

Chairman Brosseau The next report is that of the Committee on Highway Finance

REPORT OF COMMITTEE ON HIGHWAY FINANCE

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For the report of the Committee on Highway Finance there will be substituted at this time the report of the Special Investigation of Urban Aspects of the Highway Finance Problem, conducted under the auspices of the Highway Research Board by Professor Viner, of the University of Chicago, who is also a member of this Committee

REPORT OF INVESTIGATION OF URBAN ASPECTS OF THE HIGHWAY FINANCE PROBLEM

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THE PURPOSE AND SCOPE OF THE STUDY

This study has for its purpose an examination of those problems connected with the financing of highways which affect most closely and peculiarly the governments and residents of urban communities In 1924 a committee of the National Tax Association, of which the chairman of this Committee and the writer were members, presented a comprehensive report on the problems of financing of rural highways, but in accordance with its instructions, it excluded consideration of the specially urban aspects of the problem from its study The present study deals with three sets of problems

- 1 The special interests of cities and of urban motor vehicle owners in the highway finance policies and practices of state and county governments,
- 2 The methods and problems of urban highway finance,
- 3 The financial aspects of the traffic congestion problem

This study is, therefore, in a sense, a supplement to the study made by the Highway Finance Committee of the National Tax Association, and deals only with problems not considered by the latter study

URBAN CONTRIBUTIONS TO RURAL HIGHWAY REVENUES

To secure information with respect to the prevailing systems of state highway finance as they bear specially on the interests of urban communities, a questionnaire was sent to the appropriate officials in all the states, and supplementary information was obtained by personal corre-

spondence, by an examination of official reports of various state highway and tax commissions, and from other miscellaneous sources.

The tremendous growth in recent years of motor transportation has made necessary a great increase in expenditures for rural highways. Such expenditures for the United States as a whole now approximate \$1,000,000,000 annually and appear to be stabilized for the time being at this level. To a large and growing extent the funds for these expenditures are obtained by the special taxation of motor vehicles, in the form of Federal excise taxes on motor vehicles and parts, passed on in part in the form of Federal aid to the States for highway purposes, and of State motor vehicle license and fuel taxes. In 1924 the special taxation of motor vehicles produced revenues equal to about 45 per cent of the total expenditures of the country as a whole for the construction and maintenance of rural highways, exclusive of interest on highway indebtedness,¹ and the percentage has been steadily rising each year. It will in all probability reach 50 per cent in 1925.

The Federal excise taxes and the State motor vehicle license and fuel taxes within each State apply equally to automobiles of the same class regardless of whether they are owned and used in cities or in rural areas. The other sources of rural highway revenues are predominantly State and county ad valorem taxes on general property and bond issues, and the bond issues will in the main be redeemed with funds derived from property taxation or from special taxes on motor vehicles. State and county levies on general property are, with only two exceptions of importance,² applied to urban and rural population at uniform rates within each taxing district, and in these two instances the rates are higher on urban than on rural property.³ It follows that urban dwellers and urban vehicle owners make the same contribution per unit of property and per vehicle of the same class to the cost of financing rural highways as do rural dwellers. It is possible from available data to estimate roughly the relative amounts contributed to the costs of rural highways in the form of motor vehicle taxes by rural and urban vehicle owners.

The Federal Census for 1920 shows that on January 1, 1920, there were 2,285,531 automobiles and trucks on farms.⁴ The total registra-

¹ National Automobile Chamber of Commerce, *Facts and Figures of the Automobile Industry*, 1925 edition, p. 49.

² Minnesota and North Dakota.

³ There are often substantial differences, however, between the ratios of assessed to true values for urban and rural property, respectively, with the result that the effective rates are different though the nominal rates are equal. Whether for the country at large such differentiation in assessment ratios operates in favor of or against urban property it is impossible to decide from the scanty evidence available.

⁴ 15th Census of the United States, Vol. V, p. 514.

tion of motor vehicles for the country as a whole in the course of 1919 was 7,565,446, and in the course of 1918 was 6,146,617⁵

Assume that one-seventh of the vehicles registered in 1918, or 878,088, were scrapped during 1919. This would make the number of vehicles in existence on January 1, 1920, 6,687,358, or the registrations during 1919 minus the number scrapped during 1919. On this basis, the proportion of urban to total vehicles on January 1, 1920, was approximately 66 per cent. Some allowance should be made, however, for automobiles owned by rural dwellers who are not farmers and by residents in villages and small towns properly to be included as part of the rural area. It is estimated that this would reduce the percentage of urban-owned to total vehicles to 60 per cent, and it would be inferable that urban vehicle owners contributed in about the same proportion to the motor vehicle tax revenues.

To obtain an exact figure further corrections would have to be made. The average motor vehicle tax paid per vehicle is much greater for trucks than for passenger cars,⁶ and on January 1, 1920, only 6.0 per cent of the motor vehicles on farms were trucks⁷ as compared to 11.7 per cent of the registrations in 1919 in the United States as a whole.⁸ Variations in tax rates combined with variations in percentages of urban to total vehicles as between different States, possible variations in the average payments of gasoline taxes between rural and urban vehicles owing to different annual mileage per vehicle of these two classes of vehicles, and possible variations in the average license fees paid by rural and urban passenger cars because of differences in the type of vehicle commonly owned by rural and urban dwellers, respectively, are further factors affecting the estimate here made of the proportion of the motor vehicle tax revenues paid by urban-owned vehicles. These factors, however, probably tend, in the aggregate, to increase rather than decrease the proportion contributed by urban vehicle owners. If there has been no substantial change since 1920 in the proportions of rural to urban vehicles, the estimate of 60 per cent as the proportion of motor vehicle tax revenues contributed by urban vehicle owners is a conservative minimum estimate. On this basis of calculation urban motor vehicle owners contributed approximately \$260,000,000 in motor vehicle taxes to the financing of rural highways in 1924.

⁵ National Automobile Chamber of Commerce, Facts and Figures of the Automobile Industry, 1925 edition, p. 5.

⁶ A comparison for 1924 for 28 states made by Dr. Henry R. Trumbower showed an average license fee of \$10.70 per passenger car as compared to \$21.90 per truck (Proceedings of the Fourth Annual Meeting of the Highway Research Board, 1925, p. 86). As trucks ordinarily consume more gasoline per mile than do passenger cars, the contribution to gasoline taxes is also probably greater per car for trucks than for passenger cars.

⁷ 15th Census of the United States, Vol. V, p. 514.

⁸ Facts and Figures of the Automobile Industry, 1925 edition, p. 4.

URBAN USE OF RURAL HIGHWAYS

It is protested in many quarters, and especially by municipal officials, that this is an inequitable situation, and that urban dwellers should not be required to pay the bulk of the costs of rural highways, especially since rural dwellers make little or no direct contribution to the costs of urban streets. The volume of protest is steadily growing, and as will be shown later, it has already resulted in some States in a measure of reorganization of the highway finance relations of State and city, and county and city governments. Defense of the maintenance of the existing relationship is most conspicuous on the part of the motor interests. They oppose any diversion of highway revenues from the State or county treasuries to the municipalities on the grounds that (1) It would tend to retard the State and county programs of highway construction and maintenance, (2) the highway improvement program of cities is less elastic and flexible than the rural highway program, and the cities will procure funds by some means or other to carry out at least the major elements of their programs, and (3) the transfer of highway revenues from the State and county treasuries to the municipalities will not relieve the urban motor vehicle owners as such of any special tax burdens which they already bear, since urban streets are now financed only to a negligible degree by special municipal taxation of motor vehicles. These arguments, and especially the first two, have a considerable measure of validity, but they appeal to reasons of expediency and not to the fundamental equities in the situation.

To the protest that it is inequitable that urban property owners and urban motor vehicle owners should be forced to contribute to the cost of rural highways at the same rates per unit of property or per vehicle as rural property or vehicles, while, on the other hand, rural property and rurally owned motor vehicles are not required to make any direct contribution to the costs of city streets, a more cogent reply could be made if it could be demonstrated that traffic on rural highways consists predominantly of urban vehicles, whereas but a slight percentage of the traffic on city streets consists of rural vehicles. Statistical data on these points appear to be sadly lacking. Of the many city traffic surveys which were examined, there was not one which attempted an estimate of the percentage of motor traffic on city streets which consisted of foreign vehicles. Municipal highway officials who were consulted confirmed, however, the common impression that the great bulk of traffic on the streets of the large cities consists of local vehicles, and that the percentage of rural vehicles on the streets of great cities is at any one moment negligible.

