A CIVIC GUIDE TO ECONOMY IN MUNICIPAL GOVERNMENT

NUMBER FIVE

Public Works
Who shall doubt "the secret hid
Under Cheops' pyramid"
Was that the contractor did
Cheops out of several millions?

RUDYARD KIPLING
EXPENDITURES for public works activities frequently approximate half of the city’s total operating budget. The danger is ever present that such a volume of spending may be accompanied by waste, especially if the department is overstaffed, if records are inadequate, if operations are poorly planned, and if the organization is not closely knit. The opportunity is also present, however, for rendering public works services economically and efficiently if accepted procedures are followed.

An appraisal of the operations of the public works department will indicate whether your city government has taken advantage of this opportunity. Is the department so organized as neither to overburden administration nor confuse the lines of authority? Are unit costs compiled for the purpose of planning future operations and appraising current operations? Are truly economical routing procedures used? A study of the operations of the public works department in your city will reveal whether affirmative answers, indicating satisfactory operations, can be given to such questions as these.

This manual has been prepared to facilitate a comparison of your city’s public works activities with good techniques and procedures. The extent to which they conform to accepted standards is a measure of their economy and efficiency.
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A CIVIC GUIDE TO A GOOD MUNICIPAL PUBLIC WORKS DEPARTMENT

The activities of a public works organization probably vary more widely than those of any other municipal department. Frequently in fact the very name, "public works," is not even used. In determining what should be discussed in this manual, the following activities were selected as being the most representative for public works: street cleaning, street construction and repair, refuse collection and disposal, sewage system, motor transport, inspectional services, and public building management. This is exclusive of the department's staff agencies or those concerned with research and recording.

The fact that the public works department is usually the largest spender of municipal funds certainly should make this department a focal point for citizens interested in economical and efficient government. Because of its very size and complexities, public works often is avoided by these same people. Some politicians, however, recognize it as the principal political plum.

In spite of its supposedly technical nature the public works department can be satisfactorily investigated by the lay citizen interested in good government. The principles of good management apply here in much the same manner as in private business while standards of efficiency have been worked out for most departmental activities by authorities in public works fields.

ADMINISTRATIVE ORGANIZATION

There is no stereotype for public works organization. The variation in the types of activities performed and the local problems which every public works department must face make it impossible to recommend any one organization which will always be adaptable to local conditions. There are two rather definite rules, however, which can be used to measure the effectiveness of any public works organization.

Probably the more important of the rules is holding to a minimum the number of agencies reporting immediately to the director. It is a fairly well-established fact that a department having more than five or six agencies reporting immediately to the director (exclusive of staff agencies or those merely assisting the director) cannot operate in a truly efficient manner. Eight agencies reporting to the director should be the absolute maximum. It is physically impossible for a director to give sufficient attention to more than this number of divisions or bureaus. As a result, in departments which do have a larger number, the agencies usually are little kingdoms unto themselves receiving little outside direction and in no way coordinating their activities with those of other agencies in the department.

The other rule of almost equal importance with the first concerns the consolidation of like activities in the same agencies. Fortunately, it complements the first. The chief advantages of this consolidation are: it makes possible the combination of many administrative and clerical jobs; it better enables the administrators to shift employees from one job to another to meet peak work-loads; and it results in a better balance of expenditures between similar programs.
The chart below shows how the activities discussed in this report might be combined in an effective organization. It will be noted that there are only six operating agencies. This does not mean, however, that this organization will necessarily fit local conditions in any given instance. Refuse collection in some cases, for example, might be combined with street cleaning and repair, or inspectional services might be combined with public building management. The chart does indicate that it is not too difficult a problem to cut down the number of agencies in a public works department to effective working size.

The position of director of public works in most cities is filled by a man with engineering training, although in cities of sufficient size to have both a director and a city engineer, more attention should be (but seldom is) given to the director's administrative ability. Frequently, cities have duplication in the assistance provided the director—both an assistant director and a city engineer. This duplication stems from a misconception of the proper functions of the city engineer. He, in reality, is the assistant to the director and, if he carries on his duties properly, the position of assistant director is not necessary except in the largest cities. Even here it is doubtful if the positions should be on a coordinate level.

### AN EFFECTIVE ORGANIZATION FOR A PUBLIC WORKS DEPARTMENT

![Organizational Chart]

*In small cities this usually consists of only one employee.*
Another specific suggestion that can be made concerns the consolidation of street cleaning and repair. The variations in seasonal work-loads for these activities generally complement each other. Most street repairs can best be made in the warm summer months while the street cleaning work is much heavier in the fall and winter when leaves clog the gutters and when debris has to be cleaned from streets after snow and rain. Street cleaning work is even more heavily concentrated in the winter months when snow removal is assigned—and it usually is—to this agency. Thus, if street cleaning and repair are under the same head, men can easily be shifted from one activity to the other.

MEASURING THE COST OF PUBLIC WORKS ACTIVITIES

In public works operations, direct relationships can be drawn between cost and accomplishment. The expense of resurfacing a square yard of pavement, of collecting or disposing of a ton of refuse, of cleaning a mile of street, and of performing similar work units can be computed according to the cost of labor, materials and supplies, equipment, and overhead. Such costs are known as unit costs.

