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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

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SOME ASPECTS OF THE FISCAL BURDEN

ON

ROAD - TRANSPORT

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## TABLE OF CONTENTS

	<u>Page</u>
A. Introduction	1
B. The concepts of costs of roads, expenditures on roads and fiscal levies on road-transport	2
C. Some basic viewpoints in connection with fiscal levies on road-transport	3
D. Importance of these viewpoints in practice	4
E. Relationships between costs and expenditures on roads and fiscal levies on road-transport	5
1. Costs of roads versus fiscal levies on road-transport	5
2. Expenditures on roads versus fiscal levies on road-transport	6
F. Problems involved in the determination and allocation of costs and expenditures on roads and fiscal levies on road-transport	7
1. Determination of costs and expenditures of the road-system and fiscal levies on road-transportation	8
2. Apportionment of costs or expenditures on roads between road-users and non-road-users	10
3. Apportionment of share of costs or expenditures on roads, to be borne by road-users, among various categories of road-users	10
G. Consequences of the analysis for the implementation of fiscal policy	12
H. Factual relationship between expenditures on roads and fiscal levies on road-transport in a number of countries	12
I. Conclusions	13
Appendix 1 List of literature on the allocation of costs and expenditures on roads, 1937-1957	15

	<u>Page</u>
Appendix 2 Percentage of expenditures on roads assigned to road-users (i.e. motor vehicles) in various studies	18
Appendix 3 Expenditures on roads and special fiscal levies on road-transport; calculations made in the State of Ohio	20
Appendix 4 Costs of roads and special fiscal levies on road-transport; calculations made in The Netherlands	29
Appendix 5 Some data on expenditures on roads and fiscal levies on road-transportation	36

## SOME ASPECTS OF THE FISCAL BURDEN ON ROAD-TRANSPORT

### A. Introduction.

The financing of road construction comprises a substantial portion of the loans which the International Bank has extended in the past and the road sector is one in which the Bank can be expected to have a continuing interest. In view of this it seems worthwhile to formulate some general principles on the adequacy of the fiscal burden which a government imposes on the road transport sector. This paper is a very preliminary attempt to contribute to the formulation of such principles.

When the Bank considers a loan in the railway field, or in any other sector where a direct charge is made to the purchaser for services rendered, the Bank usually considers whether present and prospective revenues of the enterprise as a whole are adequate to cover costs, including return on the capital invested. In addition, it determines whether the proposed investment, let us say for expansion of facilities, will add sufficiently to the income of the enterprise or of the economy-at-large to justify the additional investment.

The role of financial criteria in the road field has only recently come more to the foreground in the Bank. An important issue is to what extent the various taxes imposed on the users of existing highways, local roads and streets should provide an adequate reimbursement for the costs which the government has incurred in making road facilities available. There is also reason for appraising the benefits of new road facilities with regard to the financial return of fiscal charges on the transport sector; the adequacy of such charges is a particularly important question in countries where new construction activity in the highway field is imposing a substantial burden on the government budget.

The problem of the amount of fiscal levies which should be imposed on road transportation can to a large extent be seen as a problem of pricing of government services. It has provoked considerable discussion in recent years, particularly in the United States where political and economic pressures have led to a very substantial increase in highway expenditures.<sup>1/</sup> The extensive exchange of views in connection with highway financing cannot be said to have led to a clear consensus. Nevertheless, the discussions on general principles have been quite illuminating and substantial progress has been achieved in devising practical methods for allocation of road expenditures or costs among various classes of highway users once a certain basic principle of allocation had been adopted.

This paper takes the view that neither economic analysis nor practical considerations dictate the rule that all financial outlays (including expenditures on new construction) made by the government in

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<sup>1/</sup> See Appendix 1 for a survey of some of the available literature on the subject.

the highway field should be "covered" by tax receipts currently accruing from charges imposed on the users of the road system. The position is taken, however, that over the long term at least a predominant share of the costs of roads should be borne by road-users.

In order to substantiate this view and to clarify various issues successive sections of this paper will deal with (1) some problems of concept; (2) some basic viewpoints in connection with fiscal levies on road-transport; (3) the importance of these viewpoints in practice; (4) the relationships between costs and expenditures on roads and fiscal levies on road-transport; (5) problems arising in practice in connection with the allocation of costs and expenditures on roads and fiscal levies on road-transport; (6) consequences of the analysis for the implementation of fiscal policy and (7) the factual relationship between expenditures on roads and fiscal levies on road-transport in a number of countries.

B. The concepts of costs of roads, expenditures on roads and fiscal levies on road-transport.

In many discussions on the fiscal burden on road-transportation the concepts of costs of roads and expenditures on roads are used synonymously, which is a source of much confusion. The concept of expenditures is particularly relevant in the context of problems of financing of roads. The cost-concept on the other hand is especially useful in connection with problems of administration of the road-system, allocation of fiscal burdens among road-users and for establishing proper competitive conditions between road-transport and other means of transportation.

Costs for a certain period of time represent the value of the various goods and services, sacrificed in the process of production during that period of time. With respect to roads the process of production should be conceived as the supplying of road-services by the existing road-system. Costs incurred in connection with this process consist of the following elements: depreciation, interest, maintenance and general costs (such as those for traffic police and general administration).

Expenditures on the other hand express the amounts actually spent during a certain period of time.

The differences between costs and expenditures - with respect to roads - can be summarized as follows.

a) Expenditures for construction or improvement of roads during e.g. a certain year may be considerably larger or smaller than depreciation of the road-system during that year. Depreciation calculated on the basis of the lifetime of the assets represents the value of the productive resources sacrificed and should be counted as costs and not these investment expenditures.

b) Similarly, expenditures on maintenance will often vary from year to year. In this case, a standard-amount, based on experience during a number of years should be counted as costs, and not the amount that happens to be spent on maintenance during a certain year.

c) Sometimes roads give rise to interest expenditures, but sometimes they do not, viz. when their construction was financed from public savings. Since use of capital in a certain direction implies a lost opportunity for its use in other directions, interest on the total capital investment should in all cases be taken into consideration as an element of costs.

d) Past costs of construction of a road (i.e. historical costs) may differ substantially from present costs that would have to be made for its replacement (i.e. replacement costs). It is widely agreed that replacement costs should be considered when calculating certain cost-elements, such as depreciation, not historical costs.

Fiscal levies on road-transport should be interpreted in the context of this study as all special taxes or fees on this sector, excluding taxes or fees levied on the economy at large. This means that direct taxes will be left out of consideration, since they are generally levied indiscriminately on the various sectors of the economy. For the same reason, indirect taxes such as import duties and sales taxes on motor vehicles and tires will only be taken into account insofar as they exceed the level of indirect taxes at large.

C. Some basic viewpoints in connection with fiscal levies on road-transport.

With respect to the various viewpoints to be considered in connection with the determination of fiscal levies on road-transport, four are emphasized.

One point of view stressed is that of derived benefit. Benefits are of course directly derived from roads by their actual use, but in many cases they are also enjoyed whether the beneficiary is using the road-system or not.

A second relevant viewpoint is that of cost. Roads are a part of the "plant" of the motor transport industry and a facility for individual owners of automobiles and levies on motor vehicles can be seen primarily as prices charged to users to cover the cost of the facilities provided. In connection with this viewpoint special attention is sometimes drawn to the equalization of competitive conditions among various types of transportation.<sup>2/</sup>

A third view emphasizes the ability-to-pay. As in fiscal policy generally, it is argued, the level of fiscal burdens on road-transportation has to be determined after due consideration of the ability-to-pay of the owners of various types of motor vehicles and of other groups.

A fourth line of thought focuses special attention on traffic congestion, giving rise to "spillover" costs in the shape of reduced operating efficiency, and claims that fiscal levies on road-transport

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<sup>2/</sup> E.g. in the extensive report on "Carrier Taxation", submitted to the U.S. Congress in 1944 by the Board of Investigation and Research, created by the Transportation Act of 1940 - House Doc. 160, 79th Congr., 1st sess.

should be fixed at such a level that too intensive use of the road-system in view of existing facilities would be avoided.<sup>3/</sup>

D. Importance of these viewpoints in practice.

Among the four viewpoints mentioned in the preceding section the aspect of traffic congestion as a possible determinant for fiscal levies on road-transport seems mainly theoretical. For this reason it will not be considered in this paper; a dynamic approach to traffic congestion will imply improvement of road facilities and not limitation of traffic by high levies, unless alternative transport facilities can be assumed to be available at lower real cost.

Considerations of ability-to-pay play a role in every modern tax system and consequently they should also be kept in mind when fiscal policy is formulated with respect to road-transportation. If e.g. the fiscal policy of a country aims at relatively high taxes on luxuries it may be appropriate to levy high taxes on certain types of passenger cars, independently of other considerations. Meanwhile, considerations of ability-to-pay stand apart from the problem of pricing of road services proper, to which this paper addresses itself in particular. It should be realized moreover that the applicability of the ability-to-pay principle to fiscal levies on road-transportation is limited insofar as commercial vehicles are concerned.

