A STUDY

of the Feasibility and Desirability of

A CITY WIDE MOTOR COACH SYSTEM

To Replace Existing Local Transportation Systems

in the

CITY OF LOS ANGELES

In compliance with a resolution of the City Council

Submitted by

BOARD OF PUBLIC UTILITIES & TRANSPORTATION

Compiled by:
S. M. LANHAM, Valuation Engineer.
With Cooperation of
J. W. WALTERS, Transportation Engineer.

Approved by:
J. OGDEN MARSH,
Chief Engineer & General Manager.

COUNCIL RESOLUTION NO. 449 (1935)
IN COMPLIANCE WITH WHICH THE BOARD OF PUBLIC UTILITIES AND TRANSPORTATION SUBMITS THE ENSUING REPORT

The following Resolution adopted by the City Council was transmitted to the Board of Public Utilities and Transportation February 8, 1935, for its consideration and report:

"WHEREAS, it has recently been reported in the public press that there is a movement in this City looking toward the establishment of a municipally-owned and operated motor coach system, to replace the existing local street car systems; and

WHEREAS, it is essential that the facts be determined in respect to the probable costs, revenues and general feasibility of such a project;

NOW THEREFORE, BE IT RESOLVED, that the Board of Public Utilities & Transportation be requested to hold public hearings and to make a general study and report on the feasibility and desirability of a city-wide, municipally-owned and operated motor coach system in the City of Los Angeles. The aim and scope of this survey should be broad enough to establish:

(1) Initial method of financing such project;
(2) Routes;
(3) Headways;
(4) Hours of service;
(5) Standard of service;
(6) Vehicular miles run;
(7) Vehicular hours operated;
(8) Average speed;
(9) Volume of patronage;
(10) Fares;
(11) Operating rules and practices;
(12) Design of the vehicles to be employed from the standpoint of capacity, comfort and convenience to passengers and of economy in operation and maintenance;
(13) Number of coaches required;
(14) Garage, shop and other facilities and appurtenances;
(15) Estimate of investment in plant and equipment;
(16) Estimated annual operating revenues;
(17) Estimated annual operating expenses;
(18) Estimated annual fixed charges;
(19) And all other phases of the transportation business so as to comprehensively determine if a city-wide motor coach system can
    (a) Efficiently and economically handle the present and future mass-transportation requirements of metropolitan Los Angeles;
    (b) Offer greater convenience in comfort to the traveling public than is now provided by street cars;
    (c) Solve the present unsatisfactory service condition and provide the City with better coverage;
    (d) Handle the present street car traffic and occupy less space in the streets than do street cars and offer less obstruction to other vehicular traffic;
    (e) Successfully operate on a city-wide five-cent fare.

AND BE IT FURTHER RESOLVED, that said Board of Public Utilities & Transportation be requested, after holding a public hearing in connection with this subject, to file with the Public Utilities Committee of the City Council as soon as possible a full report of such study."

April 30th, 1935.

Honorable Public Utilities Committee,
City Council,
City of Los Agneles.

Gentlemen:— SUBJECT: Report on the establishment of a municipally-owned and operated motor coach system.

The following report on the establishment of a municipally-owned and operated motor coach system is made pursuant to a resolution of the City Council February 8th, 1935.

In compliance with said resolution the Board held three hearings as follows: March 19th, 22nd and 26th. It was the hope of the Board that the Municipal Bus League would cooperate with it and supply data in support of their contentions as to the feasibility of such a system of transportation as described in said resolution. The representatives of the League who appeared at the hearings disclaimed their having any such data or that they had made any detailed study of such a system, stating that the propaganda put out by them was based on certain studies made by their president, Victor Wilson, who avoided appearing at any of the hearings held by the Board.

This report is a careful study and analysis of the ascertainable facts in connection with the establishment of a hypothetical municipally-owned and operated motor coach system of public transportation to replace the existing local street car systems and motor busses now operated by the two street railway companies. Every effort has been made in the analysis of the data collected to treat same from a purely logical and engineering standpoint without prejudice or bias, and without regard to whether municipally or privately owned and operated.

No attempt has been made in the report to answer categorically the various items set up in the said resolution of the Council and an effort to do so will be made here largely by reference to the report.

(1) The initial method of financing is set up in Section 8 of the proposed ordinance and provides that the Council shall provide all necessary funds required prior to receipt of revenues from the operation.

(2) The routes are assumed to be the same as at present operated, as it will be necessary to serve practically all locations now served even though the detail of routing might be changed. (See page 21 of the report.)

Some advantages might be gained in routing by reason of the use of busses. However, the existing physical restrictions would automatically confine their operation through the downtown area to the same paths now followed by rail and bus lines. (See page 22 of the report.)

(3) The headways are assumed to be frequent enough to take care of present riders with due regard for limited seating capacity of proposed busses as compared with present equipment.

(4) The hours of service are assumed to be as at present.

(5) It is assumed the only overloading would be that resulting from irregular operation and temporary loading fluctuations.

(6) The bus miles operated is estimated at 76,000,000 per annum. (See page 34 of the report.)

(7) The vehicular hours operated would be approximately 6,500,000 per annum, depending on the actual speed per hour.

(8) The average speed to be expected from an all bus system would not exceed twelve miles per hour. (See page 27 of the report.)

(9) The volume of patronage is assumed to be the 1934 volume of 257,538,000 persons, plus 32.3%, being the amount by which the volume of traffic in 1930 exceeded that of 1934. (See page 27 of the report.) The year 1930 has been assumed to represent the normal volume to which patronage may be expected to return. A further addition to traffic may reasonably be expected due to passenger appeal of new equipment. Experience in other cities indicates that this can reasonably be placed at 15%, although in our estimates this additional 15% has been disregarded. (See page 28 of the report.)

(10) The estimate of revenue is based upon the system of fares proposed by the Municipal Bus League, except that we estimated that 90% of the passengers would pay 5c, 7% would pay 10c and 3% would pay half fare, or 2½c. (See page 37 of the report.)

(11) The operating rules and practices are assumed to be reasonable and to be fixed by the proposed Commission and are not considered to be pertinent to this study.

(12) The design of vehicle is assumed to be thirty passenger gas busses as set forth in statements by the Bus League and should be as comfortable and as economically operated as such light busses usually are. It is probable however that experience would show that a different and heavier type would be more comfortable and satisfactory to the public and would not materially change this estimate.

(13) The number of busses required, based on the 1934 traffic, would be 2179, and based on 1930 traffic, 2883. (See page 28 of the report.)

(14 and 15) Plant and equipment, which includes garages, shop and other facilities and appurtenances, has been studied from both the physical and financial aspects. Storage facilities with appurtenances would be required at various strategically located points throughout the city as well as centrally located shop facilities, administrative offices, etc. (See page 25 of the report.)

The total estimated investment required to replace facilities now operated, based on 1934 volume of patronage, is, for plant and equipment other than busses $4,410,296, for busses at price stated by the Municipal Bus League, $13,074,900, for busses at price more in line with that now quoted by principal manufacturers, $19,611,000. Total investment on former basis—$17,485,196, and on latter basis $24,021,296. (See page 33.)

(16) Estimated annual operating revenues, assuming 1934 patronage, arrived at as described under (10) plus 1% for other revenue, equals $10,258,357. (See page 37.)

(17) Estimated annual operating expenses, corresponding to revenues given under item (16) estimated at $12,988,400.

(18) The items constituting annual fixed charges, that are applicable to a municipal operation, are included in the estimated operating cost per mile. Interest on investment is estimated at 5%. (See page 38.)

(19-a) The question as to whether "a city-wide motor coach system can efficiently and economically handle the present and future mass-transportation requirements of metropolitan Los Angeles" is to be answered in the light of ascertainable facts and experience.

In any study of efficiency of operation of busses, consideration must be given to its effect on other traffic on the streets and to whether as efficient operation can be had with a single type of equipment as could be had by using such other types as might best serve the particular portion of the area under consideration. In this connection it seems worth while to quote from the report on page 16 as follows:

1. The local mass transportation problem cannot be divorced from the general problem of traffic congestion in the downtown district.
2. When considering local facilities, the ultimate plan for serving the entire community should be kept in mind.
3. Increased population will bring about increasingly complex traffic problems until it will be ultimately necessary to provide some sort of off-surface rapid transit facilities.
4. Adequate transportation facilities of the correct type are vital to the proper development and continued welfare of a city.
5. Any one type of transportation medium cannot adequately and economically serve the entire area; a desirable system being comprised of a proper combination and coordination of the various types of facilities avilable in the transportation field.

The matter of economical operation is one of comparison only; that is to say no operation, in itself, can be said to be economical except as it is compared with some other similar operation. This makes it necessary to consider the cost of motor bus operation in comparison with the other types viz; street cars and trolley busses for the particular conditions of operation under which service is to be given.

The relation of the total investment required for each type and of their operating costs makes it essential that they be used in proper combination to effect the most economical operation possible. To substitute gas busses for rail operation where traffic is heavy would result in greatly increased operating costs. On the other hand the costs of maintaining and operating rail facilities where traffic is light would far exceed bus operating costs. For intermediate traffic the trolley bus proves most economical. (See pages 2, 35 and 36 of the report.)

(19-b) There can be no question but that up to date busses would be more comfortable in some ways than the type of street cars at present operated, particularly on account of upholstered seats, and if quiet operation is considered a factor of comfort. However it is a fact that no vehicle operated on the pavement runs as smoothly as one operated on rails. So far as comfort and safety is concerned no doubt the busses loading and discharging passengers at the curb are superior to the street cars and are on an equality with the trolley bus.

(19-c) The matter of service and coverage is entirely one of financial ability to provide sufficient and adequate equipment, the particular type used having little bearing provided the type selected is one that can be successfuly operated through the congested central area on account of heavy traffic.

(19-d) The amount of street space that would be occupied by a motor bus system on 30 passenger capacity busses, carrying the same number of passengers as are now being transported would be 41% greater than the units they would replace. (See page 28 of the report.)

(19-e) The proposed system cannot successfully operate on a city-wide 5c fare. The annual deficit would approximate $3,500,000. (See page 39.)

This comprehensive report has been the result of a thorough study of the question submitted to the Board of Public Utilities and Transportation by the City Council in relation to the technical problems involved, and the various conclusions contained herein are predicated upon the application of engineering principles to the respective problems presented by the resolution of the City Council.

We are mindful that the City Council in their request for a report from this Board is desirous of receiving all information of a technical nature, coupled with whatever conclusions may be arrived at by reason of experience with reference to the transportation problems of this city. All departments of the City government dealing with transportation problems realize that public welfare demands service commensurate with the requirements of a city with the metropolitan aspect of Los Angeles.

From a study of the above and the references to the report it is evident that there is at least grave doubt if the establishment of a complete all motor bus transportation system for Los Angeles would not prove to be a costly experiment both from the financial and traffic points of view. The fact that no large city has established such a system is probably because a study of such operation has disclosed its impracticability.

It is equally evident that the service rendered by the present transportation systems is inadequate to the requirements of satisfactory transportation in the following respects:

Equipment is unsatisfactory to the public because of high floor level; making it difficult and unsafe to get on and off; inadequate loading and unloading platforms, causing loss of time; lack of uniformity in type of entrance and exit, some cars being front entrance, other center, or rear entrance, so that passengers are uncertain where to approach a car to board; most cars with uncomfortable wooden seats; extreme noise due to motor gears and wheels; also poor acceleration and deceleration which slows up operation, especially through the business district; extreme irregularity of service resulting in over-loading individual cars, which condition may or may not be susceptible of correction; a very unsatisfactory fare structure, especially in its lack of uniformity between the two operating companies and between the rail lines and the busses, this lack of uniformity resulting in an unsatisfactory transfer situation.

Many of the above deficiencies will be before the State Railroad Commission for its consideration at the hearings on the complaint filed with said Commission by the City on April 10, 1935, and the Board of Public Utilities & Transportation will cooperate in every way in this connection in order to assist in the formulation of plans designed to provide the best possible transportation service at the lowest possible fare, looking to the best interests and welfare of the City as a whole.

While the Resolution of the Council does not mention the proposed initiative ordinance which will be on the ballot May 7th providing for the operation of so-called "jitney" busses, and it is not considered in the body of this report it is felt that the report would be incomplete without mention of the danger to the City of its adoption.

The City had an experience some 18 years ago with this type of service which became so unsatisfactory that there resulted the adoption in June 1917 by initiative action the present so-called jitney bus Ordinance which this new Ordinance seeks to repeal. Public convenience and necessity demands that every modern City be provided with a correlated transportation **SYSTEM**. Because of its unregulated character the jitney bus is disruptive of any such regular system irrespective of whether such system is privately or publicly owned and regardless of the type of vehicle used. From its effect upon other transportation there seems nothing favorable to be said of jitney bus operation. It is individual, each operator being independent. Therefore transfers can not be interchanged, and the only possible way it can operate practically, on a five cent fare, is along the routes of heavy travel thus depriving the regular transportation system of its best revenues. Such an operation would make it impossible to successfully operate any transportation system, because all the unprofitable operation of off peak, nights, Sundays and holidays would

have to be carried on by the system while the jitneys skimmed the cream of the rush hour travel with no responsibility to do otherwise. The proposition has no merit other than that of supplying employment to a few men who can obtain possession of some kind of automobile that can be operated, whether fit or otherwise.

Because of a strong conviction that the adoption of a transportation system composed exclusively of motor busses would be undesirable, if not actually dangerous on account of traffic interference, and also because it would deprive the City of the opportunity of taking advantage of such improvements in other types of transportation as might make it desirable to adopt more than one type of equipment, we feel it not amiss to again draw attention to this feature of the proposed initiative Ordinance.

Respectfully submitted,

BOARD OF PUBLIC UTILITIES & TRANSPORTATION

(Signed) George Marcell, President.

(Signed) Henry M. Burgeson, Vice-President.

(Signed) Harry S. Hargrave, Commissioner.

(Signed) David Blumberg, Commissioner.

(Signed) Thomas Humphrey, Commissioner.

A STUDY OF THE FEASIBILITY AND DESIRABILITY OF A CITY WIDE MOTOR COACH SYSTEM TO REPLACE EXISTING LOCAL TRANSPORTATION SYSTEMS IN THE CITY OF LOS ANGELES

In Compliance with Council Resolution (No. 449, 1935)

Board of Public Utilities & Transportation
Engineering Division

Compiled by:
S. M. LANHAM, Valuation Engineer.
With Cooperation of
J. W. WALTERS, Transportation Engineer.

Approved by:
J. OGDEN MARSH,
Chief Engineer & General Manager.

INTRODUCTION

For the past year or two attention has been focused upon the questions of the adequacy of service and reasonableness of fare on the local transportation systems. Recently, plans have been sponsored by various groups looking toward the operation of new or additional facilities, which it is claimed would bring about desired improvements. Two of these plans are to be placed before the voters at the municipal election to be held May 7th, 1935. One of them contemplates the repeal of the present so-called "jitney bus" ordinance thus removing existing restrictions so as to permit the operation of so-called "jitney busses" in all parts of the city. The other proposes the establishment by the City of a municipally owned and operated bus system.

This report is made in compliance with a resolution adopted by the City Council on February 8th, 1935, in which reference was made to newspaper publicity given movements looking toward the establishment of a municipally owned and operated motor coach system, to replace existing mass transportation facilities, and asking that the Board of Public Utilities & Transportation hold public hearings and make a general study and report upon the feasibility and desirability of such a project.

The newspaper reports referred to in the resolution related to the plan of a group calling themselves the Municipal Bus League. This group prepared the ordinance which would make it mandatory upon the City Council to establish such a system, and circulated initiative petitions necessary to have it placed upon the ballot at the coming election.