Although governmental cost accounting is commonly considered a technical subject, the opportunities which it presents for economical government are so great that civic groups should acquaint themselves at least with its broader principles. Unit costs are almost an absolute necessity in translating work programs into accurate budgets although probably their principal value lies in their use in spotting inefficient operation. By comparing the unit costs with those in other cities and with prior years in the same city, it is possible to tell when the cost of any activity is out of line.

Two basic elements must be determined before unit cost accounting can be used: the unit of measurement to be applied and the methods of assigning expense to the various activities. Units of measurement for most public works activities already have been established by a Committee on Uniform Street and Sanitation Records of the American Public Works Association.* Not only will public works departments find these units in most cases the most practical but also the fact that they are being increasingly used throughout the country will better enable the local department to make comparisons with other cities.

The different elements of expense which should be charged to the various activities are labor, equipment use, materials, and general overhead. Daily time reports made out by the crew foremen serve as the basis for determining the labor cost to be charged to each activity. The expense of motorized equipment can be computed from the reports of the public garage, provided the cost of equipment and the expense of the garage are accurately charged to each activity by a system of rentals which is discussed subsequently in this manual. In the absence of a public garage, the use of motor equipment can be shown on the daily time reports from which motor equipment expense can be roughly computed for the various operations. The expense of materials should be determined from stockroom reports. Overhead expenses must be based on ordinary invoices and pay-roll records and then prorated among specific operations.

Although unit cost accounting can and has been used successfully in cities with a population as small as 10,000, a word of caution should be added: unit costs can be over-used. The "cost" of cost accounting itself more than overbalances its advantages in some cases. Especially is this true for activities requiring a cumbersome method of recording, those requiring considerable estimating to arrive at final cost data and those for which the unit of measurement is somewhat questionable.

The engineering division should be the technical research and record-keeping agency for the entire department. In effect, the division serves as the "assistant director of public works." To a large degree, the effectiveness of the entire department is dependent on the quality of engineering skill in this agency. Because of this, the engineering background of the key men demands close scrutiny. At least the head of the division should have a good background in municipal engineering.

A model organization suggested for the division of engineering includes the following sections: design of projects, survey and field engineering, supervision and inspection, maps and records, standards and research, and possibly a few functional sections such as traffic engineering and street lighting. While this organization was primarily designed for larger cities, it does indicate the types of work that should be performed by any engineering agency, however small. In general, it can be said that the engineering division should be responsible for the department's planning and designing; for the contracting and supervision of construction let to private firms; and for the establishment of standards and specifications for work done by the department.

The traffic engineering, suggested as one of the activities of the engineering division, should not be confused with that phase of traffic engineering which is properly a police function. Traffic engineering in this division should be concerned largely with ways of improving street design either for the purpose of removing traffic hazards or for expediting traffic movement. The traffic engineering phases under police control should deal with the more immediate problems of pavement markings, placement of stop signs, location of traffic lights, and installation and maintenance of safety zones. The police department should control these phases of traffic engineering because it is charged with the responsibility of traffic enforcement.

Street lighting in the average city is usually supplied by a private power company; the distribution system as well is generally owned by the power company. As a result, many an engineering division believes itself relieved of all responsibility for street lighting. Nothing is farther from the truth. A large portion of American cities have street lighting systems which became antiquated twenty or thirty years ago because the cities have left the improvement of the systems largely in the hands of private power companies. New developments in kinds and sizes of lamps, intensity, spacing, height, and methods of reflecting light to the pavement have made it possible in many cases to improve the lighting of streets and to lower the cost at the same time.

One of the common errors in engineering organization which should be avoided is the assignment of men on a purely functional basis. Assigning one man to street repair, for instance, and another to sewerage, and still another to refuse collection may be wasteful of the division's manpower. Often there is not enough work to justify full-time operation in many of these agencies. The natural tendency is for the engineering employees to look to the head of the agency to which they are assigned for direction rather than to the head of the engineering division, to whom they theoretically are responsible. As a result, the engineering division gradually loses control of its employees and its work program.

For those interested in additional material on modern street lighting methods, the following pamphlet is recommended: Illuminating Engineering Society, Traffic Safety Lighting (New York: The Street and Highway Lighting Safety Bureau, 1939).
One of the best checks on efficiency a citizen can make in an engineering division is an examination of the division’s method of filing field notes. Particularly in small cities, the tendency is to let the field notes accumulate. Before long, they become so numerous that it is difficult to locate a specific one. The notes should be systematized, probably by streets, since a good system of past field notes is a proved timesaver in field work. Closely related to this is the necessity for keeping adequate maps of the city’s water and sewage systems indicating in detail all valves and connections. The time and material saved when breaks occur more than justify the effort of keeping the maps.

STREET CLEANING

From the standpoint of the number of men on the payroll, the street cleaning agency customarily is the largest in the public works department. Frequently it continues to use antiquated procedures. Reluctance to drop unnecessary employees is the major reason for this condition, although inertia is sometimes a factor. Because of this, the street cleaning agency merits the special attention of those interested in economy in government.

