TOWARD A RATIONAL APPRAISAL OF HIGHWAY COST ALLOCATION: A POSITION PAPER

by

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(The opinions, findings, and conclusions expressed in this paper are those of the author and not necessarily those of the sponsoring agencies.)

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1963

1969

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INTRODUCTION

Policies which are justified on economic grounds may not always seem politically feasible. This observation has been true in the case of tax structures in general and has tended to be true for highway user taxation in particular. While nationwide both public administrators and economists have overwhelmingly agreed that expenditures for highway programs should be paid for on the basis of the benefit principle of taxation, this agreement has not culminated in a similarly widespread commitment to ascertaining how the burdens (highway costs) should be allocated among highway users.* This paper addresses this issue of cost allocation from two standpoints:

1. Is there a reasonable case for some commitment to analyzing highway cost allocation in Virginia?

2. And, if studying cost allocation is desirable, what can be learned from the literature about an appropriate methodology for a cost allocation study in Virginia?

THE CASE FOR ANALYZING COST ALLOCATION

In Virginia, considerable sums of money are generated and expended on transportation facilities, particularly highways. The highway user taxes which have supported these expenditures through an earmarked trust fund are predicated upon the cost responsibility principle of taxation; that is, if a significant portion of public expenditures are for the benefit of an identifiable group, the cost of the programs benefiting these identifiable groups should be borne

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*States which have committed significant efforts to this issue are Oregon, Wisconsin, New York, and Georgia.

by them. Because there are several classes of highway users, an equitable highway user tax structure has been typically described as one in which subsidies from one class of users to another are avoided. The importance of imposing charges (tax rates) which are appropriate to recover the costs occasioned by each user class goes further than equity, however. Such a tax structure approximates a market pricing mechanism, and as such contributes to increased efficiency in the overall allocation of resources.

In recent years, the single most important user tax has been the fuel tax, and among classes of users all have paid the same rate, with the exception of the operators of heavy trucks. Since 1958, when the gross receipts tax was repealed, these for-hire common carriers have paid a $0.02 per gallon road tax, supposedly reflecting their additional occasioned costs.(1) Because the last major change in the tax structure that involved a differential among user classes was occasioned by the passage of this $0.02 road tax, it is reasonable to assume, for the purposes of this paper, that with the institution of that $0.02 differential, the tax structure was equitably designed, at least in the sense that the legislature had agreed that a fuel tax differential of a particular magnitude between cars, pickups and vans, and heavy trucks was required. Although one must assume that the institution of the road tax differential increased the equity of the tax structure, as will be noted below the nature of the tax structure can be easily eroded through time, particularly if a change in one aspect of the structure is not examined in terms of how it affects the entire structure.

For example, in 1959 the motor fuel tax was $0.06 per gallon payable at the pump by all users; the road tax on common carriers was $0.02 — a 33% differential. In 1965 the motor fuel tax was increased to $0.07 while the road tax remained at $0.02, thus reducing the differential to 28%. In 1972, due to rapidly rising construction costs, the fuel tax was increased to $0.09 per gallon; yet the road tax remained at $0.02 to reduce the differential to 22%.(2)

Obviously, the fact that the gasoline tax rate has been changed several times since 1958 while the road tax has remained constant indicates that the equity between the class of users which pay the road tax and those classes that do not has been altered significantly.(2) While these legislative changes are singularly responsible for a significant change in the tax structure among vehicle weight classes, changes in other factors have intensified the need for some commitment to examine the existing tax structure from the standpoints of equity and cost allocation. Among these factors are the following:

1. federal increases in truck weight limits which lead to significantly increased maintenance and construction costs;

2. changes in the distribution of traffic over time, in terms of both the light vehicle/heavy vehicle mix and the resident/non-resident heavy vehicle mix;

3. the likelihood of highway tax increases in the future which will again alter the tax shares among users; and

4. changes in the type of highway and transportation programs being funded.

On balance, what do the factors noted above suggest about the equity of the current highway user tax structure? One is on solid ground, in the writer's opinion, in arguing that since the initiation of the $0.02 road tax in 1958, light vehicles have paid an increasingly higher share of highway costs in the sense that the road tax rate as a share of the motor fuel tax rate has not maintained its original level. In this context, heavy axle loads have been increasingly subsidized by lighter axle loads. Furthermore, given the recent passage of federal legislation raising the maximum weight limits on common carriers, the tendency towards tax burdens to become misaligned with actual occasioned costs has probably been intensified.