In accordance with the Council's request that this Board hold public hearings, the Board addressed communications to the group which had been receiving such widespread publicity, and to other interested parties. Those who appeared for the Municipal Bus League professed to have made no detailed study, but stated that their belief in the feasibility of their project was based upon the studies made by a Mr. Victor Wilson, who failed to appear in response to the Board's request. However, an analysis has been made of their proposal, as indicated by general statements of those who did appear at the hearings, and by propaganda circulated in support of their proposition. At these hearings, held during the month of March, a third suggestion was presented by the Central Voters' Council, who favor the adoption of an enabling act which would permit the City to establish a general municipal transportation system, using whatever type of facilities appear best adapted to its needs.

Those familiar with the development of our major cities fully realize the importance of transportation to the community and the necessity of avoiding costly experiments. In making this study it has been assumed that the Council in requesting a report on the feasibility and desirability of such a system, has in mind its desirability in relation to whatever facilities would be best adapted to serve the present and future mass transportation needs of the City of Los Angeles.

Accordingly, consideration has been given to each of the suggestions made in the hearings held on the subject; to the various developments in the mass transportation field; to the proper use to be made of each of the types of facilities avilable; and to their relation to conditions in the City of Los Angeles. Opinions based upon experience have been obtained from major operators regarding the relative merits and proper use of each of the various types of vehicles now available for local street transportation.

Regard has been given to many exhaustive studies made of Los Angeles transportation problems at considerable expense, both to the City and private interests. It is our belief that the conclusions resulting from these studies should not be completely ignored when dealing with any proposal affecting mass transportation in Los Angeles.

TRANSPORTATION VEHICLES

Development and Scope of Application

Surface transportation is handled for the most part by three types of vehicles—the electric railway street car, the gasoline bus and the trolley bus, or trackless trolley. The street car, still the most widely used, was the first to be developed, and the trolley bus is the latest generally accepted development.

For a good many years little improvement, from the standpoint of the general public, was made in the conventional street car. During this period the automobile, and along with it the gasoline bus, was being developed and improved at a rapid pace. Improvements and refinements in this rubber-tired vehicle, resulting in increased dependability, riding qualities and appearance, and a marked decrease in operating costs, brought about the growing popularity in the transportation field. Its greater flexibility, lower first cost and the fact that no investment is required in roadbed or overhead, have contributed to its continued increasing use for mass transportation since about 1920.

In many cases transportation facilities have been provided with the gas bus, where the patronage available precluded the construction of rail facilities; in other cases the gas bus has been used to develop new territory or serve as a feeder to already established rail operations; and in still other instances rail facilities which could not be made to pay because of insufficient patronage, have been abandoned in favor of the gas bus.

During the past few years the electrical industry has given considerable attention to the development of a vehicle which would embody the more desirable features of both the gas bus and the street car. The vehicle which they have developed, known as the trolley bus or trackless trolley, operates on rubber tires and offers the advantages of more noiseless operation than either the gas bus or street car, more flexible operation than the street car, since its path is not confined to a definite lane in the street, having a fifteen foot swing each way, the smoothness of operation given by the electric motor, freedom from gas fumes and the economy resulting from a central source of power.

The electric railway industry has realized for some time that improvements must be made in the street car, if it were to retain its place in the transportation field. As a result, in 1930 the electric railways formed a special committee known as the Presidents' Conference Committee, whose purpose was to conduct research work and develop an improved electric railway car which would be more attractive, more comfortable, faster, less noisy and less costly than the then existing designs. Fifty-one companies, comprised of operators and manufacturers, subscribed in excess of a half million dollars towards the development of the improved vehicle. This committee has recently completed specifications for a car which it is claimed offers all of the improvements contemplated, and manufacturers are reported to be ready at the present time to produce the new type of equipment.

Another development in the mass transportation field has been the so-called gas-electric bus, which uses a gasoline motor to develop the electrical

energy required to drive the bus. In this way the flexibility of the gasoline bus is realized, along with the smoothness of operation resulting from electric power. There has not, however, been widespread acceptance of this type of vehicle.

The advantages claimed for each of the above types of rolling stock as compared with the others, include the following:

The gasoline bus: Low initial cost, due to freedom from track and overhead construction requirements; absence of rails in the streets; quick acceleration and deceleration; quietness of operation; simplification of the routing problem due to the flexibility of the vehicle; maneuverability in traffic and the possibility of loading at the curb, thus eliminating loading zones from the center of the street.

The trolley bus: Lower initial cost than street railway, since no track construction is required, although an additional wire is required in overhead construction; smoother operation obtained by use of the electric motor instead of the internal combustion motor; noiseless operation, having neither motor nor gear noises of the gas bus nor the rail noise of the street car; high rate of acceleration and deceleration; maneuverability in traffic which makes possible the loading and unloading of passengers at the curb; greater load flexibility and lower operating costs than the gas bus; freedom from exhaust fumes resulting from the operation of the gasoline bus, although in this connection it should be pointed out that recent experiments indicate that butane gas may be used as fuel instead of gasoline and eliminate this objection to the gas bus. However, it is doubtful if butane gas produces any less carbon monoxide than gasoline.

The recently developed Presidents' Conference Committee street car: For this new car there are claimed the qualities of rapid acceleration and deceleration equivalent to those of either of the above two types, a freedom from noise equal to that of the automobile, absence of vibration experienced with internal combustion motors, greater seating capacity, the greatest loading flexibility and lowest direct operating cost per seat mile, and greater riding comfort.

The majority of those associated with the transit industry seem to feel that the street car can most profiably be used where heavy loading and frequent headways are experienced; that the gasoline bus is indispensable as a feeder to the electric railway and should be used in more sparsely settled areas where the smaller units will suffice and make possible more frequent headways; that the trolley bus serves a field in between these two. The trolley bus being the latest development, is not yet as extensively used as either of the other two. The American Transit Association, whose members operate each of these types, has considerable data in regard to this matter. Based upon their studies they state that in proportion to its capacity, the operating cost of the trolley bus is substantially less than that of the motor bus and slightly less than that of the street car. With respect to the field of use, they state that while exceptions will always be found, "generally speaking, it is believed that where the required headway is more than four or five minutes the trolley bus can serve more economically than can the street car, and that where the required headway is less than fifteen minutes, the trolley bus can serve more economically than the motor bus."

Having in mind the fact that there were the three types of vehicles available for mass transportation and that many of the member companies were faced with the economic problem of selecting that type which would both satisfy the needs of the community served, and prove a profitable investment for the company, the American Electric Railway Association, now known as the American Transit Association, appointed a Committee on the Economics of Rolling Stock Application, to determine the relative costs of operation of the three types and to develop data to be used as a guide in selecting the proper vehicle for a particular operation. This Committee in its report in 1931 had this to say:

> "* * * It is the relative effect of investment and operating costs which primarily determines the field of economic application of the various vehicles. A street car with the largest investment cost has the lowest operating cost per passenger hauled. The trolley bus with a much lower investment has slightly higher operating cost per seat mile and the gas bus with the smallest investment has the highest operating cost. As the traffic density increases the fixed charges per mile become less and as a result the high investment cost for rail service is warranted for very heavy traffic. For lesser densities of traffic the gas bus with its small investment is most suitable. Between the two classes of service is a field of application where the trolley bus, with its moderate investment cost and low operating cost is available. * * *"

The following table indicates the growing use of the gasoline bus, and on the page immediately following this table appears a chart showing graphically the trend of total passengers carried by rail and by bus, and the increasing percentage of bus passengers.

PASSENGER TRAFFIC AND VEHICLE-MILES OPERATED BY ELECTRIC RAILWAYS AND AFFILIATED BUS UNDERTAKINGS

Includes only those rail lines included by the Census Bureau and bus lines which are subsidiary to them or which have taken their place where rail lines have been superseded. It does not include so-called independent bus lines which never have had any connection with electric railway properties.

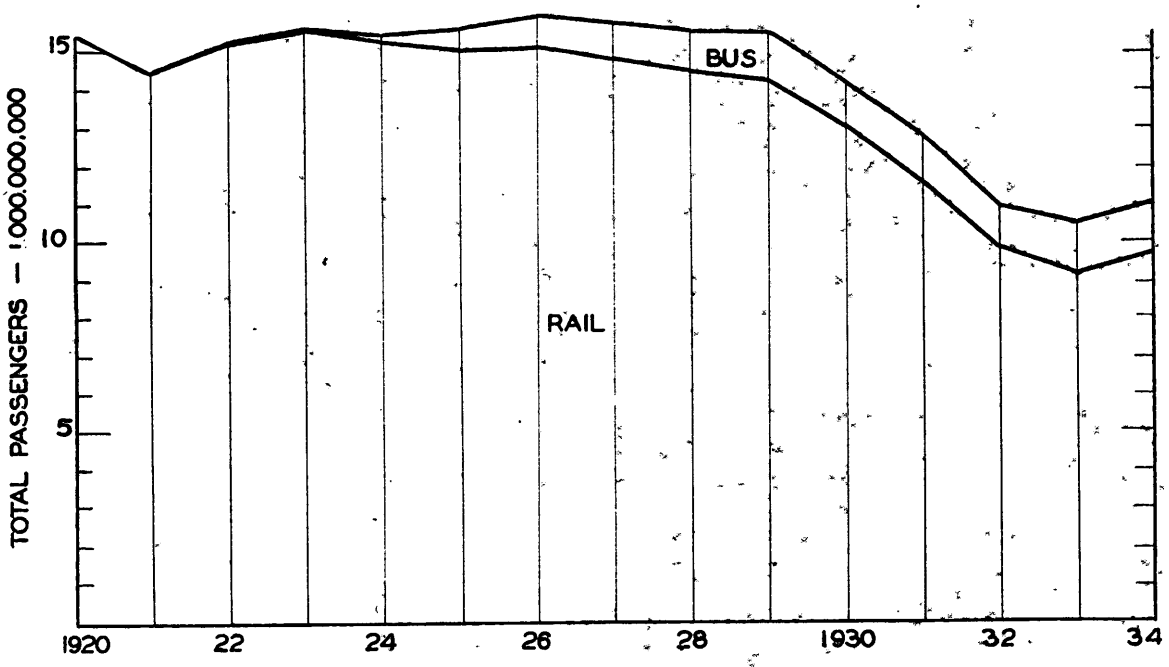
Year	Passengers Carried			Vehicle-Miles		
	On Rail Cars	On Busses	Total	Car-Miles	Bus-Miles	Total
1917	14,506,914,573*		14,506,914,573	2,139,801,530*		2,139,801,530
1918	14,243,415,000		14,243,415,000	2,079,000,000		2,079,000,000
1919	14,915,994,000		14,915,994,000	2,105,000,000		2,105,000,000
1920	15,540,715,000	8,270,000	15,548,985,000	2,153,000,000	2,272,000	2,155,272,000
1921	14,574,439,000	18,795,000	14,593,234,000	2,111,000,000	5,163,000	2,116,163,000
1922	15,331,399,851*	40,447,000	15,371,846,851	2,124,523,362*	11,112,000	2,135,635,362
1923	15,650,000,000	92,471,000	15,742,471,000	2,150,000,000	25,373,000	2,175,373,000
1924	15,312,000,000	225,000,000	15,537,000,000	2,180,000,000	72,187,000	2,252,187,000
1925	15,167,000,000	520,000,000	15,687,000,000	2,204,000,000	154,268,000	2,358,268,000
1926	15,225,000,000	845,000,000	16,070,000,000	2,220,000,000	224,083,000	2,444,083,000
1927	14,901,435,276*	991,000,000	15,892,435,276	2,163,772,982*	292,369,000	2,456,141,982
1928	14,521,000,000	1,126,400,000	15,647,400,000	2,113,400,000	338,170,000	2,451,570,000
1929	14,363,000,000	1,280,700,000	15,643,700,000	2,060,600,000	401,071,000	4,923,341,000
1930	13,088,000,000	1 249,100,000	14,337,100,000	1,995,200,000	419,558,000	2,414,758,000
1931	11,611,000,000	1,213,400,000	12,824,400,000	1,858,600,000	415,220,000	2,273,820,000
1932	9,888,535,364*	1,186,798,764*	11,075,334,128*	1,690,194,175*	417,492,718*	2,107,686,893*
1933	9,285,500,000	1,179,600,000	10,465,100,000	1,602,400,000	411,210,000	2,013,610,000
1934**	9,778,300,000	1,368,300,000	11,146,600,000	1,611,000,000	448,540,000	2,059,540,000

*From United States Census of Electrical Industries; remaining figures are American Transit Association estimates.

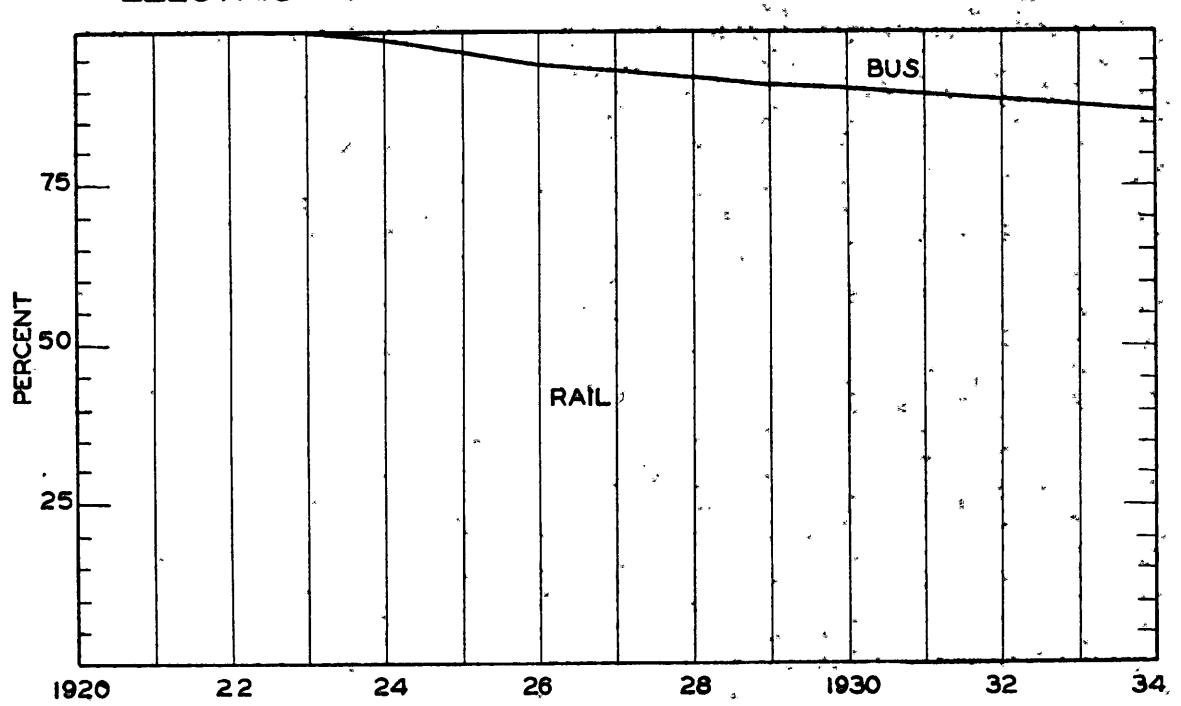
**Preliminary estimate.

Note: Data from Transit Journal.

PASSENGERS CARRIED BY ELECTRIC RAILWAY COS.
AND
AFFILIATED BUS OPERATORS IN UNITED STATES.



PERCENT OF PASSENGERS CARRIED BY RAIL & BUS
ELECTRIC RYS. & AFFILIATED BUS OPERATORS IN U S.