Cleaning Methods

There are at least five methods of street cleaning in common use today: “white wings” cleaning, flushing, “hosing” or washing from hydrants, gang cleaning and mechanized cleaning. Most cities use a combination of two or more of these methods.

White wings (or the beat patrol process of cleaning) are commonly used in the business areas of a city. The men customarily work alone, hand-brooming the dirt into piles and shoveling the sweepings into push-carts. The methods of disposal vary widely although the most common is emptying the push-carts into receptacles placed throughout the business areas and then emptying these into trucks which carry the sweepings to city dumps.

The heavy traffic in the business sections normally makes it impossible for the white wings to sweep the center of the streets.

The theory is that sweeping the center of the streets is not necessary since the traffic tends to throw the dirt toward the curbs.

Often, however, it becomes necessary to flush the street to free the center from gravel or fine dirt. The process of flushing consists of washing the street with a motorized water tank. A driver, and a helper who handles the water nozzles, are used to operate a flusher tank. The tanks are generally used at night when the streets are relatively free of automobiles.

Streets sometimes are washed directly from hydrants instead of using flusher tanks; however, this is usually impractical unless the streets have a decided slope.

Gang and mechanized cleaning are the two most commonly used methods for cleaning streets outside of the business areas. The gang cleaning process—the older of the two—consists of hand-brooming the streets and shoveling the dirt directly into trucks. Under this process the men work in groups of four to ten with a truck for every one or two gangs of men.

Mechanized sweeping is accomplished with machines capable of performing various operations of the cleaning activity. Some of the better machines not only sweep the street, but also pick up and store the sweepings in a hopper. Where a mechanized sweeper can be used, it is possible for it to replace three fairly large gang-cleaning crews.
Comparative costs per cleaning mile (including disposal costs) have been gathered by the Institute for Training in Municipal Administration:

- Flushing $1.15 to $2.25
- Mechanized Cleaning 1.75 to 3.25
- White Wings Cleaning 3.00 to 5.50
- Gang Cleaning 3.50 to 7.00

In making cost comparisons, citizen groups should take into consideration such variable factors as the kind and condition of street paving, climate, traffic, parking, topography, and type of district. These factors also influence the selection of the proper street cleaning method.

Those interested in economy should urge their city to use mechanized sweeping whenever possible. Although there are occasions when mechanical sweeping is impractical, instances of this nature are much less common than many city officials admit. Mechanical sweepers do not work well on very rough or uneven pavement, however, and are not practical on streets where cars are continuously parked. The latter, even in business sections, can be overcome by prohibiting over-night parking.


**Other Procedures**

Other factors, as well as the method or process used in cleaning streets, are also of importance. One of the most significant of these is routing. This applies equally to any of the processes of cleaning. Definite routes should be mapped for the mechanical sweeper or men so that the least amount of time or gasoline is wasted in going to or coming from the job, or in back tracking while on the job. Cities having adequate cost records have indicated that this is a major item of cleaning expense.

Closely related to routing is the frequency of street cleaning. In many cities the practice is to assign areas to the different crews, and when they have gone over their area once, to have them begin all over again. This is likely to lead to unnecessary expenditures for cleaning and to a wide variation in the cleanliness of the city’s streets. A much better practice is to make assignments on a "selective" rather than an area basis; that is, to concentrate on those streets most needing a cleaning, rather than on those scheduled on a routine area basis.

The attitude of the taxpayer and the public official toward the littering of streets also has an important bearing upon street cleaning costs. If ordinances are passed controlling littering, and these are supported by an educational campaign to secure compliance, and if receptacles are provided at convenient places for disposal, streets can be maintained with less frequent cleanings.

**STREET CONSTRUCTION AND REPAIR**

Too many variables exist to make possible the recommendation of any specific kinds of pavement. Weather, subsoil conditions, and heavy traffic all must be considered in selecting the most economical paving in any given case. A few general suggestions can be made. Most patented road mixtures tend to be more expensive than comparable unpatented processes. Low grade oil pavements, even in residential areas, tend in the long run to be more expensive than pavements requiring a larger original capital outlay. And repair work should be of the same strength and quality as that of the original pavement.

The failure to anticipate and plan for a satisfactory street program is the major shortcoming of the average street construction and repairs agency. The need for an
adequate street program can hardly be
overemphasized. It is imperative both to
secure the investment in streets and high-
ways, and to prevent extremely burdensome
taxes or heavy borrowing in some years to
make up for inadequate street programs of
prior years. This applies equally to con-
struction and to repair work.

**Construction Procedures**

Street construction and major reconstruc-
tion projects in most cities are let to private
firms on a contract basis. Except in the
larger cities, there is not enough work of this
type to make it practical for the city to carry
on its own construction program.

Private contracts, however, do not relieve
the city of all street construction respon-
sibilities. The municipality should make the
plans for street construction and see that the
private firm fulfills its contract. Usually both
the planning for and inspection of street con-
struction are the responsibility of an engi-
neering division in the public works depart-
ment.

The engineering agency ordinarily exer-
cises the engineering research function in
the public works department and as such is
best fitted to handle the construction plan-
ing and inspection. The fact that the de-
partment's best engineering talent often is
in this agency is an added reason for plac-
ing the street construction program under its
supervision.

