported that this plan can reduce interior painting costs by 100 percent, more or less, depending on local conditions.[10]

Another plan, used by the City Board of Education of Los Angeles, Calif., as well as by other school districts over the country, substitutes a wall and ceiling washing procedure for painting where practical. It is reported that the use of appropriate solutions, applied by proper equipment, will set back former painting frequencies by several years, and may cost about one-fourth as much as a new paint job. In most instances, the results are so good that the average person does not realize that there has not been a repaint job.[11]

Most of these exterior and interior paint and wash jobs can be placed on a definite, planned schedule, but emergencies and other conditions will make it necessary to do some painting on a nonscheduled basis. Provision should be made for both the scheduled and the nonscheduled jobs. Experience indicates that about 80 percent of the painting budget is required for the former; 20 percent, for the latter.[12]

Roof Repair

One of the most irritating of school maintenance problems is a leaking roof. Failure to take precautions to prevent leaks may lead to serious damage to interior surfaces, walls, and equipment, and may cause discomfort to teachers and pupils. These precautions can be taken by school district maintenance personnel through a program of preventive maintenance, which requires frequent inspections, minor repairs as needed, and in some instances, periodic treatment to preserve roof life. Experience has shown that roof maintenance of this type is far cheaper than neglect.

Although it is generally recognized that in most school districts major roof repair and replacement jobs should be performed by reliable roofing contractors, either on a contract or on a time and materials basis, experience shows that inspections, minor repairs, and treatment for preservation can be done efficiently and economically

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[10] Ibid.

[11] Ralph G. Corwin. Maintaining Interior Painted Surfaces. *American School and University*. New York: American School Publishing Co. Vol. I. (29th ed.) 1957-58. p. 277.

[12] Edwin G. Berry. Preventive Maintenance. *1956 Proceedings*. Association of School Business Officials. Evanston, Ill.: The Association, 1957. p. 299-306.

by the regular school maintenance staff. Some illustrations of minor repairs are remopping loose flashings, patching roof cracks, and removing blisters which sometimes appear on built-up roofs. Preservation treatments are given primarily to two types of roofs, metal and builtup. Metal roofs should be coated with a roof paint or a specially prepared compound every 3 to 5 years to prevent rust, fill pits and small holes, and cement joints. Built-up roofs often lose their natural oils, and a standard treatment to preserve their life is to give them a coat of hot composition every 5 years. This procedure restores the natural oils to the roofing materials, puts new life into the paper, fills small holes, and contributes to a longer roof life.

Window Shades, Blinds, Curtains

Other periodic maintenance tasks are concerned with the repair of window shades, blinds, and demounting, drycleaning, and remounting drapes and curtains. Most cleaning and dusting operations are functions of the custodial staff, but repairs may be made by the maintenance department, depending on local policy. Where special equipment is required to make such repairs, however, it seems appropriate that this work be done by regular maintenance men. For example, certain types of window shades are manufactured so that the rollers do not have to be replaced as often as the cloth. In some instances, it is possible to reverse the cloth on the rollers to obtain further service from the same shades; when this cloth becomes too worn, soiled, or is torn, it can be replaced by new cloth. This procedure, while not difficult, should be done with precision if satisfactory results are expected.

Venetian blinds may also require expert workmanship when they are repaired. Individual slats may be bent, kinked, or damaged; pull cords, cord locks, tapes, and cross ladders wear out every 4 or 5 years, sometimes more often; in order to replace these parts, or to make necessary repairs, it is often necessary to disassemble the blind. Such work can be done more effectively in the maintenance shop than on the school premises.

Another illustration of similar maintenance is demounting, drycleaning, and remounting auditorium and window drapes and curtains. This should be done once every 4 or 5 years to prevent rotting.[13] The maintenance crew should be able to handle this job more efficiently than the custodial crew.

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[13] Elbert L. Brimley. Preventive Maintenance Planning. *Custodial Training*; January 1957. p. 40–42.

Weatherproofing Windows, Doors, Walls

A common source of damage to buildings is moisture penetration, chiefly through defective roofs. Other points of penetration are outside windows, doors, and walls. Regardless of the type of material used, or how well the buildings have been constructed, the ravages of climate tend to break down exposed surfaces. This weathering process not only contributes to deterioration but also shortens building life.

Eternal vigilance is required to discover points where putty and calking compounds have fallen away, where masonry joints have opened, and where other exterior surfaces have cracked. Prompt action in resealing, recalking, replacing putty, repointing masonry joints, and repairing cracks will keep joints tight and moisture out, thus effecting savings in renovating costs and prolonging building life.

There is no way to predict with certainty the exact interval at which these weatherproofing jobs may have to be performed, but experience indicates that the span is between 5 and 10 years, depending on quality of materials, standards of workmanship, and local climates.

Repairing Heating Plants

School heating plants are usually given routine, preventive maintenance at the close of each heating season. Under normal conditions, steam and hot water plants may need to be replaced about every 30 to 35 years.[14] In the meantime, such plants may require periodic maintenance at intervals of from 5 to 10 years. For example, water-tube type boilers may require tube replacement; cast iron boilers may develop cracks necessitating replacement of sections; and grates in manually fired furnaces may become overheated, causing them to sag, fuse, or break, either of which will require replacement. These and similar types of repairs for heating plants cannot be anticipated, or planned in advance, but it should be recognized that, regardless of day-to-day and season-to-season care, use and age of heating plants make such repairs necessary at varying intervals.

Cleaning Septic Tanks

Another example of periodic maintenance, dealing primarily with rural schools where an approved public system of sanitary sewers is not available, is the cleaning of septic or settling tanks. Frequency of cleaning depends on such conditions as tank capacity, volume and

[14] George Blumenauer. Planned and Preventive Maintenance Can Save School Money. *Nation's Schools*, 48: 88-90, September 1951.

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character of sewage treated, and digestion of sludge. If either sludge or scum is permitted to reach the outlet device, particles will be flushed into the disposal field and will clog the system, causing liquids to rise to ground surface and sewage to back up in plumbing fixtures. When this happens, it is necessary to clean the tank, and it may be necessary to construct a new disposal field.

In order to prevent a shutdown of the school plant while a new disposal field is being constructed, and to avoid costs incident to such construction, it is best to measure the depth of the sludge and the thickness of the scum mat in the vicinity of the outlet baffle at least twice a year. The tank should be cleaned when the bottom of the scum mat is within approximately 3 inches of the bottom of the outlet baffle, or the sludge on the bottom is from 1 to 2 feet deep. In most instances, the tank will have to be cleaned about every 2 years.[15]

In school systems having few septic tanks, it is probable that such cleaning operations can be accomplished more economically by commercial firms specializing in this work than by school maintenance departments. However, local experience may be used as the basis for deciding who is to do such work.

Replacement

Replacement maintenance is concerned primarily with repairs by the substitution of new parts for old in worn and damaged furniture and equipment, and by the substitution of new elements for old in school structures. It does not include the substitution of complete new school facilities for old facilities.

Like much periodic maintenance, the exact time at which replacement maintenance must be scheduled is unpredictable, but carefully kept records, regular inspections, and experience may be of value to maintenance personnel in developing replacement schedules. Records will establish the age of furniture, equipment, and structures; regular inspections will reveal the probable time at which replacement will be necessary; and experience will indicate the frequency with which such work has been done.