The benefit-viewpoint brings out the fact that benefits are derived from the road-system by various groups. They are derived most directly, of course, by the immediate users of roads and by producers and consumers having close economic contacts with these users. Apart from that, certain benefits of a different nature accrue to groups of producers and consumers. A well-known case, especially relevant in underdeveloped countries, is that of the extension of a road-system to increase the access of regions, broaden markets and promote a better division of labor. Other examples of benefits for the community at large or more limited groups are the availability of government services provided by means of vehicles, such as police and fire protection and postal services, the availability of roads for defense purposes and rising property-values brought about by road construction. In some cases these benefits may be said to be more or less a function of the actual use that is made of a road-system (e.g. additional employment created by an access-road will be closely related to the frequency of use of that road), whereas in other cases they exist mainly on account of "readiness-to-serve", apart from whether a road is used frequently or not (police and fire protection, defense).

Still other benefits from roads may accrue to a community quite apart from vehicular use, such as advantages for abutting property on account of better sewers, street lighting and right-of-way for public utility installations.

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<sup>3/</sup> E.g. J. M. Buchanan - The prices of highway services, National Tax Journal, June 1952.

Efforts to allocate fiscal levies in connection with road-transportation by use of the viewpoint of derived benefits have met with substantial practical difficulties - especially in view of the problem of expressing these benefits in quantitative terms - and have not led to unchallenged results so far. Nevertheless an analysis of comparative benefits, be it in a simplified form, is essential if it is felt that the full costs or expenditures of a road-system should not be borne solely by road-users and that consequently some share should be imputed to the general taxpayer or the owners of abutting property (see also section F 2 below).

The principle of cost is especially valuable in the context of the problem of pricing of road-services to elaborate a just structure of fiscal levies on road-transport. Once the share of costs to be borne by direct users of the road-system has been fixed, an allocation of costs to various road-users is essential to this purpose. The cost-principle is also useful as a tool to promote the establishment of equal competitive conditions among various types of transportation, a subject of substantial practical importance.

E. Relationships between costs and expenditures on roads and fiscal levies on road-transport.

1. Costs of roads versus fiscal levies on road-transport.

As is implied by the preceding remarks there are no grounds for requiring the total costs of the road-system of a territory to be covered under all circumstances exclusively from fiscal levies on road-transport. Considerations of ability-to-pay and benefit can give rise to a total of levies both exceeding and falling short of total costs.

Despite this there will in many cases be good reasons to accept the equality of costs and levies at least as the basic rule and to see to what extent this rule should be modified in practice.

In more developed countries (especially in a country like the United States) strong pressure is often exercised to obtain additional road-facilities, although from the point of view of priorities different types of investment (e.g. in schools) might be of equal or perhaps higher priority. In cases like these much is to be said for the acceptance as a practical rule of conduct of the principle of full covering of road-costs by user-charges. Moreover, the additional benefits to be derived from new roads by those not directly using the road-system will often be only limited in these circumstances.

In case of road-construction in underdeveloped countries the general benefits of road-construction (apart from those accruing to direct road-users) will often be of more importance. But here also there will be an important reason for stressing in practice the desirability of full covering of road-costs by user-charges, viz. the necessity of mobilizing a maximum amount of financial resources for purposes of development. On the other hand it has to be realized that in the case of the underdeveloped countries it may be impracticable to pursue a policy of full covering of costs during the first years after the construction of a new road-network. Traffic

densities - with respect to the whole road-system or to that of part of a country - may increase only slowly and user-charges may be insufficient to cover the costs of still "immature" roads in the early stages unless they were imposed at such a level that they would interfere with a region's development. This argument for temporary subsidies on road-transport is a variant of the familiar infant-industry argument for tariffs.

Another reason, justifying at least a predominant portion of road-costs to be covered by user-charges is that the benefits for non-road-users compared to those for road-users often will not be very important in quantitative terms. This will be notably true for main highways and through-streets, less with respect to local rural roads and local access streets.<sup>4/</sup>

A further argument for equalization of costs and levies can emanate from reasons of competition. When limited groups of vehicles (e.g. trucks and passenger buses) are competing actively with other means of transportation (such as railways and ships) a discrepancy between the part of road-costs, attributable to the group of vehicles concerned and special fiscal levies on these vehicles will give rise to an artificial - i.e. government-imposed - advantage or disadvantage in competitive position (supposing the competing means of transportation is not to be a source of public savings or to be subsidized), which may lead to a misallocation of resources.

The conclusion thus emerges that - ~~although~~ arguments can be raised against a fiscal policy aiming simply at equalizing costs of roads and fiscal levies on road-transport - there are nevertheless good grounds for requiring at least a predominant share of costs or roads to be borne by road-users over the long run.<sup>5/</sup>

## 2. Expenditures on roads versus fiscal levies on road-transport

The argument for covering expenditures on roads, as opposed to covering costs, from fiscal charges on road-transportation has little justification in principle except where such expenditures happen to be equivalent to costs. If expenditures are averaged over a long period they may roughly approximate annual costs. However, where the capital stock in the road sector is being expanded at a rapid rate, particularly in an underdeveloped country, full equalization of expenditures and fiscal charges in the early phase of road development

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<sup>4/</sup> Cf. Appendix 2, giving a survey of percentage allocations, used in a number of studies.

<sup>5/</sup> The argument in this section and the conclusion are primarily concerned with the possibility of a relatively low fiscal burden on road-transportation ("undertaxation"). Meanwhile, it should be realized that a relatively heavy fiscal burden on road-transportation, making desirable a moderation of fiscal levies ("overtaxation") may also prevail.

might interfere with economic growth. The financing of a substantial portion of road investment in such circumstances by loans or by general tax revenues would be in order.

Nevertheless, a link between expenditures and levies on road-transport is often established.

First, there is the practice of adopting long-term road-programs (comprizing both expenditures on construction and on improvement and maintenance) and requiring these programs to be financed entirely from levies on road-transport.<sup>6/</sup> This method of finance generally has been a consequence of the increased demand for road-facilities and the practical impossibility to obtain resources for their financing in a different manner.

When this last limitation does not exist (because sufficient funds can be borrowed to finance all or part of investment expenditures) a different financial structure can be found; it implies the use of levies on road-transport to finance the service of contracted highway-loans.

Each of these financial structures may or may not be associated with the existence of a road-fund, to which on the one hand revenue from levies on road-transport is assigned and from which on the other hand expenditures connected with roads are financed. This system may have some merit if the alternative threatens to be the use of public funds for less essential purposes. But systems of assigned revenues may, as is well-known, create themselves waste of financial resources through rigidities in revenue- and expenditure-patterns.<sup>7/</sup>

Another manner of linking expenditures and revenues from roads is the toll-road system. This system too has generally originated in lack of alternative ways of finance and has gained substantial ground in the United States after World War II. Mostly, under this system current expenditures and the service of loans, contracted to finance construction, are intended to be financed from tolls.

F. Problems involved in the determination and allocation of costs and expenditures on roads and fiscal levies on road-transport.

In the preceding paragraph the position was taken that while no universal rule can be prescribed for covering costs or expenditures on roads completely by special fiscal levies on road-transportation, in practice a complete covering of costs is often advisable, and a complete

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<sup>6/</sup> This system was followed e.g. in several states of the United States; however, levies did not need to cover the share financed by Federal Aid.

<sup>7/</sup> For a more detailed discussion of these points see e.g. E. R. Schlesinger - The role of assigned tax revenues in a development program, January 12, 1954 (IBRD - EC 25).

covering of expenditures is sometimes necessary. If complete covering is not the objective, the question arises whether methods can be devised to put the share to be borne by non-road-users on a more solid basis than "general judgment" alone.

Moreover, in both the "complete covering" and "incomplete covering" alternatives, problems arise in connection with the allocation of the amounts to be levied from road-transportation among the various categories of road-users. The same issues present themselves when it is intended to investigate the impact of special fiscal levies on the competitive position of certain categories of road-transportation.

These various problems will now be considered.

1. Determination of costs and expenditures of the road-system and fiscal levies on road-transportation.

Before the allocation of costs or expenditures can be undertaken, the total amounts involved have to be determined. The same is true for existing fiscal levies on road-transportation which will have to be compared with costs or expenditures.

Determination of total expenditures does not present special economic problems that have to be considered here. As far as existing fiscal levies on road-transportation are concerned, there may be practical problems in defining which part of certain levies is "special" or in assessing which part is derived from e.g. use of gasoline by non-road-users; but mostly their solution will not be too difficult.

More substantial problems arise in determining the costs of a road-system. As was already mentioned before, these consist of the following elements: depreciation, interest, maintenance and general costs.

Depreciation and interest can only be calculated on the basis of a certain value of a road-system; consequently a calculation of costs itself has to be preceded by an approximation of this value.

In order to approximate the value of a road-system, first of all the concept "road-system" has to be clarified. This will give rise to a number of problems, differing from territory to territory owing to specific conditions. Almost everywhere a decision will have to be taken on which part of streets, bridges, viaducts, tunnels, ferries and rail-road crossings should be included in the road-system. Since in many cases these assets are joint provisions (e.g. a railroad crossing is of importance to both road and rail transport), giving rise to joint costs, the imputation may cause difficulties. Theoretically, it might be argued that if the railway existed first, the cost of a railway crossing should be imputed to road-transport and conversely. A historical investigation of all relevant cases does not seem practicable, however, nor the outcome always satisfactory. Therefore, cases like these can only be solved by "rules-of-thumb". This procedure will be especially justified, if the ultimate outcome of the calculations is not seriously affected.

