REPORT OF COMMITTEE ON HIGHWAY TRANSPORTATION COSTS

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This report consists of four sections The first presents a method for determining the true annual cost of any specific highway as of the date when the data are assembled, including an annual charge predicated on future periodic reconstruction. The second section presents a method for estimating the annual cost of a highway as of date when data are not available for computing the true annual cost. The third section presents a method for determining the cost of vehicle operation that is applicable to automobiles and commercial vehicles The fourth outlines a method of calculating the cost of highway transportation per vehicle mile of road use, by applying the data of sections I or II and III

SECTION I

Comprehensive Method of Computing the Annual Cost of Highways

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) may be put in terms of a formula as follows:

$$C = \text{Average annual road cost} = \left(\begin{array}{c} \text{cost to} \\ \text{construct} \end{array} + \frac{\text{yearly maintenance}}{\text{rate of interest}} + \frac{\begin{array}{c}\text{periodic maintenance} \\ \text{(reconstruction)}\end{array}}{(1 + \text{rate of interest})^n - 1} + \cdots \right) \text{times rate of interest}$$

$$\text{that is, } C = r\left[A + \frac{B}{r} + \frac{E}{(1+r)^n - 1} + \frac{E'}{(1+r)^{n'} - 1} + \text{etc} \right] \quad (1)$$

Where

C = average annual road cost
A = cost to construct
B = yearly maintenance cost (every year).
E (or E') = expenditure for periodic maintenance every n (or n') years (Replacement is an "E" value.)
r = the rate of interest prevailing in current state financing

While the basis of the computations is relatively very simple, the actual computations may be very much involved because of the great number of items to be taken into account Unless the records relating to any particular road are complete, it will not be possible to obtain the data for exact computations, but many of the state and municipal highway departments do have good records of the more recent projects

The desirability of special consideration and separate statement of the expenditures for grading, drainage structures, and right of way is emphasized

On account of the fluctuations of the value of money, the cost can only be compared as of a specific date by applying the data from the Engineering News-Record price index numbers, or other reliable source.

The items of information needed for the determination of highway cost are shown in Figure 1. The actual cost of each item is to be determined and then calculated as of date Annual road cost is then computed by applying the sums thus obtained for each group of items in formula 1.

SECTION II

Method of Estimating Approximate Cost of Highway Transportation

The approximate cost of highway transportation may be estimated when data are not available for computation in accordance with the