Thus, it is contended that two points are fairly clear: (1) Through acquiescence, the legislature has allowed whatever equity existed in the tax structure in 1958 to be altered. (2) The changes in tax shares paid by different weight classes have tended to reduce the relative tax burden of heavy axle loads so that a general case for increasing the tax differential between heavy and light axle loads is reasonably strong.[2] However, estimates of costs occasioned by different weight classes would aid significantly in the development of appropriate tax rates.

In the following section, some of the recent literature on cost allocation is presented to provide insight into appropriate methods for allocating costs.

WHAT CAN BE LEARNED FROM THE LITERATURE

1972

AASHTO As the Basis of Recent Studies

Cost allocation and highway user tax equity have received significant attention recently at the federal government level as well as among several states. For example, in the 1978 Surface Transportation Act, Congress called for a new study of highway cost allocation to be completed by January 1982. In February 1979, the Congressional Budget Office prepared a paper entitled Guidelines for a Study of Highway Cost Allocation[3] to assist in the three-year study required by the Act. Published works at the state level include reports on a March 1979 cost allocation study performed by the Georgia DOT, a 1976 cost responsibility study completed by the Oregon DOT, and a 1976 study of cost allocation prepared by the Wisconsin DOT. All of these efforts were aimed at devising and implementing a tax structure consistent with occasioned highway costs for different vehicle weight classes.

While there is little question that heavier axle loads occasion greater costs than lighter loads, difficulties arise in accurately determining exact costs occasioned by each weight group. Nevertheless the engineering evidence collected during the AASHO Road Tests provides a wealth of information to aid in this determination and, although the tests were completed in 1961, the evidence and formulas developed in that $27 million study are generally accepted by the engineering community and are applicable to current cost allocation studies. Furthermore, while awaiting the 1982 cost allocation work commissioned under the Surface Transportation Act, results of the AASHO tests are in fact the state of the art. (See for example the 1972 AASHTO Interim Guide for the Design of Pavement Structures.) In fact, in reviewing even the most recently completed cost allocation studies (the Oregon study and the Georgia study), one will find that the assumptions about relative cost assignments by vehicle weight classes draw heavily from the data developed by the AASHTO. Therefore, it is quite defensible to draw on the AASHTO work as a basis for cost allocation work.

The Incremental Approach

The most widely accepted approach to analyzing highway costs is the incremental approach. Generally, this approach attempts to assign each element of highway cost to the class of vehicle which occasions that cost. Within this general approach, there are two avenues:

1. assignment from the standpoint of occasioned construction costs alone, and

2. assignment of incremental pavement cost on the basis of damage.

To every extent possible, the assignment of costs of pavement should be based upon estimates of how each weight class damages pavement, not on the basis of occasioned construction cost. The justification of this point is clear. If costs are assigned solely on the basis of the added construction expenditure over and above that necessary to support a basic vehicle, heavy vehicles are favored because pavement strengths increase to the seventh power of the added thickness. This means that a great deal of strength is added by the 8th inch of pavement as compared to the first 7 inches of pavement, and the assignment of cost on the basis of added strength allows heavy axle loads unfair advantage of the economy of scale in pavement construction.(3) However, from the standpoint of damage, the AASHTO results show that a 20,000-lb., single-axle does the damage of approximately 5,000 cars.* Although the incremental approach is a simple concept in the sense that vehicles bear the costs occasioned by them, it requires some amplification. Costs should be separated into two categories — uniquely occasioned costs and jointly occasioned costs.

Uniquely occasioned costs are those costs that can be assigned to a single class of vehicle. Some examples are:

1. Guardrails — light vehicles

2. Climbing lanes — low power-to-weight ratio vehicles

3. Overlooks and scenic roads — light vehicles

4. Truck weigh stations — heavy vehicles

With respect to such costs as a category, if the overriding purpose of a facility or improvement is to meet the needs of a particular class of vehicle, this class should be assigned the project cost. (Improvements to coal haul roads is an excellent example.)

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*See Appendix A.