Roofing, plumbing, floor surfaces, furniture, and equipment are examples of areas where replacement maintenance may be required. For example, experience seems to indicate that roofing may have to be replaced every 20 to 25 years; plumbing, at intervals of 25 to 30 years; and floor surfaces, every 15 years.[16]

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[15] Ohio State Department of Health. *Health and Sanitation Standards for School Buildings.* Columbus, Ohio: The Department, 1952, p. 71–72. *Manual of Septic Tank Practice.* Washington: U.S. Government Printing Office, 1959. p. 29–32. U.S. Department of Health, Education, and Welfare, Public Health Service. (Public Health Service Bulletin No. 526.)

[16] George Blumenauer. *op. cit.*

Furniture and equipment, broken or damaged in use, may often give many additional years of service if damaged or broken parts are repaired or replaced. In smaller school systems where it is not feasible to purchase, hold, and store extra equipment, to be used as replacement when old equipment breaks down, it may be necessary to make repairs on an emergency basis. In larger systems, it may be economical to operate furniture and equipment shops where repairs are made on a continuous basis. In such systems, repaired, restored, and refinished furniture and equipment is placed in a warehouse or storage room until it is needed. When a requisition for this equipment is filled, the broken or damaged equipment which it is to replace is taken to the maintenance shop to be repaired and subsequently stored for use at some future time. In this type of replacement maintenance, there is no particular cycle, but restored furniture and equipment is always available for replacement purposes when needed.

In Lincoln, Nebr., an "Eight-Year Plan" for furniture repair and replacement is said to be very satisfactory.[17] Under this plan, all furniture in a particular building is repaired, refinished, and restored every 8 years. This involves the replacement of damaged parts, such as wooden and metal legs, work surfaces and the like, and the insertion of new bolts, screws, and rivets where needed. If only refinishing is required for a piece of furniture, this work is accomplished at the individual school during either a holiday period or the summer vacation. When repairs require machine work, the furniture is carted to the central shop where machines are available. Regluing may be done on location rather than at the central shop, depending on the type and amounts necessary.

In addition to furniture, there are other types of equipment, such as typewriters, business machines, audiovisual equipment, physical education and play apparatus, intercommunication systems, clocks, and transportation equipment, which require replacement maintenance. Of these, typewriters, business machines, and audiovisual equipment may require minor annual maintenance. When parts are worn or broken, they must be replaced with new ones.

Replacement maintenance for transportation equipment may depend more upon miles of service and road conditions than upon the length of use. For example, tires may need to be replaced every 20,000 to 25,000 miles; brakes, relined every 50,000 miles; and motor overhaul, or exchange, every 100,000.

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[17] R. H. Park. Care of School Furniture. *American School and University.* New York: American School Publishing Co. Vol. 27, 1955–56, p. 437.

It should be pointed out that some accounting systems classify expenditures for new furniture and equipment, major replacements, remodeling, and modernization of structures as capital outlay rather than maintenance expenditures.

Emergency Maintenance

As has been indicated, fortuitous circumstances often create a need for certain types of maintenance at inopportune times. If such maintenance must be done in order to keep the school plant in operation, it is referred to as emergency maintenance. School officials who fail to recognize the possibility of emergencies, and make no provision for meeting them, may encounter difficulties in meeting previously established maintenance schedules.

There is no infallible rule by which emergency maintenance needs can be predetermined, but provision can be made for them by allocating about 35 percent of the total man-hours available to routine and emergency maintenance.[18] An additional precaution can be taken by designating from 10 to 20 percent of the total annual maintenance budget, depending on age and condition of buildings and equipment, for this purpose.[19] If these steps are not taken, it is probable that some scheduled maintenance may have to be deferred.

Improvement Maintenance

As used here, improvement maintenance refers to the repair and upkeep of school grounds and sites. School grounds improvement includes: Repairing and replacing walks, fences, tennis courts, playground surfaces, lawn-sprinkling systems, outside flagpoles, driveways, sewers, and irrigation ditches. Improvement of sites includes regrading, reseeding lawns, and replacing shrubs. Initial expenditures for these items, that is, at the time a building was constructed, are capital outlay expenditures, subject to State and local laws and customs, but those incurred in replacing or renewing such items may be appropriately charged to maintenance.[20]

It is not difficult to determine the need for such improvements when the building maintenance survey is made. Good judgment may predict the time at which they should be made. Once the need has

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[18] Arthur G. Hoff and Thomas J. Mile. Controlled Maintenance. *American School Board Journal*, 134: 80–82, March 1957.

[19] How New York Spends School Building Maintenance Funds. *American School Board Journal*, 126: 53, February 1953.

[20] Paul L. Reason and Alpheus L. White. *Financial Accounting for State and Local School Systems*. Washington: U.S. Government Printing Office, 1957. (U.S. Department of Health, Education, and Welfare, Office of Education, Bulletin 1957, No. 4.) p. 74.

been determined and the time has been established, the improvements can be incorporated in the long-range master schedule.

DETERMINING MAINTENANCE SHOP NEEDS

Some factors which condition school district maintenance shop and equipment requirements are size of the district, board policy, and services rendered by school plant personnel. For example, if a school district is small, has no definitely organized maintenance program, contracts most of its maintenance work, and requires only routine service from school plant personnel, it will have little need for a maintenance shop with specialized equipment. On the other hand, medium to large districts, having well organized plant operation and maintenance departments whose personnel perform all operating and most maintenance tasks, need special shops and an assortment of tools and equipment to provide prompt and economical service.

In school districts where such shops are needed but have not been established, careful attention should be given to: (1) Shop type, size, and location; and (2) shop equipment.

Type, Size, and Location

The shop facilities needed by a school district will depend upon the volume and nature of repair work to be performed. In small districts where work volume is small, maintenance personnel is limited, and only minor repairs are made, there may be no justification for elaborate shop facilities. In such instances, the rolling shop—a truck with a covered bed which is equipped with necessary tools—may be sufficient.

Another type is the custodial or maintenance shop located in each school building. In still other districts, one general shop with units for special types of repair jobs, such as electronics, furniture, office machines, welding, electric motors, and hardware repair may be found satisfactory.

In large districts, where the volume of work in each of several different repair categories is heavy, it may be feasible to plan one shop for each of several repair areas. For example, if a district operates a pupil transportation system, it may be desirable to plan the schoolbus maintenance shop and storage garage as a separate unit. Likewise, if furniture repair—and sometimes furniture manufacturing—is a large operation, it may be expedient to plan this as a separate shop. In other cases, three or four shops—each designed to provide for a number of related repair and maintenance operations—may be found advantageous. For instance, all repairs and maintenance work involving the use of metals may be done in one shop that

is equipped to handle, store, cut, weld, and fabricate metals; repairs involving the use of wood, in a carpentry shop; those involving motor vehicles, in an automechanics shop; and those concerned with electrical equipment and electric services, in an electronics shop. Regardless of shop type, however, outstanding economies in plant operation and maintenance are said to be effected in school districts where maintenance shops are operated.[21]

Shop size, a factor which influences shop efficiency, must be taken into consideration when planning a maintenance shop of any type. Ample space should be provided for administration; for the storage of raw materials and supplies; for work areas and the installation of appropriate machinery and equipment; for toilet, shower, and dressing facilities for employees; for the storage of items brought in for repair; and in some cases, for the storage of repaired items. Local variations in types of shops, in number of shop employees, in operations performed, in equipment installations, and in storage requirements preclude a listing of specific space requirements for each of the areas listed above.