The importance of having a regular street
program has already been mentioned. In
street construction, this should take the form
of a long-range replacement and expansion
program, usually on a 10, 15, or 20-year
basis. The program should be so planned
that the city should spend approximately the
same amount each year instead of having the
entire replacement load fall on two or
three consecutive years.

**Repair Procedures**

The function of repairing streets, exclusive
of major replacements, customarily is sepa-
rated from street construction when the
repair work is performed by city employees.
As in street construction, the major weakness
of most street repair agencies is their lack
of any planned program. All repair work
except that of an emergency nature can be
planned in advance if adequate work pro-
grams and cost accounting records are used.
Even emergency repairs can be approxi-
mated from prior years' experience. Emer-
gencies also can be held to a minimum if
a well-rounded repair program is in effect.

**Locating Breaks and Holes**

The methods used in determining the
streets to be repaired is important in assur-
ing a satisfactory system of streets and eco-
nomy in street repair expenditures. Pave-
ments which have been allowed to deterio-
rate over a long period of time are more
expensive to repair and seldom can be
restored to their former condition. A "stitch
in time" has a very real application in this
case.

In spite of the increased cost of repairing
neglected streets, many municipalities base
their repair programs on a complaint basis;
that is, they use the complaints of the citi-
zens as almost their only method of deter-
mining which streets to re-

A much better policy is to have some-
one in the repair agency inspect the streets and
report those needing attention. Then the
repair crews can repair all breaks and holes
—both major and minor—in the specified
areas. In small cities, it probably is not
necessary to have separate inspectors since
the street mileage is not too great for the
head of the repair agency to inspect. In
addition to the economies previously men-
tioned, the inspection basis for repairs should
result in a saving of travel time for the crews
since this procedure makes it possible to
route the crews.
Regulating Utility Cuts

Cuts made for water, gas, or sewer connections frequently cause deterioration of urban pavements. Not only is the pavement broken, but also the ground underneath the pavement is excavated. Because of this, cities should have a policy which holds the number of cuts to a sensible minimum and requires repair with materials of equal quality immediately after the cut has been made.

One method of keeping down the number of cuts in relatively new pavement is to add a penalty for such repairs. Penalties may be graded in accordance with the age of the pavement. If this policy is widely known it encourages residents to plan ahead so that necessary connections will be made before new pavements are laid.

Utility cuts should be closely supervised by the city so that only those necessary are made; so that they are reasonably limited in size; and so that the pavement can be replaced as soon as possible. The city should repair all cuts and bill the utility for them to avoid the chance of inferior replacements.

Repair Crews

The size and number of repair crews varies greatly, not only with the miles of streets in a city, but also with the different types of streets. In larger cities the repair crews are generally specialized by types of streets; in the smaller cities this is neither necessary nor desirable. Although some specialization of crews is needed, the tendency in many cities is to overspecialize with the result that much of a crew's time is lost in traveling.

Almost all cities should have an emergency crew in addition to any which may be specialized by type of pavement. The emergency crew is needed to make temporary gravel or rock fills in areas where the other men are not working. The number of other repair crews that will prove to be the most economical can only be determined by experimentation and by comparison of present costs with those of prior years.

REFUSE COLLECTION AND DISPOSAL

The collection and disposal of refuse—garbage, ashes, and rubbish—are usually municipally performed activities. Some cities, however, let out refuse collection and disposal on a contract basis to private firms. A third and less frequently used method consists of leaving collection and disposal entirely up to the individual residents.

Varying circumstances in American cities make it impossible to recommend any one of these plans to the exclusion of the other two. Generally, the most satisfactory results are obtained from municipal operations, although the other types of operation are conducted successfully in some cities. It is frequently argued that the cost of contract collection is lower because private agencies make more efficient use of labor and equipment than governments. Undoubtedly, the poor management which too frequently characterizes municipal collection adds support to the argument. Municipal service, however, can be made less expensive if it is effectively administered. Private arrangements between the collectors and individual residents usually result in much higher costs to citizens than either municipal or contract service.

Collection

The cost of refuse collection is dependent on several variables in addition to what is commonly considered "efficiency": all types of refuse may be collected or the service may be confined to garbage alone; collection may be made three times a week, weekly, or at even less frequent intervals; and refuse may be picked up at the curb or collected at the back door. Local wage rates and
population densities also produce variations in collection costs among cities. Annual per capita costs of municipal refuse collection in 136 cities surveyed in a recent study ranged from $.095 to $2.96, indicating the impossibility of satisfactorily comparing costs unless all varying factors involved are taken into consideration.*

No recommendation is made as to the quantity of service a city should provide. Local conditions and public sentiment should determine both the type of refuse to be collected and the frequency of the collection. There are techniques of good municipal refuse collection which, if effected, result in economy despite the limitations of the service.

Work Procedures

One of the essential factors in an efficient collection service is a routing plan which equalizes light and heavy work days as much as possible. Most cities route crews individually with each crew working only on its own assignment regardless of the amount of work on the other routes. As the size of the routes is usually based upon heavy collection, crews tend to complete their work early when collections are light or even normal, thereby wasting both manpower and equipment. On the other hand, if records are based upon light or normal conditions, crews will be forced to work overtime when collections are heavy in order to finish their routes. This can be exceedingly expensive if high overtime rates are paid.

