

REPORT OF COMMITTEE ON HIGHWAY COSTS

R. W. CRUM, *Chairman*

H. S. FAIRBANK

SIGVALD JOHANNESSEN

R. L. MORRISON

WILFRED OWEN

C. D. CURTISS

SHOREY PETERSON

C. B. McCULLOUGH

COSTS OF HIGHWAYS TO THE PUBLIC AND USES OF COST COMPUTATIONS

SYNOPSIS

Since the word "cost", if used without reference to the specific relation intended may be indefinite, the Committee defines three combinations of elements involved in highway cost analysis; annual economic cost, annual disbursement and annual revenue from taxes and fees.

Computations of highway costs are needed for: economic evaluation of improvements, for determination of needed annual income and tax rates and for aid in comparing highway transportation costs with those of other forms of transportation.

For economic evaluations, annual economic costs are appropriate. For determination of needed revenue and tax rates anticipated annual disbursement is the controlling factor. For aid in comparing costs of different transportation systems, computations of annual economic cost are proper for only those parts of the public or private investment chargeable to purposes of transportation.

The term "cost" or "annual cost" has been loosely used to mean any one or more of several different groupings of the factors that enter into the financing of highway work. This indefinite use of the word "cost" is conducive to confusion in thinking on the economics of highway transportation and the committee believes that a clarifying statement on the purposes for which cost computations are required and on the various elements of cost and their combinations will be helpful.

The word "cost" if used alone without qualification is indefinite as its meaning depends upon the relation in which it is used. Cost is one thing to the producer of an article, but something quite different to the consumer. In this report the cost of highways to the consuming public is considered.

ELEMENTS OF COST

There are three combinations of cost elements that need definition and clarification; annual highway economic cost, annual highway disbursement and annual highway revenue from taxes and fees.

Economic Cost of Highways

There are three sets of factors to be considered in estimating the economic costs borne by the public in the case of publicly owned transportation facilities or by the customers in the case of privately owned transportation facilities. These are:

1. Tangible Costs
 - (a) Amortization of Investment (or expenditures on account of depreciation, necessary for preservation of the investment value intact).
 - (b) Maintenance
 - (c) Administration and Operations
 - (d) Interest on borrowed money
2. Interest on invested capital, exclusive of borrowed money
3. Taxes.

The cash payments made by the public for the provision of highway transportation facilities include item 1. Taxes and interest on the rest of the invested capital are indeterminate items which may be properly considered in estimates of economic highway cost, depending upon the particular use to be made of the estimates.

The Committee on Highway Transportation Costs of the Highway Research Board presented in 1929¹ and 1930¹ methods for computing annual economic cost of highways, not including taxes, as follows:

"The annual cost of a road (not road value) may be expressed as the total average yearly expenditure that will construct, replace and maintain in perpetuity in standard serviceable condition any existing road under existing traffic and climatic conditions. This amount may be calculated either by method (A) or method (B).

Method (A): By determining the amount of money which if set aside today will return in perpetuity as interest, sums sufficient to pay annual interest charges on construction cost, to provide a sufficient annual maintenance charge, and to accumulate periodically necessary replacement costs; and by multiplying that amount by the rate of interest prevailing in current state financing.

Method (B): By determining directly the aggregate of the annual cost of each of the items entering into the cost of constructing a road and replacing and maintaining it indefinitely, or for a very long period.

Method A presupposes that by periodic expenditures the original investment is kept intact indefinitely.

Another expression of economic cost exclusive of taxes may be stated as follows: The annual economic highway cost is the sum of the annual interest on depreciated capital, the estimated annual depreciation, and the annual cost of maintenance and operation.

Highway Disbursement

Annual disbursement differs from economic cost in that it includes only the cash expenditures for the year made on account of constructing, maintaining and operating highway facilities and services. It includes the following items:

1. Expenditure of capital for replacements, betterments and extensions.
2. Payments to reduce indebtedness.
3. Interest payments on borrowed money.
4. Maintenance and operation expense.