B.P.U. & T.

Having in mind the fact that there were the three types of vehicles available for mass transportation and that many of the member companies were faced with the economic problem of selecting that type which would both satisfy the needs of the community served, and prove a profitable investment for the company, the American Electric Railway Association, now known as the American Transit Association, appointed a Committee on the Economics of Rolling Stock Application, to determine the relative costs of operation of the three types and to develop data to be used as a guide in selecting the proper vehicle for a particular operation. This Committee in its report in 1931 had this to say:

> "* * * It is the relative effect of investment and operating costs which primarily determines the field of economic application of the various vehicles. A street car with the largest investment cost has the lowest operating cost per passenger hauled. The trolley bus with a much lower investment has slightly higher operating cost per seat mile and the gas bus with the smallest investment has the highest operating cost. As the traffic density increases the fixed charges per mile become less and as a result the high investment cost for rail service is warranted for very heavy traffic. For lesser densities of traffic the gas bus with its small investment is most suitable. Between the two classes of service is a field of application where the trolley bus, with its moderate investment cost and low operating cost is available. * * *"

The following table indicates the growing use of the gasoline bus, and on the page immediately following this table appears a chart showing graphically the trend of total passengers carried by rail and by bus, and the increasing percentage of bus passengers.

PASSENGER TRAFFIC AND VEHICLE-MILES OPERATED BY ELECTRIC RAILWAYS AND AFFILIATED BUS UNDERTAKINGS

Includes only those rail lines included by the Census Bureau and bus lines which are subsidiary to them or which have taken their place where rail lines have been superseded. It does not include so-called independent bus lines which never have had any connection with electric railway properties.

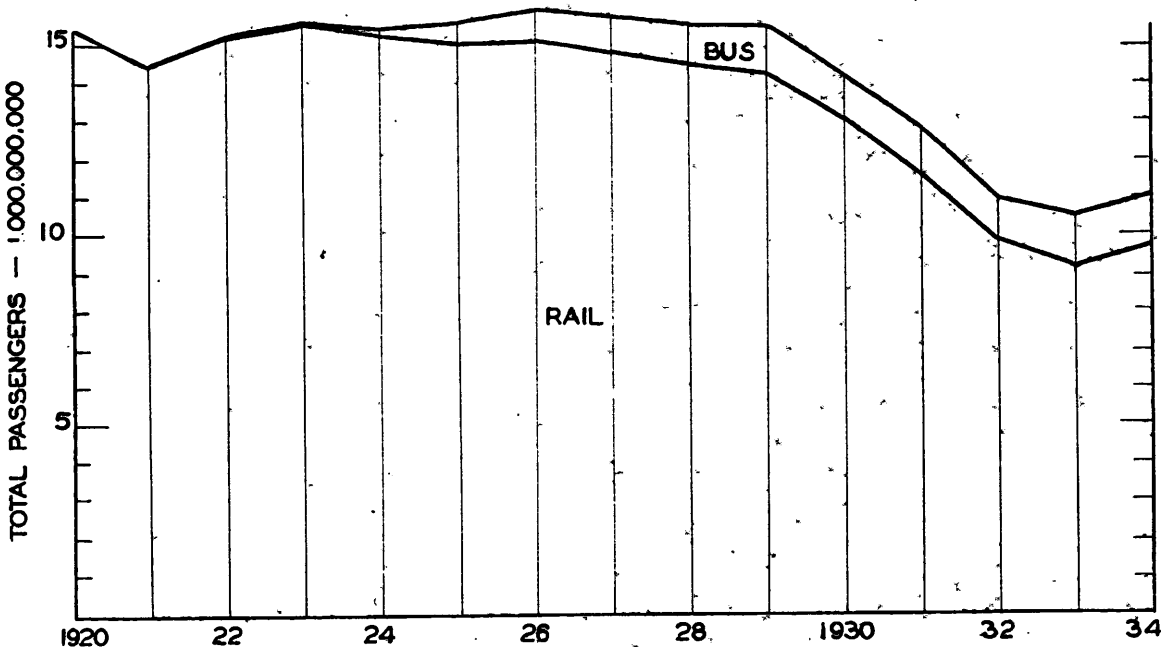
Year	Passengers Carried			Vehicle-Miles		
	On Rail Cars	On Busses	Total	Car-Miles	Bus-Miles	Total
1917	14,506,914,573*		14,506,914,573	2,139,801,530*		2,139,801,530
1918	14,243,415,000		14,243,415,000	2,079,000,000		2,079,000,000
1919	14,915,994,000		14,915,994,000	2,105,000,000		2,105,000,000
1920	15,540,715,000	8,270,000	15,548,985,000	2,153,000,000	2,272,000	2,155,272,000
1921	14,574,439,000	18,795,000	14,593,234,000	2,111,000,000	5,163,000	2,116,163,000
1922	15,331,399,851*	40,447,000	15,371,846,851	2,124,523,362*	11,112,000	2,135,635,362
1923	15,650,000,000	92,471,000	15,742,471,000	2,150,000,000	25,373,000	2,175,373,000
1924	15,312,000,000	225,000,000	15,537,000,000	2,180,000,000	72,187,000	2,252,187,000
1925	15,167,000,000	520,000,000	15,687,000,000	2,204,000,000	154,268,000	2,358,268,000
1926	15,225,000,000	845,000,000	16,070,000,000	2,220,000,000	224,083,000	2,444,083,000
1927	14,901,435,276*	991,000,000	15,892,435,276	2,163,772,982*	292,369,000	2,456,141,982
1928	14,521,000,000	1,126,400,000	15,647,400,000	2,113,400,000	338,170,000	2,451,570,000
1929	14,363,000,000	1,280,700,000	15,643,700,000	2,060,600,000	401,071,000	4,923,341,000
1930	13,088,000,000	1,249,100,000	14,337,100,000	1,995,200,000	419,558,000	2,414,758,000
1931	11,611,000,000	1,213,400,000	12,824,400,000	1,858,600,000	415,220,000	2,273,820,000
1932	9,888,535,364*	1,186,798,764*	11,075,334,128*	1,690,194,175*	417,492,718*	2,107,686,893*
1933	9,285,500,000	1,179,600,000	10,465,100,000	1,602,400,000	411,210,000	2,013,610,000
1934**	9,778,300,000	1,368,300,000	11,146,600,000	1,611,000,000	448,540,000	2,059,540,000

*From United States Census of Electrical Industries; remaining figures are American Transit Association estimates.

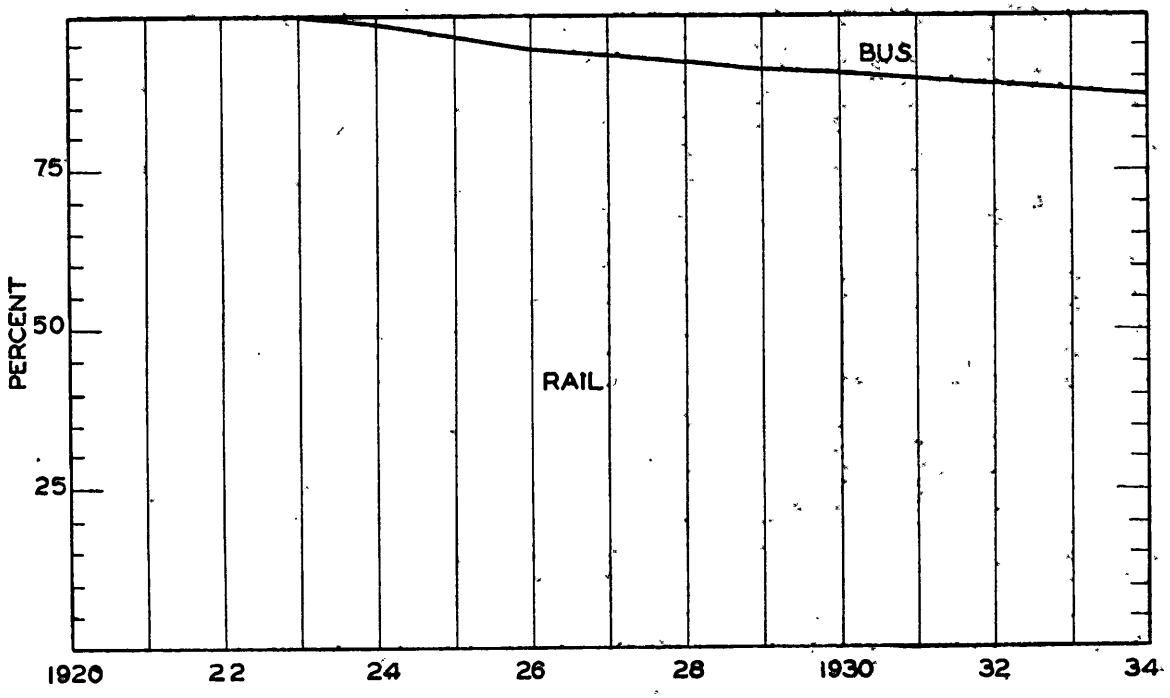
**Preliminary estimate.

Note: Data from Transit Journal.

PASSENGERS CARRIED BY ELECTRIC RAILWAY COS.
AND
AFFILIATED BUS OPERATORS IN UNITED STATES.



PERCENT OF PASSENGERS CARRIED BY RAIL & BUS
ELECTRIC RYS. & AFFILIATED BUS OPERATORS IN U S.



B.P.U. & T.

The use of the bus in Los Angeles has not differed greatly from the average here shown for the United States, nor from that in the other cities with a population of one million or over, as can be seen from the following figures:

	Percentage of Passengers Carried by		
	Bus	Trolley Bus	Both
New York	10.84	0.08	10.92
Chicago	0.13	2.00	2.13*
Philadelphia	5.62	0.16	5.78
Detroit	14.17	0.02	14.19
Los Angeles	12.89	.....	12.89**

*Does not include Chicago Motor Coach Co. Figures are not available.
**Does not include figure for several independent operators.

In New York, the great bulk of passengers are carried on the rapid transit lines, the surface rail and bus lines serving principally as cross-town feeders. Certain restrictions concerning construction and paving requirements have influenced the extension of bus lines into new territory and the substitution of busses for certain of the rail lines.

The Chicago Surface Lines operates both gas and trolley busses as feeders to their street railway system. The operation of both types of bus is restricted to the outlying sections, none of them entering extensive shopping districts.

In Detroit and in Los Angeles, the two cities showing the highest ratio of bus operation, some bus lines are operated as through lines into the congested area.

Indianapolis is frequently referred to as a city in which the coordination of the three types of transportation has proven highly successful. The plan followed there "has been to operate the heavy duty lines with street cars, the lines in between with trackless trolleys, and the lines with longer intervals and reaching into the outlying districts with gas busses."

A good many smaller cities and towns depend solely upon the gas bus or gas and trolley busses for transportation service. Only seventy cities in excess of 25,000 population are served exclusively with gas or trolley busses, and only seventeen of these are of 50,000 population or over. Of this number, only three have a population of over 100,000, and in some of them, like the city of Glendale, California, the busses are operated as an auxiliary to the interurban electric railway service. The largest city served exclusively by busses is San Antonio, Texas, which has a population of 231,500.

In 1934 trolley busses were being used in twenty-three cities in the United States, including New York, Chicago, Philadelphia, Detroit, New Orleans, Indianapolis, Toledo, Columbus and Memphis. Other cities, including San Francisco, have ordered trolley busses.

The operations in any of the cities served exclusively by busses cannot be taken as criteria upon which to base an opinion that an exclusive bus system would be successful in the city of Los Angeles, due to the great differences in area, population density, available revenues, traffic conditions and type of development. Neither can the success of a city-wide motor coach system be predicated upon the bus operations in any of the major cities, such as New York and Chicago.

It therefore appears that there is a proper field for each type of rolling stock here discussed, and that in developing any transit system, consideration should be given to the proper use of each of them. The conditions from the standpoint of transportation needs probably vary as much in Los Angeles as in any other city in the United States, due to its size, extent, distribution of population and other conditions more or less peculiar to it. It is important to every city that its transportation facilities be designed to provide the best possible service at the lowest operating cost, and with the most economical use of street space.

TRANSPORTATION FACILITIES IN CITIES OF 10,000 OR MORE POPULATION

Size of Cities by Population	No. of Places	Local Busses only	Thru Busses only	Local Busses & thru st. cars	Local Busses & Local st. cars	Thru Busses & Local st. cars	Thru Busses & thru st. cars	Local st. cars only	Thru st. cars only	Number Local Transportation	Number of Busses operated	Number of st. cars operated
Over 1,000,000	5	----	----	----	5	----	----	----	----	----	3,552	16,718
250,000 to 1,000,000	32	----	----	----	32	----	----	----	----	----	3,961	14,391
100,000 to 250,000	56	2	----	3	48	1	2	----	----	----	2,835	4,124
50,000 to 100,000	98	13	----	8	58	1	10	8	0	----	1,817	2,259
25,000 to 50,000	185	71	6	24	41	----	29	12	2	----	1,506	845
10,000 to 25,000	606	172	99	40	12	3	81	22	41	136	1,151	262
Total	982	285	105	75	196	5	122	42	43	136	14,822	38,599

Data from Bus Transportation, Feb. 1935.

THE LOS ANGELES AREA

Factors Affecting Transportation Requirements in the Various Districts

It is essential to any community that adequate and proper transportation facilities be provided, that these facilities be planned according to the population to be served and not limited by political boundaries; that the service in areas within the community having distinct characteristics be based upon the needs therein, and that the servcie in each area be planned with due respect to its relation to the community as a whole. While the experience of other cities in working out their transportation problems may be of help, we cannot base a prediction as to the success of an all-bus operation in Los Angeles upon the results in any other city. No two cities have developed in the same manner. Neither have any two cities identical conditions with respect to population, traffic congestion and related problems. For example, San Antonio, the largest city served exclusively by busses, does not have the same highly developed central business district with the accompanying traffic congestion as does Los Angeles.

In the development of facilities, adequate consideration should be given to the problem of providing for the expeditious movements of both mass and individual transportation units, keeping in mind the relative costs of possible methods. As great a variation in conditions from the standpoint of transportation needs will probably be found in the city of Los Angeles as in any other city in the United States. We will therefore proceed to discuss the following questions which must be considered in determining what is a "feasible and desirable" transportation system—extent, topography, population and development, climate and traffic.

Extent

The City of Los Angeles is the largest in area of any in the United States, yet is only fifth in population. Its extremely irregular boundaries embrace an area of 450 square miles, which extend north and south a distance of fifty miles and across which the width in an easterly and westerly direction varies from as little as one-half mile to several miles. These irregular boundaries wholly or partially surround several well developed areas, some of which are incorporated. These areas are so related to the city as to be practically a part of it, from a transportation standpoint. They include Santa Monica, Culver City, Beverly Hills, Inglewood, Hawthorne, Huntington Park, Bell, Maywood, Southgate, Belvedere Gardens, Alhambra, South Pasadena, Pasadena, Glendale and Burbank. In several instances transportation lines pass through one or more of them between the downtown district and other parts of the city of Los Angeles.

Some idea is gained of the extent of the city from the fact that there are electric railway lines operating northwesterly from the central business district into the San Fernando Valley as much as twenty-nine miles in length, and southerly into the San Pedro district of over twenty-three miles in length. There are various rail and bus lines operating to points in the beach districts approximately eighteen miles distant from Seventh and Broadway, which is usually considered as the focal point of the mass transportation systems. The extreme irregularity of the city is emphasized by the contrast between these more or less distant points and other well populated areas which although outside of the city limits, are within five or six miles of Seventh and Broadway.