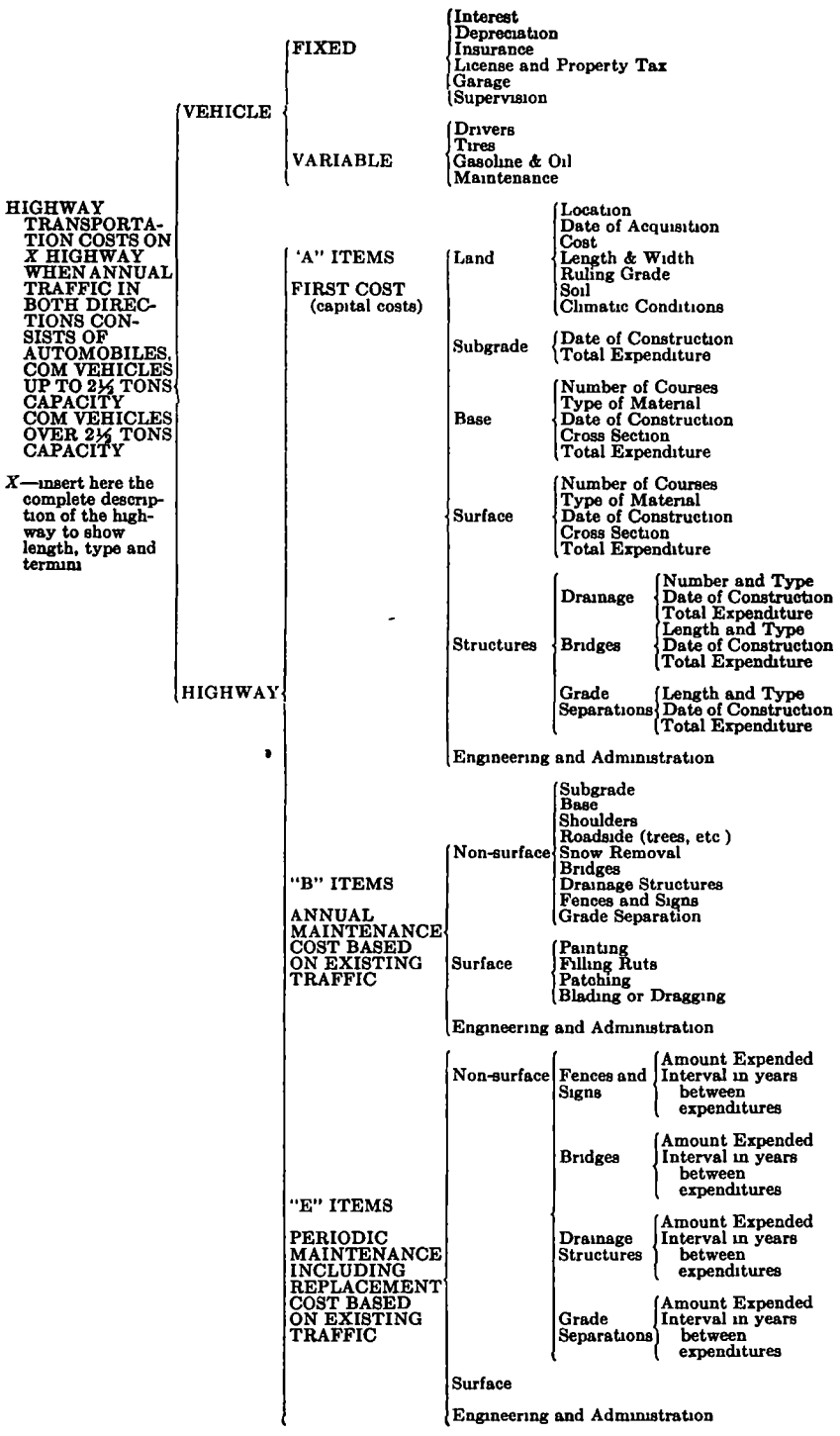
HIGHWAY TRANSPORTATION COSTS ON X HIGHWAY WHEN ANNUAL TRAFFIC IN BOTH DIRECTIONS CONSISTS OF
AUTOMOBILES,
COM VEHICLES UP TO 2½ TONS CAPACITY
COM VEHICLES OVER 2½ TONS CAPACITY
X—insert here the complete description of the highway to show length, type and termini
VEHICLE
FIXED
Interest
Depreciation
Insurance
License and Property Tax
Garage
Supervision
VARIABLE
Drivers
Tires
Gasoline & Oil
Maintenance
HIGHWAY
"A" ITEMS
FIRST COST (capital costs)
Land
Location
Date of Acquisition
Cost
Length & Width
Ruling Grade
Soil
Climatic Conditions
Subgrade
Date of Construction
Total Expenditure
Base
Number of Courses
Type of Material
Date of Construction
Cross Section
Total Expenditure
Surface
Number of Courses
Type of Material
Date of Construction
Cross Section
Total Expenditure
Structures
Drainage
Number and Type
Date of Construction
Total Expenditure
Bridges
Length and Type
Date of Construction
Total Expenditure
Grade Separations
Length and Type
Date of Construction
Total Expenditure
Engineering and Administration
"B" ITEMS
ANNUAL MAINTENANCE COST BASED ON EXISTING TRAFFIC
Non-surface
Subgrade
Base
Shoulders
Roadside (trees, etc)
Snow Removal
Bridges
Drainage Structures
Fences and Signs
Grade Separation
Surface
Painting
Filling Ruts
Patching
Blading or Dragging
Engineering and Administration
"E" ITEMS
PERIODIC MAINTENANCE INCLUDING REPLACEMENT COST BASED ON EXISTING TRAFFIC
Non-surface
Fences and Signs
Amount Expended
Interval in years between expenditures
Bridges
Amount Expended
Interval in years between expenditures
Drainage Structures
Amount Expended
Interval in years between expenditures
Grade Separations
Amount Expended
Interval in years between expenditures
Surface
Engineering and Administration