For the percentage of urban vehicles on rural highways the lack of statistical data is almost as complete. A test count made in 1922 on

the rural highways of Davidson County, Tennessee, in which county Nashville is situated, showed that 70.4 per cent of the vehicles were city-owned as compared to 29.6 per cent owned in the country. An inquiry made under the same auspices indicated that the annual mileage per vehicle on rural highways was for urban-owned vehicles 40 per cent that of rural-owned vehicles.⁹

The percentage of urban vehicles to total vehicles on the rural highways should be higher in the immediate neighborhood of cities than on portions of the rural highway system distant from any city. On the other hand, the annual mileage of urban vehicles on rural highways should be greater for vehicles owned in the smaller cities than for vehicles owned in the great cities where the mileage of street pavements is greater and access to the rural highways is ordinarily more difficult.

The Davidson County, Tennessee, data cannot be applied, therefore, to the metropolitan problem without important qualification, but they do indicate that a substantial fraction of the traffic on rural highways consists of urban-owned vehicles.¹⁰ Confirmation is supplied by the results of an earlier test made on the rural highways of Iowa, which has no large cities. On these rural highways test counts indicated that intra-county traffic from town to town plus circle traffic from town into country and back to town was 30.4 per cent of the total traffic. To obtain the total percentage of the traffic which consisted of urban cars it would be necessary to add (1) urban vehicles going from town to farm, urban vehicles going from farm to town, and (2) urban vehicles on longer trips crossing county and State boundaries, for which data were not separately gathered.¹¹ Search for further data on this point was unproductive of results.

If the principle be accepted, that the costs of financing rural highways should be borne by the users thereof and should be apportioned among the different classes of users in proportion to their use thereof, urban and rural motor vehicles should contribute to the costs of rural highways in the proportions of their respective average annual mileages on such highways. It would probably be impossible in practice to secure comprehensive and unbiased mileage data of this character if it were to be used as a basis for the apportionment of motor vehicle taxes, but the same purpose could be adequately served if at periodic intervals traffic

⁹ University of Tennessee Engineering Experiment Station, "Highway Economics and Highway Transport in Typical Counties of Tennessee," 1922, p. 19.

¹⁰ The study of traffic on the highways of Cook County, Ill., recently made by the U. S. Bureau of Public Roads and the Cook County Highway Department shows that the great bulk of traffic on the county highways is produced by Chicago and towns located within five miles of the city limits. The report of this study has been published by the Cook County Highway Department—Editors.

¹¹ T. R. Agg, "Traffic on Iowa Highways," Bulletin 56, Iowa State College of Agriculture and Mechanic Arts, Engineering Experiment Station, Jan. 21, 1920.

counts were made on rural highways to ascertain the relative proportions of urban and rural traffic and the costs of rural highways were met from motor vehicle taxation apportioned to urban and rural areas accordingly¹ If it were disclosed by such traffic counts that the relative use of rural highways by rural and urban vehicles was substantially different from their relative contributions to motor vehicle tax revenues, adjustment should not be made by differentiating in the rates of State taxation as between urban and rural vehicles, since such differentiation would open the path to serious political dangers and in any case would probably be held unconstitutional in most of the States

A more desirable procedure would be, in case it were found that the contributions of urban vehicle owners were more than proportionate to their use of rural highways, to refund to the city treasuries from the motor vehicle tax revenues sufficient to equalize the ratios of contribution to the ratios of use On the other hand, if it should be disclosed that urban vehicles are contributing less than in proportion to their use of the rural highways, which in the light of the scanty evidence available scarcely seems likely, adjustment could be made by contributing more generously out of the State revenues to the cost of rural local or secondary highways used mainly for local rural traffic In all cases account should be taken of the relative contributions of urban and rural areas to the State and county highway funds by means of property and other taxes as well as by means of motor vehicle license and gasoline taxes As a rule, road district taxes and special assessments are in rural areas now used only in the financing of local roads which serve primarily local needs and are not used to any appreciable extent by urban vehicles. But where primary highways are financed by these methods, credit should be given to the rural areas for their contributions in this form.

¹ Though contrary opinions have been expressed, a count of the relative numbers of vehicles of different types which pass the counting stations during the test period will, if the stations are sufficiently numerous and are satisfactorily distributed, account for relative mileage of the different types of vehicles on the highways in question The greater the mileage during the test period of any vehicle, the greater the likelihood that it will pass a given counting station If the information needed, as in this case, is relative mileage, counting the relative numbers of the vehicles passing the counting stations will provide it If what is wanted is the relative numbers of vehicles of different types on the highways at a given moment, the proper test is an actual count of the numbers of each type to be found on selected stretches of highway at that moment In each case, of course, the results obtained are merely an index of the situation whose accuracy is dependent on the accuracy of the count, the sufficiency in number and in location of the counting stations, the degree to which conditions at the test period are representative of conditions at other times, and other such factors

STATE AND COUNTY GRANTS TO CITIES FOR HIGHWAY PURPOSES

In a number of States grants are made by the State out of its highway funds to the cities for use in financing city streets. The treatment in this respect of large cities is often different from that accorded to small towns, and we will deal first with the cases in which cities over 30,000 in population receive State aid for street purposes from the State, either immediately or intermediately through the counties, and either in the form of appropriated grants or by permitting the cities to share in the motor vehicle tax revenues. Most of these instances are of very recent origin and are the result of pressure from the cities for a share in the motor vehicle tax revenues, but some of them are of long standing. While the list which follows may not be quite complete, it is believed to include all of the more important instances.

- Alabama 20 per cent of the net receipts from State motor vehicle licenses collected within municipal limits is returned to the municipality where collected.
- California 50 per cent of the receipts from State motor vehicle and gasoline taxes is returned to the counties. The city of San Francisco, which is also the county of San Francisco, and apparently also the city of Los Angeles through the county of Los Angeles, share in the State motor vehicle revenues through the apportionment to the counties.
- Colorado 50 per cent of the motor vehicle license fees and the gasoline tax receipts collected within each county is returned to the county. Denver City and Denver County are coterminous, and Denver City therefore receives 50 per cent of the State motor vehicle tax revenues collected within its limits.
- Maryland The city of Baltimore, which is a separate unit in the organization of the State, receives from the State 20 per cent of the State motor vehicle revenues.
- New York New York City, as a unit in the county organization of the State, receives 25 per cent of the State motor vehicle registration fees collected within its limits.
- Ohio Cities receive 50 per cent of the State motor vehicle license fees collected within their limits and 30 per cent of the gasoline tax receipts.
- Oklahoma 90 per cent of the State motor license fee receipts is returned to the county where collected, and 25 per cent of the county's share is returned to the cities and towns within the county.
- Pennsylvania Philadelphia, which is coterminous with Philadelphia County, received in 1925 a grant of \$250,000 from the State motor license fee receipts.