Topography

An important part in the development of the city, the paths of population growth, and of course upon the location of transportation facilities, all of which are inter-related, has been played by topographical features, such as the

Los Angeles River, Bunker Hill at the northwesterly edge of the central business district, the Baldwin Hills in the southwest, the Santa Monica Mountains which form the southerly boundary of the San Fernando Valley, and the Verdugo Hills on the northeast of the San Fernando Valley. The effect of these topographical features and the manner in which annexations have been made, have led us to consider the city as being comprised of five different sections or districts, for the purposes of the present discussion of city-wide transportation needs. The development and accessibility of each unit have a bearing upon the manner in which the facilities from other districts will be related to them and the type and extent of service within the particular area. Existing local and interurban transit lines are interlaced and in contemplating changes in one, thought must be given to the possible effects upon the other.

The districts chosen are:

The great San Fernando Valley, separated from the main city by the Santa Monica Mountains, comprising an area of 190 square miles, is devoted primarily to agricultural uses, although there are a few fairly extensive business centers.

The Tujunga-Sunland area, separated from the San Fernando Valley by the Verdugo Hills and from the central portion of the city by the incorporated cities of Burbank and Glendale, has an area of approximately twenty-two square miles, and is essentially agricultural in nature.

The central portion of the city, in which are located practically all of the existing local transportation facilities, constitutes only slightly over one-fourth of the total area of the city. This is a highly developed commercial, industrial and residential section. This part of the city and adjacent areas are embraced within a circle having an eight mile radius measured from Seventh and Broadway, which was termed the local transportation limit by the engineers making a Joint Survey of Street Railways for Los Angeles in 1925. This portion of the city presents the most serious transportation problems, not only because of the great number of people residing therein, but because of the fact that persons from outlying districts pass through it to reach the central business district and it is important that their travel be faciliated as much as possible.

The western district lies south of the Santa Monica Mountains, west and south of the city of Beverly Hills and extends to the beaches. It comprises an area of approximately eighty-five square miles. This section is primarily residential, although part of it is devoted to agriculture and there is considerable resort development at the beaches, which gives rise to rather decided seasonal fluctuations in transit patronage.

The Harbor district which is connected to the main body of the city by the so-called "Shoestring Strip," has a total area of twenty-six square miles, including that portion of the Shoestring Strip south of the Green Meadows Annexation. The shipping and industrial developments support a fairly dense residential area, the combination of which makes necessary the rendering of a local service in this district.

The local transportation systems serving the central part of the city do not supply the transportation requirements of all of these areas. For instance the Tujunga-Sunland area is served by a motor coach company which operates into the district by way of the city of Glendale and Foothill Blvd. Palisades Del Rey and adjacent points in the West Coast Annex are served by the interurban system which operates through the beach cities along the coast. The Harbor District is connected to the main part of the city by interurban service, but the majority of the local servcie within the area is given by independent operators.

Population

The rapid growth of the city of Los Angeles is familiar to all. It is indicated on the chart on page 12, which shows the trend of population between the years 1860 and 1930.

The total population in the city, according to the 1930 United States census, was 1,238,000. Population is widely scattered. The excessive subdivision of property and the advent of the automobile, which has obviated the dependence upon other forms of transportation, are contributing factors. The single family residence predominates, and there are still large areas devoted to agricultural use and others which are mountainous in character, all of which result in a low average population density per square mile. The great variation in density can be seen by comparing the population per square mile in each of the districts to which we have referred.

	Population per square mile
San Fernando Valley District	263
Sunland-Tujunga District	211
Central portion of city	8,500*
Western District	950**
Harbor District	2,145

*This area contains almost nine-tenths of the total population of the city, but only slightly over one-fourth of the total area.

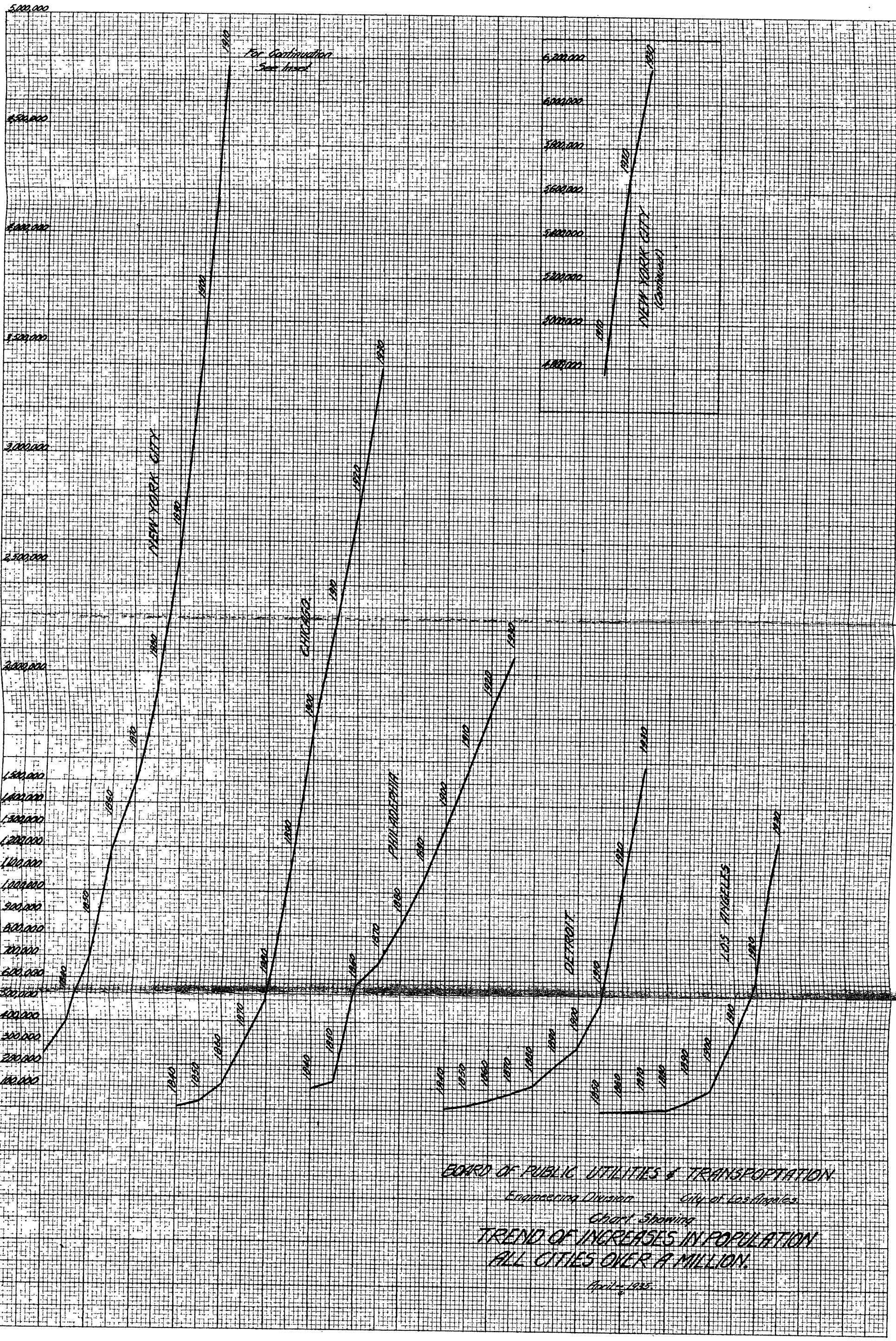
**The average population density for the Western District would be considerably higher if rather extensive undeveloped mountain areas were excluded.

The map on page 19 shows the distribution of population in the city and contiguous territory.

The average population density for the entire city is only 2,748 per square mile. This is compared with the population density of other major cities in the United States in the following table:

	Population	Area in Sq. Mi.	Population Per Sq. Mi.
New York	6,930,446	299.00	23,178.7
Chicago	3,376,438	201.90	16.723.3
Philadelphia	1,950,961	128.00	15,241.9
Detroit	1,568,662	137.90	11,375.4
Los Angeles	1,238,048	450.63	2,747.3
Cleveland	900,429	70.76	12,725.1
St. Louis	821,960	61.00	13,474.8
Baltimore	804,874	78.72	10,224.5
Boston	781,188	43.90	17,794.7
Pittsburgh	669,817	51.30	13,056.9
San Francisco	634,394	42.00	15,104.6
San Francisco and Oakland	918,457	95.16	9,651.7
Milwaukee	578,249	41.14	14,055.6

A considerable area within the city is still only partially developed, the San Fernando Valley being a notable example. Various estimates have been made of the ultimate population capacity of the city and surrounding metropolitan area, as well as the rapidity with which this development will take place. The accompanying chart shows the tendency of cities to grow uniformly after reaching a certain stage of development. Various estimates have been made of future population for both the City and the County. Whichever of these estimates proves to be the nearest correct, it is still to be expected that there will be considerable increase, as the years progress, in the number of people for whom transportation must be provided in one form or another. Present facilities should be planned so as to fit in as well as possible with future requirements.



BOARD OF PUBLIC UTILITIES & TRANSPORTATION.

Engineering Division City of Los Angeles.

Chart Showing

TREND OF INCREASES IN POPULATION ALL CITIES OVER A MILLION.

April - 1925.

Climate

The mild climate and weather conditions which make it possible to drive automobiles without undue inconvenience every day in the year, has resulted in greater use being made of the automobile in the Los Angeles area than in any other part of the nation. Not only is the number of automobiles per unit of population higher here than elsewhere, but the use made of them is greater, as shown by the following table:

COMPARISON WITH OTHER CITIES OF PASSENGER AUTOS ENTERING CENTRAL DISTRICT

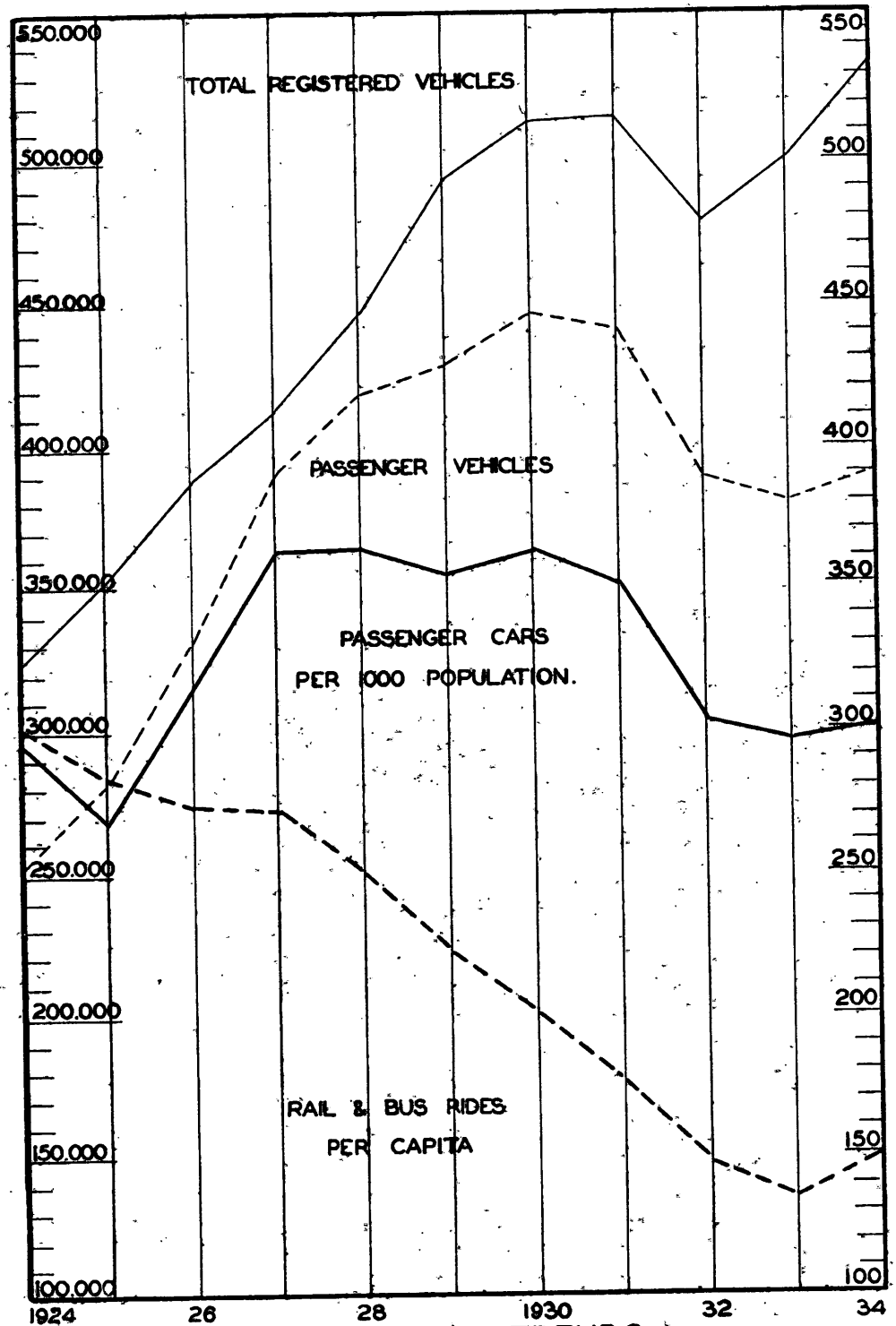
	Area Sq. Mi.	Passenger Autos
Baltimore	0.49	64,667
Boston	0.88	65,656
Chicago	0.85	113,331
Detroit	0.67	82,439
Kansas City	0.38	69,775
LOS ANGELES	**1.39**	**276,753**
Philadelphia	2.04	79,315
Pittsburgh	0.28	39,477
St. Louis	0.49	48,895
San Francisco	----	58,482
Washington	1.50	130,893

The extraordinary use of the automobile as a means of individual transportation is of especial important when considering mass transportation facilities. The private automobile has long been considered as the worst competitor of existing public transportation companies. It has not only cut the patronage, but has made it increasingly difficult to render a satisfactory service to the remaining street car patrons because of traffic congestion.

The chart on page 14 shows the number of motor vehicles and the number of passenger automobiles registered in the City of Los Angeles. It depicts the increase in motor vehicle registration during the period from 1924 to 1934 inclusive, and shows the trend of automobiles registered per one thousand population, as well as the rides per capita on the local transportation systems for the same period. The decided effect of automobiles upon patronage of local transportation systems is apparent. It is of course realized that unemployment is largely responsible for the slump in rail and bus patronage since 1929. Numerous vehicles registered elsewhere than in the Los Angeles area add to the traffic congestion, particularly during certain seasons.

Traffic

The problem of handling street traffic, particularly in the central business district, has become increasingly serious in all major cities. Although the principal movement of traffic in all cities is to and from the central business district, the problem is perhaps more acute in Los Angeles than anywhere else because of the great number of automobiles entering into that district here as compared with other cities and the restricted amount of street space available. The following table, taken from the report of Olmsted, Bartholomew and Cheney on a Major Traffic Street Plan for the city of Los Angeles, shows the proportionate area of the downtown business district devoted to roadways in Los Angeles, as well as similar data for a number of other American cities. It will be noted that Los Angeles has the smallest amount of such space.



COMPARISON OF TRENDS
OF MOTOR VEHICLES REGISTERED
IN L.A. CITY WITH TOTAL PASSENGERS
CARRIED BY
LOCAL RAIL & BUS LINES.

B.P.U.&T.