Once the road-system has been determined, its value will have to be estimated. Since this cannot be done for every road separately (except when only a few roads of recent construction are involved) the only practicable way will be to make estimates for parts of the road-system by estimating the number of "units" and multiplying these by "unit values" (e.g. an estimate can be made of the area, occupied by roads, by multiplying - for various types of roads separately - the total length by an average width; next the number of acres thus obtained can be multiplied by an average price per acre - if necessary again for some types of roads separately - to arrive at the total value of the terrain used for road purposes; similar calculations can be made for body and surface of roads). In some cases (e.g. large bridges) more direct methods of estimation may be practicable.

To calculate depreciation, estimates are necessary of the lifetime of various parts of the road-system. With respect to interest or cost of capital, the problem is the percentage to be adopted; in principle this percentage should equal the rate of return on alternative investments.<sup>8/</sup> Once value of the road-system, lifetime of the assets and applicable rate of interest have been decided upon, the yearly charge on account of depreciation and interest can best be calculated by means of annuities.

With respect to maintenance it was pointed out already that it would be arbitrary to consider amounts spent during one specific year, since these may differ markedly from other years; a standard, based on experience, therefore has to be adopted.

General costs can often be based on direct information or to be approximated through applying a percentage of other costs.

If calculations of the costs of a road-system for a number of years are required, the most simple procedure seems to be to derive amounts for later years from those of a base-year by the use of indices for changes in both quantities and values.

As follows from this survey, the problems involved in approximating the costs of a road-system, though by no means insolvable, are extensive. This explains why in most cases of "cost" studies of roads in fact, expenditures for a limited number of years were considered. A serious effort to calculate the costs of the road-system of a country was undertaken recently in the Netherlands.<sup>9/</sup> This study, described in Appendix 4, indicates that the revenues from special levies on motorized road-transport roughly approximate the costs of the road-system.

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<sup>8/</sup> Cf. R. Sadove - Cost of capital in the choice between hydro and thermal power, December 14, 1956 (IBRD - EC 53).

<sup>9/</sup> Earlier studies of road-costs (for the United States) can be found in "Public aids to domestic transportation" (79th Congress, 1st Session, House Document 159, Washington D.C. 1944; for period 1921-1940).

2. Apportionment of costs or expenditures on roads between road-users and non-road-users.

This subject has received a good deal of attention in the existing literature on allocation of road costs or expenditures; it is examined in several of the studies, mentioned in Appendix 1 of this paper.

Many of the efforts have clustered around two ideas which have commonly been designated Predominant Use and Relative Use.

Under the former method highways are classified according to their predominant use or benefit, and costs are assigned accordingly. In its simplest form, it is assumed that local rural roads and local access streets in the cities are primarily of benefit to adjacent property holders and the local communities, and that these roads should be financed entirely through property taxes or other local contributions. It is assumed that the primary highways and streets are of predominant benefit to motorists and should be financed entirely through motor revenues. The county and intermediate roads and streets under this method have always been a source of embarrassment, because obviously they combine both types of benefit, neither of which is "predominant". Ordinarily it is held that their costs should be divided in some indefinite proportions between both motorists and property holders.

Under the Relative Use method efforts have been made to appraise more accurately the different types of benefit derived from the highways and to assign their costs accordingly. It has, for example, been attempted, among other things, to determine the proportionate use of highways and streets for "land service" purposes and "the part such facilities play in the direct discharge of basic functions of government". 10/

Although these studies - some of which went into still more detail than mentioned here - have without doubt contributed considerably to a better understanding of the problem, they cannot be said to have led to clear-cut solutions. Since costs or expenditures assignable to general property, to governmental functions, and to neighborhood and community services are in essence practically unascertainable, "general judgment" will inevitably remain to a considerable extent the basis of every solution of this problem. 11/

3. Apportionment of share of costs or expenditures on roads, to be borne by road users, among various categories of road-users.

This apportionment can give rise to two kinds of problems.

First, a problem of division of costs or expenditures between motorized and non-motorized transport may arise. This problem is virtually non-existent in a country like the United States, but is relevant to other parts of the world where non-motorized transport is

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10/ H. D. Simpson - Highway Finance; A study prepared for the Ohio Program Commission, Columbus (Ohio) 1951, p.75.

11/ For the outcome of some studies, see Appendix 2.

still relatively important. The best approach seems to be to assess which minimum road-requirements would have to be fulfilled for various types of non-motorized transport alone - a much narrower and less well-surfaced road would have sufficed in most cases - and, having regard to this and to traffic-frequencies - to impute part of total costs or expenditures on roads to these types of transport.<sup>12/</sup>

The second kind of problem consists of the allocation of costs or expenditures to various kinds of motorized transport (trucks, passenger buses, passenger cars, etc.; each of which can be broken down further owing to specific requirements). Numerous studies have been devoted to this subject in the United States during the last twenty years; some of the more important ones are mentioned in Appendix 1. One of the most promising lines of thought has turned out to be the "incremental-" or "cost-caused-" method, which is based on the idea that vehicles of different dimensions and weights differ in their requirements for road-facilities. The approach involves an attempt to differentiate expenditures, <sup>13/</sup> attributable to vehicle weight and size and to allocate these expenditures to vehicles in graduated weight and size increment groups. The method can, depending on the nature of the inquiry involved, be applied to both historical data and forecasts made in connection with future road-programs. An example is described in Appendix 3 of this paper.

By use of the incremental method, the responsibility for expenditures on roads of various groups of vehicles can be assessed with a considerably larger degree of accuracy than by any other method. This method involves complicated calculations, however, and the very extensive statistical information required will often not be available.<sup>14/</sup> Moreover, in certain cases, considerable injustice can remain, since the use of roads by individual vehicles may differ substantially from the average for certain groups on which the determination of fiscal burdens according to the incremental method is based.

A corollary of the incremental method - and of other methods of imputation as well - is that the amounts of taxes paid by groups of vehicles on account of already existing taxation will have to be assessed as accurately as possible. For this purpose also, detailed information will have to be collected, especially on the use of fuel.

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<sup>12/</sup> An example of this procedure is described in Appendix 4.

<sup>13/</sup> In general the word "costs" is used, but actually expenditures are involved.

<sup>14/</sup> For these reasons some of the more recent studies on this subject, made in the United States, have been based on a simplified method, called "cost-function method". Though less precise, its results have also been found valuable in practice. (For further details see "Description of plans for the highway cost allocation study", U.S. Bureau of Public Roads, Washington D.C., 1957, p. 11-13).

G. Consequences of the analysis for the implementation of fiscal policy.

Analysis along the lines described in the preceding sections of this paper should contribute considerably to a more rational level and structure of fiscal burdens on road-transportation than often still prevails. Especially the apportionment of fiscal charges among various categories of vehicles can be put on a sounder basis by systematic study. Application of the incremental method will in general result in (1) a flat rate of taxation on gasoline, used by various groups of vehicles and (2) differentiated amounts of motor vehicle taxation to be paid by different groups of vehicles on the basis of their specific responsibility for road-expenditures or -costs.

The foregoing discussion has also shown that the possibilities for quantitative analysis are much more limited with respect to the apportionment of fiscal levies related to the existence of roads between active road-users and others, in which context comparative benefits are especially relevant. Broad judgments will to an extent remain inevitable here. They will be mostly reflected in property tax assessments (influenced by location of properties with respect to roads) and rates of levies on the general taxpayer.

H. Factual relationship between expenditures on roads and fiscal levies on road-transport in a number of countries.

Data on costs of the road-system in various countries are not available. Data on expenditures on roads and fiscal levies on road-transport on an international basis are scarce too; the only source of readily available information that could be discovered so far is the International Road Federation.<sup>15/</sup> This information is defective in two respects: it does not refer to years later than 1950 and the data on expenditures given for various countries are not always based on the same definition (e.g. in some cases expenditures on streets by local authorities and those on bridges have been included and in other cases excluded). Nevertheless the figures seem to be sufficient to provide a general impression on some factual relationships.

A sample of these data (for 23 countries) has been used to construct the three tables of Appendix 5.

Expenditures and fiscal levies have been compared in Table III. It shows the relatively high level of the fiscal burden on road-transport in the countries included; in at least 15 of the countries reviewed, revenue exceeded total expenditures on roads. These countries

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<sup>15/</sup> World Road Statistics (last edition 1953, published 1955).

include both more and less developed countries so that the relatively larger expenditures in the more developed countries will have been matched by the effect of greater traffic-densities and/or higher tax-rates.<sup>16/</sup> On the other hand, certain countries included in the table appear to impose a relatively low fiscal burden on road-transport: Chile, Mexico, Southern Rhodesia, Tanganyika and New Zealand.

Tables I and II show the basic data from which the ratios in Table III were derived. It can be seen from Table I that not much of a general pattern seems to exist as far as the distribution between expenditures on construction, improvement and maintenance is concerned. Most of the countries in the table, however, have in common that expenditures by state, provincial and/or local governments were substantial compared with those of the central government; often they were even predominant.

Table II shows that compared with the distribution of expenditures on roads between central and local governments, a relatively larger part of revenue was in general collected by the central government; in many instances this was the major part.

On the whole, fuel-taxes were the most important source of revenue from road-transport. In a number of countries, fuel was mainly taxed through import-duties, but in many other countries, including those with important domestic production, the accent was on other types of fuel-taxes.

Despite the overall preponderance of fuel-taxation, taxes on vehicles were relatively substantial in many countries.

The table is unable to show the very complicated structure of taxation of road-transport (especially of vehicle-taxes) which is characteristic for almost all countries.