Wisconsin The State makes grants to cities out of its highway fund as follows (a) City streets connecting portions of the State highway system, \$300 to \$500 per mile, depending upon the classification of the streets, (b) other city streets, cities with population over 10,000, \$100 to \$200 per mile of street, the amount per mile increasing with the population

In a few instances State aid is given to large cities for highway purposes in other ways than by grants or by refunds of a fraction of the motor vehicle tax receipts In Alabama, Iowa, and Kansas, the State shares in the cost of construction of highways within city limits which connect the street system with the State highway system In Washington the State pays the cost of maintenance of State highways within city limits In other States, as for instance, California for one State route passing through Los Angeles, and Louisiana for two State routes passing through New Orleans, the State in exceptional cases contributes to the cost of specified State routes passing through, or on the outskirts of large cities As a general rule, subject only to occasional exceptions under special circumstances, all other States require the larger cities and towns to finance from their own municipal funds the pavements which are connecting links in the State highway systems

In general, also, the counties make no contribution out of county tax revenues to the financing of the streets of large cities, though the situation is complicated in a number of instances by the merging of the county with the municipal governmental organization Three exceptions to this general rule have been found, however In Arkansas and Florida the counties turn over to the cities within their limits for street use part of the proceeds of the county road taxes In the State of Washington, 50 per cent of the cost of arterial streets in excess of assessments against neighboring property is borne by the counties or the districts with which such streets connect Nebraska presents an exceptional instance of the reverse character Not only do the State and the counties make no contribution to the financing of the streets of the larger towns, but the cities of Omaha and Lincoln are required to contribute out of city funds 50 per cent of the cost of construction of outlet highways outside their limits but adjacent thereto

These various grants from State and county funds in aid of urban highway finance follow no uniform rule, and there is no evidence which indicates that the basis of apportionment of the State and county funds between urban and rural purposes has in any instance been determined by consideration of the respective ratios of urban and rural use of the highways and urban and rural contributions through taxation to their support In a number of the instances cited, cities share in the State motor vehicle tax revenues only because of the accidental fact that the municipal and county organizations have been merged or are coter-

minous These grants are not very important even in the aggregate, an examination of the detailed evidence indicating that they did not exceed \$20,000,000 in 1923 for all cities in the United States having a population of 30,000 or over

Small towns, and especially those under 2,500 in population, receive more generous treatment It is the general rule or the frequent practice in a majority of the States for the State itself to construct or to provide funds for the construction of standard sections of State highways passing through towns not exceeding a specified population, in some cases maintenance also is provided by the State This is a desirable practice, if for no other reason than to provide a safeguard against serious impairment of the efficiency of State highway systems through the persistence of unpaved or unsatisfactorily maintained sections within the limits of small towns In a few States, especially in New England, small towns receive aid from the State in financing their general street program whereas larger cities receive no such aid This may perhaps be justified on the ground that for very small towns the town limits are not to any appreciable extent traffic boundaries and common financing with the surrounding rural highways is logical In States in which the county is an important political unit, it would be more desirable that any aid given to small towns for their general street program should be given by the county rather than by the State Such streets, like local rural roads, render little service to the dwellers in large cities, and they should not be made, through their contributions to the State tax revenues, to contribute to their support.

URBAN HIGHWAY EXPENDITURES

The most formidable difficulty which research in the problems of highway finance encounters is the lack of adequate statistical data, and this lack is even greater for urban than for rural highway finance Such data as are available are rarely sufficiently detailed or suitably classified to serve effectively the purposes of research in the problems of urban highway finance, and it is, for instance, impossible to determine with any close degree of accuracy the amounts of urban highway expenditures and the sources of urban highway revenues for the larger American cities

Table I presents the statistics of highway expenditures in 1923 of all American cities over 30,000 in population, as compiled by the Federal Census Bureau To obtain all-inclusive figures, it would be necessary to add to the total of \$324,607,000 shown in the table a substantial item for interest on highway indebtedness, another substantial item for the portion of police department expenditures incurred in connection with traffic regulation, and a minor item for the costs of pavement construction and maintenance, snow removal, and street sprinkling in-

curred by electric railways in carrying out their franchise obligations. There are no data upon which to base even rough estimates of the amounts involved in these additional items, but it seems to the writer a reasonable guess that if these were added the total highway expenditures would not fall short of \$400,000,000 per annum. If there be added the expenditures of the thousands of incorporated places under 30,000 in population, the total figure might well reach \$450,000,000, or about 45 per cent of the total expenditures on rural highways.

TABLE I
HIGHWAY EXPENDITURES OF AMERICAN CITIES OVER 30,000 IN POPULATION, 1923¹

| Purpose | Expenditures | Total | |
|--|---------------|---------------|---------------|
| Outlays | | | |
| Streets, roads, and alleys | \$177,010,000 | \$204,643,000 | |
| Other highway structures | 23,722,000 | | |
| All other | 3,911,000 | | |
| Expenses | | | |
| Supervising departments | 2,388,000 | 119,964,000 | |
| Roadways | 52,069,000 | | |
| Other highway structures | 11,603,000 | | |
| Prevention of street dust | 3,189,000 | | |
| Snow and ice removal | 8,277,000 | | |
| Street lighting | 34,967,000 | | |
| Waterways | 902,000 | | |
| Repair and construction for compensation | 6,569,000 | | |
| | | | 119,964,000 |
| | | | \$324,607,000 |

¹ U S Bureau of the Census, Financial Statistics of Cities, 1923

Table II presents data illustrating the trend of per capita highway expenditures for 146 cities for which continuous comparable data were procurable. If these cities can be taken as representative of the general urban situation, per capita urban expenditures for highways have increased only moderately in the last 20 years, and if allowance is made for the decline in the purchasing power of the dollar they have *decreased*. Such increase as is shown in the table has been confined to the post-war period and much of it could reasonably be explained as due to high prices and to an attempt to make up for the enforced curtailment even of urgent expenditures during the period of the war, without reference to other causes. The cities have been increasing their expenditures on other services much more rapidly than on highways. This is in sharp contrast to the situation with respect to rural highways, for there has

been since the advent of the automobile a very marked increase, both absolute and in relation to State and county expenditures on other activities, in the per capita expenditures on rural highways. A rough estimate shows, for example, that the per capita expenditures of the American people on rural highways were about \$2.00 in 1910, \$5.00 in 1920, and \$8.50 in 1923. This contrast would appear to indicate that the development of motor transportation has exercised a much less marked influence on urban than on rural highway expenditures.

TABLE II
PER CAPITA EXPENDITURES FOR HIGHWAY PURPOSES OF 146
AMERICAN CITIES, 1903 TO 1923¹

| Year | Outlays | Expenses | Total | Percentage of total expenditures for all purposes |
|------|---------|----------|--------|---|
| 1903 | \$3.62 | \$1.64 | \$5.26 | 27.7 |
| 1905 | 2.87 | 1.67 | 4.54 | 22.4 |
| 1907 | 3.26 | 1.91 | 5.17 | 22.5 |
| 1909 | 3.29 | 1.71 | 5.00 | 21.4 |
| 1911 | 3.79 | 2.04 | 5.83 | 22.9 |
| 1913 | 3.39 | 1.93 | 5.32 | 21.4 |
| 1915 | 3.76 | 2.06 | 5.82 | 21.7 |
| 1917 | 3.25 | 1.96 | 5.21 | 20.1 |
| 1919 | 2.41 | 2.04 | 4.45 | 16.3 |
| 1922 | 4.85 | 2.87 | 7.72 | 16.8 |
| 1923 | 5.22 | 3.01 | 8.23 | 17.3 |

¹ Computed from data in U. S. Bureau of the Census, Financial Statistics of Cities, 1923.

The cities have been growing rapidly in population, and therefore in density of population per square mile. On the supposition that an explanation of the moderate increase in recent years in the per capita highway expenditures of cities might be found in the increasing density of urban population, Table III was constructed to test the hypothesis. If the increase in density of population, other things remaining the same, tends to reduce the per capita highway costs, the per capita expenditures for highway expenditures should vary, as between cities of different population, inversely to population. Table III, however, indicates that there is no significant difference in the highway expenditures per capita between cities grouped according to size of population, and fails, therefore, to confirm the hypothesis. An examination of the detailed data for individual cities likewise fails to reveal any tendency of per capita highway expenditures to vary inversely to the size of the city.