In cities above 50,000 the trend is toward integrated crew routing methods, by which assistance is given crews experiencing heavy or slow collection days. This may be done by employing a part-time, or "swing" crew; by transferring members of one crew to another; or by shifting one crew to another route when it completes its first assignment early. The success of these procedures depends upon the efficiency of administration. Central control should be maintained constant by a supervisor or dispatcher receiving frequent reports from the drivers. Although individual routing plans may be practicable in relatively small cities, any added administrative costs of the integrated crew method are more than offset by lower costs of operation, if the scope of the service is even moderately large.

Use of Crews Between Loads

Alert taxpayers may well check the utilization of collection crews while the refuse is being transported to the city dump or incinerator. If the haul is short and little time is lost it may be good practice to use this interval as a rest period. If the trucks are of sufficient size to necessitate trips for dumping only in the middle and at the end of the day, the first interval may be used as a luncheon period and the men released at the completion of the second load. The use of an extra truck in the collection and disposal of refuse may obviate the necessity of forced idleness on the part of workers by making it possible for continuous work throughout the day. In the absence of these conditions, economical use of the men requires that additional work be found while refuse loads are being transported to the disposal point. One between-load assignment sometimes given to collectors is the cleaning of alleys, streets or catch basins. If the collection service also includes the pick-up of garbage cans from the rear of homes to the street curb, the interval between hauls may well be used for this purpose.

Separation of Refuse

Residents themselves may contribute toward economy in refuse collection and disposal by complying with municipal regulations governing the separation of refuse by type. Where such regulations have not been established it would be well for citizen groups to press for their enactment. It is more expensive to collect all materials together. The separation of garbage from ashes and rubbish makes it possible to collect garbage frequently and to limit the

collection of other materials to once or twice a month. Moreover, separation will increase the economy of disposal operations where garbage is fed to hogs (not recommended) or where incineration requires the separation of combustible and noncombustible materials.

Disposal

Adequate refuse disposal requires a consideration not only of costs but also of the public health and aesthetic factors involved. Ashes and noncombustible rubbish are disposed of by dumping, while combustible rubbish may be either dumped or burned. The main problem of refuse disposal is that of garbage—commonly fed to hogs, burned, or dumped.

Hog Feeding

Hog feeding is often considered the most economical method of garbage disposal because garbage usually can be sold at a small price per ton. The amount the city receives, however, usually varies greatly with the price of hogs, and during periods of low prices the city seldom receives anything. The use of this method is debatable because of the contention of the U. S. Department of Public Health that the practice has served to increase the incidence of trichinosis. Even though garbage is disposed of by hog feeding, the problem of the disposal of that part of the garbage not eaten by the hogs is still present. Consideration must also be given to the undesirability of maintaining hogs in or near a city.

Incineration

Incineration requires the maintenance of a special plant and the employment of men to operate it. If there is not enough combustible rubbish to maintain fires of sufficient intensity for burning the garbage, fuel must be purchased. These factors render incineration a relatively expensive method, although it is an effective one from the standpoint of public health. Incineration also requires the segregation of garbage and perhaps of combustible rubbish, thus serving to complicate collection methods unless garbage is effectively separated by householders.

Dumping

Disposal by dumping is inexpensive and can be either one of the best or one of the worst methods of garbage disposal depending upon the control exercised. Uncontrolled dumping means unsightly, malodorous deposits of garbage or mixed refuse, which are fertile breeding grounds for rats, flies, and other vermin. Spontaneous combustion is a constant danger. Under controlled methods, garbage and mixed refuse can be disposed of by dumping in such a manner that the interests of economy and health are both served and the disposal site is neither an eyesore nor a health problem.

Controlled dumping or the sanitary-fill method consists of depositing refuse in depths of several feet and covering it the same day with a foot or more of earth or ashes. This method has been successfully used in a large number of cities. Its cost is much lower than that of incineration, although it differs considerably in various cities. In New York City, for example, the cost of controlled dumping was found to be about one-fourth that of incineration, while in Portland, Oregon, it was found to be one-half.

There are, however, certain limitations to the use of the controlled dumping method. In cities with only limited areas available for sanitary-fill, the convenient sites are rapidly filled so that eventually refuse has to be transported a considerable distance. Hauling costs then have to be considered in determining whether such a disposal method should be continued. Above all, the city government must maintain close control over sanitary-filling; otherwise poor practices will render the procedure little better than uncontrolled dumping.
Citizens are well aware of the dangers to community health when streams become polluted from inadequate disposal of sewage. This realization, coupled with the technical nature of sewage disposal operations, has discouraged public inquiry into the costs of the city’s network of sewers and treatment plant. Usually it is only when there is a failure in the system that public interest is aroused. In spite of this, there are opportunities for effecting economies in sewage disposal operations which laymen with only a general knowledge of sanitary engineering can recommend to their public officials.