#### I. Conclusions.

1. Fiscal levies on road-transport should be determined observant of a number of viewpoints of which those of cost and benefit are most important in practice (parts C and D).
2. Although arguments can be raised against a fiscal policy, aiming at equalization of costs of roads and fiscal levies on road-transport, there are various practical grounds for requiring over the long run at least a predominant share of costs to be borne by road-users (part E 1).

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<sup>16/</sup> More detailed study would be required to disentangle the influence of these two factors. In view of the deficiencies of the basic data and the complicated structure of levies on road-transportation, this more detailed analysis has not been undertaken.

3. Equalization of expenditures on roads and fiscal levies on road-transport is in principle not a necessity either. Despite this it is often the only practicable method of financing; consequently it has been applied in many cases (part E 2).
4. The calculation of costs of a road-system gives rise to many problems; these are by no means insolvable, however (part F 1).
5. Many efforts to apportion costs or expenditures on roads between road-users and non-road-users have been based on the "predominant-use" or "relative-use-methods"; both are to an extent arbitrary (part F 2).
6. The apportionment of the share of costs or expenditures on roads to be borne by road-users among various categories of road-users, can best be based on the "incremental-" or "cost-caused-" method. Considerable results have been achieved in this field (part F 3).
7. Information on expenditures on roads and fiscal levies on road-transport in various countries is scanty. The examination of some readily available information gives the impression that in several countries the fiscal burden on road-transport is relatively high, but that in other countries the opposite is true (part H).

APPENDIX 1.

List of literature on the allocation of costs  
and expenditures on roads, 1937-1957.

1. Report of the Interim Committee for a study of the Motor Transportation Act and the fees and taxes paid by the road users for the highway facilities provided by the State of Oregon, 1937.
2. The economies of highway planning - McCullough, C.B. and Beakey, J.; Technical Bulletin no. 7, Oregon State Highway Department, 1937 (revised 1938).
3. A study of highway costs and motor vehicle taxation in Illinois - Glover, V. L., Illinois Department of Public Works and Buildings, Division of Highways, 1937 (mimeogr.).
4. Annual highway costs Province of Ontario - Breed, C.B., Older, C.R., Downs, W.S., submitted to Railroad Association of Canada, 1938.
5. A study of highway costs and motor vehicle payments in the United States - Breed, C. B., Older, C.R., Downs, W.S., Association of American Railroads, 1939.
6. Highway costs and motor vehicle payments in Massachusetts, Connecticut and Rhode Island - Breed, C.B., made to trustees of New York, New Haven and Hartford Railroad, 1939.
7. Public aids to transportation, Volume IV, public aids to motor vehicle transportation - Federal Coordinator of Transportation, 1940.
8. Highway costs and motor vehicle payments in Vermont - Breed, C.B., Vermont State Railroad Association, 1940.
9. A critical review of public aids to motor vehicle transportation. (In Association of American Railroads, "What is public aid to transportation") - Breed, C.B., Older, C.R., Downs, W.S., 1940.
10. American Highway policy - Dearing, Charles L., Brookings Institution, 1941.
11. Highway costs and their allocation among taxpaying groups; Breed, C.B., National Tax Association Proceedings, 1941, pp.718-725.
12. Public aids to domestic transportation - Board of Investigation and Research, House Document 159, 79th Congress, 1st Session, 1944.

13. Fifth report of the Commission on State Tax Policy, New Jersey, 1950.
14. Taxing Washington's motor vehicles equitably for highway services; Nelson, J.C., 1950.
15. Highway finance; a study prepared for the Ohio Program Commission; Simpson, Herbert D., Columbus, Ohio, 1951.
16. Proposed system of highway financing for Missouri; Rudder, S.M., Highway research abstracts, 1952, Volume 22, no. 5.
17. A factual discussion of Illinois motor truck license fees. The Illinois Federation of Truck Associations, 1952.
18. Study of motor vehicle taxation in North Dakota. North Dakota Motor Carriers Association, 1952.
19. Allocation of highway costs in Ohio by the incremental method; Pancoast, D.F., Columbus, Ohio, 1953.
20. Highway use and highway costs, A report of the Joint State Government Commission to the General Assembly of the Commonwealth of Pennsylvania, 1953.
21. Testing the equity of Virginia's motor vehicle tax structure, A report to the Commission established by Senate Joint Resolution no. 48. Virginia's Highway Users Association, 1953.
22. An equity study of truck taxation in Kansas. Kansas Motor Carriers Association, 1954.
23. An analysis of highway use taxes in Kentucky. The Kentucky Motor Transport Association, Inc., 1954.
24. An incremental analysis based upon the ten year ASF proposed highway program, (Minnesota) Public Administration Service, Chicago, 1954.
25. Financing highway improvements in Louisiana; Ross, William D. Division of Research, College of Commerce, Louisiana State University, Baton Rouge, La., 1955.
26. A study of the relationship of pavement costs to vehicle weight, Engineering Experiment Station, The Ohio State University, Columbus, Ohio, 1955.
27. Costs of the road, First report. Total costs and revenue from levies, The Hague, The Netherlands, 1955. (Text in Dutch language).

28. Allocating motor-vehicle-tax responsibility by the incremental method, a symposium, Bulletin 121, Highway Research Board, Washington 25, D.C., 1956.
29. Allocation of road and street costs, part I, an equitable solution to the problem, Washington State Council for Highway Research, Seattle, Washington, 1956.
30. Equitable highway cost allocation in North Dakota, Koenker, William E. and Larson, Arlyn J. Bureau of Business and Economic Research, University of North Dakota, Grand Forks, N.D., 1956.
31. Description of plans for the highway cost allocation study as required under section 210 of the Highway Revenue Act of 1956, U.S. Department of Commerce, Bureau of Public Roads, Washington D.C., 1957.

Percentage of expenditures on roads assigned to road-users  
(i.e. motor vehicles) in various studies.

Source	Year of publication	Primary highways	Secondary and local roads	City streets
Joint committee <sup>1/</sup>	1933	100.0	—	—
Ennis <sup>2/</sup>	1935	85.0	85.0	51.0
Duncan <sup>3/</sup>	1935	82.0	82.0	25.0
Oregon Highway Commission <sup>4/</sup>	1936	85.6	10.9	18.5
Werbitzky <sup>5/</sup>	1937	90.0	66.0	50.0
Glover <sup>6/</sup>	1938	90.0	60.0	50.0
Breed, Older, and Downs <sup>7/</sup>				
Period 1921-32	1939	89.9	89.8	48.3
Period 1933-37	1939	90.6	90.6	48.1
Federal Coordinator <sup>8/</sup>				
Period 1921-32	1940	80.0	15-31.5	12-28.5
Period 1933-37	1940	83.0	34.0	30.0
New Mexico Highway Com- mission <sup>9/</sup>	1940	100.0	30.0	15.0
Utah State Tax Commission <sup>10/</sup>	1940	90.0	60.0	50.0
Allen <sup>11/</sup>	1941	100.0	44.0	73.0
Dearing <sup>12/</sup>	1941	100.0	0	—
Board of Investigation and Research <sup>13/</sup>				
Period 1921-30	1944	75-84	15.5-24.5	16-29.5
Period 1931-40	1944	85	25.5-30	31-40
Simpson <sup>14/</sup>	1951	—	81.7 <sup>15/</sup>	—
Ross <sup>16/</sup>	1955	—	71.8-72.6 <sup>15/</sup>	—
Washington State Council <sup>17/</sup>	1956	88-100	22-56	15-64

<sup>1/</sup> Joint Committee of Railroads and Highway Users, Regulation and taxation of highway transportation, January 30, 1933, p.16.

<sup>2/</sup> William D. Ennis, Motor vehicle taxation in New Jersey, report to New Jersey Taxpayers Association at request of Associated Railroads of New Jersey, 1935, p.11.

<sup>3/</sup> C. S. Duncan, Assn. of American Railroads, Highway competition, 1935, p.8.

/Continued on next page

Appendix 2 continued.

4/ Oregon Highway Commission, An analysis of highway tax structure in Oregon, 1936, pp.112-113.

5/ H. M. Werbitzky, Missouri State Highway Department, Study of Missouri highway and street costs chargeable to motor vehicles, 1937, pp.20-21.

6/ V. L. Glover, Division of Highways, Illinois Dept. of Public Works and Buildings, A study of highway costs and motor vehicle taxation in Illinois, 1938, pp.11-13.

7/ C. B. Breed, Clifford Older, and W. S. Downs, Highway costs, report to Assn. of American Railroads, 1939, pp.54,104.

8/ Federal Coordinator, Public aids, IV, 1940, pp.33,44-45, 159. For secondary and local roads and city streets a uniform increase of 1.5 percent a year from 1921 to 1932 is specified.

9/ New Mexico State Highway Commission, Future highway requirements of New Mexico, 1940, p.61.

10/ Utah State Tax Commission, Study of Utah highway and street costs as a basis for charges against motor vehicles as compensation for road use, 1940, p.41.

11/ E. D. Allen, Analysis of highway cost and highway taxation with an application to Story County, Iowa, Iowa Engineering Experiment Station Bulletin 152 1941, p.74. Separate percentages are given for primary urban streets (100) and other urban streets (72.3), and for county trunk roads (62.8) and county local roads (36.4).

12/ C. L. Dearing, American highway policy, 1941, pp.154-163. The extent of motor vehicle responsibility for city street expenditures is not considered.

13/ Board of Investigation and Research, Public aids to domestic transportation, 79th Congress, 1st Session, House Document No. 159, Washington D.C., 1944, p.283.