Another factor which influences shop efficiency is location. Each shop should be properly located as to be easily accessible from all parts of the school district. Man-hours used, gasoline consumed, and the cost of wear and tear on trucks in transporting broken or damaged equipment long distances to and from maintenance repair shops can devour much of the maintenance dollar. Similarly, if field crews assemble at the maintenance shop each day to be transported to particular buildings where maintenance work is in progress, and if portal-to-portal pay is allowed, a considerable portion of the wages paid produces no services for the district when the shop is not properly located. Furthermore, shops should be so located that the handling and transportation of raw materials and supplies will be reduced to a minimum. Whether there be one, two, or more shops and warehouses, they should be centralized to insure proper coordination between operation and maintenance.[22]

Shop Equipment

The school maintenance department cannot be expected to make needed repairs or perform essential maintenance services unless its equipment and tools are of the kind and quantity to permit satisfactory performance. The type of tools and equipment needed, like

[21] Harold D. Hynds. Long-Term Economies in Maintenance and Operation. *School Management*, 17: 4–5, March 1948.

[22] N. L. George. Some Principles for the Organization and Operation of a Central School Shop Service. *American School Board Journal*, 120: 41–92, February 1950.

type of shops, will depend on the scope of the program, which may vary. It seems impractical, therefore, to suggest specific tools and types of equipment for all programs. These should be selected by local officials when they analyze the operations to be performed by the maintenance department.

In general, however, tools and equipment may be classified as on-the-job or portable, in-the-shop or fixed, and handtools and equipment. Portable tools are those that may be powered by gasoline motors, electricity, or by hand and can be easily moved from place to place. These include electric drills and grinders, power-driven handsaws and planes, spray-painting equipment, mowers, electric hammers, floor scrapers and sanders, welding equipment, and forges. Fixed equipment is regarded as those items that are too heavy to be moved readily from place to place, some of which may have to be bolted to the floor when in use. Examples of fixed equipment are bandsaws, circular saws, planers, jointers, drill presses, and lathes. Handtools are those without power which can be carried from place to place in a tool box or in the hand and depend upon hand manipulation for service. Some examples of handtools are hammers, saws, planes, wrenches, screwdrivers, nail punches, drills, and spirit levels.

Experience seems to indicate that all portable and all fixed tools and equipment should be provided by the school district. Practices differ with respect to ownership of handtools. Some authorities feel that these, too, should be furnished by the district.[23] Others feel that if the worker furnishes his own handtools, he will look after them, and thus relieve the maintenance department of in-and-out check-ups.[24] Local practice may be used to determine whether such tools are to be furnished by the district or by the worker.

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[23] Floyd G. Hoek. Care of Maintenance Tools. *American School and University*. New York: American School Publishing Co. Vol. 25, 1953–54. p. 377–378.

[24] L. C. Morrow. *Maintenance Organization and Management* (No. 1 of *Plant Service Library*). New York: Factory Management and Maintenance. [No date] p. 8–164.

CHAPTER IV

Financing the Maintenance Program

SCHOOL PLANT maintenance, like other phases of the educational program, must be adequately financed to be effective. Considered a local responsibility in some States, maintenance is financed by funds derived from local tax levies. Other States, recognizing the importance of protecting State and local investments in school properties, allocate some State funds to local districts for plant operation and maintenance. Generally, such funds are distributed either as a fixed amount per student in average daily attendance or net enrollment, or as a fixed amount per teaching position allowed by State regulations and used by the district. Some States include these funds in their equalizing or foundation programs; others distribute them as flat grants.

Practices concerning State control over the expenditure of such funds vary. Some States earmark them specifically for school plant operation and/or maintenance; others stipulate that they must be spent for maintenance only; others permit local school board discretion in their use.

Regardless of the source of maintenance funds, or of controls exercised over their expenditure, it is generally felt that they are rarely sufficient to meet the needs in most school districts. Frequent explanations for inadequate appropriations are: "Maintenance is the stepchild of the school district," and "The maintenance budget is the first to be cut when school expenditures have to be reduced." These statements are not always without foundation, but school officials can, and should, defend proposed expenditures by presenting tangible evidence of the importance of maintenance to the school district. Such evidence can be presented to the school board and to fiscal authorities through: (A) The maintenance budget, and (B) maintenance records.

THE MAINTENANCE BUDGET

In preparing the maintenance budget, school officials should be careful to distinguish between physical improvements which can be charged to capital outlay, and repairs and upkeep chargeable to maintenance. It is generally agreed that expenditures for extensive remodeling of buildings, major replacements of buildings and equipment, additions to buildings, and improvements to grounds are capital outlay expenditures, and may or may not be placed on a pay-as-you-go basis, depending on local policy, tax limitations and other factors. On the other hand, all maintenance expenditures should be placed on a current basis, using funds from local tax levies, from State allocations, or a combination of local and State funds.[1]

Uniformity of maintenance expenditures is another important point to consider in developing annual maintenance budgets. Maintenance should be planned so that expenditures can be apportioned as uniformly as possible every year to prevent excessive costs 1 year and meager costs the next. This uniformity will contribute to the development of a systematic plan of work for maintenance personnel, will create a favorable impression on taxpayers, and may play an important part in determining whether or not boards and fiscal authorities accept and approve maintenance budgets.

Procedures for the preparation of school budgets differ somewhat in the various States. For this reason, it is not feasible to outline here a detailed plan by which the maintenance budget may be developed. Rather, it seems more appropriate to suggest some steps that can be taken by school officials to justify cost estimates, to secure board approval of requests, and to obtain appropriations for maintenance needs. These are: (1) Making a maintenance survey, (2) establishing maintenance priorities, and (3) presenting recommendations.

Making a Maintenance Survey

The starting point for a continuous, long-range maintenance program is a careful and thorough survey of each school plant in the district. This is particularly true in districts where maintenance has never been on a planned, organized basis. The method of conducting such a survey has been described in an earlier section of this study. Suggestions concerning instruments to be used in collecting data, types of data to be collected, and methods of evaluating these data will be discussed here.

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[1] George F. Womrath. *Efficient Business Administration in Public Schools.* Milwaukee, Wis.: The Bruce Publishing Co. 1932. p. 400.

With respect to survey instruments, local school officials may develop forms appropriate for their use by providing for the recording of complete and accurate data under three major headings: (a) Site, (b) building, and (c) equipment.

In school systems having separate work crews for each of these areas, it may be feasible to develop a separate instrument for each area. In systems where areas of work are not so well defined, it may be desirable to develop one instrument covering all areas.

Regardless of the number of instruments used, however, each should provide space for the following types of identification data: School name or designation, date of construction, date or dates of major remodeling and/or additions, probable life expectancy of the existing structure, grades taught, date of the survey, and names of members of the survey team. In addition, there should be at least seven major columns with such headings as: (1) Line item identification, (2) present condition, (3) what is needed, (4) estimated cost (labor, materials, total), (5) when needed, (6) priority assigned, and (7) other remarks.