Figure 1

exact method outlined in Section I An estimate should be made for each type of construction of which a sufficient mileage exists to permit reasonably accurate computations of average costs per mile, or per square yard The several items of cost to include are shown in Figure 2 Then equation 1 applies as before Each of the costs outlined in Figure 2 should be determined from actual records of expenditures on the system of roads in question, or if records are not available, from the cost of like items on other roads The calculations will be of little value unless data are available for use in determining the principal items, but some minor items may be estimated without influencing the results appreciably. The costs will in general be determined as follows:

Item 1

Right-of-Way. Assume the easement for the right-of-way to have a value equal to the value of the land for agricultural or other purposes at the present date.

Item 2

Drainage Structures. Use the actual cost of the drainage structures as of record except for major stream crossings that serve traffic from additional miles of road. The fair proportion of the cost of these major stream crossings to be charged against the system under analysis The cost of major stream crossings is to be reduced to a cost as of a specific date by applying the Engineering News-Records price index, or other reliable data

Item 3

Earthwork and Prior Surfaces Charge the actual cost of grading and prior surfaces. By prior surfaces is meant any wearing surface that has become an integral part of the existing wearing surface, as when a surface is changed to a higher type.

Item 4

Road Surface. Determine from the construction records the actual total cost of the road surface and reduce to a cost as of a specific date by applying the Engineering News-Record price index, or other reliable data, to the sections constructed during each year.

- APPROXIMATE HIGHWAY TRANSPORTATION COST ON ANY ONE TYPE OF ROAD SURFACE BASED ON AVERAGE EXPENDITURES FOR THAT TYPE IN A STATED AREA (CITY, COUNTY OR STATE) FOR AN AVERAGE TRAFFIC OF AUTOMOBILES AND COMMERCIAL VEHICLES PER ANNUM
  - ROAD COSTS
    - VEHICLE
      - FIXED
        - Interest
        - Depreciation
        - Insurance
        - License and Property Tax
        - Garage
        - Supervision
      - VARIABLE
        - Drivers
        - Tires
        - Gasoline and Oil
        - Maintenance
    - "A" ITEMS FIRST COST (Capital costs)
      - Right-of-way
      - Drainage Structure
      - Earthwork and Prior Surface
      - Road Surface
      - Signs and Other Appurtenances
      - Administration and Engineering
    - "B" ITEMS ANNUAL MAINTENANCE COSTS BASED ON EXISTING TRAFFIC
      - Non-surface, i e , Shoulders, Signs, Drainage Structures, etc
      - Road Surface
      - Administration and Engineering
    - "E" ITEMS PERIODIC MAINTENANCE BASED ON EXISTING TRAFFIC
      - Date of Expenditure
      - Total Expenditure

Figure 2

Item 5

Signs and Other Appurtenances Compute the total cost of signs, guard fence and similar appurtenances Crossing eliminations existing on the system to be handled in the same manner as major stream crossings.

Item 6

Engineering and Administration. The cost of engineering and administration is to be determined by applying to the total cost of all of the foregoing items the percentage which represents the actual cost of this item in the jurisdiction (5 per cent may be used as a close approximation.)

Item 7

Summary. The grand total of items 1 to 6, inclusive, constitutes the quantity A in formula 1

Item 8

Maintenance Cost. The items of maintenance cost shall be determined from records of maintenance cost on the roads under consideration, supplemented by records of cost on like roads under equivalent traffic conditions in near-by areas where climatic conditions are similar Where the types of surfaces require routine maintenance supplemented by periodic special maintenance such as resurfacing, reoiling and the like, the annual maintenance cost shall be determined as prescribed in Section I. The maintenance costs shall include the appropriate rental charge for equipment

Item 9

Engineering and Administration on Maintenance. This shall be determined by calculating the ratio of such overhead costs to the total expenditures for maintenance in the jurisdiction, and applying that percentage to total of Item 8.