TABLE III
PER CAPITA HIGHWAY EXPENDITURES OF CITIES CLASSIFIED
ACCORDING TO POPULATION 1923¹

| Population | Outlays | Expenses | Total |
|--------------------|---------|----------|--------|
| 500,000 and over | \$4 77 | \$3 37 | \$8 14 |
| 300,000 to 500,000 | 6 31 | 3 32 | 9 63 |
| 100,000 to 300,000 | 5 19 | 2 80 | 7 99 |
| 50,000 to 100,000 | 5 70 | 2 50 | 8 20 |
| 30,000 to 50,000 | 5 51 | 2 80 | 8 31 |

¹ Computed from data in U. S. Bureau of the Census, Financial Statistics of Cities, 1923

The failure of the urban statistics to disclose any such marked influence on urban highway expenditures of the growth of motor transportation as is apparent in the statistics of rural highway expenditures is perhaps to be explained by the following factors, which are presented as tentative hypotheses and not as observed facts

1 The development of motor transportation has increased traffic on rural highways relatively more than on city streets and has therefore made necessary relatively greater increases in expenditures on rural than on urban highways

2 The city street systems, at least in so far as width, mileage and sub-structures were concerned, and possibly also with respect to type of surface, were better prepared to meet the demands of motor transportation than were the rural highways prior to the modern era of highway improvement

3 On city streets the adjustment to the increased volume of traffic has been made in large degree by permitting congestion to develop and by restrictive legislation, whereas on rural highways, extension of facilities was more flexible, because it was not seriously hampered by high cost of the additional land necessary for such extension nor by the location thereon of expensive buildings, and adjustment has consequently been effected in greater degree by providing increased facilities for traffic

SOURCES OF MUNICIPAL HIGHWAY REVENUES

American municipal expenditures for highway purposes are in the main financed out of the general revenues of the cities, and even where special funds exist for highway purposes the published statistical returns often fail to segregate them. It is possible, therefore, to ascertain even approximately for the cities as a whole the specific sources from which their highway revenues are derived, and the amounts and proportions

from each source. There is available, however, some material which if analyzed indicates in a general way the sources of municipal highway revenues.

Special motor vehicle taxes —There are no compilations of the amounts of revenue derived by American municipalities from either special municipal motor vehicle taxes or from grants or refunds from State motor vehicle taxes. The Census Report on Financial Statistics of Cities for 1923 shows, however, that the receipts in that year of all American cities over 30,000 in population from "general licenses" amounted to \$12,417,001, and a comparison of the detailed figures given under this head with evidence from State and city financial returns indicates that revenues from motor vehicle license taxes comprise at least 90 per cent of this amount, and that the figure given includes the share of cities in the receipts from State motor vehicle license taxes as well as the revenues from the few municipal motor vehicle taxes, which are independent of, or additional to, the State taxes.

An analysis of the detailed data from this and other sources leads to the estimates that in 1923 American cities over 30,000 in population shared in the receipts from State motor vehicle license taxes to a total amount of not less than \$7,000,000 and not more than \$8,000,000, and that these cities received from separate municipal motor vehicle taxes not less than \$4,000,000 and not more than \$4,500,000. Only eight cities over 100,000 in population imposed municipal motor vehicle license taxes, namely, Chicago, St. Louis, Kansas City, Louisville, Omaha, Richmond, and Memphis, and these eight cities collected approximately \$4,000,000, of which approximately three-fourths was collected by Chicago alone. To these amounts should be added shares of the cities in State gasoline taxes and also receipts from special municipal taxes on bus and truck lines and on motor vehicles for hire, for which no data are available. It is assumed that \$5,000,000 is a generous estimate to cover these additional items for the year 1923.

Receipts from highway privileges —The Census Bureau reports for 1923 receipts from highway privileges for all cities over 30,000 in population totalling \$26,700,000. These cover payments from steam and electric railroads (also from bus and taxi companies for the privilege of using the streets), and receipts from public utilities for the privilege of placing wires, pipes, poles, and other equipment on or under the streets, charges for the privilege of maintaining vaults under sidewalks, etc.

Receipts from earnings of highway departments —The Census Bureau reports for 1923 receipts from earnings of highway departments of all cities over 30,000 in population a total of \$7,955,684, of which \$7,211,235 covered receipts in compensation for repair and construction, not explained but probably referring to pavement repairs and construction required or made necessary by and compensated by electric railways and by public utilities locating their equipment in the sub-surface.

Receipts from subventions and grants by other civil divisions—The Census Bureau does not separate receipts of cities from subventions and grants by other civil divisions for highway purposes from receipts for other purposes, but the total receipts in 1923 of all American cities over 30,000 in population from State and county subventions and grants for other purposes than education amounted to \$10,294,276. It is probable that the great part of these grants was for highway purposes, and it will be estimated that highway grants amounted to \$10,000,000.

Receipts from special assessments and special charges for outlays—The Census Bureau does not separately classify the purposes for which special assessments are levied. In 1923 the total receipts of all cities over 30,000 in population from special assessments were \$122,273,060, of which \$117,966,561 were for capital outlays and \$4,306,505 for current expenses. Some of these receipts were from assessments for sewers, parks, and other non-highway purposes, but the predominant use of special assessments by American cities is to provide funds for highway purposes, and it is a conservative estimate that of these receipts \$100,000,000 were for such purposes.

TABLE IV
ESTIMATES OF HIGHWAY REVENUES OF AMERICAN CITIES OVER 300,000 IN POPULATION BY SOURCES COMPARED WITH HIGHWAY EXPENDITURES, 1923

| Items | Revenues | Percentage of total expenditures |
|---|--------------------------|----------------------------------|
| HIGHWAY EXPENDITURES | | |
| Outlays | \$204,643,000 | |
| Expenses | 119,964,000 | |
| Total | 324,607,000 | |
| HIGHWAY REVENUES | | |
| Apportionment of receipts of State motor vehicle license taxes | ¹ 7,500,000 | ¹ 2 3 |
| Municipal motor vehicle taxes | ¹ 4,250,000 | ¹ 1 3 |
| Apportionment of receipts of State gasoline taxes, and municipal taxes on bus and truck lines and vehicles for hire | ¹ 5,000,000 | ¹ 1 5 |
| Receipts from highway privileges | 26,700,000 | 8 2 |
| Receipts from earnings of highway departments | 7,955,000 | 2 5 |
| Receipts from State and county grants | ¹ 10,000,000 | ¹ 3 1 |
| Receipts from special assessments and special charges for outlays | ¹ 100,000,000 | ¹ 30 8 |
| Other sources | ¹ 163,202,000 | ¹ 50 3 |
| Total | 324,607,000 | 100 0 |

¹ Estimated

In Table IV the estimates of highway revenues by sources are tabulated and compared with the total highway expenditures of cities. It should be remembered that the statistics of highway expenditures do not include the interest payments on highway indebtedness, the expenditures of police departments on traffic regulation, nor the costs to electric railways of the paving and other highway services which they are required to contribute. On the other hand, the total figures for highway revenues do not include the value of the highway services rendered by electric railways. The amount attributed to "other sources" must come in the main from property taxes or from receipts from bond issues, and the bond issues will in the main eventually be liquidated from the receipts of property taxation. In 1923 over 92 per cent of the tax receipts of American cities over 30,000 in population was derived from property taxes. If this percentage be applied to the figure in Table IV for "other sources" and if it be assumed that all State and county grants to cities for highway purposes are derived ultimately from motor vehicle taxation, the estimate is reached that the highway expenditures for 1923 of American cities over 30,000 in population were, or would eventually be, financed 45.3 per cent from taxes on property, 30.8 per cent from special assessments on property, 10.7 per cent from highway earnings, 8.2 per cent from motor vehicle tax revenues, and 5.0 per cent from other sources. If the estimate that the inclusion of omitted items would raise the total to \$450,000,000 be accepted, the percentages would be about as follows: Property taxes, 59.0 per cent, special assessments, 22.2 per cent, motor vehicle taxes, 5.9 per cent, highway earnings, 7.7 per cent, other sources, 5.2 per cent.

MOTOR TRAFFIC AND URBAN HIGHWAY FINANCE

This situation contrasts sharply with the method of financing rural highways, especially because of the small percentage of urban highway revenue which comes from motor-vehicle taxation as compared to the 50 per cent or so of the rural highway revenues which are derived, either in actual fact or in equivalence, from Federal and State taxes on motor vehicles and gasoline. Are there any valid reasons why motor vehicles should contribute in so much smaller proportion to the cost of city streets than to the cost of rural highways?

In the first case, the use of rural highways for other purposes than motor transportation is now negligible, whereas city streets are used to an important extent by pedestrian traffic, electric railways, and in some cities horse-drawn vehicles. If the principle of charging the costs of highways to users were rigidly followed, all of the sidewalk costs and a substantial cost of the crossings at intersections should be charged to pedestrian traffic. The city itself should also bear a part of the costs proportionate to the use of city streets by municipal fire, garbage-

disposal, police and other service vehicles. The electric railways and horse-drawn traffic should also contribute.