Jointly occasioned costs are the responsibility of all users, although they may be disproportionately ascribed to some classes of users. These are the costs which are usually thought of as being related to size, weight, or axle weight of vehicles; however, where expenditures are for the common good (as possibly in the case of signals) then costs could be allocated on the basis of vehicle miles of travel. Proposed guidelines for major jointly occasioned costs follow.*

1. Paving and resurfacing costs. These costs should be allocated in proportion to the axle-load equivalent of each class (as developed by the AASHTO in the 1972 Interim Guide), except for some small portion (maybe 10% to 15%) of pavement which doesn't depreciate with vehicular use. This small portion of cost should be allocated according to the existing traffic mix.

2. Right-of-Way costs. A basic or minimum right-of-way width must be established (possibly 10 ft.). Then the common cost portion is calculated on the basis of minimum width to actual width on each system. The costs remaining (or incremental costs) should be allocated according to design-hour passenger car equivalents.

3. Widening costs. These costs should be allocated according to design-hour passenger car equivalents.

4. Bridge costs. This item is very difficult to analyze because the question of what is a "basic bridge" comes into play. Bridge costs could be allocated by calculating common costs on the basis of the dead-load-to-total-load ratio then assigning the remainder of costs on the basis of vehicle ton-miles.

5. Costs of grading and compaction. This, again, is a difficult cost item to assign, since it varies by both system and terrain. The suggestions are as follows:

    a. Since subgrade compaction improves pavement durability, these costs should be allocated along with paving.

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*These are based upon the guidelines proposed by the Congressional Budget Office for the study mandated by the 1978 Surface Transportation Assistance Act.

b. Embankment compaction should be a common cost up to minimum road width. Costs beyond that should be assigned by design-hour volume in passenger car equivalents.

c. Common excavation costs should be determined on the basis of minimum pavement width. Assign remaining costs by design-hour, terrain-specific, passenger car equivalents.

Pertinent Findings from the Oregon Cost Allocation Study

1. In Oregon, approximately 73% of highway costs are assignable; only 23% are common costs. The common cost items were assigned on the basis of vehicle miles of travel (VMT) and of the total budget; heavy vehicles pay approximately 38%.

2. In assigning construction costs, the "basic road" is a road adequate for a 6,000-lb. gross weight vehicle. Increased costs occasioned by successively heavier vehicles and axle weights are the responsibility of those heavier vehicles. Appendix B shows increments of added pavement and base required for greater axle weights. Within each axle weight class, added costs are assigned in proportion to total axle miles.

3. One foot of lane width and 2 ft. of shoulder are considered the sole responsibility of heavy axles (see Appendix C).

4. Increased structural strength of bridges is required for increases in gross vehicle weight above 20,000 lb.. Structural strength requirements level off at a gross weight of 44,000 lb..

5. Maintenance costs are allocated as follows:

   a. Eighty percent of the surface maintenance costs are the responsibility of vehicles heavier than the basic vehicle.

   b. Eighty percent of shoulder maintenance costs are assigned to heavy vehicles.

   c. Fifty percent of bridge maintenance costs are assigned to heavy vehicles.

1976

6. Development of the tax schedule in Oregon is based upon estimating a weight-mile cost responsibility schedule by 2,000 lb. gross weight groups; then, for relatively light vehicles, that weight-mile tax is converted to a fuel tax. For heavier vehicles, a weight-mile tax is paid.