In order to provide a checklist for the survey team, it may be desirable to subdivide the first heading, major line item identifications, into minor specifics, as the following:

The SCHOOL SITE, one of the three major phases of the survey instrument, may have major line item identifications with minor specifics, as follows:

Play Areas
- Surfacing
- Play apparatus
- Safety

Pedestrian Traffic
- Walkways
- Covered passageways
- Steps
- Ramps
- Safety

Vehicular Traffic
- Roads and driveways
- Site entrances and exits
- Loading platforms
- Parking
- Safety

Lawn Beautification
- Turf
- Shrubs
- Flowers
- Statues

General
- Fences
- Drainage
- Erosion control

BUILDING, the second major phase of the survey instrument, may have two sections, one dealing with exteriors and one with interiors. These may be further subdivided as follows:

Exterior

Roof:
- Coping
- Parapet
- Flashing
- Projections—
  - Skylights
  - Chimneys
  - Vent pipes
  - Ventilators, etc.
- Gutters
- Scuppers
- Downspouts
- Roof deck
- Roof mat

Walls (masonry, concrete, stucco, curtain wall, etc.):
- Above grade—
  - Cornices
  - Sills
  - Joints
  - Windows—
    - Calking
    - Putty
    - Lintels
    - Sash ventilators
- Below grade—
  - Footings
  - Foundations
  - Joints between walls and sidewalks
  - Areaways
  - Window wells

Interior

Structure:
- Ceilings
- Walls and partitions
- Floors
- Stairs and stairwells

Finishes:
- Plaster
- Paint
- Tile

Light and light control:
- Electric wiring and fixtures
- Windows
- Shades and blinds

Plumbing:
- Drinking fountains
- Sinks
- Basins
- Urinals
- Water closets

Heating and ventilation:
- Furnace
- Motors
- Radiation
- Ducts and fans
- Automatic controls

Doors and hardware

Built-in equipment:
- Chalkboards and tackboards
- Curtains and tracks
- Pulleys and ropes
- Stage and gymnasium equipment
- Lockers and cloakrooms
- Auditorium seats

EQUIPMENT, the third phase of the maintenance survey, may be divided into such sections as:

Shop (depending on local offerings)
- Agriculture
- Industrial arts
- Auto mechanics
- Electronics

Business Education
- Typewriters
- Office machines
- Others

Home Economics
- Stoves
- Sewing machines
- Washing machines
- Refrigerators
- Dryers

Cafeteria
- Stoves
- Ovens
- Refrigeration
- Mechanical ventilation
- Tables

Audiovisual
- Motion picture projectors
- Film strip projectors
- Screens

Science
- Laboratory tables
- Cabinets and storage vaults
- Display cases

Furniture
- Student desks and chairs
- Teachers' desks
- Library tables
- Book cases
- Office furniture

It is not suggested that the foregoing classification and breakdown of items to be inspected in the maintenance survey is an all-inclusive list. In developing the survey instrument or instruments, local officials will want to include all items pertinent to their school district maintenance requirements.

The remaining six headings of the suggested survey instrument should also have columnar headings, as previously indicated, with sufficient space in each column opposite every line item for recording all data called for by the heading. For example, the second heading (present condition) asks for an evaluation of the condition of each item on which inspection is made. The condition should be recorded as "New," "Good," "Fair," or "Poor," depending on the state of repair. If repairs are needed for any item these should be indicated under heading three (what is needed); and their estimated cost, broken down as to labor, materials, and total, should be entered under heading four (estimated cost). The time at which repairs or replacements are expected to be needed should be recorded under heading 5 (when needed). Data under headings 4 and 5 will be useful in determining current and future maintenance budgets as well as in scheduling maintenance work.

The survey team should carefully evaluate its maintenance recommendations for a given school plant *after* completing the inspection for that plant and *before* leaving the premises. This will give the team an opportunity to re-examine areas about which there may be differences of opinion. Based on this evaluation, priority ratings of "1," "2," or "3" should be assigned to each item needing maintenance. Repairs most urgently needed should be rated "1"; those that will prolong the life of the building and equipment, "2"; and others that are desirable, "3." The ratings should be recorded in colmn 6. Observations, explanations, and other pertinent data may be recorded in column 7.

Finally, space should be provided at the end of the instrument for recording estimated maintenance and repair costs (labor, materials, and total) for each of the three priority groups for the particular building, and it should then be submitted to the central office.

Establishing Maintenance Priorities

When the survey instruments for all school plants in the district have been transmitted to the central office, the superintendent and his staff, or a committee, composed of the superintendent, the director of buildings and grounds, selected staff members, and designated members of the board of education, should review and evaluate the recommendations for the entire school district. To get a composite picture for the district, it may be desirable to prepare three separate documents, one showing survey team recommendations for priority "1" for all schools in the district, with total estimated cost; another showing survey team recommendations for priority "2"; and a third showing such recommendations for priority "3."

It seems improbable that most school districts will be able to provide funds to meet all three schedules during 1 year. It is possible that the cost of repairs and replacements having first priority may exceed available resources during the first year. If this is true, it will be necessary for the committee to reevaluate all priority "1" recommendations in order to defer some of the less urgent needs to a later date. Some of these, along with some of the priority "2" recommendations, may then be scheduled for the second year. At the end of the second year, remaining needs of the first and second category, if any, may be scheduled for the third year along with as many priority "3" needs as can be handled during that year. By this time, the program should be so well established that it will be continuous.

Presenting Recommendations

When maintenance priorities have been agreed upon and an attainable schedule developed, it is necessary to translate this schedule into dollars and cents so that it can be incorporated into the total school budget. This is a job for the business manager, the finance officer, or the superintendent, depending on business management procedures in the particular district.

Even though the maintenance budget has been prepared with painstaking care, it is of little value unless it is adopted by the school board, and unless funds for its implementation are made available by the appropriate fiscal authority.

Securing board approval of the maintenance budget and obtaining funds to cover proposed expenditures often depend upon proper presentation of needs to the board and to the fiscal authority. For this reason, considerable importance should be attached to making a convincing, fair, accurate, and documentary presentation. This may be done by the superintendent, the business manager, the fiscal officer, or the director of buildings and grounds. Regardless of who does the job, however, careful attention should be given to the use of charts and data which will show exactly where the money is to be spent and why it is to be spent there.

Several advantages seem to be inherent in this plan of presentation: The board will be completely informed and can make wise decisions with regard to items in the maintenance budget. Good teacher-staff and teacher-board relationships can be established; teachers will be able to see where the money is to be spent, and can weigh the relative importance of the uses of maintenance funds, thus eliminating the feeling among some that their school will be neglected while other schools will get the lion's share of maintenance work. Parents will be satisfied because they can see that all schools are to be treated fairly and equally, thus making for good community-board relationships. Finally, those who levy taxes and vote appropriations will have a full understanding of school maintenance needs, and an opportunity to feel the "public pulse" concerning these needs; and if they discover a favorable public sentiment, will be inclined to vote the appropriations requested.

MAINTENANCE RECORDS

The purpose of keeping maintenance records is to supply useful information concerning school maintenance services. Such records provide a history of property and equipment, a current reference concerning details of work to be performed, establish accurate data for cost estimates, and are of inestimable value to school officials in

securing the adoption of, and appropriations for, the maintenance budget. The type of records and the manner of keeping them, will depend primarily on the services rendered by the school district. Districts with extensive maintenance services will require more complete records than are necessary in districts with limited services. In order to establish a system of maintenance records that will be satisfactory for a given school district, the local board should make decisions concerning: (1) The type and scope of records to be kept, and (2) responsibility for keeping these records.

Type and Scope of Maintenance Records

Maintenance records for school districts with extensive maintenance services fall into four basic types, as follows: (a) Inventory, (b) cost, (c) control, and (d) contractual. The scope of each of these types may be expanded or limited to fit local conditions, and for the purpose of this discussion, will be limited to a few illustrations.

Inventory Records

The school district maintenance inventory, which is a list of all school property, equipment, furniture, and maintenance supplies, is intended to provide an accurate accounting of these items with respect to type, quantity, location, condition, and value. It should include:

1. Sites and playground apparatus.
2. Buildings and contents.
3. Warehouse maintenance supplies, such as paints, varnishes, hardware, doors, windows, glass, replacement parts for furniture, fixtures, and equipment.
4. New and reconditioned furniture and equipment stored for future use.
5. Fixed and portable maintenance equipment usually stored in maintenance shops.
6. Transportation equipment, such as cars, trucks, station wagons, and school buses.

Several inventory forms may be necessary for listing items. A recent publication on school property accounting[2] defines terms, suggests accounting forms, describes procedures, and classifies various types of school property and equipment for accounting purposes. This publication should be helpful to local officials in setting up an accounting and inventory system for school properties.