The Network of Sewers

Formerly it was customary to combine both storm and sanitary sewers in the same system. Since cities were relatively small and far apart, treatment was seldom necessary and both types of sewage could be emptied directly into a nearby body of water. The same sewage system naturally was used for storm and sanitary sewage inasmuch as one system obviously was cheaper than two. The growth of American cities and metropolitan areas, with the accompanying danger to water supplies from untreated sewage, has necessitated the construction of more and more treatment plants. In combined sewer systems all sewage must go through the treatment plant, thereby increasing costs. Experience has shown that it does not take many years for the increased treatment cost to erase any initial savings which were made by installing a combined system.

Heavy rainfalls also add a health problem to the other disadvantages of combined sewers. Because the intake capacity of treatment plants is seldom sufficient to handle the large volume of storm water, sewage sometimes backs up through house connections during periods of extreme rainfall. A lesser evil under such conditions is to open flood gates and let sewage bypass the treatment plant; this, however, pollutes the stream for a short period.

In cities having the combined system, the cost of an immediate transition to the separate system is prohibitive. It would be well, however, for citizen groups to place emphasis upon long-term plans for sewer construction which call for the gradual replacement of a combined system with separate storm and sanitary sewers. Any new sewer construction, such as the extension of sewer service to new sections of a city, also should provide for separation of the two types of sewers.

Maintenance

The regular inspection of sewers, followed by cleaning and repair where necessary, will help to keep maintenance costs at a minimum. The public works department which establishes no periodic schedule for sewer inspection runs the risk of incurring unnecessary expenses—either for repairs on large breaks which could have been avoided through prompt attention, or for opening up sewers which became clogged when cleaning was deferred too long.

Emphasis should also be placed on good workmanship and design in sewer construction. Defective joints permit extraneous materials to enter the sewers and obstruct the passage of sewage. The necessity for removing tree roots from blocked sewers is frequently an indication that joints were not originally set tight and secure. Obviously, laymen cannot actually inspect sewer construction, but they can insist that adequate inspections of all original work be made. Inasmuch as newly constructed sewer systems should be relatively free from repair for the first twenty or thirty years, the public works department owes the public an explanation if repairs become necessary within a shorter period. Either the original construction was inferior or the subsequent maintenance inadequate.
Costs

The cost of constructing a sewer system is dependent upon both the size of the area to be served and its topography. Per capita costs are usually greater in the larger municipalities and in cities which, because of their location on flat terrain, are unable to utilize completely gravity flow. Unlike water systems which are nearly always dependent on pumps to produce the desired pressure, sewer systems in most cases can be made self-operating by following the natural slopes to a disposal plant. When pumps are used to lift the sewage to higher levels, the cost of the sewer system is sizeably increased.

Some cities have resorted to sewer rentals as a means of financing the construction of sewer systems. Whether or not sewer rentals are to be charged is obviously a matter for local decision after weighing the arguments both for financing the system out of general revenues and for placing it on a self-liquidating basis. If the decision has been made in favor of sewer rentals, the charges probably should be determined on the basis of metered water use, with adjustments that take into account the use of private water supplies and large amounts of water not going into the sewage system.

The Treatment Plant

The complete sewage treatment process consists of three stages. The primary treatment removes, by means of settling and digestion tanks, the undissolved solids and renders them inoffensive. The oxidation process goes a step farther by removing through oxidation the organic materials in solution left over after the sewage has been subjected to the primary treatment. Finally, by disinfection with chlorine gas, sewage germs which escape the first two stages are killed.

The degree of treatment necessary in a given city is dependent upon a number of factors: the size of the city; the size of the stream; later uses of the stream as a source of public water supply; and many others. Whether the plant is to provide for only the first stage of treatment, the first and second, or all three is, therefore, a question for experienced sanitary engineers to decide. Because of the high cost of complete sewage treatment, it may sometimes be more economical to arrange for a new source of water supply or to move a bathing beach rather than to purify the sewage to the extent necessary to protect completely such waters from pollution.

The adequacy of a plant's records reflect to a great extent the efficiency with which it is operated. The plant superintendent should have readily available detailed data on the physical operation of the plant, as, for example, the gravity flow of sewage, the electric power consumed, the percentage of dry solids, etc. Information also should be available relating to chemical and biological analyses of raw and treated sewage. With adequate cost data the manager can compare plant performance during one period with that of another and make any necessary changes to increase the efficiency and economy of its operation.

Generally, the construction of plants designed to afford primary treatment alone costs from $2.00 to $4.00 per capita, while annual operation and maintenance costs for such plants may range from a few cents up to $.30 per capita. Complete treatment plants, which follow the initial tank treatment with some form of oxidation, usually show a construction cost of from $7.00 to $14.00 per capita with an annual maintenance cost of from $.60 to $1.00 per capita. Certainly, public works officials should be asked to justify any costs which are above the upper limits mentioned.


** The Institute for Training in Municipal Administration, Municipal Public Works Administration (Chicago: The International City Managers' Association, 1941), p. 169.
MOTOR TRANSPORT

The consolidated management of motor transport offers vast opportunities for economy in city government. The likelihood of still greater expansion in the use of motorized equipment in the future makes motor transport one of the most important fields in city government for economies.