PROPORTIONATE AREA OF DOWNTOWN BUSINESS DISTRICTS DEVOTED TO ROADWAYS

	Per Cent
Washington, D.C.	44
San Diego, Cal.	41
Cleveland	39.5
Seattle	37.5
St. Louis	37
San Francisco	34.5
Pittsburgh	34
Portland	34.5
Minneapolis	30.5
Detroit	29.5
Chicago	29
Denver	27.5
Salt Lake City	25.5
Toledo	24
Los Angeles	21.5

Because of traffic congestion, much time and money has been spent by the City and interested groups in the development of methods of control and other restrictions designed to alleviate this situation. Traffic signal installations, ordinances prohibiting parking, and the restriction of left-hand turns at certain intersections are among the more familiar steps that have been taken. Not many years ago the City went to the expense of cutting the Second Street tunnel through Bunker Hill in order to give an additional outlet for traffic to and from the central business district. It is quite evident then, that no steps should be taken which tend to further decrease the maximum use of the limited amount of street space available in the central business district and thus nullify the advantages gained from the relief measures heretofore taken. Street traffic congestion is closely associated with mass transportation and it is therefore necessary to give consideration to the effect upon traffic of any proposal. The value of a traffic artery depends upon the number of people who can move over it, and it is essential to the City that that type of mass transportation facility be used which will permit the most rapid movement of those facilities and of individual transportation mediums. Therefore, where traffic movement is a serious problem because of street congestion, that type of vehicle should be selected which will be most saving of street space required per passenger carried.

The problems related to these factors and their importance to the community have caused the City of Los Angeles and various other organizations interested in the development of the city, to make exhaustive studies and recommendations in connection with traffic in general and mass transportation in particular. As long ago as 1911 the City of Los Angeles engaged Bion J. Arnold, a well known engineer, to make a study and report upon transportation problems in the City of Los Angeles. The more outstanding reports subsequent to that time include the report made in 1920 by the Railroad Commission on Railroad Grade Crossing Elimination and Passenger and Freight Terminals in Los Angeles, the Major Traffic Street Plan made to the Traffic Commission in 1924, the Joint Report on Street Railway Survey, City of Los Angeles, in 1925, in which engineers of the Board of Public Utilities, the Railroad Commission and the carriers participated, the report of a Comprehensive Rapid Transit Plan for the City and County of Los Angeles by Kelker-De Leuw & Company in 1925, made to the Los Angeles City Council and the County Board of Supervisors, and the recent report of Mr. Donald M. Baker to the Central Business District Association on a Rapid Transit System for the Los Angeles Area.

The population density in some of the districts we have outlined can be seen to be too low to support a purely local service. They are therefore dependent upon interurban facilities for all uses.

None of the independent bus operators referred to render a local service into the central business area. In the Harbor District there are six companies operating a total of approximately forty one-way route miles. The principal one of these is the San Pedro Motor Bus Association, which operates in San Pedro proper.

The Western area is served by the Bay Cities Transit Company, which also operates in Santa Monica; the Culver City Municipal Line operating from the end of the Los Angeles Railway's Washington Boulevard car line to Venice; the Santa Monica Municipal Line operating from the end of the Los Angeles Railway's Pico Street car line to Santa Monica; the Pasadena-Ocean Park Stage Line operating through Hollywood between these termini; also two or three less extensive operations.

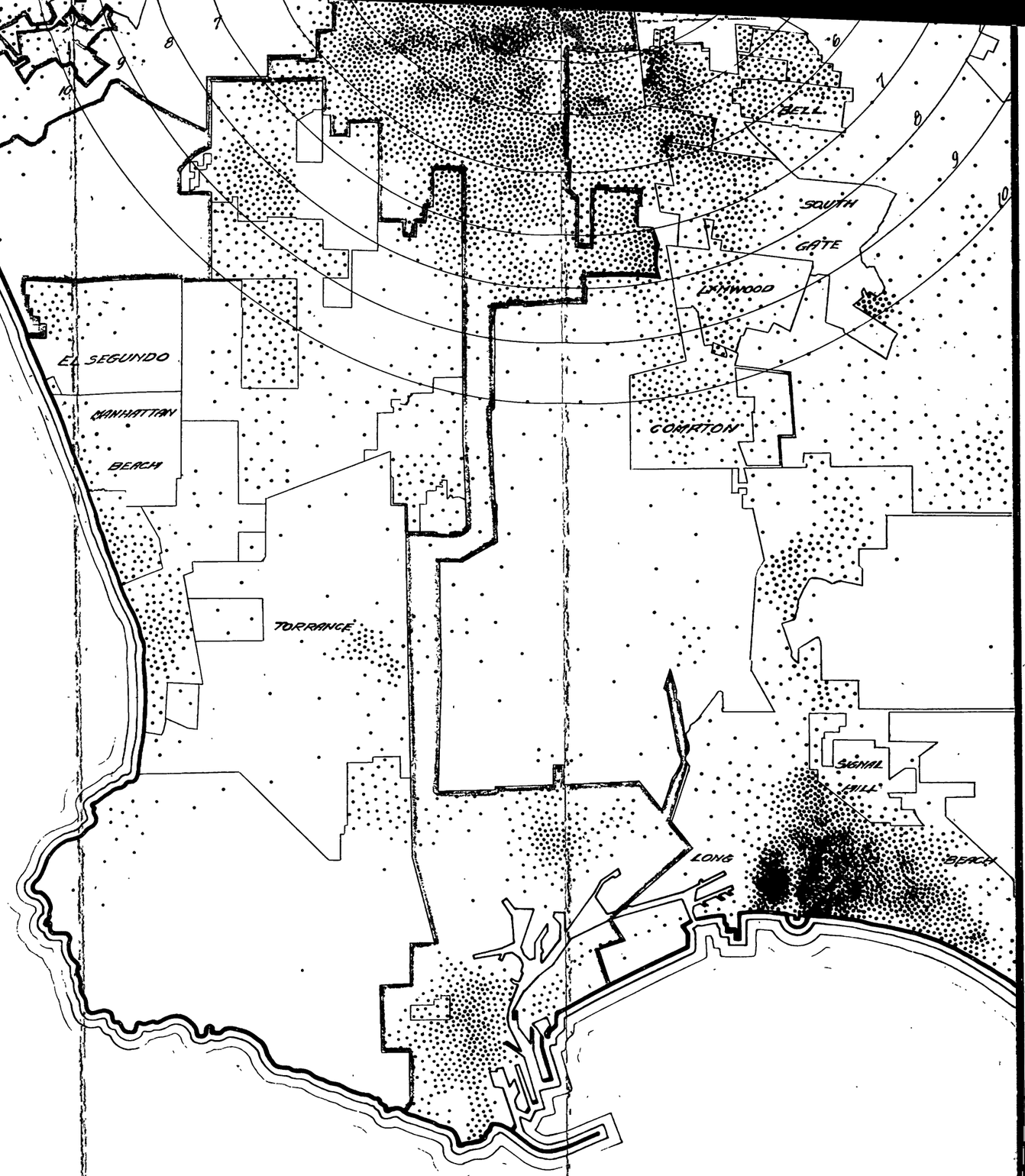
The Original Stage Line operates into San Fernando Valley by way of Burbank, and from Burbank into Hollywood.

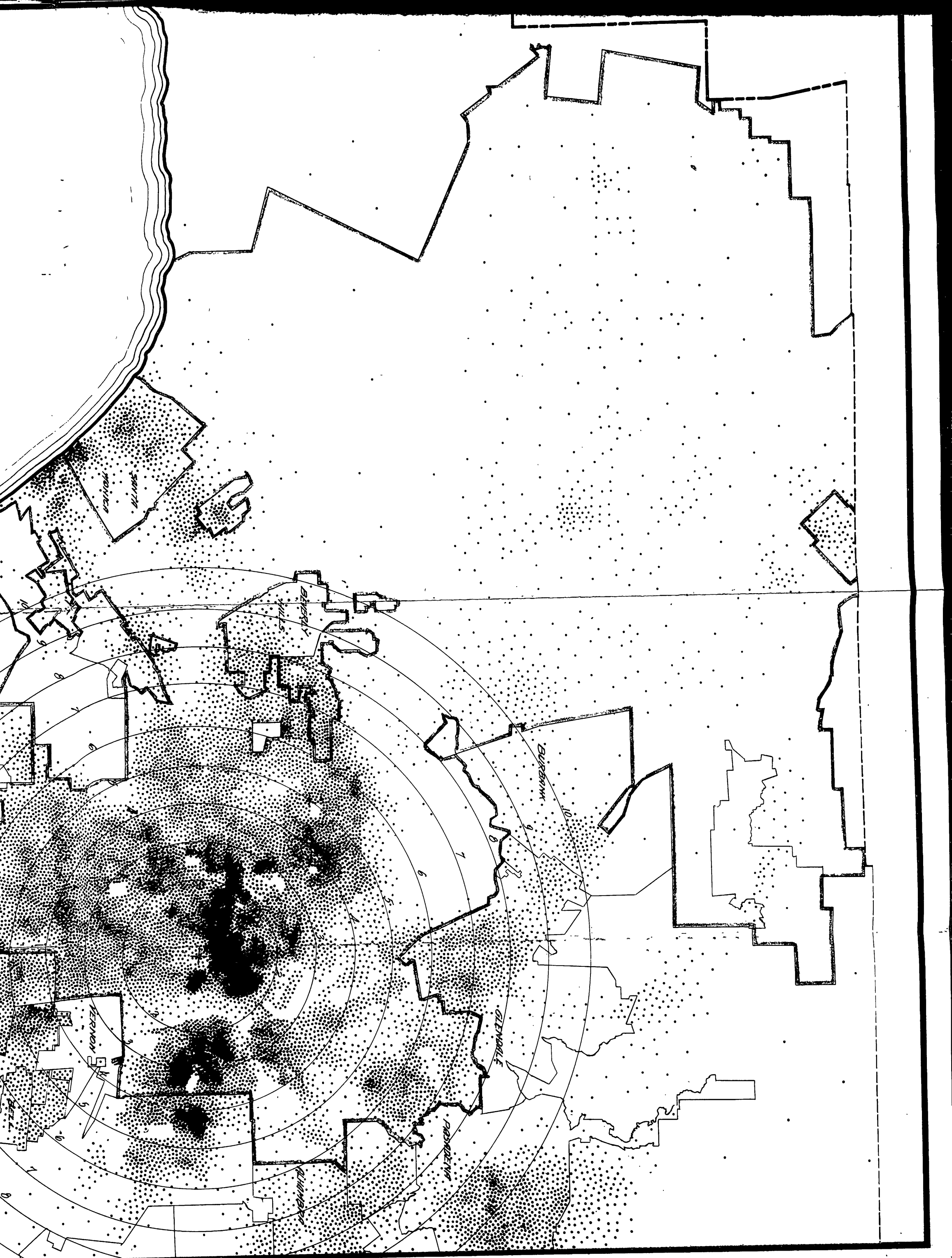
BOARD OF PUBLIC UTILITIES AND TRANSPORTATION
ENGINEERING DIVISION
LOS ANGELES CALIF.

DISTRIBUTION OF POPULATION
CITY OF LOS ANGELES
AND ADJACENT TERRITORY.

ONE DOT REPRESENTS 100 POPULATION

PORTION OF A MAP SHOWING
DISTRIBUTATION OF POPULATION
IN THE COUNTY OF LOS ANGELES.
PREPARED BY
THE REGIONAL PLANNING COMMISSION
WM. J. FOX DIRECTOR.




SANTA MONICA
BEVERLY HILLS
BURBANK
GLENDALE
PASADENA
ALHAMBRA
VERNON
BELL
10
9
8
7
6
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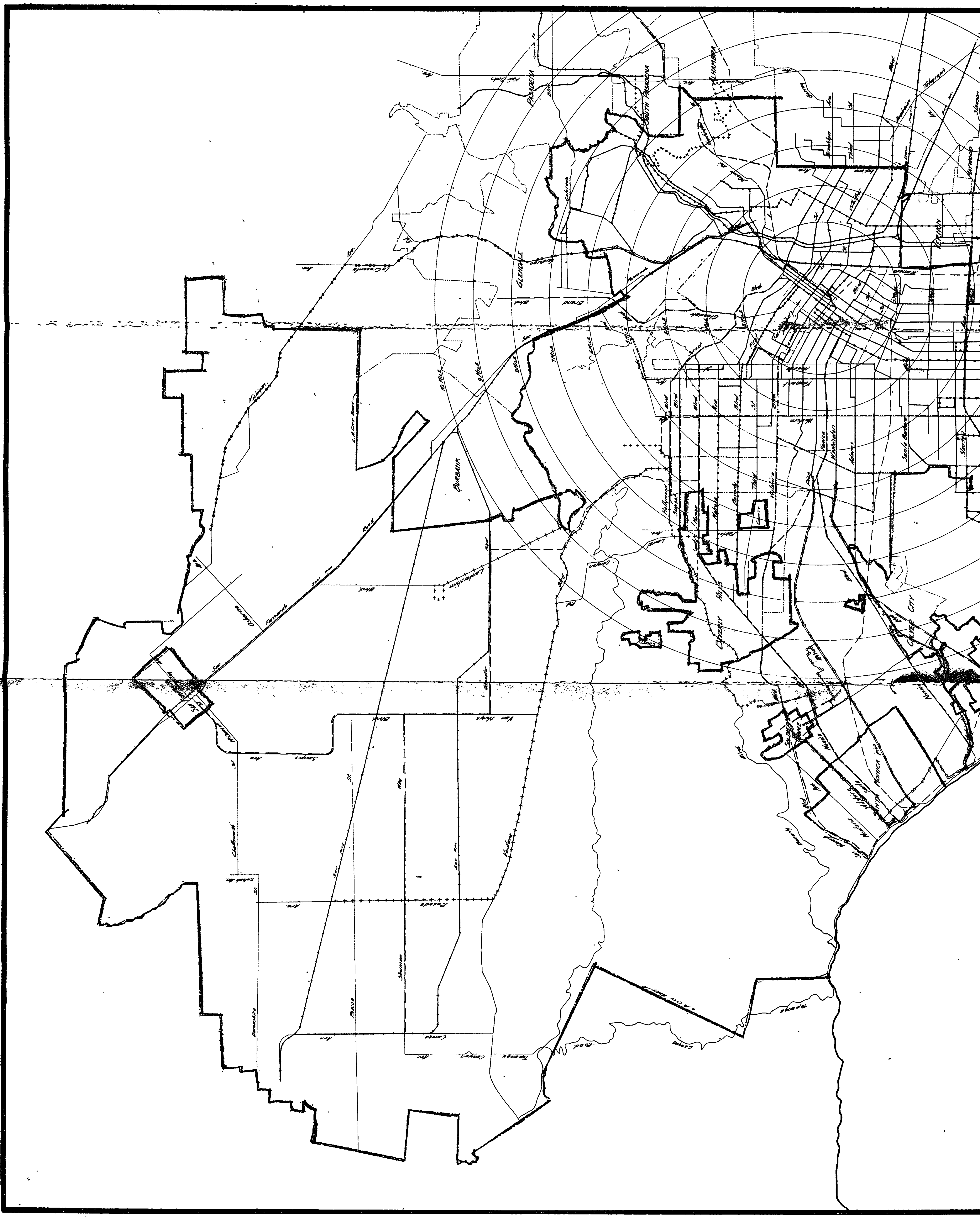
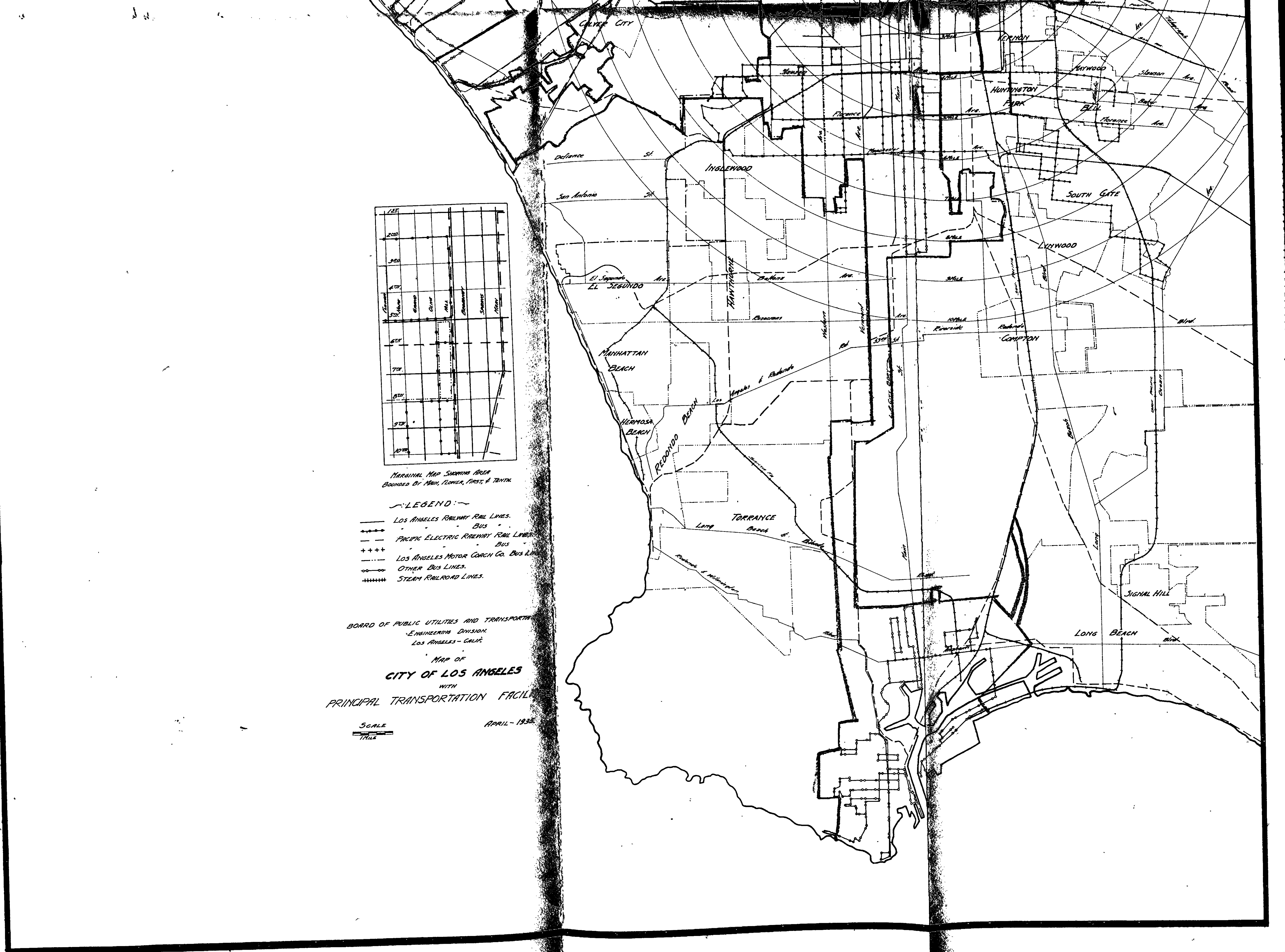
4
3
2
1