[2] Paul I. Reason and George G. Tankard, Jr. *Property Accounting for Local and State School Systems.* Washington: U.S. Government Printing Office, 1959. (U.S. Department of Health, Education, and Welfare, Office of Education, Bulletin 1959, No. 22.)

Cost Records

Itemized records of job costs will show how much school districts are paying for their repair work. These records, initially entered on a regular field job sheet, may be transferred to permanent forms when the job has been completed. The completed job sheet should describe the job, list all materials used, show the type and amount of labor employed, indicate the number of miles traveled to and from the job (using the maintenance shop or headquarters as the point for departure and return of workers); give the estimated cost of the job, the dates on which the work was started and finished, the date and cost of the job if done previously, and should show the total cost of the current job, with a breakdown as to labor and materials.

That portion of the job sheet which calls for "materials used" should be completed by inserting the quantity, namebrand and company from which purchased, order number, if any, company invoice number, and cost of all materials used on the job. If any materials are secured from warehouse stock, the requisition number and cost should be substituted on the job sheet for order and invoice numbers, respectively.

Another section of the job sheet is concerned with the type and amount of labor employed. Such information as name and classification of workers, hours worked, hourly wage rate, and total wages paid to each employee should be recorded in this section.

In school districts where cost records are maintained, several advantages seem apparent. Comparisons can be made between the relative economy of work performed by school maintenance crews and work let out on contract. Data contained in such records may serve as a basis for making cost estimates for future jobs. Employee efficiency will tend to improve, because supervisors and workers know that a check is being made on their work. Over a number of years, job frequency can be established, and finally, community-board relationships may be improved, because evidence will be available to show that funds were spent where they were needed.

Control Records

All records and reports which contain information concerning maintenance inspections, schedules, costs, and jobs (planned, under way, and completed), data on appropriations, expenditures, and unobligated balances (either on an annual basis or on a cumulative basis) may be regarded as control records. If such records are kept current, school officials can use them to keep the maintenance program under control at all times, thus preventing maintenance neglect in some schools and eliminating pressures for excessive work in others. Basic types of control records are: Specific maintenance control

records and cumulative general control records for each school; master control records and master budget control records[3] on all schools in the district. A brief description of each type follows.

The specific maintenance control record should be divided into three major sections corresponding to the three parts of the maintenance survey instrument (site, building, and equipment), because certain types of data from the instrument will have to be transferred to the control document. These three sections should be desingated as: "Maintenance Control—Site"; "Maintenance Control—Buildings"; and "Maintenance Control—Equipment." They should provide space for recording data common to all, such as: Inspection date, needs, year repairs are scheduled, estimated cost, order number, date performed, and actual cost. Other types of data will differ for each section, these being classified according to major and minor specifies outlined in the survey instrument. Exhibits 1, 2, and 3, in appendix A, illustrate how these forms may be constructed.

The cumulative general control record for each school is designed to show the cumulative cost of work done on each building over any desired number of years. It also furnishes data for making comparisons, in terms of specific kinds of expenditures, among the schools of the district. The line-item breakdown may follow any convenient pattern, but it is suggested that it be extensive enough to cover all major and minor specifics. Exhibit 4, appendix B, illustrates this type of record form.

The master control record for all buildings owned by the district is a convenient way of consolidating maintenance expenditures, by years and for as many years as desired, for each of the three maintenance categories (site, building, and equipment). Exhibit 5, appendix C, is a sample of this record.

The master budget control record should show how much money has been budgeted for each building, how much has been spent, how much remains to be spent, the estimated unobligated balance at the end of the year, and the actual unobligated balance at the close of the fiscal period. These data should be entered opposite the name of each building in the district. Exhibit 6, appendix D, is an illustration of this record form.

These record forms are exhibited in the appendix for the purpose of showing how they may be developed. Local officials may wish to modify them to meet the requirements of their particular maintenance patterns.

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[3] Adapted from Ronald Brown. A Successful Plan for the Economical and Efficient Maintenance of School Buildings. *Bulletin of the School of Education Indiana University.* (Vol. 31, No. 4.) Bloomington, Ind.: Bureau of Cooperative Research and Field Service, Indiana University. September 1955, p. 15–38.

Contractual Records

In many school districts some maintenance jobs are of such nature that they can be performed more economically by outsiders than by the school maintenance department. A complete roof replacement is an example. Such jobs are generally awarded to local contractors on the basis of competitive bids. If school maintenance of any significance is performed in this manner, officials should require bid bonds and should execute a written contract with the successful bidder. This contract should be complete and should cover essential relationships and obligations.[4]

The nature of work to be done under this contract may necessitate that the board of education protect itself and the school district by requiring the contractor to furnish performance, surety, and warranty bonds, as well as insurance covering district liability, as needed. These documents, along with working plans and specifications—if these are required—should become a part of the district's maintenance records.

RESPONSIBILITY FOR MAINTENANCE RECORDS

The foregoing discussion indicates that, among other things, data contained in maintenance records can be used to justify appropriations. This function attaches so much importance to record keeping that responsibility for this task should be determined by the school board or by the superintendent.

It is not suggested here that any fixed pattern be followed, but in some school districts where there is an extensive maintenance program, it has been practical to hold school principals responsible for equipment inventory records for individual schools; the warehouse foreman, for warehouse inventories; maintenance shop foremen, for shop inventories; the maintenance supervisor, for portable maintenance equipment; and the transportation supervisor, for pupil transportation equipment. Practice indicates that cost and control records are kept in duplicate, one set by the business manager and the other by the superintendent of buildings and grounds. Contractual records, such as contracts, bonds, and insurance policies, are kept by the business manager. Other documents relating to contractual records, such as working drawings and specifications, are kept by the superintendent of buildings and grounds, copies of which may also be in the hands of the maintenance supervisor and in individual school offices.

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[4] N. E. Viles. *Local School Construction Programs.* Washington: U.S. Government Printing Office, 1957. (U.S. Department of Health, Education, and Welfare, Office of Education, Bulletin 1957, No. 20.) p. 33.

CHAPTER V

Reducing Maintenance Costs

FOR THE SCHOOL YEAR 1955–56, the cost of maintaining the public elementary and secondary school plants in continental United States amounted to $319,559,000[1] exclusive of school plant operating expenses. This expenditure accounted for nearly 4 percent of total expenditures for public education at these levels, and amounted to about $25 per pupil. While this amount—and more—may be amply justified in light of maintenance aims and purposes, it seems probable that, in relation to total current expenditures, future school maintenance costs might be reduced without serious consequences by careful attention to some of the major factors which influence these costs. Four such factors will be discussed in this chapter: (A) New construction; (B) maintenance equipment and supplies; (C) maintenance practices; and (D) continuous evaluation.

NEW CONSTRUCTION

The excuse that "hindsight is better than foresight" is of little value when school plants, new or old, require excessive expenditures for upkeep. Experience indicates that many maintenance problms confronting school people are inherent in building design, construction, and choice of materials and equipment. It seems obvious that if certain steps are taken during the planning, construction, and equipping stages of new plants, most of these problems need not arise. Among the more important steps are: (1) Utilizing reservoirs of experience; (2) standardizing components; (3) specifying low maintenance materials; (4) requiring adequate inspection and supervision; (5) choosing nearby suppliers of mechanical equipment; (6) purchasing furniture and equipment by specifications; (7) arranging on-site training for maintenance personnel; (8) filing building plans and specifications; and (9) providing a building manual.

[1] *Biennial Survey of Education in the United States, 1954–56.* Washington: U.S. Government Printing Office, 1959. (U.S. Department of Health, Education, and Welfare, Office of Education. Ch. 2.)