REFERENCES

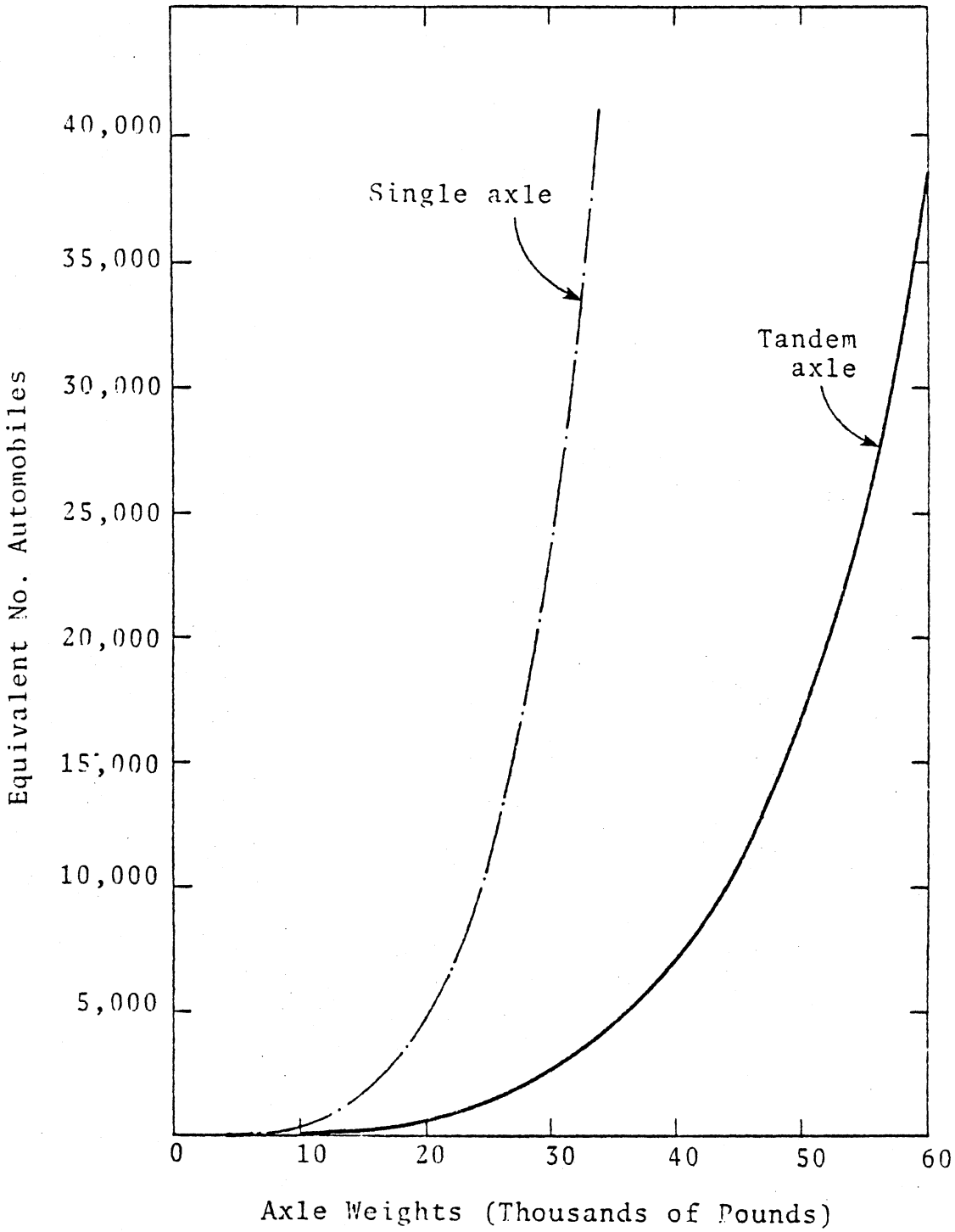
1. The Virginia Highway Construction and Maintenance Fund, A Survey of Revenue Sources, Virginia Highway and Transportation Research Council, September 1979, p. 62, D. D. McGeehan.

2. The Desirability and Feasibility of Alternative Means of Financing Transportation in Virginia, Virginia Highway and Transportation Research Council, November 1978, p. 62, G. R. Allen.