14/ Herbert D. Simpson, Highway finance, a study prepared for the Ohio Program Commission, Columbus, Ohio, 1951, p.86.

15/ Percentages for whole road-system.

16/ W. D. Ross, Financing highway improvements in Louisiana, Louisiana State University, Baton Rouge, La., 1955, pp.135, 137.

17/ Allocation of road and street costs, part I, an equitable solution to the problem, Washington State Council for Highway Research, Seattle, Washington, 1956, p.1.25.

APPENDIX 3

Expenditures on roads and special fiscal levies on road-transport; calculations made in the State of Ohio.

Character of inquiry

Around 1950 extensive studies were made in the State of Ohio on the future need for roads of that State. After due consideration of the various possibilities a twenty-year program was adopted, comprising both construction and maintenance of all highways, roads and municipal streets. This program was to begin around the middle of 1952. Together with the various engineering studies an extensive examination was made of the most desirable ways of financing the program. This examination was based on the general philosophy that - apart from a certain share, to be borne by the community at large (to be specified below) - all expenditures under the program were to be financed from levies on vehicles, using the road system during the period of the program.

Based on this general principle, two methods for the allocation of expenditures to vehicles were used, viz. the "standard" method and the "incremental" method.

The standard method of solving the problem was based on the adoption of the ton-mile as the unit for measuring the use of highways. This method was much simpler than the incremental method, but was only rough and therefore deficient; e.g., it favored heavier weight types of commercial vehicles (which give rise to the more expensive elements of construction). For this reason the calculations based on the incremental method were of greater relevance, although their results became available only in 1953 against data, calculated by means of the standard method, in 1951.

Since the Ohio study on the basis of the incremental method (undertaken by D. F. Pancoast<sup>1/</sup>) is generally considered to be one of the most valuable from the point of view of methods, its main principles will be discussed at some length below<sup>2/</sup>. Inevitably, the exposition is somewhat complicated and technical. Its main purpose is to give a general idea of the numerous factors that have to be considered when an effort is undertaken to allocate road-expenses with a reasonable degree of accuracy.

Explanation of incremental method.

The incremental method is based on the fact that a highway system, designed only for light motor-vehicles (being mainly passenger cars) would involve much smaller construction and maintenance expenditures than a system, carrying only heavier types of vehicles (such as multi-axle-trucks). In applying this method an effort is made to subdivide

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<sup>1/</sup> D. F. Pancoast - Allocation of highway costs in Ohio by the incremental method; Columbus, Ohio, December 1953.

<sup>2/</sup> Readers interested in the subject may also be referred to a recent publication of the U.S. Bureau of Public Roads, which gives a systematic exposition of the various procedures, involved in the incremental method (see Appendix 1, no. 31).

the total expenditures on a highway system in successive increments, each increment being considered as "caused" by a certain class of vehicle.

The following example, given in the Ohio study, may illustrate the method. Suppose the share in expenditures is considered of two two-axle trucks, weighing 6,000 and 13,000 lbs. loaded, and requiring a thickness of concrete pavement of 4 and 7 inches respectively. If the thickness of the pavement of the road, the expenditure on which has to be allocated, actually amounts to 9 inches, the incremental method implies that the first truck should only pay its share of the expenditures for the first 4 inches of pavement and the second truck its share of the expenditures for both the first increment of 4 inches and the second increment of 3 inches. The expenditures on account of the third increment of 2 inches should be borne by vehicles heavier than the two mentioned above. If the vehicle with a gross-weight of 13,000 lbs. has an empty weight of only 5,000 lbs., the incremental method implies moreover that this vehicle, insofar as travelling empty, should only pay a share in the expenditures on the basic 4 inches and insofar as travelling loaded, moreover a share in the expenditures for the second increment.

Determination of the responsibility of several types and sizes of vehicles for expenditures under the program.

I. Amount of expenditures on roads to be levied from road-transport and various relevant breakdowns.

A. Average annual expenditures.

As previously mentioned, the program covered 20 years. The motor-vehicle share of total expenditures was fixed at 82.5% after Federal Aid had been deducted.<sup>2/</sup> The average annual expenditures, to be covered from motor-vehicle levies, were thus fixed at \$207 mln.

B. Breakdowns of average annual expenditures,

The highway system (including all roads and municipal streets) was first divided into four categories, types A, B, C and D, according to designed load capacity. Type A included all highways, etc. capable of sustaining large numbers of repetitions of 19,000 lb. axle-loads, type B of 14,000 lb. axle-loads, type C of 8,000 lb. axle-loads and type D of 4,000 lb. axle-loads.

Total annual expenditures were subdivided among these four types of roads. The sub-totals for every type were moreover subdivided into expenditures on pavement, structures, grading and drainage, right-of-way, maintenance, Highway Patrol and Motor-Vehicle Bureau (the

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<sup>2/</sup> This percentage was derived from a previous study by H. D. Simpson (see Appendix 1, no.15) where on the basis of a number of simplifying assumptions the share in expenditures of non-road-users was estimated to be 18.3%.

results are shown in Table 1 below).

To arrive at these sub-totals and in view of some further refinements, necessary for the imputation to various types of road-transport, each of these categories had to be studied in detail.

Expenditures on pavement, structures, grading and drainage, and maintenance were all found to vary with vehicle size and weight, although not to the same degree. The spread between expenditures on pavements required for vehicles with differing axle-loads proved much greater than that for expenditures on structures (due to the greater impact on expenditures on the weight of structures itself). Allocation of costs of grading and drainage proved difficult, since the relationship with axle-loads was not very close. In the case of maintenance-expenditures, 24% (including such expenditures as traffic marking and snow and ice control) was found to have no relationship to the type or weight of vehicles; consequently only 76% was allocated on the basis of weights.

Expenditures on right-of-ways, Motor-Vehicle Bureau (charged with issuing vehicle and drivers' licenses and similar functions), Highway Patrol and 24% of maintenance did not vary with vehicle size and weight. Those on right-of-ways and maintenance (24%) were found suitable for allocation on the basis of vehicle-miles, whereas the other expenditures were allocated equally among all vehicles.

II. Numbers of vehicles to pay these expenditures and various relevant breakdowns.

In order to enable the allocation of increments of expenditures, the numbers and types of vehicles and the distances they travel on various kinds of pavements had to be studied in considerable detail. For the past, information was available on all of the details mentioned below (although the information was by no means as comprehensive as might have been desirable in several respects); for the purpose of the study, forecasts were made for 1962 (being the "mid-year" of the program). These forecasts, based on projected traffic trends, comprized the following elements:

A. Estimated number of vehicles ("registrations") for each of the following vehicle-classes: (1) passenger cars; (2) farm trucks; (3) commercial trucks; (4) trailers; (5) tractor-trucks; (6) semi-trailers and (7) buses.

B. Breakdown of each vehicle-class by number of vehicles in empty weight groups by increments of 1,000 lbs.

Empty-weight groups were chosen because Ohio licenses motor vehicles (except passenger cars) on the basis of empty weight (consequently passenger cars could be excluded from this subdivision).

C. Estimated average distance travelled by each class of vehicle in each empty-weight group.

D. Estimated total vehicle-miles travelled by each class of vehicle in each empty-weight group.

These data were found by multiplying these sub. C with the relevant number of vehicles.

E. Breakdown of total vehicle-miles travelled on type A, B, C and D highways (for each vehicle-class in each empty-weight group).

F. Breakdown of total axle-miles travelled on type A, B, C and D highways (for each vehicle-class in each empty-weight group).

To obtain this information, vehicles of all classes and empty-weight groups had to be subdivided into axle-numbers with their respective loads. In view of the breakdown of highways in A-, B-, C-, and D-types, the following axle-load groups (in 1,000 lbs.) were chosen: 0-4, 4-8, 8-14, over 14.

### III. Application of incremental method to collected basic data.

On the basis of the data, described briefly sub. I and II, the incremental method of allocation of expenditures could be applied to the various types and sizes of vehicles. This had to be done separately for those elements of expenditures that had been differentiated between vehicle sizes and weights (as outlined sub. I) and those elements of expenditures that had not been differentiated that way.

E.g. an average share in expenditures on pavements of a vehicle of a certain type belonging to one of the empty-weight groups could be derived by a combination of the collected data on the total number of vehicles of the same type belonging to that empty-weight group, the total number of axle-loads of that group of vehicles (subdivided into the four axle-load groups chosen), the total number of axle-miles travelled by these axle-loads on type A, B, C and D highways and the expenditures on pavement to be made on these four types of highways (subdivided for the increments of axle-loads). Calculations for the other size- and weight-determined elements of expenditures took place along similar lines.

Allocations of expenditures which do not vary with vehicle size or weight among vehicles were simpler. These expenditures could be allocated either on the basis of vehicle-miles or of the number of vehicles.

As an illustration of the strong differences in responsibilities for expenditures of groups of vehicles, a part of the main results of the calculations is reproduced in Table 2 below. Similar strong differences as shown between passenger cars, farm trucks and commercial trucks were found for trailers, tractor-trucks, semi-trailers and buses, groups which were omitted from the table for the sake of brevity.

Determination of actual special tax-contributions of several types and sizes of vehicles and of additional contributions required.