Secondly, rural highways serve no other purpose than transportation whereas city streets serve a variety of other purposes. They are the means of access of light and air to the adjoining buildings. They serve as fire barriers between city blocks. Their surface and underground areas are used as the locations for the equipment of most public utilities, telegraph and telephone poles and wires, water, sewage, and drainage mains, gas mains and electric wires, etc. Where they are parked or boulevarded, or where trees and lawns are maintained within the street area the streets serve as elements in the beautification of the city and as recreation areas for the city population.

Third, most of the highway services, such as street lighting, abatement of dust, removal of snow, street cleaning, are not made necessary solely by the existence of vehicle traffic, and serve, not only such traffic but also pedestrian traffic and the occupants of adjoining buildings. Rural highway services to other than vehicular traffic are negligible, and under some circumstances rural highways are a detriment rather than an advantage to immediately adjoining property.

It has already been shown that the per capita highway expenditures of the cities have not increased greatly since the advent of the automobile, and that if allowance be made for the decline in the purchasing power of the dollar they have actually decreased. It is undoubtedly true, however, that the per capita expenditures, such as they are, are greater than they would be if there had not been so tremendous a development of motor transportation. The principle supported by the Highway Finance Committee of the National Tax Association that the costs of rural highways should be borne by the users thereof is applicable to urban highways in the same way and for the same reasons *to the extent that the fundamental conditions are similar*. The costs of providing urban facilities for motor transportation, to the extent that these facilities are made necessary by the growth of motor transportation and serve no other important purpose than that of facilitating such transportation, should be met by charges on the users of such transportation.¹ What proportion of the total urban highway expenditures is properly to be charged to motor vehicles it is impossible to estimate with any reasonable degree of accuracy until more detailed statistics of the objects of such expenditures are made available and until those in charge of the operation of the various urban highway services analyze these operations with a view to ascertaining the relative degrees in which various urban activities benefit therefrom.

¹ Subject, however, to the qualification made later with respect to special assessments.

The items in the urban highway costs which can with most certainty be charged to motor vehicles are the costs of construction and maintenance of roadway pavements, of street widenings made necessary by the growth of motor traffic and of traffic regulation. It seems doubtful that motor traffic has a sufficient degree of responsibility for any of the other items in the highway bill to justify imposing upon it the cost thereof. Even for the items here specified, certain important deductions should in equity be made. Other types of transportation using the paved surfaces should share the costs with motor traffic in proportion to use thereof and damage thereto. The city should meet, out of its general tax revenues, a portion of these costs to cover the pedestrian's share therein. There should not be charged to motor traffic any repair or other pavement costs made necessary by operations in connection with the sub-surface utilities. The city should also meet, out of general or departmental funds, a share of these costs proportional to the use of the roadways by its own vehicles. Motor traffic should be credited, toward its share of these costs, with whatever revenues the city may receive from State or county which are derived from motor vehicle taxation.

SPECIAL ASSESSMENTS IN URBAN HIGHWAY FINANCE

The estimate was made above that special assessments levied against land assumed to benefit from highway improvements and levied in proportion to the assumed benefits, in 1923, met half the costs of "outlays" or capital expenditures for durable highway improvements. The "benefits" to land from highway improvements are ordinarily not benefits separate and distinct from the direct benefits of the improvements to the users thereof, but are a different manifestation of the same benefits. The benefit to land from a highway improvement is for the most part merely the result of the ability of the landowner to extract from the user of the improvement all or part of the monetary value of the improvement to the latter. Land adjoining a new highway improvement rises in value precisely because it is anticipated that its owner will be able to perform such an extraction, and it rises in the measure of such anticipation. To the extent that there is a benefit to land, there is, with minor qualifications, an equivalent subtraction from the net benefit to the user of the improvement.

If a highway improvement is financed by special assessments against actual increases in land values unmistakably resulting from the improvement, this makes certain that the cost of the improvement shall be paid out of that portion of the benefit to the users of the improvement which the landowners expect to be able to appropriate for themselves, but in the absence of friction and assuming the accurate assessment of costs against benefits to adjoining land, it is theoretically possible that

charges against users and assessments against benefited land, whichever method is adopted, shall in the final incidence be borne fully by the owners of the benefited land¹

Assuming the possibility of the satisfactory administration of special assessments, they are generally preferable to taxes on highway users, because they reach the benefits where they concentrate in relatively few hands and where the entire spread of the benefits over the duration of the improvement is at once capitalized and thus made available for immediate assessment. Where a highway improvement of a durable sort results beyond reasonable doubt in a substantial increase in the market value of neighboring land, it is clearly more equitable to charge the cost of the improvement against the benefited land, but with the amount of the benefit to the land as a maximum for the assessment, rather than to spread the cost through general property taxation on property of all kinds and locations, regardless of its share in the benefits resulting from the improvement. To most persons also it would seem more equitable to charge the costs against the benefits to land rather than against such benefits as the landowners permit to remain with the users.

There is much greater scope in urban than in rural highway finance for the use of special assessments, as a substitute for taxes on highway users, to meet the costs of durable highway improvements. Special assessments cannot be properly administered unless they result from the improvements which they are intended to finance substantial, concentrated, and readily ascertainable increases in the value of land in the immediate neighborhood of the improvement. This is much more likely to be the case for street improvements than for improvements to rural highways. The chief benefit to land values from a new rural highway may be in the urban centers at its extreme limits, or the benefits may be spread lightly over a wide area extending across county and even State lines. In rural highway finance the only effective way of reaching the important beneficiaries of improvements is to tax the immediate beneficiary—the highway user. In urban highway finance special assessments may often be a more certain and more convenient method of achieving this purpose.

There is need of caution, nevertheless, in the use of special assessments. It is generally taken for granted that because ordinarily they are subject to the legal principle that the assessment must not exceed

¹ This assumes that the users of the improvement are "ultimate consumers" of the service it renders, for example, travellers for pleasure, and do not pass the benefit on to employers of their services or to purchasers of their products, as well as to adjoining land owners. For other than pleasure traffic, charges on users are theoretically preferable to special assessments because they will be passed on in part at least to all the ultimate beneficiaries of the improvement and not to one class of beneficiaries, landowners, alone.

the value of the benefit and because their administration is always subject to certain legal restrictions intended to safeguard the assessee, special assessments are always in fact, what they must be in law, special charges against special benefits. There is reason to believe that in most cities where special assessments are much used, there is inadequate technique for ascertaining the existence, the location, and the amount of benefit, and the special assessment tends to become merely a special land tax levied over an arbitrarily delimited area and with erratic variations of rates as between different parcels of land. Very often what appears to be an increase in land value due to an improvement may upon examination turn out to be merely part of a general rise in land values and often a fictitious one due to the decline in the purchasing power of the monetary unit.

Very often the anticipations of land owners with respect to the stimulus which a projected improvement will give to land values transpire after the event to have been mistaken. Many improvements are competitive in their effect on land values. An improvement in locality *X* gives it an advantage over locality *Y* which shows itself in a rise in land values in *X*. Locality *Y* thereupon undertakes a similar improvement and its land values again come to a parity with values in *X*. But *X* has now lost its temporary superiority and its land values fall back to their original level. The result of an investigation covering a number of years would under such circumstances show little or no effect on land values in *X* and *Y* of the improvements made by them, but the usual technique of special assessment, which deals only with prospective benefits of an improvement not yet made and disregards the effects of the improvement on land values outside the area of supposed benefit, would here find a proper basis for the levy of benefit assessments. All persons with special assessment experience know of instances where improvements financed by special assessments have lowered the market value of the assessed land because of the assessment burden for which it was made liable. It has been only the general rise in land values, due to growth of population and to the general rise of prices, which has kept the shortcomings of the special assessment as commonly administered from receiving the serious attention which they call for.

TAXATION OF ELECTRIC RAILWAYS FOR HIGHWAY USE

It is the common practice in American cities to levy a privilege tax on electric railways for the privilege of using the city streets, or to require them to construct and maintain at their own expense the paving within the track space and for a specified distance on each side. They are also required in some cities to remove the snow and to sprinkle the streets on which they operate. The item "receipts from highway privileges," amounting in 1923 to \$26,700,000, includes amounts re-

ceived from electric light, telephone, and water companies for the privilege of using the surface or sub-surface of streets for their structures and equipment, and also receipts for the privilege of maintaining vaults under the streets, fruit, gasoline, and other stands on the streets, and awnings, signs, etc., extending over the sidewalk. But a large portion of these receipts consists of amounts paid by electric railways for the privilege of using the streets.