SECTION III

Annual Vehicle Costs

The following items comprise the cost of operation of a motor vehicle, which for convenience, are to be reported on the annual basis There is appended a table showing a method of reporting these costs in such a manner as to permit the calculation of cost per mile

A. FIXED COSTS

Item 1

Annual Interest Charge. This is obtained by computing the interest on the investment less accrued depreciation at an appropriate rate. (6 per cent suggested by the committee)

Item 2

Annual Depreciation Charge It is recommended that depreciation be computed as a uniform annual charge during the life of the vehicle. For automobiles the present information indicates that the average life will be about seven years and the depreciation per annum will be about 15 per cent of the initial investment

Item 3

Annual Insurance Cost Actual amount paid but when no insurance is carried, use the standard rate for " fire, theft, public liability and property damage."

Item 4

Annual license fee plus property taxes, if any are paid, but not including gas tax.

Item 5

Annual Cost for Garage The actual rent paid or the rental value of the garage space in which vehicle is housed

Item 6

Annual Supervision Costs Applicable to fleets of vehicles that require supervision and management. The cost to be determined from accounts and prorated to each vehicle

B. VARIABLE COSTS

Item 7

Annual Cost of Drivers Actual amount paid for drivers

Item 8

Annual cost of tire equipment, including repairs and replacements.

Item 9

Annual cost of gasoline and lubrication.

Item 10

Annual cost of maintenance, including all expenditures for the mechanical upkeep of the vehicle, cleaning and painting

SECTION IV

Transportation Costs

The annual cost of any system of roads as determined by Method I, or the approximate annual cost as determined by Method II, is reduced to annual cost per mile

The average cost of automobile operation per mile is determined as prescribed in Section III

The cost of vehicle operation chargeable per mile of road is calculated by applying the average cost per vehicle per mile to the average yearly traffic on the road and by subtracting from this the sum per mile of travel that amount of traffic has paid into road funds through the gas tax and license fee.

Summary On the basis of the foregoing, the following formula is proposed:

$$\left.\begin{matrix}\text{Highway}\\ \text{Transportation}\\ \text{cost per vehicle}\\ \text{mile}\end{matrix}\right\} = \frac{\left\{\begin{matrix}\text{Annual cost}\\ \text{of roads}\\ \text{per mile}\end{matrix}\right\} + \left\{\begin{matrix}\text{Annual operating cost per mile}\\ \text{of annual traffic, less contri-}\\ \text{bution to road funds}\end{matrix}\right\}}{\text{Annual traffic per mile}}$$

This report undertakes to lay the general groundwork only for consideration of the subject It indicates the several kinds of data that must be assembled in order to develop satisfactory quantities for use in the formulas proposed Appended is a form proposed for use in securing certain data regarding the cost of vehicle operation together with an analysis of the items which enter into a complete statement of highway transportation costs covering both vehicle and highway charges.

FORM FOR REPORTING THE ANNUAL COST OF A MOTOR VEHICLE

Make Type Body Model Year When purchased . 19 Capacity passengers or tons Average load passengers or tons Total mileage to date below Mileage for year . % of mileage on Paved Road . . . % of mileage on Unpaved Road

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Annual Cost for Year Ending 19

No	Item	Amount	Remarks
Fixed Costs			
1	Annual interest charge on depreciated value	$	
2	Annual depreciation charge	$	
3	Annual insurance cost	$	
4	Annual cost of license and taxes	$	
5	Annual rental cost of garage	$	
6	Annual pro rata supervision cost	$	
Nos 1-6	Total annual fixed cost		$
Variable Costs			
7	Annual cost of drivers	$	
8	Annual cost of tires	$	
9	Annual cost of gasoline	$	
10	Annual cost of lubrication	$	
11	Annual cost of maintenance	$	
7-11	Total annual variable cost		$
1-11	Total annual costs		$
	Cost per vehicle-mile		¢

NOTE—All amounts entered should be determined by actual accounting, where possible When estimated, note "est" after figures and explain basis upon which estimate is made

Confidential
Owner ...
Address ...
Reported by .