Motor transport management can and often does, mean simply the repair of city-owned motor equipment in a city garage. This replaces the use of separate departmental garages or repairing which is let to private garages, and results in a saving to the city. Actual ownership and control, as well as repair, by a centralized motor transport agency makes still more economies possible. When the equipment is owned by the motor transport agency, automobiles usually must be returned to the garage when not in use, thus making pleasure trips in city cars difficult. The agency also, if it retains ownership, is responsible for the ordinary running condition of the equipment; that is, it must see that the cars have enough water and oil, and that they are greased whenever they need it.

Location of the Activity

The proper location of motor transport is dependent on at least two factors: the extent of the service and the form of government. If services are limited to motor equipment in public works, naturally the public works department is the best location for the activity. Frequently, in city manager or strong mayor governments, the activity is set up as a separate department. It is argued by those who favor a separate department that the great opportunities for economy in motor management justify the direct attention of the chief executive. Much of the same attention, however, can be directed toward motor transport management if it is a separate and distinct division of the public works department.

Inclusion of All Motor Equipment

As is true in private industry, the more equipment serviced by a city garage, the greater the opportunities for economy. For this reason a garage for all city-owned motorized equipment is to be preferred to a smaller garage. Few cities are of such size as to justify more than one city garage. Even in those few cases, however, it is better to have two or possibly three garages which service different types of equipment rather than to have separate departmental garages.

The Use of Rentals

Setting up motor transport management on a rental basis is widely regarded as the best method of handling the expenses chargeable to the various departments. Under the rental basis, a revolving fund is set up for the motor transport agency and motorized equipment is purchased and repair expense is paid from this fund. Departments are then charged a rental—usually on a mileage basis—for their use of the equipment. The rental charges, varying in amount for the different types of equipment, should include: the estimated repair expense for the various pieces of equipment; the depreciation expense for the equipment; and a portion of the overhead costs. The charges can be based largely on data taken from the cost accounting records. As the name “revolving fund” implies, the motor transport agency should be completely self-supporting after the original grant is made; the rental charges should entirely offset all expenses of the agency.

The use of rentals makes it possible to charge motor equipment expense accurately to the proper accounts and departments (which is fundamental to adequate cost accounting). The opportunity for comparing operation and repair expense of similar equipment is another good reason for using rentals. Higher repair expenses on one piece of equipment either means rough usage or that the time has come for a trade-in. The motor transport agency is in a position to correct either of these conditions. Cost records also indicate the type of car which is the most economical for the various uses.
INSPECTIONAL SERVICES

The inspectional services in this discussion are limited to: building inspections (inspection of new buildings, not fire prevention inspections), smoke abatement, boiler inspections, weights and measures, plumbing inspections, elevator inspections, and electrical inspections.

Frequently these services are not consolidated under one agency but appear as separate divisions, often in more than one department. Consolidation of these services in one agency, however, has important advantages. It results in a saving of administrative and clerical personnel and also makes it possible to assign inspectors to more than one type of inspection.

Even in cities where inspectional services are consolidated there is no assurance that they will be located in the public works department. Often they are in the police department. Those who favor this argue that they are essentially protective services and as such are a police function. On the other hand, the fact that this work is concerned with matters requiring engineering skill is a logical reason for placing the activity in the public works department. Although inspectional services are protective in character, their resemblance to other police activities stops at this point.

Financing the Service

Customarily, fees are charged for the different services on the basis of the inspections made or permits issued. Usually, however, the revenues from these inspections go into the general fund of the city and little or no attempt is made to see whether they offset the expenditures of the division.

The revenues from the inspections should be equal to the expenses of the inspectional services. While there is no justification for inspectional revenues exceeding expenditures, there is every reason for the agency being self-supporting. Most of the services are not general in character and do not benefit the entire public. Inspection of electrical wiring, for example, benefits only those living in the house just wired. The same can be said for all of the other services with the exception of smoke abatement and weights and measures. Even in these services the city is only trying to prevent unsatisfactory conditions which would not exist if the offending businesses were not in operation.

A separate fund for such services, with only inspectional revenue going into the fund and all inspectional expense being paid from the fund, is the surest way of making the agency self-supporting. On the other hand, there are disadvantages to earmarking revenue and setting up a large number of funds. If a separate fund is not used, frequent tabulations should be made to see that revenues and expenditures are about equal. Attention should also be given to the individual inspectional services within the agency to see that their revenues and expenditures, too, are in balance.

Organization

The chief value of combining inspectional services is the economy that proper organization makes possible in a consolidated agency. Instead of having an inspector make only one type of inspection, he can be assigned to several different types. In either a large or small city, this usually makes a saving in personnel possible. In a small city, all of two or more types of inspections under this system can frequently be performed by one man; in a larger city, if several types of inspections can be performed by each inspector, large savings are possible in routing individual inspectors so that they make several different types of inspections in one area.

Some officials believe it is impossible to use inspectors interchangeably for several different types of inspections because each type requires special knowledge on the part of the inspector. While it is entirely true that some special knowledge is required of the
inspectors, in most cases the training can be given to them on the job. An examination of inspectors in most cities is likely to indicate that they have had no prior experience in their work before being employed by the city. Certainly this should be proof that they can be trained on the job for more than one type of inspection. In larger cities a few specialized inspectors could be retained for those relatively few jobs requiring highly technical training.