In 1919, after which year the Census Bureau returns ceased to differentiate between the various types of highway privileges, the revenue from charges for the use of space on or under the highways by privately owned public utilities, mainly electric railways, amounted to 93 per cent of the total receipts from highway privileges, as compared to 7 per cent from charges for the use of space for miscellaneous special purposes, such as awnings, gasoline, pumps, signs, etc. It has been estimated, also, that the annual cost to American electric railways of rendering the paving services required by their franchises exceeds \$20,000,000. This probably includes the item amounting to \$7,211,000 for 1923 of compensation to city highway departments for repair and construction services, most of which undoubtedly came from electric railway companies who, instead of doing their own paving, had it done for them at their expense by the municipal highway departments. In a few cases, as, for instance, Chicago, the city also receives a share of the receipts of the surface railroads.

The electric railways make, therefore, a substantial annual contribution to the cost of urban highways. Their representatives, in fact, complain that they make too large a contribution, especially as compared to motor transportation, and that this discrimination in taxation operates as a subsidy to competing methods of urban transportation. They protest especially vigorously against the paving requirements, which they characterize as an obsolete survival from the days of horse cars, when the horses did actually wear out the pavements.

There is no evident reason why electric railways should contribute more heavily in proportion to their use of city streets than other types of transportation, and it is in fact desirable that competing types of transportation should bear the highway costs properly attributable to them in proportion to their use of the highways, in order that their relative capacity to render transportation service should be tested under equal conditions. The fact that electric railways are common carriers, whereas private automobiles are not, should have no bearing on the question, since the special privileges enjoyed by a common carrier are granted in the public interest rather than in the interest of the carrier and are accompanied by special and onerous obligations and restrictions. But if electric railways are being required to make too great a contribution to highway revenues, it is only true, if true at all, in com-

parison with other types of transportation. In so far as the paving and snow-removal requirements are concerned, they are clearly arbitrary and have no necessary relationship to the costs to the cities resulting from the operations of electric railways. Under existing conditions, electric railways should be required to meet the highway costs incurred by the cities on their behalf to the same degree as such requirement is imposed on other types of vehicular traffic using city streets

In so far as paving is concerned, it is proper to attribute to electric railways such increase in the costs of construction and maintenance of pavement as result from the presence of tracks and the operation thereon of street cars. How this increase can be computed is a problem for the engineers, but the type of test suggested by some engineers, namely, a comparison of the paving costs on two streets of similar width, one with and one without street car tracks, is clearly defective unless the character and volume of vehicular traffic on both streets is constant and unless the same standard of maintenance is applied to both streets. But in large cities, and especially in the congested portions thereof, space utilization is a more important economic factor than the wear on pavements, and a thoroughgoing apportionment of highway costs would take into account the comparative utilization of space of the different types of carriers as well as their wear on the pavements

FINANCIAL ASPECTS OF URBAN TRAFFIC CONGESTION

A careful survey of the American literature on the traffic congestion problem has made it clear to the writer that the explanation of the causes of traffic congestion and the appraisal of the comparative merits of the many proposals which have been made for its solution are primarily technical problems for the engineer and the transportation expert to deal with. There are, nevertheless, some angles of the problem which are at the same time important and of special concern to municipal finance, and with these I propose to deal briefly.

Any program of highway improvements to remedy traffic congestion raises four fundamental financial questions

1. How much will it cost?
2. Is there any alternative program which would bring greater relief at the same cost, or the same degree of relief at less cost?
3. Is the relief it will bring of sufficient economic importance to warrant its cost?
4. Who should pay this cost, and how?

Estimating the costs of public improvements and the results of such improvements on traffic conditions is of course a technical task which belongs presumably to the highway and traffic engineers. The question who should pay the costs, and how, has already been dealt with at some

length It may be added, however, that whether the municipal government meets the costs in the first instance by taxation or by borrowing, the long-run costs to the community as a whole will in either case be the same For the policy of financing an expensive program of highway improvements by borrowing it can be argued that it is not as likely as the pay-as-you-go method to lead to the costly and uneconomic postponement of the making of improvements until long after the need for them has become urgent The voting public is almost everywhere more favorably disposed towards projects for highway or other major public improvements if they are to be financed by borrowing instead of by current taxation On the other hand, it can be argued for the pay-as-you-go policy that it is less likely to lead to a premature or over-ambitious program of expenditures Ordinarily, however, if the improvement program is extensive and cannot conveniently be carried out in gradual stages over a period of some duration, it cannot in practice be financed out of current taxes and must be either financed by borrowing or abandoned The arbitrary debt limits to which many cities are subject often operate as insurmountable obstacles to the execution of urgent programs of highway improvement There remains the most fundamental and the most difficult question of all, namely, is the project worth its cost?

WHAT IS MEANT BY TRAFFIC CONGESTION

The first requisite for an adequate analysis of the problem of traffic congestion would appear to be a careful definition of "congestion" The nearest approach to a formal definition which I have been able to find in the literature is the following

"The meaning of the term 'congestion' as applied to traffic conditions in this report is that degree of overcrowding of vehicles in streets that obstruct freedom of circulation, with attendant consequences of economic waste and inconvenience" But maximum freedom of circulation, convenience and economy for an individual vehicle is to be obtained only if there are no other vehicles on the road This is defining congestion by calling it overcrowding, which is not very helpful There are two different senses in which the term is commonly used, first, to indicate such a volume of traffic on the roads as to reduce below its potential maximum the speed at which traffic moves, and which I will call "retardation of traffic," and second, to indicate the presence on the roads of so great a number of vehicles as to reduce the "traffic capacity" of the roads, whose consequences I will term "suppression of traffic"

The term "traffic capacity" of a street is used to indicate the number of vehicles per hour which can be passed through at a given point in the street The traffic capacity of a street increases sharply with increases

in the speed of movement of traffic until a speed of about 14 or 15 miles per hour is reached. At speeds higher than this the traffic capacity of the street steadily decreases with increases in the speed movement because of the increase in the safe braking space between vehicles. For an uninterrupted stream of traffic, the theoretical traffic capacity at a speed of traffic movement of 14 or 15 miles per hour appears to be about 125 per cent of the capacity at 30 miles and about 140 per cent of the capacity at 40 miles. Below 15 miles per hour, speeding up of traffic therefore increases traffic capacity, above 15 miles per hour it decreases traffic capacity.¹

Traffic congestion therefore has two phases (1) The retardation of traffic, and (2) the suppression of traffic. An increase in the number of vehicles on the road always tends to retard the rate of movement of the traffic. If the increase in the number of vehicles goes beyond a certain point it not only retards traffic but it reduces the amount of traffic which can be passed through the street per hour. Where the only speed restriction is that which is the automatic result of the number of vehicles on the road, reduction of speed retards traffic until a minimum speed of about 14 miles per hour is reached, but increases traffic capacity, further reduction of speed not only retards traffic but it also suppresses traffic by reducing traffic capacity.

There are to be found scattered through the literature on the traffic problem numerous estimates of the economic loss to different urban communities resulting from the prevailing traffic congestion. Recently an estimate of \$2,000,000,000 per year for the United States as a whole due to traffic congestion and improper control of traffic facilities has been given wide publicity. These estimates of the costs of traffic congestion commonly ignore the "suppression of traffic" phase of traffic congestion, although they deal almost exclusively with traffic areas where congestion has retarded the rate of traffic movement to far below the rate of maximum traffic capacity and has therefore resulted in considerable suppression of traffic. Though they profess to be estimates, therefore, of economic costs of retardation of existing traffic, in no case that I have encountered is any indication given of the basic speed, 10 miles per hour, 30 miles per hour, 60 miles per hour, or whatever it may be, from which the degree of retardation, and by inference the amount of time and money lost, are measured. Acceptance of the current estimates as reasonably accurate would be much easier if it were made clear just what it is that they estimate. In any case, estimates of the costs of congestion should take into account the economic loss due to suppression of traffic, which, for all we know, may be more important than retardation of traffic. The development of a satisfactory technique for estimating

¹ Cf. Regional Plan of New York and Its Environs, Highway Traffic in New York and its Environs, Lewis and Goodrich, pp. 80 ff.

the costs of traffic congestion will not come until congestion is analyzed and dealt with in quantitative rather than qualitative terms

REMEDIES FOR TRAFFIC CONGESTION

Any program for the relief of traffic congestion should be written in terms of the volume and character of traffic for which provision is intended to be made and the standard of provision which it is planned to give to it. Provision should be made, of course, for anticipated expansion of traffic, estimated as best it can be from such factors as population trends, automobile registration trends, per capita passenger mileage movements per annum as density of urban population increases, etc. Estimates of prospective needs for traffic facilities are often so made as to imply that all that is sought for the future is the avoidance, as the volume of traffic grows, of any intensification of the existing degree of congestion. Most such estimates, moreover, overlook the stimulus to traffic which results from the extension of traffic facilities of itself, and which would lead to an increase in traffic after the extension was made even though population, motor vehicle registrations, and other such basic factors remain constant.