Utilizing Reservoirs of Experience

Among recent developments in educational administration is a concept that it is desirable to involve in decision making those people who will be directly affected. Educational literature dealing with school plant planning stresses the importance of securing the participation of professional staff members, other school employees, pupils, and lay citizens in such planning.[2] In many cases, educational consultants and school plant specialists from State departments of education, as well as consultants from private firms, render valuable assistance in planning school facilities. Boards of education and superintendents are happy to have this assistance, but they frequently overlook others who may make valuable contributions with respect to plant operation and maintenance economies—custodians, custodial supervisors, and maintenance personnel.

Custodians and custodial supervisors may know from experience the types of custodial equipment and apparatus needed, the design and location of space for housing them, and the placement of various types of equipment with relation to each other so as to provide optimum plant operation and maintenance. In addition, they may be able to give competent advice regarding the number and location of electric outlets, service sinks, and hot and cold water faucets, for efficient custodial service. Furthermore, custodians who are to operate the mechanical systems of new school buildings should be encouraged to visit and inspect such buildings in the various stages of construction. They may thus become intimately acquainted with design, construction, and operating details as new structures grow to completion.[3]

In the same manner maintenance personnel can draw upon experience to recommend maintenance economies which can be built into new structures.[4] They can suggest that:

1. It is poor economy to bury piping so thoroughly that sections of walls, ceilings, or floors have to be removed at great expense to make repairs on pipe lines.
2. Pipe chases should be large enough to permit later maintenance operations with ease.
3. Certain types of hardware and certain finishes require less maintenance than others.

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[2] *Guide for Planning School Plants* (1958 edition). National Council on Schoolhouse Construction. Nashville, Tenn.: The Council. (W. D. McClurkin, Peabody College, Executive Secretary.) 1958, p. 8.

[3] Norman J. Boyan. Involving the Custodian in School Building Planning. *American School and University*, Vol. 29, New York: American School Publishing Co., 1957, p. 99–102.

[4] Norman W. Marble. Planning for Maintenance in New Construction. *Nation's Schools*, 44: 64–66, October 1949.

4. Doors and door bucks should be of the right kind and weight to hold the type closers specified.
5. Adequate flashings should be specified and provision made for fire safety.
6. Certain types of floor covering or floor finishes have greater durability than others.
7. Water, sewer, gas and steam lines should be large enough to accommodate future additions, if contemplated.

Standardizing Components

Some designers, administrators, teachers, and citizens object to school building standardization of overall design, but are not necessarily opposed to modified standardization of component parts, such as windows, doors, chalkboards, hardware, plumbing fixtures, electrical outlets and switches, heating equipment and controls, and classroom equipment. It is not difficult to standardize these items for new buildings, but for older buildings the process may be slow, depending upon the need for repairs, replacements, and remodeling. With fewer types and sizes of material and equipment, a smaller but more complete stock of repair and replacement parts need be kept in inventory, and yet repairs can be made promptly as needed. Also, workmen, having fewer types of jobs to perform, should be more proficient. These items can be a big factor in the reduction of maintenance costs.

It seems obvious that if windows are standardized throughout the system, glass replacement could be handled much more efficiently and at less cost than would be possible if windows and window lights vary in size, because glass replacement involving various sizes and consequent waste in cutting is quite expensive. For example, a recent survey of school buildings in a district with an enrollment of about 117,000 pupils revealed that more than 20,000 window lights had been broken between the spring and fall sessions. The cost of replacing this glass was estimated at more than $60,000, a cost of $3 per light, or nearly 52 cents per child enrolled.

Doors for classrooms, exits, closets, shaft openings, storage rooms, gymnasiums, and auditoriums can be grouped and standardized as to size, design, and type.

Details and examples concerning other components need not be given here, but experience indicates that maintenance costs can be reduced through their standardization.

Specifying Low-Maintenance Materials

The relation of initial cost to maintenance cost is a problem of grave concern to school administrators, architects, boards of education, and the public. That the initial cost of a school structure could

well represent a relatively small down payment as compared with the cost of maintenance over the life of the building is a generalization based more on experience than on research. Architects are often asked to justify the use of more costly materials in terms of savings in maintenance over the years, but it has been difficult for them to reduce this problem to dollars and cents.

In an effort to provide research evidence in this area, the School Planning Laboratory of Stanford University and the Educational Facilities Laboratories, Incorporated, recently sponsored a study to determine the relationship between initial cost and maintenance cost. This study[5] was limited to 20 buildings under 10 years of age in one school district. It defined initial cost as cost of buildings only, excluding such costs as excavation, work outside building lines, architectural fees, and the like; and maintenance cost as cost of repairs to buildings only, excluding upkeep of grounds and repairs to movable equipment. The study revealed a correlation of −.46 between initial cost and maintenance cost, both expressed on a square foot basis. This correlation shows a substantial inverse relationship, namely, that as initial costs rise, maintenance costs fall. Conclusions of the study strongly suggest that "the path of real economy leads in the direction of initial costs high enough to permit the use of quality products in school construction."[6]

In specifying materials, long-run costs should be given due consideration. For example, in one case, asphalt tile was omitted from concrete floors for reasons of economy. It was later discovered that the extra maintenance costs of the concrete floors would have paid for the tile in only 3½ years.[7]

Requiring Adequate Supervision and Inspection

It is often taken for granted that architects will provide competent supervision throughout connstruction, and give the completed job a thorough architectural and engineering inspection before it is accepted by the board. Unfortunately, this is not always true. Architects are often asked to cut their fees, and where this happens, they may attempt to absorb the loss by neglecting supervision during construction and omitting inspection when the job is completed. If the board pays the standard fee for complete architectural-engineering services, it should not only insist upon, but receive, competent supervision and inspection on each job.

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[5] William J. Zimmerman. The Relation of Initial Cost to Maintenance Cost. *School Planning Laboratory Reports.* Stanford, Calif.: Stanford University School Planning Laboratory. August 1959. p. 1.

[6] Ibid.

[7] *Cutting Costs in Schoolhouse Construction.* American Association of School Administrators. Washington: The Association. 1952. p. 13.

A recent survey [8] reveals that the standard fee for complete architectural services, including planning and designing, supervision, and inspection, ranges from 4 percent of construction costs in some States to as much as 9 percent in others. Of these standard fees, the amount attributed to planning and designing ranges from 3 percent in some States to 6.4 percent in others; and the amount attributed to supervision and inspection ranges from 1.5 percent to 2 percent.

The purpose of on-the-job supervision and inspection is to protect the school district against the substitution of inferior materials for those specified and to give reasonable assurance that all work has been properly done. Such protection and assurance constitute an important factor in reducing future maintenance costs.

Choosing Suppliers of Mechanical Equipment

Of some significance in determining future maintenance costs of new school buildings is the availability of technical service for mechanical equipment. Nearby distributors, who maintain service departments and carry a complete stock of repair parts for equipment which they sell, can answer service calls and make repairs much more cheaply than distributors who are located in distant cities. Recent trends in school construction indicate that architects and engineers are specifying a greater variety of complicated equipment and controls than formerly. When such equipment fails to function, the services of factory-trained mechanics are often required. If these services can be obtained more reasonably from nearby suppliers than from others, it seems prudent that from the standpoint of maintenance economy, local dealers should be chosen to furnish mechanical equipment. This does not imply that "closed" specifications should be used, but that an annual service contract, or similar document, may be considered along with bid prices on the equipment.

Purchasing Furniture and Equipment by Specifications

The term "furniture and equipment," as used here, refers to such items as seats, desks, lockers, laboratory tables, auditorium seating, instruction machines, and the like, but does not include heating, plumbing, and electrical services, which are generally considered a part of the building.