After the responsibility of various groups of vehicles for expenditures under the highway-program had been determined, the Ohio study proceeded to investigate the specific tax-contribution of these vehicles resulting from the existing levies on gasoline and diesel fuel. To this end detailed data were required on fuel consumption of the types of vehicles. The results of these calculations are shown in Table 2 as "gas tax credits".

Finally, the differences between "expenditure-responsibilities" and "gas tax credits" showed the amounts of taxes that had to be collected on top of existing levies on motor fuel - either by means of a license fee or a combination of a license fee and a third tax - in order to arrive at a just sharing of burdens on the basis of the incremental method (see again Table 2). It should be remarked that the amounts shown in the last column of Table 2 were still "smoothed" by one of the well-known statistical methods to ease their handling in practice.

Some comments on the study.

The Ohio study has shown that if sufficiently detailed and reliable data on road-transport are collected and these data are used in an intelligent manner, a considerably more equitable and efficient structure of fiscal levies on road-transport can be arrived at than is the case without systematic investigations. On the other hand the importance of the problems that remain basically unsolved in the incremental method and consequently the limitations of the results of the calculations should not be lost sight of.

One of the basic weaknesses of the incremental method is the logically unsolved problem of the distribution of fiscal burdens on road-transport between highway users and the community at large. As was mentioned before, in the case of the Ohio study, 12.5% of highway expenditures was imputed to the general tax-payer (after the amount of Federal Aid had already been deducted). Although the choice of this percentage was based on the results of previous study (see note 2 on page 21 of this appendix), it was arbitrary to a considerable extent.

A second weakness of the study - not inherent to the method, which can also be applied to historical data - is that even on the basis of the best statistical information, projections of road-traffic for a period 10 years ahead and with a degree of breakdown as that actually applied, cannot be more than very broad guesses. Periodical revisions will consequently be essential and are likely to lead to important differences in outcome.

A further point of criticism is that even with the very refined systems, applied in the study, deviations from averages calculated for the sub-classifications are likely to be substantial and, hence, inequities will remain.

Finally, objection should be raised against the continuous intermingling of the words "costs" and "expenditures" in the study. Actually the study deals only with the financing of "expenditures", and no effort to define and measure "costs" is made at all. Accordingly, the word "costs" was avoided in the preceding exposition.

Table 1

Motor-vehicle Share of Annual Program Cost (less Federal Aid)

<u>Highways</u>	<u>Pavement</u>	<u>Structures</u>	<u>Grade &amp; Drain</u>	<u>Right of Way</u>	<u>Maintenance</u>
Type A	\$34,794,121	\$15,285,480	\$25,746,798	\$13,643,161	\$20,848,844
Type B	8,442,010	5,276,008	7,297,569	1,019,847	11,817,381
Type C	9,078,642	6,669,987	7,302,922	426,072	19,913,232
Type D	1,286,501	915,774	1,914,083	111,109	9,886,067
Totals	\$53,601,274	\$28,147,249	\$42,261,372	\$15,200,189	\$62,465,524

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Note: To this must be added \$5,167,000 for the Highway Patrol and Motor-vehicle Bureau.

Table 2

Summary of Program Cost Responsibility of Motor Vehicles

Type of vehicle by empty weight group	Estimate 1962 registration	Motor vehicle share of program cost (in dollars)				Cost not varying with vehicle size or weight
		Costs varying with vehicle size of weight for various highway types				
(1)	(2)	Type A (3)	Type B (4)	Type C (5)	Type D (6)	
Passenger cars	2,848,000	44,205,597	14,089,183	24,280,806	9,167,137	27,596,183
Farm trucks						
1,001-2,000	523	3,489	1,540	3,731	1,678	3,201
2,001-3,000	16,800	133,840	64,527	166,822	84,180	127,164
3,001-4,000	35,400	339,528	179,546	489,393	258,655	334,222
4,001-5,000	12,000	142,102	80,574	227,739	121,685	137,727
5,001-6,000	9,120	156,827	91,913	283,787	116,690	126,065
6,001-7,000	5,920	127,660	75,470	212,450	84,143	94,038
7,001-8,000	4,100	216,772	117,566	350,434	58,829	74,260
Commercial trucks						
1,001-2,000	1,498	18,734	7,205	6,414	2,088	11,335
2,001-3,000	48,075	699,508	296,787	293,570	112,887	433,574
3,001-4,000	101,407	1,837,524	840,598	939,306	364,086	1,085,463
4,001-5,000	32,979	730,306	358,130	427,563	153,710	409,778
5,001-6,000	39,426	1,119,553	566,187	712,086	217,609	571,308
6,001-7,000	34,920	2,508,068	1,282,062	1,771,699	177,085	565,267
7,001-8,000	21,820	2,856,769	1,427,761	1,373,313	64,459	392,638
8,001-9,000	13,915	3,142,886	1,255,552	865,473		276,094
9,001-10,000	6,200	2,359,183	686,555	547,582		138,011
10,001-11,000	3,055	1,708,489	325,297	234,104		75,985
11,001-12,000	2,121	987,983	176,877	111,333		56,370
12,001-14,000	1,337	698,088	85,287			38,609
14,001-16,000	368	509,153				12,319
16,001-20,000	197	333,544				7,861
Over 20,000	34	67,054				1,431

/Continued next page.

Table 2 (Continued)

Summary of Program Cost Responsibility of Motor Vehicles

Type of vehicle by empty weight group	Estimated 1962 regis- tration	Total motor vehicle share of program cost(dollars)	Cost responsi- bility per vehicle (Col. 8 : Col. 2) (dollars)	Gas tax credit (dollars)	To be collec- ted by licensee or other fees (dollars)
(1)	(2)	(8)	(9)	(10)	(11)
Passenger cars	2,848,000	119,338,906	41.90	30.78	11.12
Farm trucks					
1,001-2,000	523	13,639	26.08	15.31	10.77
2,001-3,000	16,800	576,533	34.32	19.04	15.28
3,001-4,000	35,400	1,601,344	45.24	23.83	21.41
4,001-5,000	12,000	709,827	59.15	29.39	29.76
5,001-6,000	9,120	775,282	85.01	38.32	46.69
6,001-7,000	5,920	593,761	100.30	45.89	54.41
7,001-8,000	4,100	817,856	199.48	73.03	126.45
Commercial trucks					
1,001-2,000	1,498	45,776	30.56	28.12	2.44
2,001-3,000	48,075	1,836,426	38.20	33.75	4.45
3,001-4,000	101,407	5,066,977	49.97	41.06	8.91
4,001-5,000	32,979	2,079,487	63.06	49.06	14.00
5,001-6,000	39,426	3,186,743	80.83	59.90	20.93
6,001-7,000	34,920	6,304,181	180.53	103.04	77.49
7,001-8,000	21,820	6,114,940	280.24	135.12	145.12
8,001-9,000	13,915	5,540,005	398.13	177.47	220.66
9,001-10,000	6,200	3,731,331	601.83	260.81	341.02
10,001-11,000	3,055	2,343,875	767.23	297.98	469.25
11,001-12,000	2,121	1,332,563	628.27	280.34	347.93
12,001-14,000	1,337	821,984	614.80	328.39	286.41
14,001-16,000	368	521,472	1,417.04	524.29	892.75
16,001-20,000	197	341,405	1,733.02	628.35	1,104.67
Over 20,000	34	68,485	2,014.26	707.64	1,306.62

APPENDIX 4

Costs of roads and special fiscal levies on road-transport;  
calculations made in The Netherlands.

Character and present status of inquiry.

In 1950 a small committee was set up in The Netherlands, having as general assignment the study of problems related to the co-ordination of the various means of transport in the country. In September 1952 this committee was asked to investigate especially the influence of fiscal policy on the competitive position of road-transport vis-a-vis the railways, viz. by costs incurred by the government on behalf of the road-system on the one hand and special fiscal levies on road-transport on the other hand.

The committee published its first report in December 1955.<sup>1/</sup> In this report a detailed calculation is made of the costs of the road-system of the country, especially of the part attributable to motorized road-transport. These costs were calculated in several stages, viz. by a) making an inventory of the road-system as a whole; b) determining the part of the road-system, related to motorized road-transport; and, c) calculating the costs of this part. The special fiscal levies on road-transport were also examined.

The committee is still working on a second report. In this report both costs and fiscal levies will be broken down and examined in detail for passenger cars, passenger buses, trucks, etc. separately, since the degree of competition of these groups with the railways differs markedly (for passenger cars it is said to be slight).

Despite its incompleteness and the influence on its contents of specific characteristics of the country examined - many dikes, canals, bridges and ferries and the relatively great importance of bicycle-traffic - the first report of the committee provides a valuable contribution to the solution of the problems of method involved in studies of the public costs and levies, related to roads. For this reason some of the main procedures, adopted in the report, are briefly outlined below.

Inventory of the road-system as a whole.

This inventory involved a closer study and definition of the following elements: terrain used for road purposes; body of roads; surface of roads (of various kinds); "supplementary provisions" (i.e. provisions forming an integral part of the road-system, viz. some viaducts and tunnels, culverts, ditches, traffic lights and illumination-equipment in general, plantings) and "joint provisions" (i.e. provisions made for roads and other transport-systems - railways, waterways - together, viz. other viaducts and tunnels, bridges, ferries, railroad crossings).

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<sup>1/</sup> Kosten van de weg (Costs of the road), The Hague, 1955.

Separation of that part of the road-system related to motorized road-transport.