The methods proposed by traffic engineers for the relief of traffic congestion fall into five classes: (1) Improved traffic guidance, (2) minor improvements to existing traffic facilities, (3) major extensions of highway facilities, (4) zoning and decentralization of business, (5) traffic restriction. Any expense involved in traffic guidance and in minor improvements to existing traffic facilities, such as removal of obstructions, laying of smoother pavements, narrower sidewalks where roadways are congested and sidewalks are not, easier curves at intersections, through modifications in sidewalk corners, are clearly justified where they will bring an appreciable measure of relief. Zoning can be used to ameliorate traffic conditions by decentralizing traffic and by reducing the need for transportation. It must, however, be gradually applied and conservatively administered if it is not to impair seriously existing real estate values and if it is to receive the necessary degree of support from public opinion. Relief to existing traffic congestion by zoning must always, therefore, be a slow process, a matter of decades if not of generations. Its major contribution to the solution of the traffic problem must be sought in its use to forestall prospective intensifications of traffic congestion by preventing further over concentration of traffic-producing enterprises in narrowly circumscribed areas. It has an important and constructive place in the long-run program, but its potentialities are limited in dealing with the congestion which already prevails. In congested areas of large cities major improvements are liable to involve great expenditures, because more land for street space can ordinarily be acquired only at prohibitive cost and in many locations

is wholly out of the question, while the cost of construction of elevated or sub-surface traffic ways is many times greater than the cost of the existing natural surface facilities. In many instances, however, the only alternatives are serious traffic congestion growing progressively worse as the city grows in population, a tremendously expensive program of major highway improvements, or traffic restriction. In most American cities adjustment is being made to the pressure of expanding volume of traffic by a compromise between these three.

For most, and probably for all, large American cities a program of providing in the congested areas ample facilities for all the traffic, whatever its type, which would offer itself if the facilities were there, would involve so staggering a cost that such a program would clearly be impracticable. It is clearly uneconomical also to tolerate the persistence of a degree of traffic congestion so great as to reduce substantially the traffic capacity of the streets. The long-run program of dealing with the traffic problem must necessarily provide both for extension of facilities and for restriction of traffic. The general sentiment in support of the free and unrestricted use of the public streets is powerful, and headway against it can be made only very slowly. Nevertheless, traffic restriction is inevitable. If it is not applied by traffic officials in accordance with a carefully designed plan, it will come about automatically and in greater degree through the suppression of traffic resulting from acute congestion.

To what extent in any particular situation the problem of traffic congestion should be met by extension of facilities and to what extent by restriction of traffic should be determined only after careful study of the situation and the application of as scientific a technique as can be developed for the comparison of the costs of the improvements with the economic costs of traffic restrictions if the improvements are not made. It is an unfortunate element in the situation that in most American cities the imagination of the public is more easily captured by projects for expensive ornamental driveways and boulevards in outlying sections of the city than by the more prosaic but usually much more urgent improvements which would serve to give substantial relief at the points at which traffic congestion is most acute. There are few American cities in whose congested areas an immediate and extensive program of major highway improvements planned to furnish an increase of traffic facilities is not economically justifiable. As land values rise fairly steadily in the traffic centers of large cities and as the process of replacing old and moderately-sized buildings by new, more expensive, and higher buildings progresses, the cost of major improvements requiring the utilization of increased land space becomes greater, and the need for such improvements becomes more intense. In such cases delay is usually very expensive.

THE NEED FOR TRAFFIC RESTRICTION

The common practice, nevertheless, of measuring the extent of traffic facilities needed by the amount of traffic which would be present if the facilities were there is dangerous, because it fosters the delusion that traffic facilities are costless or that provision must be made, regardless of the cost, for all the facilities which traffic may demand. There is a scope for traffic restriction as one of the means of meeting the problem of traffic congestion. On purely economic grounds traffic restriction is always clearly preferable to the suppression and acute retardation of traffic which results from extreme traffic congestion. Up to a certain point, which differs with circumstances and can be determined only approximately and only by careful and expert survey of the situation, traffic restriction is more economical than the extension at great cost of existing traffic facilities. Traffic restriction would suppress traffic, but properly applied it would differ from the suppression of traffic resulting from acute congestion because it would not be accompanied by an impairment of the traffic capacity of the existing highway facilities, and because it would select the traffic to be suppressed in accordance with the economic importance of different types of traffic instead of arbitrarily.

In congested areas, what most needs economizing is not wear of the pavement but space utilization. The primary object of traffic restriction should be so to control the volume of traffic as to maximize the traffic capacity of the congested highways. There should be no restrictions on any highway, therefore, unless the volume of traffic in the absence of restrictions is so great as to retard the speed of traffic movement substantially below the rate at which traffic capacity would be at its maximum for that highway. Where maximum traffic capacity can be maintained only by the application of traffic restrictions, the restrictions should be applied to various types of traffic and of carriers in inverse order to their utilization of road space per unit of transportation service rendered. In congested areas speed above the rate which brings maximum traffic capacity is to be regarded as an expensive luxury and to be given little extra consideration, inability to maintain that optimum speed is on the other hand an expensive nuisance and should be penalized. Where congestion is exceptionally acute, comfort and convenience of passengers must also become a minor consideration and must yield to movement of traffic if there is conflict between them. As traffic conditions ordinarily vary widely as between different periods of the day the restrictions also should be made to vary according to traffic conditions, being intensified at the traffic peaks and lightened or wholly removed at the traffic troughs.

Many estimates have been made of the relative efficiency, in terms of space utilization per unit of transportation service rendered, of the dif-

ferent types of passenger carriers, but in no case that I have seen have these estimates taken into account all the factors which require consideration in estimating space utilization, or been based on tests made under conditions which permit of decisive determination of the most economic use in terms of passenger transportation to which a given stretch of highway can be put. What they do show conclusively enough is that in congested areas pedestrian traffic makes economical use of space per person per mile travelled, and that parking of private cars and loading and unloading of freight carriers at the curb and on the sidewalk is the most extravagant form of space utilization. They show also beyond reasonable doubt that private automobiles and taxis, with their average load in every city under two persons and a large fraction of that load consisting of chauffeurs, are much less economical users of congested road space per passenger mile than either motor busses or electric street cars. As between electric surface railways and motor buses, however, the evidence which is commonly brought to bear in favor of one or the other is contradictory and inadequate for conclusive determination of their relative economy as users of road space.

THE TEST OF UNECONOMICAL SPACE UTILIZATION

The proper test of relative economy in use of space has not yet been definitely worked out, and to some extent it must probably be a different test under different circumstances. The most common test applied to different types of passenger carriers using surface ways is square feet of space occupied per seat. This is inadequate in a number of respects. Among the additional factors which should always be given consideration are, the possibilities of reasonable overload at traffic peaks, the speeds per mile in conjunction with the corresponding minima of side-clearance and safe braking distance, and the interference with other types of traffic. If vehicles are not permitted on congested highways if their width plus their necessary clearance exceeds the maximum width available on such highways per lane of traffic, width is a negligible factor and lineal feet tests are more conclusive than square feet tests.

The data presented in Table V indicate how different types of passenger carriers meet some of these tests of economy in space utilization.