PASADENA
SOUTH PASADENA
ALHAMBRA
GLENDALE
BURBANK
BEVERLY HILLS
CULVER CITY
SANTA MONICA
VERNON


MARGINAL MAP SHOWING AREA
BOUNDED BY MAIN, FLOWER, FIRST, & TENTH.
~LEGEND:~
LOS ANGELES RAILWAY RAIL LINES.
" " BUS "
PACIFIC ELECTRIC RAILWAY RAIL LINES
" " BUS "
LOS ANGELES MOTOR COACH CO. BUS LINES
OTHER BUS LINES.
STEAM RAILROAD LINES.
BOARD OF PUBLIC UTILITIES AND TRANSPORTATION
ENGINEERING DIVISION.
LOS ANGELES - CALIF.
MAP OF
CITY OF LOS ANGELES
WITH
PRINCIPAL TRANSPORTATION FACILITIES
APRIL - 1938
SCALE
1 MILE
CULVER CITY
VERNON
HAYWOOD
HUNTINGTON PARK
BELL
INGLEWOOD
SOUTH GATE
LYNWOOD
EL SEGUNDO
HAWTHORNE
COMPTON
MANHATTAN BEACH
HERMOSA BEACH
REDONDO BEACH
TORRANCE
SIGNAL HILL
LONG BEACH

The Tujunga-Sunland area is served by the Motor Transit Company, which has a widely developed interurban stage system. Another line operating through the City is the Pickwick Stage Line. A part of the operations of the Lang Motor Coach Company extends into Los Angeles. In addition to those enumerated, various small independent operators serve outlying areas.

There has been very little change in the amount of street railway trackage for many years. Practically all the additional transportation facilities required since 1920 have been supplied by the establishment of bus lines, either as feeders to the rail lines or as additional lines from newer areas into the downtown district, or crosstown lines connecting newly developed business districts. This expansion of the transit systems with bus lines instead of rail facilities was occasioned by the unusually rapid growth occurring in Los Angeles shortly after 1920 and the wide distribution of the population increment influenced by factors to which we have referred before.

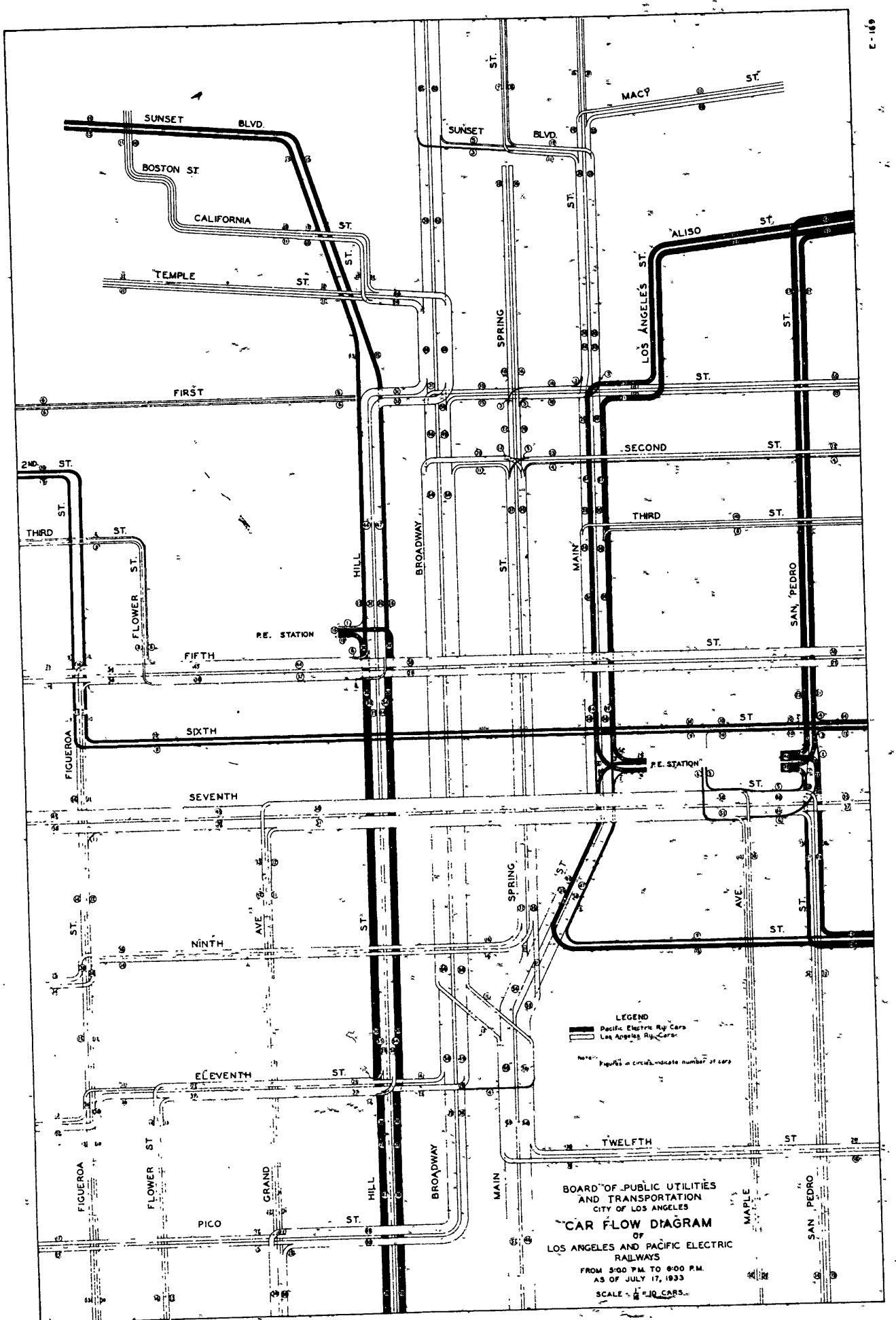
The existing independent operations result in some duplications of service, and the lack of proper correlation at some points. The location of transit facilities has been influenced by population growth and in turn the existence of transit facilities has influenced the location of population. Where a service has once been established in a neighborhood, vigorous opposition is usually shown to any attempt to restrict that service. Therefore, although service might not be replaced in a few cases, where it is hardly justified now, it would undoubtedly be necessary to serve practically all locations now served, even though the detail of routes might be changed. Most bus lines have been placed in response to specific demands and it is to be expected that the basis for these demands continue regardless of who was operating the system.

The interlacing of local and interurban service on certain Pacific Electric Railway lines results in a query as to what might be the effect on the interurban service if the local service were replaced by another operation. The lines into San Fernando Valley operates over the same tracks as do the Hollywood lines. The amount of interurban patronage is slight compared to the local patronage. If the local service is superseded, a higher proportion of the fixed costs will have to be assessed to the interurban operations. An important question to residents of the valley depending upon this interurban service, then, is whether they alone can support continued operation.

Both the service and the fares charged, particularly by the two railway companies, have been the object of more or less continued criticism. The existing fares of the Los Angeles Railway provide for a fare of seven cents cash or six and one-quarter cents through the purchase of tokens, within a six-mile circle with its center at Seventh and Broadway. On the few lines which extend beyond this limit, the lines are divided into zones. The fare from points within the inner zone into a second zone is ten cents, and is higher for each succeeding zone. The fare system of the Pacific Electric Railway is set up on a different basis. The system is divided into a series of approximately uniform zones, the inner zone extending approximately two and one-half miles each way from Seventh and Broadway and successive zones being approximately two to two and one-half miles in length. On this system the fare is five cents within any one zone, ten cents through two zones and into a third, and fifteen cents through four zones. Through the purchase of a sixteen-ride book, persons may ride from points in the second zone through the first zone for a six and one-quarter cent fare. With one or two exceptions, the primary fare of the Los Angeles Motor Coach Company is ten cents. The payment of a ten cent fare at many points permits transfer from the rail lines of one company to the rail lines of the other, directly or by using the Los Angeles Motor Coach Company as an intermediate carrier.

Central Business District

The local operations of the Pacific Electric and Los Angeles Railway concentrate upon a few streets in the central business district. The physical


SUNSET BLVD.
BOSTON ST.
CALIFORNIA ST.
TEMPLE ST.
FIRST ST.
2ND ST.
THIRD ST.
FIFTH ST.
SIXTH ST.
SEVENTH ST.
NINTH ST.
ELEVENTH ST.
TWELFTH ST.
PICO ST.
MACY ST.
ALISO ST.
SECOND ST.
FIGUEROA ST.
FLOWER ST.
HILL ST.
BROADWAY
SPRING ST.
MAIN ST.
LOS ANGELES ST.
SAN PEDRO ST.
GRAND AVE.
MAPLE AVE.
P.E. STATION
P.E. STATION
LEGEND
Pacific Electric Ry. Cars
Los Angeles Ry. Cars
Note: Figures in circles indicate number of cars
BOARD OF PUBLIC UTILITIES AND TRANSPORTATION
CITY OF LOS ANGELES
CAR FLOW DIAGRAM
OF
LOS ANGELES AND PACIFIC ELECTRIC RAILWAYS
FROM 5:00 P.M. TO 6:00 P.M.
AS OF JULY 17, 1933
SCALE - 1/2" = 10 CARS

arrangement of streets and the obstruction to travel offered by Bunker Hill make necessary the restriction of operation to these few streets. The accompanying diagram on page 22 shows the streets upon which these two companies operate in the central business district and the relative amount of operation on each street. The existing bus operations between Second and Eighth Streets on Hill are not shown on this diagram. There are between sixty-five and seventy bus movements between Fifth and Eighth during the rush hour, only part of which extend as far north as Second Street. Although some advantages might be gained in routing through the use of busses, the existing physical restrictions would automatically confine their operation through the downtown area to almost the same paths now followed by rail and bus lines. For example, nothing could be gained by attempting to move busses across the central business district over Fourth Street, since the operation over the grade west of Hill Street would be undesirable. There is no direct outlet for Hill Street north of Temple Street.

In addition to the surface operations shown by this chart, the Pacific Electric Railway brings a good many passengers into the downtown district by way of its subway, extending from Hill Street between Fourth and Fifth Street to Second Street and Glendale Boulevard. It will be recalled that the vigorous demands of residents of the Hollywood area for a more rapid service than could be given by surface cars because of street traffic congestion, resulted in the Company constructing this subway. Any plan which replaced existing Pacific Electric local service with an all-surface operation such as an exclusive bus system would have to be, would result, then, in proportionately increasing the traffic congestion on those thoroughfares from which Pacific Electric operations were removed upon completion of the subway, and likewise would add to the congestion in that restricted area referred to as the central business district.

ANALYSIS OF THE PROPOSAL OF THE MUNICIPAL BUS LEAGUE

The Board of Public Utilities attempted to have all interested parties present at hearings upon the matter of a city-wide municipally owned motor bus system, held in compliance with the Council's request. Special effort was made to have the officers of the Municipal Bus League present to explain their plan, which had given rise to the Council's request. Some of the officers of the League appearing for the organization filed a general statement relative to their proposal. Those who appeared professed to have made no detailed study, but stated that their belief in the feasibility of the project was based upon studies made by the president of the organization, a Mr. Victor Wilson, who failed to appear. In this statement and subsequent testimony, the officers who appeared gave their ideas to the manner in which the system should be established and developed, the areas to be served, the standards of service to be given and of the probable financial outcome. A mimeographed pamphlet entitled "Wake up Los Angeles" was introduced in evidence and was identified by an officer of the organization as a pamphlet both prepared and distributed by the Municipal Bus League, containing information relative to their purpose and certain details of their plan. The pamphlet was devoted to laudatory statements concerning the advantages of busses over street cars and included what were called tentative estimates of the investment required to establish a municipal bus system to replace existing rail and bus facilities and of the revenue and expenses to be expected from the operation of the system. It was indicated that these estimates were the result of the studies attributed to Mr. Wilson and upon which the organization had relied in arriving at its conclusions as to the desirability and feasibility of its proposal.