In some cases this could be done easily, viz. by the exclusion of many rural roads with unhardened surfaces, separate cycle-paths and sidewalks. In other cases, viz. those joint provisions, more complicated issues were involved. Some of the most important lines of conduct that were adopted were as follows:

- In the case of city streets the part of the street under 6 meters was considered as a part of the "dwelling-function" and not imputed to road-transport. The part in excess of 6 meters was imputed to the "road-transport function".<sup>2/</sup>
- In the case of roads used by both vehicles and bicycles (a common situation in The Netherlands) a part of the road corresponding to a "standard-cycle path" was imputed to bicycle traffic and the residual part to motor vehicle-traffic.<sup>3/</sup>
- For roads on special dikes (serving mainly for water-checking purposes), terrain and body were excluded from the road-system; the surface of the road was included.
- In case of roads, being at the same time smaller dikes along canals, a road of a similar character without water-checking purposes was accounted for in the road-system.
- In case of very wide ditches or canals along roads, having a special draining function, only a part corresponding to a "standard-ditch" was attributed to the road-system.
- For crossings with railways and many bridges, half of the crossings or bridges were considered to be part of the road-system and the other half part of the railway- and waterway-system respectively (for some important projects, e.g. bridges across main rivers, this system was refined).

Calculation of the costs of that part of the road-system, related to motorized road-transport.

In order to enable cost-calculations, first of all the value of the road-system, related to motorized road-transport had to be determined.

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<sup>2/</sup> This general procedure was still refined as follows. In connection with the calculation of maintenance-costs - to be discussed below - half of the costs of the part of streets, imputed to the "dwelling-function", was attributed to road-transport. Furthermore, 20% of the costs of streets assigned to the "road-transport function" was attributed to non-motorized road-transport, i.e. to bicycle traffic.

<sup>3/</sup> But a part of the costs of the "standard-cycle path" was moreover attributed to motorized road-transport (on the basis of traffic frequencies).

This was done for 1950 on the basis of both replacement costs and historic costs.

Since it was impossible to calculate the value of every road separately, the whole road-system, insofar as relevant, was subdivided into its constituting elements and the value was determined for each of these elements. Terrain used, body of roads and surface of roads were first measured as separate entities on the basis of approximations of the number of units of their respective dimensions; next total values of each category were approached by multiplying these numbers by their respective "unit-values". As far as the calculation of historic costs was concerned, the finding of "unit-values" met with major obstacles. The problem was solved by adopting with respect to roads, constructed before 1940 as "unit-value" the average price of the assets concerned during the period 1930-1940 and for roads that were constructed afterwards, the prices in the years of construction. The position was taken that the road-system existing before its use by motorized-transport should be included in the calculation of values.

For other parts of the road-system, viz. viaducts, tunnels, bridges, ferries, railroad crossings, etc. partly more direct systems of estimation could be applied (sometimes based on samples), whereas in other cases percentage increases of the value of other elements of the road-system were applied. The calculation of costs itself mainly took place along the following lines:

- Depreciation. This was calculated on the basis of replacement value only, adopting the following lifetimes for the various parts of the road-system: terrain and body of roads unlimited (so no depreciation); surface: first-class roads and streets above 6 meter - lifetime 25 years, second-class roads 30 years, third-class roads 40 years, certain rural roads 75 years; bridges and other supplementary and joint provisions 75 years.
- Interest. Two calculations were made: one on the basis of the replacement value of the assets and one on the basis of the historic value of the assets (the reason being that both types of calculation found support in the commission). All calculations were based on an interest-rate of  $3\frac{1}{2}\%$  (being the yield of "gilt-edged" government securities during 1950-1953); the position was taken that a premium for risks ("reward of the entrepreneur") should be excluded from the interest-rate.

Technically, depreciation and interest were calculated together by means of annuities (in order to equalize the amounts of depreciation plus interest for separate years).

- Maintenance. Certain standards were adopted, based on samples, opinions of experts, etc.

- General costs (traffic police, cost of administration, etc.)  
These were based in general on information that was directly available; imputation to motorized and non-motorized road-transport took place on the basis of percentage distributions (20% of costs of traffic police was imputed to non-motorized traffic; for other general costs this percentage was 10).

Apart from a calculation of costs for 1950 (the results of which have been reproduced below as Table A), similar calculations were made for 1951, 1952 and 1953. This was done by the use of volume- and price-indices, reflecting the changes that had occurred since the base-period.

Calculation of special fiscal levies on motorized road-transport.

The following levies were accounted for: (1) motor vehicle-tax, (2) import-duty and excise on gasoline, (3) import-duty on motor vehicles and tires, (4) turnover-tax on amounts of (2) and (3). In all these cases certain adjustments had to be made to the revenue figures for these taxes, viz. to exclude use of gasoline by ships, manufacturing industries, agriculture, etc. and to deduct a "normal" percentage of import-duties (applicable to all kinds of imports and consequently not to be considered as a special levy on motorized road-transport). Most of these corrections turned out to be relatively unimportant; for the excise on gasoline, e.g. the correction amounted to no more than 2%; the deduction for "normal" import-duties on vehicles and tires - which is not stated explicitly in the report-must also have been small in view of the comparatively low "normal" level of import-duties in the country. The result of these calculations for 1950 is reproduced below as Table B.

Conclusions to be drawn from the calculations.

The main results of the calculations of both costs and levies for 1950-1953 have been summarized in Table C. The committee reminds its readers that when making a comparison of the totals of costs and levies, it should be realized that the special levies on road-transport are a part of general fiscal revenue and not existing for road purposes alone. The point is stressed that the totals given should be used primarily as a basis for the more detailed calculations (to be published later), aiming at a comparison of the share in costs of the road-system and in special fiscal levies of special groups of motorized road-transport (such as trucks and passenger buses) which are competing actively with the railways. These more detailed calculations will have to show to what extent fiscal policy with respect to motorized road-transport is on balance an "artificial element" in this competition.

Table A

Costs of the road-system in 1950 (insofar as imputable to motorized road-transport; mln. of guilders)

	<u>Alternative I<sup>1/</sup></u>	<u>Alternative II<sup>2/</sup></u>
1. Main roads	36.5	25.8
2. Secondary roads	29.1	21.5
3. Tertiary roads	20.8	14.7
4. Hardened non-plan roads	23.2	16.1
5. Streets	31.3	27.9
6. Bridges	27.9	16.5
7. Viaducts, etc.	9.8	6.5
8. Railroad-crossings	3.9	2.7
<u>Other costs:</u>		
9. Operating costs railroad-crossings	2.6	2.6
10. Traffic police	8.0	8.0
11. Deficit operating costs ferries	4.5	4.5
12. Administration	9.9	9.9
13. Sundries	4.5	4.5
	<hr/>	<hr/>
Total	<u>212.0</u>	<u>161.2</u>

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1/ Interest based on replacement-value of assets;

2/ Interest based on historical costs of assets.

Table B

Revenue from special levies on motorized road-transport in 1950

(mln. of guilders)

1.	Motor-vehicle tax	46.3
2.	Excise on gasoline	125.2
3.	Ordinary import-duty on gasoline	1.8
4.	Import-duties on motor vehicles and tires <u>1/</u>	13.9
5.	Sales-tax on 2 and 3	5.0
6.	Sales-tax on 4	0.6
	Total revenue	<u>192.8</u>

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1/ After deduction of a "normal" percentage of import-duties.

Table C

Costs of the road-system and revenue from special levies 1950-1953  
(insofar as imputable to motorized road-transport; mln. of guilders)

	<u>1950</u>	<u>1951</u>	<u>1952</u>	<u>1953</u>
<u>Costs of the road-system</u>				
Alternative I <sup>1/</sup>	212.0	237.6	248.8	254.8
Alternative II <sup>2/</sup>	161.2	176.8	183.6	188.4
<u>Revenue from special levies</u>	192.8	225.1	241.2	265.4

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1/ Interest based on replacement-value of assets;

2/ Interest based on historical costs of assets.

APPENDIX 5

Some data on expenditures on roads and fiscal levies on road-transportation. (Source: World Road Statistics, Revised Edition, 1953; published by International Road Federation).

Table I

Expenditures on roads and their composition  
(1950; in millions of U.S. dollars)

Countries	Total Expendi- ture	P e r c e n t a g e s p e n t o n		
		Construction	Improvement	Maintenance
<u>AMERICA</u>				
Canada (C) <u>1/</u>	10	68		32
" (P) <u>1/</u>	227	63	<u>2/</u>	37
" (L) <u>1/</u>	36	34	<u>2/</u>	66
Chile (C)	10	75	15	10
Mexico (C)	47	87	2	11
" (L)	5	100		
U.S.A. (F)	46	100		
" (S)	2,164	76		24
" (L)	1,617	43		57
<u>EUROPE</u>				
Belgium (C)	29	11	60	29
Finland (C)	23	30	26	44
" (L)	1	57	24	19
France (C)	71	30	7	63
" (P)	77	26	18	56
" (L)	34	18	41	41
Great Britain (C) <u>3/</u>	73			
" " (L)	149			
Italy (C)	21			
" (L)	58			
Norway (C)	16	)	47	(
" (L)	9	)	40	(
Sweden (C)	59	20	24	56
Switzerland (P)	34	3	54	43
" (L)	30	23	46	31
Turkey (C)	16	40	25	35
" (L)	5	43	39	18
<u>AFRICA</u>				
S. Rhodesia (C)	5	)	67	(
Tanganyika (C)	4	74	5	21
Union of S. Africa (C)	11	82	)	18
" " (P)	16	40	)	60
" " (L)	<u>54/</u>	23	)	77

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Table 1 Continued

Countries	Total Expendi- ture	Percentage spent on		
		Construction	Improvement	Maintenance
<u>ASIA &amp; MIDDLE EAST</u>				
Ceylon (C)	4	13	25	62
Egypt (C)	9			
" (L)	5			
India (C) <sup>5/</sup>	1	)	100	(
" (S) <sup>5/</sup>	20	)	33	(
" (L) <sup>5/</sup>	7	)	14	(
Pakistan (C)	3	23	6	71
" (S)	16	75	1	24
" (L)	2	21	2	77
Philippines (C) <sup>6/</sup>	12	8	)	92 (
" (L) <sup>6/</sup>	15	21	)	79 (
<u>OCEANIA</u>				
Australia (C)	5			
" (S)	45			
" (L)	28			
New Zealand (C)	19	43	)	57 (
" " (L)	19	27	)	73 (

C = Central government; F = Federal government; S = State governments;  
P = Provincial governments; L = Local governments.