In larger cities additional savings can also be made in administrative and clerical personnel by consolidating the inspectional services. When the inspectional services are separate, it is ordinarily necessary for one man in each inspectional field to be available at the office during the entire day. In addition each inspectional service customarily requires at least one clerical assistant. In a consolidated agency it is possible to centralize both the administrative and clerical help, making sizeable reductions in personnel possible.

Work Procedures

The adequacy of work procedures to a large extent can only be determined by an examination of the local inspectional agency. Some generalizations, however, can be made. As in the other phases of public works, routing is one of the most important. Definite routes should be laid out (usually on a weekly basis) for each of the inspectors so that as little time as possible is lost in traveling. If the inspectors are used interchangeably as previously suggested, the opportunities for good routing are considerably broadened since inspections of all types in one area can then be assigned to one inspector.

The use of daily time reports by the inspectors also is an important factor in good work procedures. Such reports are essential to a cost accounting system and also are useful in obtaining efficient work from the men. loafing and other factors making for inefficient operation are relatively easy to spot by comparing work records.

The enforcement procedures in inspectional services also merit close attention. The length of time for correction should be definitely stated and rigidly adhered to. If the condition is dangerous, operation should be suspended during the interim. When warrants are served on those not paying inspectional fees within the specified time, no one should be excused from court simply because he has rushed in and paid the fee after the warrant was served.

PUBLIC BUILDING MANAGEMENT

The importance of public building management varies directly with the size of the city. In large cities, the management of city-owned buildings is big business while in small cities it may be only a matter of three or four employees. Because of this, the proper degree of specialization in this field varies widely for cities of different sizes.

The first step in building management is a separation of operation and repair activities. This often exists in an elementary form even in small cities since they are quite likely to have a couple of janitors and one or possibly two repair men. Seldom in cities below 100,000, however, are these made separate agencies and even in larger cities the similarity of tasks makes it unwise to place operation and maintenance too far apart.

Operation

The principal operational activities to be performed include custodial services, telephone switchboard operation, and heating plant operation. Elevator service also is a sizeable item in the larger cities, but in cities of less than 100,000, it seldom involves major expenditures. The city hall, the fire stations, the police stations, and possibly an auditorium, are the principal buildings the operational staff is concerned with in any city.
Fairly definite standards of the amount of work janitors should perform have been established for commercial buildings and are equally applicable to public buildings. In a relatively new building, janitors assigned to cleaning offices should be able to take care of 8,000 to 9,000 square feet a night and those mopping corridors should be able to handle 9,000 to 10,000 square feet a night. In old buildings this footage might be somewhat less. Day janitors or general service men are usually not necessary in cities under 100,000 and only one or two per building are needed in the larger cities.

Generally, the use of switchboards to replace separate lines is economical in buildings having ten or fifteen separate telephones. Since telephone charges vary in different localities, it is usually wise to request comparative costs from the local telephone company for buildings having more than five separate lines.

Heating plants in relatively small cities can be handled satisfactorily by the janitors; larger cities usually require stationary engineers, although they usually handle the maintenance of other city equipment besides the heating plant. The variation in the size and kinds of heating plants makes definite recommendations impossible. One suggestion can be made: heating plants, even in large cities, seldom require round-the-clock attention of building maintenance engineers which many cities seem to believe is necessary.

**Maintenance**

Quite frequently a carpenter is the only repair man employed in small cities. Usually other repair work is let by private contract as it becomes necessary. Even relatively large cities find it impractical to have a widely diversified maintenance crew, since it is difficult to find a sufficient amount of work in their specific field to keep them busy on a year-round basis.

If private contracts are let on a yearly basis, instead of separately for each job, the city is often able to realize sizeable savings. If a construction man is sure of getting all of the city's work during an entire year, he is willing to accept somewhat less than he would for individual jobs since he can use the city work to supplement his regular line.

Another economy which is often possible in maintenance repair work is in assigning electrical, plumbing, and elevator repairs to the inspectors in these fields in the inspectional services. This costs less than private contracts and often fills the work schedules of inspectors who would otherwise not be occupied full time.

**CONCLUSION**

The main appraisal technique encouraged by the foregoing discussion is that of comparison. Citizens are urged to compare the public works activities of their city with the standards pointed out in this manual. These standards are the product of the collective experience of many public works officials. They represent practices which have been tried and adopted because they resulted in efficient operations. Although the most desirable method for performing a particular activity has been indicated wherever possible, alternative procedures also have been described with the view that, if the ideal cannot be effected, at least an improvement over existing operations will be made.

Aside from these general standards of public works operations, the economy suggestions provide civic groups with tangible support for demanding reductions in the cost of government. Many of the suggestions can be effected easily without thorough revamping of existing procedures; these will then be welcomed immediately by the conscientious public official. Other suggestions provide for economy in long-term operations.
In the last analysis, efficiency of operations is usually dependent upon a centralized, closely-knit organization, in which responsibility is clearly fixed. It is generally recognized that boards are not well adapted to the performance of administrative duties. The opportunity for evading responsibility is present where the important operations described in this manual are administered by a plural executive. Civic groups should insist that full responsibility be placed in the hands of a single director of public works. He should then have the authority to effect the departmental organization as outlined in this manual.

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