3. Guidelines for a Study of Highway Cost Allocation, Congressional Budget Office, February 1979.

1979

1979



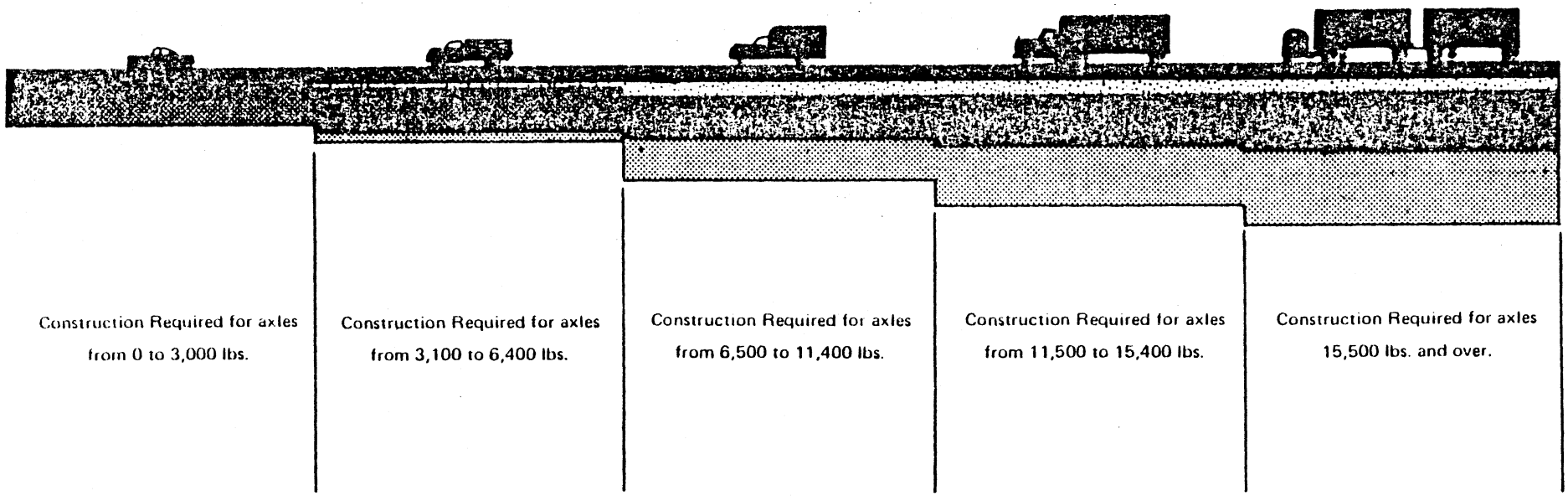
Relative Damage Caused by Increase in Axle Weights
(after AASHTO Interim Guide)

1980

APPENDIX B

INCREMENTAL METHOD OF DETERMINING SURFACING RESPONSIBILITY

Source: Origin Cost Responsibility Study



Indicates the construction required for the lightest axles considered. Cost to be shared by all vehicles in accordance with axle miles of travel.

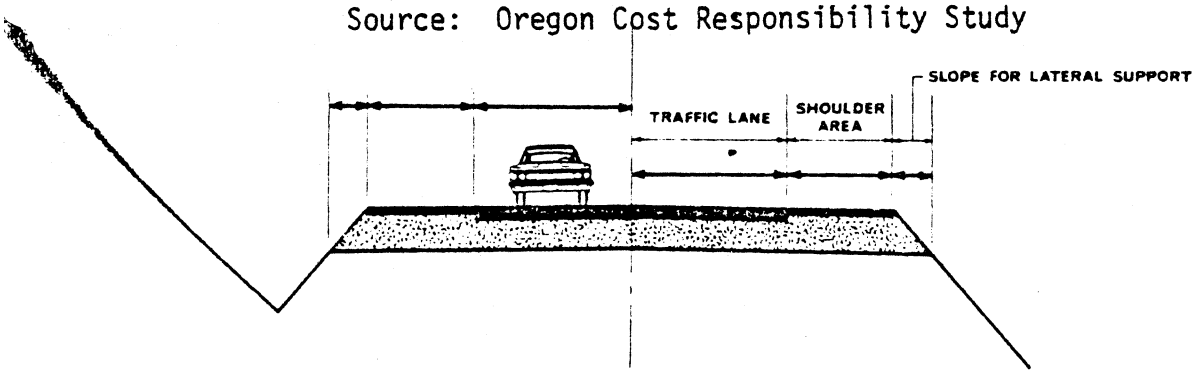
Indicates the construction required for heavier axles. Cost of each increment to be shared by the vehicles with axle weights equal to or greater than the axle weights requiring it; in accordance with axle miles of travel.