1/ Year 1949.

2/ "Improvement" included with "Construction" or "Maintenance", depending on nature and importance of work.

3/ Government grant to Road Fund.

4/ Covers only part of local governments.

5/ Year 1947.

6/ Year 1948.

Table II

Taxation on fuel and vehicles  
(1950; in millions of U.S. dollars)

Countries	Total Revenue	Percentage derived from			
		Fuel		Vehicles	
		Import duties	Other taxes	Import duties	Other taxes
<u>AMERICA</u>					
Canada (C) <u>1/</u>	23	9		91	
" (P) <u>1/</u>	198		70		30
Chile (C) <u>1/</u>	3	<u>2/</u>	98	<u>2/</u>	2
Mexico (C)	24	<u>1/</u>	45	54	
" (L)	6		94		6
U.S.A. (F)	1,480	<u>2/</u>	34	<u>2/</u>	66
" (S)	2,587		64		36
<u>EUROPE</u>					
Belgium (C)	169	24	29	6	41
Finland (C)	28	47	1	6	46
France (C)	315	<u>3/</u>	87	<u>3/</u>	13
" (L)	23		100		
Great Britain (C)	304 <u>4/</u>		47	1	52
Italy (C)	187	<u>2/</u>	76	<u>2/</u>	24
Norway (C)	26 <u>5/</u>		80	8	12
Sweden (C)	85		68	9	23
Switzerland (C)	64	34	35	18	13
" (P)	15				100
Turkey (C)	20	34	56		10
" (L)	11				100
<u>AFRICA</u>					
S. Rhodesia (C)	3	54		21	25
Tanganyika (C)	0.4	<u>2/</u>		<u>2/</u>	100
Union of S. Africa (C)	20	100			
" " " (P)	16				100

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Table II Continued

Countries	Total Revenue	Percentage derived from			
		Fuel		Vehicles	
		Import duties	Other taxes	Import duties	Other taxes
<u>ASIA &amp; MIDDLE EAST</u>					
Ceylon (C)	10	73		20	7
Egypt (C)	22	6	63	12	19
India (C)	52	57	7	21	15
" (S)	18		33		67
" (L)	1				100
Pakistan (C)	21	69	4	26	1
" (S)	3		3/		100
Philippines (C)	18	2/	4/	2/	26
" (L)	14		25		75
<u>OCEANIA</u>					
Australia (C)	63	68		32	
" (S)	27				100
New Zealand (C)	26		82	9	9
" " (L)	2				100

C = Central government; F = Federal government; S = State governments;  
P = Provincial governments; L = Local governments.

1/ Year 1949

2/ No information available.

3/ Negligible.

4/ Excludes \$70 million purchase tax.

5/ Excludes \$5 million purchase tax.

Table III

Comparison of expenditures on roads and tax-revenue from road-transport  
(1950)

Countries.	<u>Total revenue</u> Total expendi- ture	<u>Total revenue</u> Maintenance expenditure	<u>Fuel taxation</u> Maintenance expenditure	<u>Vehicle taxa- tion</u> Maintenance expenditure
<u>AMERICA</u>				
Canada (C) <sup>1/</sup>	2.3	7.1	.6	6.5
" (P) <sup>1/</sup>	0.9	2.4	1.7	0.7
" (C and P)	0.9	2.5	1.8	0.7
Chile (C)	0.3	3.5	3.5	0.0
Mexico (C)	0.5	4.7	2.1	2.6
" (L)	1.3	-	-	-
" (C and L)	0.6	5.9	3.3	2.6
U.S.A. (F)	32.2	-	-	-
" (S)	1.2	4.8	3.2	1.6
" (F and S)	1.8	7.8	4.2	3.6
<u>EUROPE</u>				
Belgium (C)	5.9	20.4	10.8	9.6
Finland (C)	1.2	2.8	1.4	1.4
France (C)	4.4	7.0	6.1	0.9
" (L)	0.7	1.6	1.6	0.0
" (C, P and L)	1.8	3.3	2.9	0.4
Great Britain (C)	4.1	N.A.	N.A.	N.A.
" " (C and L) <sup>2/</sup>	1.4	N.A.	N.A.	N.A.
Italy (C)	9.0	N.A.	N.A.	N.A.
" (C and L) <sup>2/</sup>	2.4	N.A.	N.A.	N.A.
Norway (C)	1.7	3.2	2.6	0.6
" (C and L) <sup>2/</sup>	1.1	1.9	1.6	0.3
Sweden (C)	1.5	2.6	1.8	0.8
Switzerland (P)	0.5	1.1	0.0	1.1
" (C, P and L) <sup>3/</sup>	1.2	3.4	2.5	0.9
Turkey (C)	1.3	3.8	3.4	0.4
" (L)	2.4	13.3	0.0	13.3
" (C and L)	1.5	4.8	2.8	2.0
<u>AFRICA</u>				
S. Rhodesia (C)	0.7	2.1	1.1	1.0
Tanganyika (C)	0.1	0.4	0.0	0.4
Union of S. Africa (C)	1.8	10.0	10.0	0.0
" " " (P)	1.0	1.7	0.0	1.7
" " " (C, P & L)	1.1	2.4	1.3	1.1

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Table III Continued

Countries	<u>Total revenue</u> <u>Total expenditure</u>	<u>Total revenue</u> <u>Maintenance expenditure</u>	<u>Fuel taxation</u> <u>Maintenance expenditure</u>	<u>Vehicle taxation</u> <u>Maintenance Expenditure</u>
<u>ASIA &amp; MIDDLE EAST</u>				
Ceylon (C)	2.6	4.3	2.9	1.4
Egypt (C)	2.8	N.A.	N.A.	N.A.
" (C and L)	2.0 <sup>2/5</sup>	N.A.	N.A.	N.A.
India (C)	43.0 <sup>5/5</sup>	-	-	-
" (S)	0.9 <sup>5/5</sup>	1.1 <sup>5/5</sup>	0.1 <sup>5/5</sup>	1.0 <sup>5/5</sup>
" (L)	0.1 <sup>5/5</sup>	0.1 <sup>5/5</sup>	0.0	0.1 <sup>5/5</sup>
" (C,S and L)	2.5 <sup>5/5</sup>	3.8 <sup>5/5</sup>	2.2 <sup>5/5</sup>	1.6 <sup>5/5</sup>
Pakistan (C)	8.6	12.1	8.8	3.3
" (S)	0.2	0.6	0.0	0.6
" (C,S and L)	1.2 <sup>2/3</sup>	3.4 <sup>2/3</sup>	2.2 <sup>2/3</sup>	1.2 <sup>2/3</sup>
Philippines (C)	1.6 <sup>6/6</sup>	1.7 <sup>4/6</sup>	1.3 <sup>4/6</sup>	0.4 <sup>4/6</sup>
" (L)	0.9 <sup>6/6</sup>	1.1 <sup>4/6</sup>	0.3 <sup>4/6</sup>	0.8 <sup>4/6</sup>
" (C and L)	1.2 <sup>6/6</sup>	1.1 <sup>4/6</sup>	0.8 <sup>4/6</sup>	0.6 <sup>4/6</sup>
<u>OCEANIA</u>				
Australia (C)	11.7	N.A.	N.A.	N.A.
" (S)	0.6	N.A.	N.A.	N.A.
" (C,S&L)	1.2 <sup>2/3</sup>	N.A.	N.A.	N.A.
New Zealand (C)	1.3	2.3 <sup>4/4</sup>	1.9 <sup>4/4</sup>	0.1 <sup>4/4</sup>
" (L)	0.1	0.2 <sup>4/4</sup>	0.0	0.2 <sup>4/4</sup>
" (C and L)	0.7	1.1 <sup>4/4</sup>	0.9 <sup>4/4</sup>	0.2 <sup>4/4</sup>

C = Central government; F = Federal government; S = State governments;  
P = Provincial governments; L = Local governments.

<sup>1/</sup> Year 1949.

<sup>2/</sup> Figure (s) may be higher, since no information is available on local revenue.

<sup>3/</sup> Figures are incomplete, since no information is available on central government expenditure and local revenue.

<sup>4/</sup> Figures may be higher, since maintenance includes improvement.

<sup>5/</sup> Figures will in fact be lower, since revenue relates to 1950 and expenditure to 1947.

<sup>6/</sup> Figures will in fact be lower, since revenue relates to 1950 and expenditure to 1948.