As a general rule, school officials do not include furniture and equipment in the general contract. This procedure eliminates archi-

[8] Why Can't We Buy Stock Plans for Schools? *School Management*, Vol. 1. December 1959. p. 16.

tect's fees and contractor's profits on these items. However, careful specifications should be drawn and competitive bid procedures followed when purchasing furniture and equipment. Furthermore, selection should be made as soon as feasible so that, during construction stages provision can be made for spacing, utility connections, waste lines, and other requirements.

The use of carefully prepared specifications in the purchase of such equipment can help eliminate items that are known to require excessive maintenance. For example, experience has shown that cast iron standards for fixed auditorium seats are more durable than steel standards. If cast iron standards are not specified, suppliers may deliver steel. Again, early selection may play a part in maintenance costs in that building modifications, which may be necessary because equipment specifications are not known, are often charged to maintenance rather than to construction.

Arranging Onsite Training

Local school plant personnel who are to service the mechanical systems of a new school should be thoroughly familiar with the details of every system involved. In addition, they should know the maintenance requirements of other pertinent features of the building.

Operating manuals dealing with the daily care and general maintenance of equipment are generally supplied by manufacturers, but do not meet all needs. On the completion of a new building, school plant employees responsible for operating and maintaining it should be given onsite instruction relative to the mechanical systems and other aspects of the structure. Manufacturers whose products are used in a building are generally willing to furnish factory-trained instructors for this purpose. Other manufacturers frequently provide other services relating to operation and maintenance. For example, some oil companies will make a survey, without charge or obligation, to determine the proper oil or lubricant to use with various types of equipment.

These onsite training programs, as well as other services provided by manufacturers, may obviate expensive service calls, prevent costly breakdowns, and thus reduce overall maintenance costs.

Filing Plans and Specifications

A complete set of plans and specifications for each school in the district should be filed in the custodial service room or in the principal's office. In addition, copies of these documents should be filed in the maintenance office or in some other central office. Although plans and specifications usually belong to the architect, he is gener-

ally willing to provide the school district with sufficient copies to meet its needs.

If such documents are readily available, valuable time may be saved in cases of emergency as well as in planning the long-range maintenance program. Furthermore, if subsequent additions are required, or if remodeling becomes necessary, structural drawings may be used to determine the size and capacity of weight-bearing elements, thus eliminating the need for extra architectural services and costs involved in making this determination.

Since plans and construction drawings vary in size and often become brittle with age, their storage may constitute a troublesome problem for most school districts. The need for special files and the danger of loss of drawings from deterioration may be overcome by producing small-scale photostatic copies or by microfilming. However, photostatic copies are often difficult to read, while microfilm can be examined in a viewer, and drawings so recorded can be enlarged photographically when needed. Regardless of the method used in preserving and storing these documents, it should be recognized that their value in reducing maintenance costs lies in their availability and legibility.

Providing a Building Manual

Some economies in operating and maintaining the school plant may be effected through the use of a building manual. In developing this manual, the board's contract with the architect should specify that he is to furnish the board with one or more copies of such manual upon completion of the building. Among other things, the manual should contain:

1. An aerial view of the school site, taken at minimum altitude, on a bright day.
2. A plot plan drawn to scale, showing the general outline of site facilities, including buildings, paved areas, walks, landscaped areas, incoming utility lines, main shutoffs for water, gas, and electricity; correct measurements of the site, location of fireplugs, and the names of adjoining streets.
3. A miniature floor plan, drawn to scale, of each building, including the name and number of each classroom.
4. Codes to indicate the type of floor covering and the exact measurement of each room, and roof types by building sections.
5. Manufacturers' instructions on the installation, operation, and maintenance of building components and equipment; factory lists for replacement parts for all equipment and machinery.
6. Architect's suggestions concerning light control, operation of mechanical systems, use of fire protective apparatus, proper adjustment of room temperature controls; provisions for future installations and additions, and any special features to which the architect may wish to call attention.
7. A section giving general information.

MAINTENANCE EQUIPMENT AND SUPPLIES

Another major factor effecting maintenance costs involves the use of maintenance equipment and supplies. As used here, equipment refers to tools and machinery; and supplies, to materials needed to complete maintenance jobs. Both may help reduce maintenance costs if due consideration is given to: (1) Selecting equipment, (2) testing materials, (3) planning quantity purchases, (4) taking advantage of discounts, (5) purchasing by specifications and competitive bids.

Selecting Equipment

Since labor accounts for about 80 percent of the cost of maintenance, it is imperative that school officials select labor-saving equipment for all operations requiring frequent attention. Adequate tools in the hands of competent maintenance personnel will quickly pay for themselves in time saved. Some examples of such tools are portable paint-spraying machines, electric drills, saws, sanders, and pipe-cutting machines. These and other labor-saving devices should be considered by school systems that wish to develop efficient, economical maintenance programs.

Testing Materials

The quality of maintenance materials that have been on the market for several years is generally well known but new materials, said to be superior to and cheaper than older products, are being developed at a rapid rate. Regardless of claims made for such materials, they should not be substituted for those of known quality unless tests confirm their superiority. Large school systems may have their own research laboratories for this purpose; others may be able to secure reports from a number of reputable organizations whose business is research and testing. Another source of information on this subject is a standards and specifications document prepared by the Federal Bureau of Standards. In some cases, it is advisable for local school systems to do some testing on their own. Among the products and materials that should be tested under local conditions are floor covering, mastics, seals, waxes, and finishes; paints and varnishes; roofing compounds; calking and weatherproofing substances; and cleaning compounds.

Planning Quantity Purchases

If adequate storage and distribution facilities are available, it is generally advisable to purchase maintenance materials and supplies in quantity rather than in small lots. Some advantages of quantity

purchases are: (a) Vendors usually give better prices; (b) with materials on hand, workmen will not be delayed, and man-hours will be saved; (c) many emergencies can be handled without delay, preventing interruption of services; and (d) fewer bookkeeping and clerical operations will be required in checking invoices and paying bills.

Taking Advantage of Discounts

Many vendors offer discounts ranging from 1 to 2 percent if invoices are paid within 10 days after receipt of merchandise. Some firms, considering direct orders as "house business," pay no sales commissions on them, and allow discounts equivalent to percentages usually paid in commissions. Such discounts, if taken, can mean considerable savings to the school district.

Purchasing by Specifications and Competitive Bids

When the school district purchases maintenance materials and other supplies on the basis of good specifications and competitive bids, it is more likely to get what it wants at economical prices.

Specifications may be established by brand, trade name, "or equal," by electrical, chemical, or physical characteristics; by standard samples picked at random; by describing materials as to purpose and use; or by Federal standards. These procedures will not be described here, but whatever method is used, the completed specifications document should tell the seller exactly what the district wants and what it expects him to deliver; should be broad enough to permit as wide competition as possible, and provide reasonable tolerance; should emphasize performance rather than chemical composition of method of manufacture; may describe methods of sampling and testing which will be used; may contain instructions for inspection, marking, packing, and delivery; and may include provisions for settling disputes.

If intensive local testing is not feasible or contemplated, manufacturers may be asked to certify to the district that the materials supplied are guaranteed to comply with the requirements and tests of the specifications. If this procedure is followed, performance bonds should be required.

Many States have statutes requiring school districts to purchase on the basis of competitive bids when the cost is equal to, or in excess of, certain stipulated amounts. However, in awarding contracts to bidders on maintenance supplies and materials, it may be economical to accept the best bids on individual items rather than to give the entire order to one firm which offers the lowest single

lump sum bid. This method enables dealers who are able to furnish some items, but not all, to enter bids, and hence broadens competition. In using this method, school officials should protect bidders by guaranteeing that they will not be expected to fill orders for items unless the total order exceeds a fixed minimum amount.