1982

1983

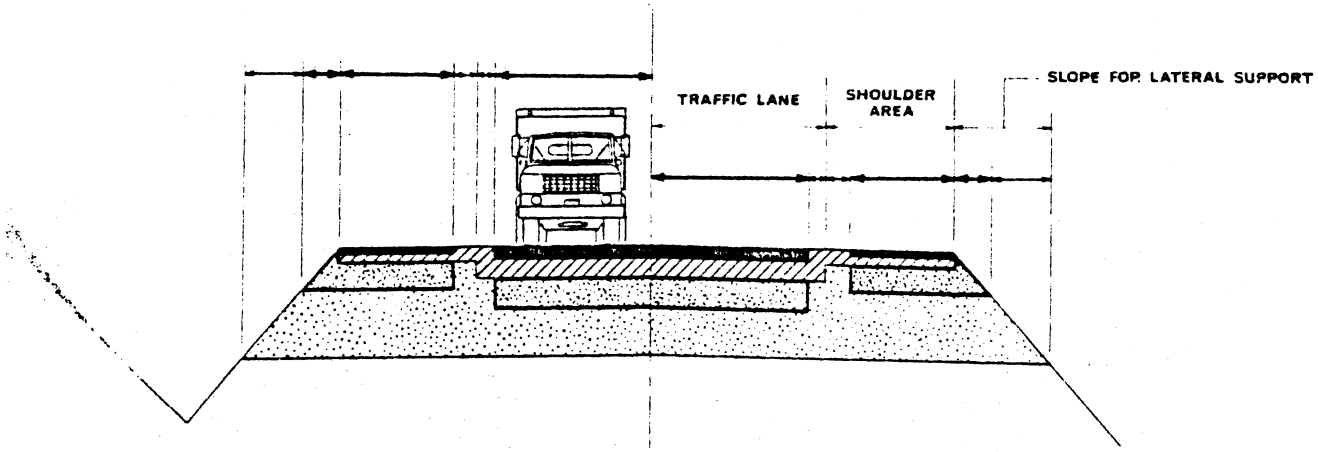
SURFACING RESPONSIBILITY

Source: Oregon Cost Responsibility Study



DESIGN REQUIRED FOR LIGHT VEHICLES ONLY

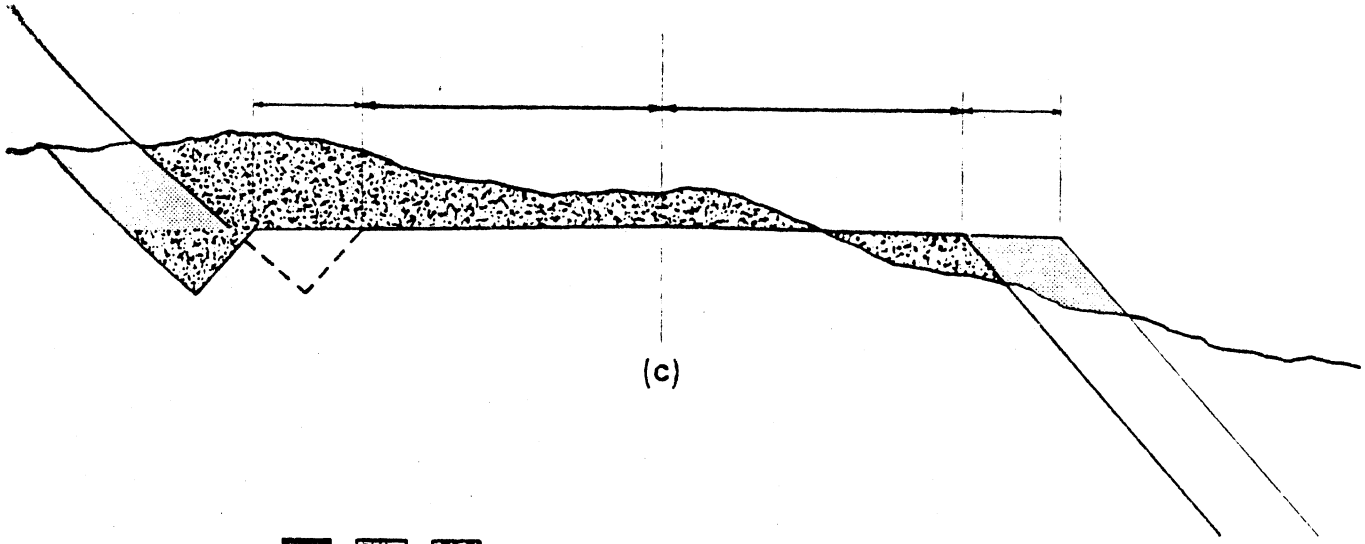
(a)



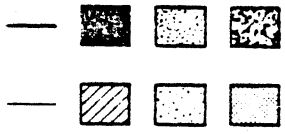
DESIGN REQUIRED FOR TRAFFIC INCLUDING HEAVY VEHICLES

(b)

GRADING RESPONSIBILITY



(c)



Responsibility of basic vehicle to be shared by all vehicles in accordance with distance travelled.

Sole responsibility of heavy vehicles.

1984