Based upon the statements filed and testimony given, their plan, in brief, entails the following ideas. The ordinance to be voted upon May 7th, would, if passed, require the City Council to establish a municipal transportation

system, restricted to gasoline busses only. It would be necessary for the Council to appoint a board, consisting of three members at a yearly salary of $5,000 each, to have full control over the system, and establish a department under that board. The Council would have to appropriate all funds for the initial stages of development. If the ordinance was adopted the Municipal Bus League would cooperate in establishing the system. They favor beginning on a small scale, on a trial and error basis, probably by duplicating service of existing operators where the heaviest loads are carried, and by placing new lines where they feel service is needed but not now given, to be followed by a gradual duplication, piece by piece, of the lines of all existing carriers both rail and bus. The opinion was expressed that starting in this way would require a small initial outlay by the Council — possibly several hundred thousand dollars.

The service to be provided is to be on a higher plane than that now given, a seat to be provided for every passenger, as nearly as possible, and more frequent headways through the operation of small units. Thirty passenger busses are favored. All loading and unloading of passengers would be at the curb. Street car rails and loading zones would be eliminated from the streets, thus relieving traffic.

In planning a bus system on this basis, the League has failed to consider several items of especial importance to those dependent upon mass transportation facilities as a medium of travel, and to others making use of the thoroughfares over which street cars and busses would travel. A particularly confusing condition would undoubtedly exist during the transition period.

Although their expressed intention is that all existing facilities be replaced, the estimates of the amount of equipment required and the total investment necessary cover only the operations of the Los Angeles Railway and the Los Angeles Motor Coach Company. Some of the assumptions made in arriving at the estimates of investment and of financial results of operation do not appear to be well founded nor entirely in keeping with their ideas of service standards.

Assumptions which apparently should be modified include the following: The method of arriving at the number of busses required would result in the same percentage of over-loads as those now carried by the Los Angeles Railway. The ability of busses to handle over-loads is not as great as that of street cars, and further, if a service of a standard they state to be desirable is given, it will be necessary to include sufficient additional busses to reduce this overload factor. They assumed that the average speed of the entire proposed system would equal the speeds of the existing bus operations of the Los Angeles Railway and Los Angeles Motor Coach Company, whose operations, for the most part, are in non-congested areas. A further adjustment was made in the number of busses required because of the assumed increase in speed of bus operation over existing rail operation. Both the investment in plant and equipment other than busses, and operating costs were predicated to some extent upon figures relating to the Los Angeles Motor Coach Company, which figures do not represent all facilities used by that company nor all of that company's costs, because of the facilities provided and expenses taken care of by the parent companies. Proper consideration was not given to the differences between carrying capacity of existing busses of the Los Angeles Motor Coach Company and the proposed busses. They also assumed that all rail lines would be removed from streets in the downtown area; also that small busses loading at the curb could satisfactorily care for the peak hour traffic.

The data prepared by the Municipal Bus League is insufficient to determine the investment, feasibility and desirability of a city-wide system which would replace all existing facilities, concerning which the Council has asked for details. This Board has therefore proceeded in the balance of this report,

to estimate the requirements and discuss relative advantages and disadvantages of both types of operation and methods of inaugurating such a system and of the possible financial outcome.

ANALYSIS OF EQUIPMENT AND INVESTMENT REVENUES AND RESULTS OF OPERATION

In planning a municipally owned and operated bus system it would be necessary to provide service for at least all areas now receiving service from existing systems. The purpose for establishing a municipally owned system is apparently twofold—to give a better service and at a lower cost. In planning to operate such a system then, it is necessary that the following items be considered: Necessary amount of equipment of the type chosen; required investment for that equipment and the other facilities necessary to complete an efficient operating system; the ability of the particular type of equipment to efficiently and satisfactorily care for the demands upon it; the operating costs and the revenues which can be obtained with the desired fare.

In order to establish a new bus system it would be necessary to acquire, in addition to the busses, the necessary land and buildings for storage, maintenance, and the facilities required for the personnel and administration, maintenance and repair, equipment, office furniture and fixtures, and other related incidentals. To provide for economical operation it would be necessary, with the number of busses required, to place storage and maintenance facilities at several strategically located points throughout the city. There would also be required central shop facilities to handle major overhauling and repair work. These would have to be provided before operations could begin. The ordinance sponsored by the Municipal Bus League provides that the Council shall appropriate the initial amounts required to start operations. The sum which the Council would be required to appropriate for this purpose in the beginning would of course depend upon whether a complete or partial system were established.

The principal advantage in beginning operation piece-meal, as suggested by the Municipal Bus League, is the possibility of experimenting to determine whether or not the type of operation would be successful. There are many disadvantages however. First, an experiment of this limited type would not be of real value nor conclusive, since it would be competing with the existing carriers. Patrons of such disconnected bus lines would be at a disadvantage due to the lack of transfer privilege. The existing systems provide extensive transfer privileges upon a single fare, while those who made use of such a bus line would be required to pay a second fare if they wished to reach points not served by the bus system. It is quite possible that a second disadvantage might be suffered by those who, because of location, were still required to patronize the existing carriers, for if competition against a single line by a municipal bus should result in that line being discontinued as a part of the company's system, then those wishing to reach points on the bus line from other parts of the city would have to pay a second fare. Because of these conditions neither the proposed bus nor the existing carrier would receive the revenue they would otherwise enjoy and probably should have, in order to operate successfully and give an adequate service. One of the advantages claimed for the bus operation is that street car loading zones would be removed from the streets with a resultant improvement in the movement of vehicular traffic. Along these lines where competition existed there would be the undesirable circumstance of having the street car loading zones still in place with busses attempting to load at the curb adjacent to them. With the busses added to the street cars and the vehicular traffic it may be seen that the situation would not be improved.

We have estimated the total number of busses that would be required to replace all the operations of the Los Angeles Motor Coach Company, the Los

Angeles Railway and the Pacific Electric Railway local lines, assuming a thirty passenger seating capacity bus, which is the size recommended by the Municipal Bus League, and approximately equal to the average seating capacity of the present busses of the Los Angeles Railway Company.

Methods Used

The units of equipment which it is necessary to have is controlled by the peak demand upon the system. The total number of busses required were therefore determined in the following manner: Actual checks made during 1934 of the passengers on the Los Angeles Railway cars outbound from the central business district between 5:00 and 6:00 P. M., the evening rush hour, were used to determine the number of busses necessary to handle that amount of patronage. It is not anticipated that the public would be satisfied to stand any great distance on a municipally owned bus system. One objective is to provide a better service than that now provided, and since the loading flexibility of the bus is not as great as that of the street car; and since the fluctuations in loading result in some vehicles being crowded while others are not filled to capacity, we have assumed an average seated load for thirty passenger busses to arrive at the total number. It is realized that this would not fulfill the desire of some that a seat be provided for every passenger. In place of those cars not operated into the central district and where overloads are not usually as great, a sufficient number of busses is included to provide the same number of seats as is now made available. This procedure was also followed in determining the number of busses necessary to take the place of Pacific Electric local cars and on all bus lines except those on which the rush hour provisions do not now exceed thirty seats per bus, in which case sufficient busses were allowed to provide existing headways. The number arrived at in this manner is perhaps too conservative if the expressed intentions of the Municipal Bus League with respect to loading standards and frequency of headways are to be fulfilled, even though the total number of units arrived at exceeds the number which they have stated would be required to serve the entire city.

Reasons for the difference between the two estimates are that they did not include the passengers carried by the Pacific Electric local lines; that the method they followed allowed for the same overloads as those now carried by these companies, and that they made a further deduction in the number of busses because of an assumed increased speed of busses over street cars. They asumed that the average speed on the proposed bus system would be 13.22 miles per hour, based upon that of the existing bus lines of the Los Angeles Motor Coach Company and the Los Angeles Railway Company, and reduced the number of busses estimated on the basis of present Los Angeles Railway performance by a percentage equal to the difference between 13.22 miles per hour and the average speed on the Los Angeles Railway's rail system, in this case taken as 11.01 miles per hour. The bus operations of both the Los Angeles Motor Coach Company and Los Angeles Railway Company are for the most part in the more sparsely settled outlying districts, and even where serving fairly well built up districts their lines follow the wider and faster thoroughfares such as Wilshire and Sunset Blvds. It could hardly be expected that an operation which was to serve the entire city and particularly the central business district would equal these speeds.

It does not appear entirely unreasonable to compare the operating conditions on the "South Broadway and Civic Center" line of the Los Angeles Railway with the Western Avenue line of the Los Angeles Motor Coach Company. The average speed during the year 1934 on this rail line was 12.07 miles per hour and on the bus line was 11.94 miles per hour. Checks made in the central business district showed an approximate average speed for all Los Angeles Railway rail lines of six miles per hour in this area. By determining the average amount of time spent over that portion of their route through the central busi-

ness district on the various lines, it was possible to arrive at the average speed for all the rail operations outside of the district. This speed was found to be approximately 13 miles per hour, or very slightly less than the speed of the bus lines of the Los Angeles Railway Company.

Through actual checks it was found that the speed of busses operating between Second and Tenth Street on Hill Street during the peak hour was approximately six miles per hour. The average speed of private automobiles on the downtown streets, as determined by the Bureau of Street Traffic Engineering, is not greatly above that of the street cars. In view of these facts, we do not believe that busses, which will be delayed by receiving and discharging passengers, will be able to make an appreciably greater speed than that now made by the street cars.

While it is possibly true that an all-bus system would slightly exceed the average speed of the present rail system, which was 10.97 miles per hour in 1934, the above facts lead us to believe that it would not be sufficiently greater to justify any modification in the number of busses determined to be necessary, either by the method we have used or by the method used by the Municipal Bus League.

The checks used as a basis for these estimates were made during the periods of normal patronage in 1934. The patronage at certain times, such as the holiday season would be in excess of that shown, and therefore it is probable that an additional number of busses would be required to handle the peak seasons. The aggregate of the passengers carried by the three present operations, both total and revenue passengers, during the ten year period 1925 to 1934 inclusive, follows:

PASSENGERS CARRIED BY LOS ANGELES RAILWAY, PACIFIC ELECTRIC RAILWAY AND LOS ANGELES MOTOR COACH COMPANY

Year	Revenue Passengers	Total Passengers
1925	287,811,000	392,899,000
1926	288,758,000	394,501,000
1927	292,746,000	401,405,000
1928	288,484,000	392,189,000
1929	267,832,000	366,142,000
1930	249,000,000	340,827,000
1931	220,965,000	303,777,000
1932	187,855,000	258,100,000
1933	171,737,000	236,110,000
1934	192,546,000	257,538,000

The steady downward trend in patronage since the beginning of the present economic depression is apparent from this table. It will be seen that the 1934 traffic upon which we have based our estimates is quite low compared with other years. Unemployment is undoubtedly largely responsible for the decreased patronage. It is plausible to assume that as conditions return to normal, patronage will increase to at least the 1930 level. Based upon the assumption that this will occur, we have proceeded to estimate the number of busses required to handle that increase to be in proportion to the amount 1930 patronage exceeded that of 1934.

The following table shows the units of equipment operated by the existing companies during the peak hour, year 1934, and the number of thirty passenger busses required to replace them; also the number of busses necessary to handle 1930 volume of patronage:

ESTIMATED NUMBER OF THIRTY PASSENGER BUSSES REQUIRED TO REPLACE PRESENT RAIL AND BUS FACILITIES OF LOS ANGELES RAILWAY, PACIFIC ELECTRIC RAILWAY LOCAL LINES AND LOS ANGELES MOTOR COACH COMPANY

Peak Period—5:00 to 6:00 P. M.

	Now in use	Required Busses
Los Angeles Railway cars outbound through Central District	581	1198
Los Angeles Railway cars in use outside the Central District	99	165
Pacific Electric Railway cars outbound scheduled through Central District	101	194
Pacific Electric Railway cars in use outside Central District	29	58
All busses outbound through Central District	85	140
All busses in use outside Central District	175	226
Total	1070	1981
10% Standby Service		198
TOTAL BUSSES REQUIRED TO CARE FOR 1934 LOAD		**2179**
Total passangers, all rail and bus lines in 1930 exceeded 1934 by 32.3%. 32.3% of 2179 equals		704
TOTAL BUSSES REQUIRED TO CARE FOR 1930 LOAD		**2883**

Wherever new transit equipment of any type has been placed in operation recently, reports indicate that additional riders have been attracted. The Municipal Bus League suggests this increase will be 25%. Data we have obtained indicates that a permanent increase will not exceed 15%. If even a 15% increase were actually realized, however, and the number of busses were increased proportionately, the total units necessary, based upon 1934 traffic, would equal 2506 and based upon 1930 traffic would be 3315.

An interesting feature brought out by the preceding tabulation and one which is of paramount importance in connection with the desirability of bus operation, is the large number of busses which would have to move through the central business district within a one hour period. Based upon 1934 patronage only, the replacement of existing facilities would require that 1532 busses go through this limited area in the one hour period during which all traffic is the heaiest, as compared with the 767 units now operated (682 street cars and 85 busses). Moreover, if the Pacific Electric Railway's local service were displaced, it would then be necessary to bring sufficient additional busses into the congested area to care for those passengers now brought in through the Company's Hollywood-Glendale Subway.

It has frequently been stated the vehicular traffic in downtown streets is rapidly approaching the saturation point, and as we have previously stated, care should be taken to see that the most efficient use possible is made of the available street space. The proposed busses would occupy 41% more street space than the units they would replace, assuming an average space of 15 ft. between units. What this would mean to downtown traffic might be better illustrated by pointing out that allowing for 15 ft. between vehicles, the introduction of busses in place of present equipment would be equivalent to moving a column of traffic one and one-half miles in length through this restricted area during the rush hour.

In order to better illustrate what this would mean, a table has been prepared showing the number of busses which would be required in lieu of the existing equipment on various streets. The average headways, or interval between busses, which would theoretically have to be maintained, as well as the average

number it would be necessary to move through each "Go" interval of traffic signals at various intersections, are also shown on the table, which appears on this and the following page. These figures are based on present conditions only and do not reflect, at all, the condition which would exist with increased patronage.

It will be observed that the average headways throughout the full hour for busses southbound on Hill St. would be 16 seconds, on Broadway 18 seconds, and westbound on 7th St., 22 seconds. That shown for Hill St. does not include interurban train movements, and of course any increase in patronage will result in decreasing these theoretical average headways. The average southbound headways would be 26 seconds and northbound 31 seconds, even if it proved reasonable to route an equal number of vehicles over each, — Main, Spring, Broadway and Hill, — making no allowance for interurban train movements.

Contemplation of what these figures would be if patronage increased to the 1930 level, linked with the fact that these are the averages which would have to be maintained and that a temporary obstruction to movement of comparatively few seconds would result in "piling up" to such an extent that free movement could not be restored, will give some idea of what the operation of an all bus system might mean in the downtown area during the rush hour.

ANALYSIS CARS AND BUS FLOW

Required on Streets in Central Business District

Based on actual number of Car units and loads and equivalent Bus units
5:00—6:00 P. M. APRIL 1934

Number GO signals per hr. 57, Time 30 sec. N. S., 25 sec. E. W., 4 sec. clear

HILL STREET

	Northbound		Southbound	
	Existing Cars	Proposed Busses	Existing Cars	Proposed Busses
	68 per hr.	117 per hr.	115 per hr.	226 per hr.
Average Headway	53 sec.	31 sec.	31 sec.	16 sec.
Number thru each GO Signal	1.2	2.1	2.1	4.0
Subway not included in above	23	46	23	46
Interurban not included in above	9	9	11	11

BROADWAY

	78 per hr.	178 per hr.	84 per hr.	202 per hr.
Average Headway	46 sec.	20 sec.	43 sec.	18 sec.
Number thru each GO signal	1.4	3.1	1.5	3.5

SPRING ST.

	29 per hr.	66 per hr.	29 per hr.	66 per hr.
Average Headway	124 sec.	54 sec.	124 sec.	54 sec.
Number thru each GO signal	0.5	1.2	0.5	1.2

MAIN ST.