TABLE V
STREET SPACE UTILIZATION OF VARIOUS TYPES OF PASSENGER CARRIERS¹

Data from Daniel L. Turner, consulting engineer, report to New York Transit Commission, May 9, 1923, and from other sources

| Carrier | Square feet per seat | Square feet per passenger | Lineal feet per seat | Lineal feet per passenger |
|-----------------------------------|----------------------|---------------------------|----------------------|---------------------------|
| Standard street car | 6 63 | ¹ 3 32 | 0 79 | ² 0 39 |
| Double-deck bus | 3 28 | ² 2 19 | 0 41 | ² 0 27 |
| Ford touring car, 2 passengers | | | 5 83 | |
| Packard touring car, 2 passengers | | | 8 33 | |
| Pedestrian | | 1 96 | | 1 25 |

¹ 100 per cent overload

² 50 per cent overload

These data take no account of necessary clearances and stopping spaces, potential speed in heavy traffic, and interference with other traffic. They assume that the motor bus is capable of a 50 per cent overload above rated seating capacity, which is perhaps open to question. The double-deck bus with an uncovered upper deck in bad weather can not attain even its rated seating capacity, but the development of a satisfactory covered upper deck would remove this handicap. Test counts made by the Chicago Surface Railways Company of the upper-deck passengers on Chicago motor busses during heavy rain showed in the count that 16 busses with partially covered upper deck averaged 26.1 passengers on the upper deck as compared to an average of only 4.4 passengers on the upper deck of 48 uncovered busses at the same time on the same routes. Another count made during rain, snow, and sleet showed 10.9 passengers on the average on the upper decks of 22 partially covered busses as compared to an average of 2.8 passengers on the upper decks of 64 uncovered busses.¹

In Chicago the average speed of busses in the Loop District was shown by tests to be 5.81 miles per hour, as compared to 6.21 miles per hour for surface cars, or about a 7 per cent superiority for the electric cars. Outside of the Loop District the busses averaged 11.87 miles per hour as compared to 11.63 miles per hour for street cars,² but in Chicago the busses outside the Loop operate on routes more favorable to speed than those of the street-car systems, namely, parks and boulevards with

¹ Computed from manuscript report of tests lent to the writer by the Chicago Surface Railways

² Data from Report of John A. Beeler, Consulting Engineer, to New York Transit Commission, January, 1923

rights of way, and with few intersecting streets. The evidence as to necessary clearance and stopping space and interference with other traffic is too contradictory and based too much on inadequate tests to have much weight one way or the other. The most conclusive test, if it were practicable, would be to test the space utilization unit of transportation service rendered, of the different types of carriers by putting through a selected mile of highway, during successive hours and under similar conditions with respect to traffic guidance, cross traffic at intersections, etc., its maximum capacity of

1. Motor busses alone
2. Private passenger cars alone, and combinations in varying proportions, of—
 - (a) Motor busses and electric street cars
 - (b) Motor busses and passenger cars
 - (c) Electric street cars and passenger automobiles
 - (d) Electric street cars, passenger cars, and motor busses

In each case each vehicle should be loaded, or be presumed to be loaded, with its potential maximum load at rush periods. Such a test would disclose conclusively the relative space utilization of the different types of passenger carriers and the ideal use to which highways could be put when subject to high traffic pressure. Such a test would be an undertaking of large proportions, but when conclusions are based on surveys of actual traffic conditions, they can never completely meet the requirements of a scientific test, and, unless the results are overwhelmingly in favor of one type of carrier against another, must always be subject to contrary interpretations.

METHODS OF RESTRICTING WASTEFUL USE OF STREET SPACE

It is a commonplace of transportation economics that in practice there will not be the most economical utilization of the equipment of the carriers or of the highway facilities provided by the municipality unless the entire transportation service is operated as a unified whole under centralized direction. With competing types of transportation operating under independent management, duplication of traffic facilities on the part of the transportation agencies and consequent wasteful use of highway space are inevitable. It is especially important, therefore, that there be municipal restriction of wasteful use of congested highway facilities where the operation of competitive transportation service tends to weaken the private motives for the elimination of wasteful traffic operations.

The employment of space-utilization tests as the sole basis for the application of traffic restrictions would imply that the value of each unit of passenger transportation service, measured, let us say in terms

of the carriage of one passenger one mile, is uniform, and would leave no room for consideration of possible differences in the classes of persons served by the different types of carriers, in the relative convenience of the different facilities to passengers, or in the rates charged and the operating and other costs incurred per unit of service for the different carriers. It would be necessary, moreover, to avoid adopting any traffic restrictions within the congested area which would seriously disrupt the transportation system of the remainder of the urban area. Under existing conditions, however, the generally hostile attitude of the public toward traffic restrictions provides an adequate safeguard against the too hasty or too severe application of restrictions, and until the public is educated to appreciate the economic injury which results from traffic congestion, it is safe to predict that there will not be as much restriction of traffic as the prevailing conditions justify. But the acceptance by the public of parking restrictions, restrictions on freight traffic in congested areas during business hours, segregation of traffic, and other traffic restrictions which have in recent years been growing rapidly in extent, indicates that if the pressure of congestion becomes severe enough the public will submit in time to the painful necessities of the situation.

It has been suggested that a system of charges for the use of traffic facilities would be the most effective method of restricting traffic to proportions adjusted to existing traffic facilities, and this is the common method whereby the wasteful use of goods and services is restrained. Unless, however, there can be devised a system of charges to which traffic will be subject only as it uses the sections of highways which are congested and only at the periods of congestion, such charges, if heavy enough to exert any influence on the volume of traffic, will operate in the same degree to restrict traffic where there are still unused traffic facilities going to waste as to restrict it where the state of congestion justifies restriction. Except, perhaps, with respect to parking, it does not appear at all likely that any system of charges can be invented and made successfully to operate which will bear heavily on excess traffic while leaving unaffected the traffic for which the facilities are ample.

Traffic charges would tend to repress in greatest degree the marginal traffic, or that traffic which is just worth its cost to those engaged in it, and this is presumably the traffic whose repression would also involve the least economic loss to the community. But there is no assurance that this marginal traffic represents a more substantial proportion of the traffic on congested highways at the periods of congestion than of other traffic and that it is therefore the traffic whose repression would result in the greatest measure of improvement to traffic conditions. Where restriction of traffic is necessary, it is better to apply it in a flexible manner and in accordance with the needs of traffic rather than arbi-

trarily by means of traffic charges which fall alike on all users of highway space, regardless of whether that space is congested or not. To suppress traffic which does not contribute to traffic congestion is at least as uneconomic, measure for measure, as to permit traffic congestion to suppress traffic below the traffic capacity of the highways.

DISCUSSION OF REPORT OF INVESTIGATION OF URBAN ASPECTS OF THE HIGHWAY FINANCE PROBLEM

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There are certain outstanding points which seem to me to be extremely pertinent to this whole discussion of finance, traffic, and congestion.

First, I was impressed, at the outset, by the recognition in this report of the problem of what I term "twilight zones" around the city borders, which is merely a repetition of the blighted zone around the central districts of our cities, but on a larger scale. Traffic surveys are developing rapidly a body of data which gives us actual numerical quantities rather than notions. Our cities are expanding their vision into their future suburbs, and our States and counties are looking inward into the problems of the city which they render more difficult. This twilight zone heretofore has rarely been given adequate study as part of the urban transportation area.

The second point is that State aid to the cities on through routes appears to be receiving increasing recognition. Apparently the counties, however, are much less willing to extend this aid. This may be even more serious in the regional plan. I can cite definitely one needful case which recently came under observation—that of a city of 70,000 people in Western Pennsylvania. It was on the line of the traffic profile shown for the Lincoln Highway, and I was impressed by the fact that the local bump or peak due to purely suburban traffic from that center of population was quite small as compared to the through State traffic, yet here the county practically refuses cooperative aid in adequate development even outside the city's borders. The Lincoln Highway runs straight through the center of the city and runs into a jam at the axis. There is no reason for that route to go there. There are alternative routes nearby. The one question is the location of a new bridge and approach perfecting the county connection just outside the city. The city can't do it and the county won't do it. This situation favors the conclusion that, in cities, especially smaller communities, which have not yet had the vision or the ability to finance proper through highways, it may be entirely proper to give to those cities certain aid from the county and State highway funds to perfect at least the *through* traffic routes, especially detour routes so badly needed. (I may