

## HIGHWAY COST-KEEPING\*

CHIEF among problems in developing a cost system for highway work is that of devising a general classification of expenditures that will conform to accounts appearing upon the ledger of the organization. Highway work is obviously a public improvement, paid for entirely from funds derived from the public revenue. Ultimately, then, the taxpayer pays for all this improvement, and is entitled to a full and detailed account of how this money was expended. The objects of a cost-keeping system are two. First, to show the efficiency of performance and facilitate the reduction of costs; secondly, to supply data which may be used for the intelligent estimating of future improvements, and to furnish material for published reports. Records of this kind are all that remain to be used for the comparing of the efficiency of one administration with that of another.

## Cost Elements

The term "cost," as generally interpreted, may be defined as the summation of expenditures, expressed in terms of money involved, to acquire or produce a utility, or perform a service, and the cost of every unit of product is composed of four basic elements of expense, viz.: (1) labor, (2) materials, (3) plant and equipment, (4) overhead charges.

Labor.—The costs of labor are divided into two classes, direct and indirect, the former being all labor chargeable against the product which can be designated as directly expended on it, such as the cost of men using picks and shovels, while the latter is all labor not directly expended, such as the cost of superintendence, and the services of watchmen, timekeepers and others, whose wages are only chargeable, pro rata, against the production of all the work units they cover.

Materials.—The costs of materials are divided into two similar classes, direct and indirect. All materials entering into the product as an integral part of its composition, such as cement, stone, sand, mixed together to form concrete, are direct materials, the oil used for lubricating and the gasoline for operating the mixer being indirect materials.

## Operating Charges

Plant and Equipment.—"Plant" includes such physical property used on the work as structures, machinery, live stock, and tools of a more permanent character than those referred to as materials. "Equipment" is a less inclusive term, and is interpreted generally to mean the smaller, and especially the movable, plant units. The cost can be charged most readily in the form of a daily rental against the work upon which it is used, and consists of "operating charges," which are (a) the expense of operation, (b) the average cost of repairs, (c) charges for the time spent in idleness, and "fixed charges," which are (d) charges for depreciation, (e) interest (f) taxes, (g) insurance.

Overhead Charges.—This includes all charges that cannot be connected directly with the cost of labor, material and plant. For convenience in accounting, and for the purpose of securing a desirable division of road cost, this may be considered as divided into two classes, "engineering and supervision" and "administration expenses." To engineering and supervision shall be charged all expenditures for surveys, plans, specifications, estimates, tests, and all engineering inspection and

supervision in the nature of oversight required to secure the proper execution of the work. Administration expenses include such expenditures as salaries and expenses of the executive officers, legal services, maintenance of office, departmental engineering, investigations, experiments, clerical staff, fiscal operations and miscellaneous fixed charges.

## Analysis

The accompanying analytical chart forms a summary of the foregoing discussion of cost elements applied to road work, and shows the relation between the cost elements and the final cost of the project as expressed in totals and by units:—

## Highway Costs

Elements of cost.	Classes of cost.	Application of cost.	Product of cost.	Summary of cost.
Labor cost...	Direct....	Wages of laborers, mechanics, teamsters, etc.	Construction, maintenance, or reconstruction of road parts, right of way, grade and roadside, roadway, ditches, drains, bridges, and culverts, and supplementary parts.	By units, direct, as performed.
	Indirect....	Wages and expenses of superintendents, foremen, timekeepers, guards, watchmen, water boys, etc., lost labor days, labor expense.		
Material cost...	Direct....	Materials entering into product as integral parts.		
	Indirect....	Supplies, used but not as a part of product.		
Plant and equipment service cost.	Operating.	Operation. Repairs. Idleness.		
	Fixed....	Depreciation. Interest. Taxes. Insurance.		
General expense cost.	Project: Engineering and supervision.	Salaries and expenses of engineers, field parties, draftsmen, inspectors, and clerks; office expenses, tests, and miscellaneous expenses for individual projects.	Plans, specifications, estimates, surveys, inspection, and direct supervision of work.	By project: upon completion may be apportioned to units.
	General: Administration.	Salaries and expenses of executive, engineering, legal, and clerical staffs; expense of office maintenance, experiments, investigations, and fiscal operations; miscellaneous fixed charges.	General direction, policy, oversight, planning, control, legal, and financial provisions.	On all operations over a period of time and apportioned to projects.

## General Remarks

In order to make any cost system successful certain fundamental principles must be followed. The data collected must be reliable, and the methods adopted, in the way of storing these data up for future use must be simple, but at the same time effective. If the data collected are not reliable, all records based upon them, of course, will be misleading and the results dangerous. If simplicity be not maintained, the purpose of the system will be defeated. Involved and complex forms are confusing to the recording officials, difficult to compile for study and analysis, and apt to be inaccurate, and a useless expense. The cost of determining cost must itself be reduced to a minimum. If the expense of obtaining cost records to point out the way to efficiency is not much below the saving effected, they have no just claim to a place in any plan of management.

A total of \$53,600 out of appropriation of \$132,000 was spent by the department of public works of St. John, N.B., during the past summer on actual paving and sidewalk operations, according to figures given out by the department. Exclusive of salaries, interest and sinking fund, etc., the appropriation for actual operations was only \$60,300, and on account of the heavy cost of snow removal and other unusual expenditures, the appropriations were pooled to take care of unforeseen demands. An overdraft of \$11,000 was necessary to care for snow removal, in addition to money taken from appropriation for new asphaltic pavements.

\*Compiled from "Highway Cost-Keeping," by James J. Tobin and A. R. Losh, U.S. Engineer Economists.