MAINTENANCE PRACTICES

Good maintenance practices contribute to economy by improving efficiency and preventing waste. They may include: (1) Planning preventive maintenance; (2) following a schedule; (3) utilizing staff specialization; (4) establishing work sequence; (5) installing two-way communication; (6) negotiating service contracts; and (7) using central maintenance shops.

Planning Preventive Maintenance

The meaning of preventive maintenance is illustrated by two proverbs: "An ounce of prevention is worth a pound of cure" and "A stitch in time saves nine." Preventive maintenance recognizes a normal life span for vital components of buildings and equipment, provides minor repairs as needed, prevents costly replacements, protects against disruptive plant failure, and often averts danger to the lives of personnel.

Following a Schedule

Efficiency and economy will be promoted and time saved if school plant maintenance is on a schedule rather than a hit-or-miss basis. This means that the entire program should be planned months in advance with recurring, periodic, replacement, emergency, and improvement maintenance being given proper perspective in the overall master schedule.

Utilizing Staff Specialization

In recent years, school administrators have come to realize that the jack-of-all-trades maintenance worker is not as efficient as he was once thought to be. They now recognize that maximum individual skills can be developed if workmen are organized by conventional trades, such as carpenters, electricians, plumbers, painters, pipefitters, mechanics, and the like; and that performance standards are improved if workers are assigned to their respective areas of specialization. However, if emergencies arise, all workers, regardless of areas of specialization, should be expected to assist in making repairs.

Establishing Work Sequence

Another practice which will contribute to maintenance efficiency is that of establishing proper work sequence. For example, if interior renovation is being done, the work sequence should be in the order of ceilings and light fixtures, walls and woodwork, doors and windows, chalk and tack boards, and floors and floor covering. This sequence will eliminate work duplication, avoid confusion, and produce more satisfactory results.

Installing Two-Way Communication

Two-way communication facilities between field crews and the central maintenance office will be helpful in reducing man-hours and transportation costs for maintenance personnel. For example, requests for emergency service are often received at the central office after work crews have departed for the day's work. Such requests can be relayed to these crews while they are in the field, thus permitting them to proceed from job to job without loss of time and excessive travel. Furthermore, if additional materials or supplies are needed for the jobs encountered, the foreman of the field crew can request the maintenance office to send them out to avoid wasted time in waiting for supplies.

Negotiating Service Contracts

Most equipment vendors are prepared to service equipment which they sell. In some instances, they offer annual service contracts at nominal cost. The contracts usually obligate the vendor to answer service calls and provide labor, but not replacement parts, at stipulated annual fees. School districts having a variety of complicated equipment may find such service contracts more economical than work performed by their own maintenance department.

Using Central Maintenance Shops

Central maintenance shops have proved advantageous in medium-to-large school districts where most maintenance functions are performed by school plant personnel. To be efficient, such shops must be adequate as to size, appropriate as to type, must have proper tools in sufficient quantity to do all required work, and must carry a supply of materials and parts to meet normal requirements.

CONTINUOUS EVALUATION

Few maintenance programs, however adequate and economical, are perfect in all details. School officials have an obligation to eliminate imperfections, or at least to make improvements, when evidence shows their existence. Such evidence may be obtained through the accumulated result of experience and through a continuous evaluation of techniques, practices, performance standards, and administrative procedures related to maintenance. The overall effect of such evaluation should be more maintenance for less money.

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Appendix A[1]

Exhibit 1

Maintenance Control—Site

School_____

Inspection date	Needs	Year scheduled	Estimated cost	Order No.	Date done	Actual cost	Play areas			Pedestrian traffic				Vehicle traffic				Lawn beautification				General			
							Surfacing	Apparatus	Safety	Walkways	Covered passageways	Steps	Ramps	Roads and driveways	Entrances and exits	Loading platforms	Parking	Turf	Shrubs	Flowers	Statues	Fences	Drainage	Erosion control	Miscellaneous

[1] The appendix forms may be changed to fit local conditions.

Exhibit 2

Maintenance Control—Building

School _____

Interior	Built-in equipment		Pulleys and ropes	
			Curtains and tracks	
			Chalkboards	
			Stage and gymnasium equipment	
			Lockers and cloakrooms	
			Auditorium seats	
	Doors and hardware		Hardware	
			Doors	
	Heating and ventilation		Ducts and fans	
			Radiation	
			Motors	
			Furnace	
			Automatic controls	
	Plumbing		Basins	
			Sinks	
			Fountains	
			Urinals	
			Water closets	
	Light and control		Shades and blinds	
			Windows	
			Wiring and fixtures	
	Finish		Tile	
			Paint	
			Plaster	
	Structure		Stairs and stairwells	
			Walls	
			Floors	
			Ceilings	
Exterior	Walls	Below grade	Areaways and window wells	
			Joints	
			Footings and foundations	
		Above grade	Windows	
			Joints	
			Sills	
			Cornices	
	Roof		Mat	
			Deck	
			Gutters, scuppers, downspouts	
			Projections	
			Flashings	
			Parapet	
			Coping	
Actual cost				
Date done				
Order No.				
Estimated cost				
Year scheduled				
Needs				
Inspection date				

Exhibit 3

Maintenance Control—Equipment

School _____

Furniture	Student desks and chairs				
	Teachers' desks				
	Library tables				
	Book cases				
	Office furniture				
Science	Laboratory tables				
	Cabinet and storage vaults				
	Display cases				
Audio-visual	Motion picture projectors				
	Film strip projectors				
	Screens and stands				
Cafeteria	Stoves				
	Ovens				
	Refrigeration				
	Mechanical ventilation and vents				
	Tables and chairs				
Home Economics	Stoves				
	Sewing machines				
	Washing machines and dryers				
	Refrigerators				
Business Education	Typewriters				
	Office machines				
	Duplicating machines				
	Recorders—Dictating				
Shop	Agriculture				
	Industrial arts				
	Auto mechanics				
	Electronics				
Actual cost					
Date done					
Order No.					
Estimated cost					
Year scheduled					
Needs					
Inspection Date					

Appendix B

Exhibit 4

Cumulative General Control

School_____

(Reported in dollars and cents)

	19__	19__	19__	19__	19__	19__	19__	19__	19__	19__
Site:										
Play areas	$	$	$	$	$	$	$	$	$	$
Pedestrian traffic										
Vehicle traffic										
Lawn beautification										
General										
Building:										
Roof										
Walls										
Interior structure										
Interior finish										
Light and light control										
Plumbing										
Heating and ventilation										
Doors and hardware										
Builtin equipment										
Equipment:										
Shop										
Business education										
Home economics										
Cafeteria										
Audiovisual										
Science										
Furniture										
Total										

Appendix C

Exhibit 5

Master Control

_____School District

(Reported in dollars and cents)

Schools	19__			19__			19__			19__		
	Site	Building	Equipment	Site	Building	Equipment	Site	Building	Equipment	Site	Building	Equipment
_____	$____	$_____	$_____	$____	$_____	$_____	$____	$_____	$_____	$____	$_____	$_____
TOTAL												

Appendix D

Exhibit 6

Master Budget Control

_____School District

Date_____

Schools	Inspection date(s)	Amount budgeted for year	Amount spent to date (by quarters)				Amount remaining current year (by quarters)				Estimated balance at end of current year (by quarters)				Actual balance at end of current year
			1	2	3	4	1	2	3	4	1	2	3	4	
TOTAL															