In modern public highway finance capital is in general not carried as a separate item and

procured from investment sources but is obtained for the most part from the same sources and in exactly the same way as money for running expense. This is one reason why public financing is not exactly analogous to the methods used in those private business enterprises where the capital is accounted for independently. It is upon disbursement requirements, past and anticipated, that public highway financial policy has been predicated.

Highway Revenue

The sums of money collected annually to be devoted to highway purposes are what the public in general recognizes as the costs to the taxpayers. These include general imposts, motor vehicle fees, motor fuel and other taxes graduated to road use.

The road fund from these revenues in any individual year is not the same as the average annual economic cost nor is it necessarily equal to the disbursement requirement for that year on account of the lag between collection and disbursements. The road fund is, however, the assessment against the taxpayers and over a term of years the average receipts must equal the average disbursements. Plans for future disbursements are based upon future expected receipts. Income from highway levies is therefore a vital factor in planning highway development programs.

In some jurisdictions part of the money raised through highway taxes is diverted to other purposes. In one sense this is a part of the total highway tax because it is generated by highway use, but it is not part of the highway disbursement.

PURPOSES FOR WHICH COMPUTATIONS OF COSTS ARE REQUIRED

1. For the economic evaluation of highway improvements.
 - (a) To aid in determining the economic warrant for a proposed highway improvement.
 - (b) To aid in determining the relative economic warrants of competitive projects and thus establishing priority schedules.
 - (c) To aid in choosing between alternate plans or design types or alternate locations.
2. For the determination of annual income necessary to provide and maintain a high-

¹ Proceedings, Highway Research Board, Vol. 9, p. 360 (1929); Vol. 10, p. 329 (1930).

way system, and for aid in the determination of equitable tax rates for highway purposes.

3. For aid in comparing highway transportation costs with the costs of other forms of transportation.

Final decision in such matters must rest partly at least upon judgment for many factors besides annual costs are involved. For instance, the benefits derived from the services must be considered as well as the costs. In the case of highways the effect of any project upon vehicle operating costs is an important factor in calculating values. Comparisons of economic costs and total required disbursements including capital outlay are also necessary to well considered decisions in formulating highway budgets and improvement programs.

USE OF COST COMPUTATIONS

1. *For the Economic Evaluation of Highway Improvements*

For this purpose computations of *Economic Annual Cost* exclusive of taxes are appropriate. In determining the economic warrant for highway improvements and in comparing the relative worth of alternative improvements, plans or design types, the computations should be put on this basis in order to reduce to a common time base the costs of capital investments of different service lives. Computations for these purposes will not be complete unless consideration is also given to all annual benefits accruing by virtue of the improvement, including any and all reductions in the cost of vehicle operation over the highways.

2. *For Determination of Needed Revenue and Highway Tax Rates*

For these purposes the controlling factors are the anticipated actual expenditures which are necessarily based upon computations of anticipated *Annual Highway Disbursement*.

Computations of annual economic cost are not usable for the purpose of determining the

required annual highway revenues because they do not furnish an estimate of the annual disbursements for the individual years for which revenues must be secured, and because the intangible items, particularly interest charges against "pay-as-you-go" highways are never paid in cash.

The highway revenue base is simply the money needed for the coming year or years as determined by plans developed as far into the future as is practical. Tax rates must be so adjusted as to produce the necessary amount of money for annual disbursements to cover maintenance, operation, interest on borrowed money, repayment of borrowed money and the capital investment needed to provide so far as is feasible the planned replacements, betterments and extensions.

The sum needed for capital investment is a necessary feature of annual highway financing. It is not predicated upon previous investment but upon future needs.

3. *For aid in Comparing Highway Transportation Costs with the Costs of Other Forms of Transportation*

Computations of annual economic cost are proper for this purpose for only those parts of the public or private investments that are chargeable to purposes of transportation. In the case of rural highways and city streets the transportation investment is something less than the total investment because in addition to providing transportation facilities, roads and streets are used as a location for public utilities and for other non-transportation purposes. City streets also aid in sanitation and serve other general purposes.

In the case of privately owned transportation facilities the taxes paid by the company are a part of the burden borne by the users of the system. On that account in comparing highway transportation costs with those of privately owned transportation systems the factor of taxes should be taken into account.