	64 per hr.	105 per hr.	46 per hr.	59 per hr.
Average Headway	51 sec.	38 sec.	75 sec.	64 sec.
Number thru each GO signal	1.1	1.8	0.8	1.0

AVERAGE—4 STREETS

	60 per hr.	116 per hr.	69 per hr.	138 per hr.
Average Headway	60 sec.	31 sec.	52 sec.	26 sec.
Number thru each GO signal	1.0	2.0	1.2	2.4

AVERAGE 4 STREETS INCLUDING SUBWAY LOCAL CARS AND INTERURBAN CARS ON HILL STREET

	68	130	80	150
Average Headway	53 sec.	28 sec.	45 sec.	24 sec.
Number thru each GO signal	1.2	2.3	1.4	2.6

BROADWAY AT 7TH STREET

	Northbound		Southbound	
Number GO signals per hr. 48, Time 35 sec. N. S., 32 sec. E. W., 4 sec. to clear				
	Existing Cars	Proposed Busses	Existing Cars	Proposed Busses
	78 per hr.	178 per hr.	84 per hr.	202 per hr.
Average Headway	46 sec.	20 sec.	43 sec.	18 sec.
Number thru each GO signal	1.6	3.7	1.8	4.2

FIFTH STREET

	Eastbound		Westbound	
Number GO signals per hr. 57, Time 30 sec. N. S., 25 sec. E. W., 4 sec. to clear				
	38 per hr.	51 per hr.	41 per hr.	83 per hr.
Average Headway	95 sec.	70 sec.	88 sec.	43 sec.
Number thru each GO signal	0.7	0.9	0.7	1.5

SIXTH STREET

	11 per hr.	14 per hr.	11 per hr.	14 per hr.
Average Headway	327 sec.	257 sec.	327 sec.	257 sec.
Number thru each GO signal	0.2	0.3	0.2	0.3

SEVENTH STREET

	60 per hr.	131 per hr.	70 per hr.	166 per hr.
Average Headway	60 sec.	27 sec.	51 sec.	22 sec.
Number thru each GO signal	1.0	2.3	1.2	2.9

AVERAGE—3 STREETS

	36 per hr.	65 per hr.	40 per hr.	87 per hr.
Average Headway	100 sec.	55 sec.	90 sec.	41 sec.
Number thru each GO signal	0.6	1.2	0.7	1.5

It should be kept in mind that until such time as other provisions were made for giving interurban service, it would be impossible to remove the tracks and safety zones of the Pacific Electric Railway on Hill St., and probably on Main St. One of the advantages claimed for bus operation has been the elimination of these zones from the center of the street, made possible by curb loading.

While on this subject, it is perhaps well to make the following observations with respect to curb loading: There can be no doubt that it is more desirable under certain conditions. However, where congestion is great and both speed and space are important factors, there are some questions as to its relative advantages. It is necessary to make bus loading zones at the curb longer than street car safety zones, because of the space which must be provided for busses to approach the curb. During peak hours of traffic it might be found difficult to move from one traffic lane into another. That lane moving along the curb is usually slower than others, due to vehicles drawing to the curb to pick up waiting passengers. Whether the busses attempted to travel in this lane or attempted to move out into the next lane after having loaded passengers and then moved back into the lane along the curb at the next intersection, their speed would be retarded and they in turn would retard the speed of other vehicles. Another retarding factor would be the private vehicles which pull

over to the curb in order to make right hand turns. These vehicles would not only prevent busses from drawing up to the proper loading point, but would delay their movement at the signal change. The serious problem presented here is apparent when it is realized that it would be necessary to move four busses through each "Go" interval of traffic signals southbound on Hill St., as shown by the preceding table. The busses now operated north along Hill Street loaded at the curb until recently, when it was found that by loading busses in the street car safety zones, a saving of 25% was made in the time required to travel from 10th to 2nd Street. This probably can be best explained by the fact that the street car, moving in a fixed path, is not subject to the delays suffered from weaving in and out required by curb loading. At signal changes the street car moves straight ahead with those vehicles which are continuing in the same direction, while the bus is interferred with by vehicles making right turns at the same time interferes with those wanting to turn to the right.

In its last Annual Report, the management of the Chicago Surface Lines had this to say with respect to the operation of busses in the main traffic arteries:

> " * * * The Chicago Surface Lines management has studied the bus situation for many years and pioneered in the development of the type of gasoline bus which is now generally accepted as the most satisfactory for city operation. The first busses of this modern type were purchased by the Surface Lines in 1927 and have been rendering satisfactory service since that time.
>
> "As to the impracticability of substituting busses for street cars throughout the city, however, there can be no question. From the standpoint of economy, both of street space and operating costs, rail operation where large numbers of passengers must be carried is far superior to bus operation. * * * To substitute busses for street cars on the main traffic arteries of Chicago would create intolerable congestion. * * * "

Investment

As we have previously stated, the method used by the Municipal Bus League in arriving at its estimate of the necessary investment in busses, land, buildings and other facilities resulted in a figure below that which could actually be expected. The prices we have obtained from manufacturers of more generally recognized busses lead us to believe that it would be difficult to obtain 30 passenger busses of a type which would prove satisfactory for much less than $9,000. It appears that any attempt to obtain busses at a figure as low as that suggested by the Municipal League would result in excessive maintenance costs and would not give all those features which would be essential to safety and a service of a necessary and desirable standard. In arriving at the total investment required as included in the propaganda circulated by it, the Municipal Bus League included 1800 thirty passenger busses for $6,000 each, or a total of $10,800,000 for busses, and $1,486,890 for land, buildings and all equipment other than busses, making a total investment required of $12,286,890. This would represent a total average investment per bus of $6,826.

In 1930 the National Association of Motorbus Operators compiled data with respect to 46 city bus operations. For those having busses with an average seating capacity of 30, they found a total average investment per bus of $11,266. The American Transit Association in 1933 developed the average investment per bus of 116 city bus operations. The total average investment per bus found was $11,243. Investment in the Los Angeles Railway's Motor Coach Division in 1934 averaged approximately $11,930 per bus, their busses having an average seating capacity of 30.1.

The bus plant of the Los Angeles Motor Coach Company and that of the Los Angeles Railway Company are located in sections of the city which are

not comparable as to value of land. These two probably represent an average cross-section of the various properties it would be necessary to provide in different parts of the city for storage, maintenance and repair facilities. The investment per bus based upon their capcity, in the two plants referred to was therefore averaged, and that amount was reduced by ⅓ to reflect present day prices to arrive at the figure used to estimate the necessary investment in land and buildings. For the investment in equipment other than busses, an average per bus based upon that of the local operators was used, with some slight downward revisions which it was felt were justified because of the assumed uniform equipment and the scope of the operation. The figures thus obtained, as compared with the investment per coach in similar items of the Motor Coach Division of the Los Angeles Railway, follow:

INVESTMENT PER COACH

	Coach Division L.A. Railway	Proposed System
Land and Buildings	$2,081	$1,217
Machinery, Tools, etc.	329	325
Spare Equipment	82	75
Fare Boxes	103	103
Service Cars	103	100
Telephone Facilities	21	20
Bus Signs	34	34
Furniture, Fixtures, Miscellaneous Material and Supplies	328*	150
	$3,081	$2,024

*Does not include furniture and fixtures.

These figures make no allowance for general office facilities, and no sum has been included for them in the following estimate of the total investment required.

Applying the average investment per bus as developed by the organizations previously referred to and that of the Motor Coach Division of the Los Angeles Railway to the number of busses estimated to be necessary, gives the following total figures for the investment necessary in busses, land, buildings and other equipment.

TOTAL INVESTMENT REQUIRED FOR PROPOSED BUS SYSTEM USING NATIONAL AND LOCAL AVERAGES

	1934	1930
National Association of Motorbus Operators—$11,266 per bus	$24,548,614	$32,491,144
Amer. Transit Association (Average 116 companies) $11,243 per bus	24,498,497	32,424,812
L. A. Railway Coach Division $11,933 per bus	26,002,007	34,414,772

Based upon the unit figures shown on the preceding page the following estimate of the required investment has been made.

ESTIMATED INVESTMENT IN LAND, BUILDINGS AND EQUIPMENT FOR PROPOSED BUS SYSTEM TO REPLACE EXISTING FACILITIES, BASED UPON 2179 BUSSES TO HANDLE 1934 VOLUME OF PATRONAGE AND 2883 BUSSES TO HANDLE 1930 VOLUME OF PATRONAGE

	1934	1930
Land and buildings	$ 2,651,843	$ 3,508,611
Machinery, tools, etc.	708,175	936,975
Spare equipment	163,425	216,225
Fare boxes	224,437	296,949
Service cars	217,900	288,300
Telephone facilities	43,580	57,660
Bus signs	74,086	98,022
Furniture, fixtures, miscellaneous material and supplies	326,850	432,450
	$ 4,410,296	$ 5,835,192
Coaches @ $6,000	13,074,900	17,298,000
Coaches @ 9,000	19,611,000	25,947,000
TOTAL INVESTMENT WITH BUSSES @ $6,000	17,485,196	23,133,192
TOTAL INVESTMENT WITH BUSSES @ $9,000	24,021,296	31,782,192

The above figures do not include any allowance for general office facilities, nor for the increased investment which would be necessary in each of the above items if the new equipment should result in new patronage. If the increment from this source amounted to 15%, the investment assuming busses at $9,000 each would be, for the year 1934 $27,624,490, and for the year 1930 would be $36,549,521. These estimates include no allowance for general office facilities.

Operating Expenses

The most prevalent method of stating operating costs is in terms of the cost per mile operated. The car miles to be operated will be influenced by the hours during which service is maintained and by the frequency of operation. The hours of service upon the present systems has been determined principally by the demands for service, or in other words, the hours during which passengers make use of the facilities. There would be few instances where the possible use which might be made would justify the operation of service for a greater period of time. Headways are determined by the available patronage and the capacity of the equipment operated. During peak hours the number of units operated are determined by the number of riders. During off-peak hours it is more a question of convenience. In those cases where the patronage requires an increase in the number of units to be operated, the present interval between cars are lessened. However, where the present patronage is not sufficient to support any more equipment than is now being supplied, there would be no decrease in headways. The headways now maintained by the Los Angeles Railway on its heavier lines during the rush hours vary from 2½ to 4½ minutes. Headways are from six to ten minutes for the remainder of the day, except for a few hours during the night when only so-called "Owl" service is rendered. For the purpose of estimating vehicle miles we have assumed no increase in the hours of service and shortened headways only where the volume of patronage makes necessary an increase in the number of units over that now used.

To arrive at the probable bus miles operated, the portion of the total vehicle miles operated by existing carriers was approximated during each—the peak, the base and the night periods. The figures for the peak period were

increased in the ratio of the number of busses required as compared with the existing equipment, both rail and bus. It was assumed that the proposed busses would operate the same number of miles during off-peak hours as do the existing busses they would supplant. An adjustment was made in the number of miles operated by street cars during the base and night hours according to the ratio of the number of seats per unit to the seating capacity of the proposed busses, since, while many cars during off-peak periods do not carry full loads, there are also many operating close to the peak hour on which the number of passengers exceeds the seating capacity. The total bus miles arrived at by this method was found to be 76,000,000 per annum, as compared with the 45,514,385 vehicle miles operated by the existing carriers in 1934.

Considerable data has been collected by the National Association of Motorbus Operators and by the American Transit Association relative to bus operating costs. Perhaps the most valuable from the standpoint of comparison in this case are the average operating costs per bus mile for 21 bus companies operating city lines exclusively, the scale of whose operations most nearly approach the operation under discussion. The operating revenues of seven of these companies were in excess of $1,000,000 per year, and of the remaining fourteen were in excess of $500,000 per year. The average operating cost per bus mile of the former was found to be 17.8c and of the latter 19.8c, although it should be pointed out that all of the companies included did not make an adequate allowance for depreciation. The average operating cost per bus mile of 116 city motorbus operations during the year 1933 as developed by the American Transit Association in its Bulletin No. 453, "Analysis of Operating Costs of Electric Railway Motorbus Lines 1933" was 17.95c per mile. Here again the figure would have been slightly higher had all companies reported an adequate amount for depreciation. It was pointed out in this bulletin that the average cost for 52 companies, all of which reported their expenses on a comparable basis, was 18.69c per mile.

For the year 1934 the operating expense per bus mile of the Los Angeles Motor Coach Company, including taxes and depreciation, was 21.02c, and that of the Los Angeles Railway Motor Coach Division was 15.62c per bus mile. The difference between the expenses per mile of these two companies is due to the difference between the average capacity of the equipment operated by the two companies. The amount of depreciation included in each of these figures was less than normal, since both companies had previously written off most of their investment in busses. The two most common methods used in making depreciation charges are on the basis of so much per mile operated, or upon a given percentage of the total cost during each year of assumed life. The most prevalent figures as determined from national data compiled by the American Transit Association is for those using the mileage basis 3c per mile, and for those using the percentage of cost basis, 20% per year. The Municipal Bus League included 1.5c per bus mile for depreciation in its estimate of operating expenses. The inconsistency of this figure is shown by an analysis using a six year life per bus, which would be equivalent to 16⅔% per year, and the estimates herein made of the number of busses required and the total bus miles per year. On this basis, each bus would operate an average of 34,878 miles per year. Assuming then that the entire investment in each bus was to be written off in six years, the depreciation cost for $6,000 busses would be 2.87c per mile and $9,000 busses would be 4.3c per mile.

The operating expenses of the Los Angeles Railway's Motor Coach Division appear especially reasonable in comparison with figures relative to other operations. Their operating cost per bus mile in 1934, exclusive of taxes and depreciation was 13.39c. Allowing 3c per mile for depreciation and .7c per mile to cover gasoline and sales taxes, which would have to be paid even by a municipal operation, results in a figure of 17.09c per mile. This figure has been here used to arrive at the estimated total operating expenses of the proposed system. Using this figure with the miles we have estimated to be operated with the 1934 volume of patronage gives a total operating cost as follows:

76,000,000 miles @ 17.09c per mile = $12,988,400

The largest single expense item is that of operators' wages. If a higher wage than that paid by existing operators should be established on the proposed system, the sum here estimated would be accordingly increased.

Previous mention has been made of the three types of rolling stock—the street car, the trolley bus and the gas bus. It was pointed out that the operating cost per unit of passenger capacity was less for the first two types than for the gas bus. The operating costs of the street car per mile operated, decrease as the number of miles operated increases, due to the fact that the heavy fixed costs incident to the roadbed and overhead required are spread over more miles of operation. It is evident that this decrease would not be as marked for the trolley bus which requires no roadbed, and would be practically negligible for the gas bus which requires neither track nor overhead construction.

When traffic density has reached a point that it offsets the fixed costs incident to rail operation as compared with operation of the other two classes, it becomes more economical to use rail facilities. This is illustrated by the following example. The bus miles which it would be necessary to operate if the existing street cars were replaced on the Los Angeles Railway's "P" line were estimated in the same manner as that used to determine the total bus miles for the proposed system. The average operating cost per car mile of the Los Angeles Railway rail lines was then applied to the rail miles and the average operating cost per bus mile, adjusted to include a reasonable depreciation charge, was applied to the estimated bus miles. The resulting operating costs indicated were more than one-third higher for the assumed bus operation than for the rail operation.

The difference between traffic densities in the city of Los Angeles and in those cities where all bus operation is now attempted, is indicated by the fact that the average number of passengers per vehicle mile in San Antonio, the largest city served exclusively by busses, during 1934 was 2.54, while on the rail lines of the Los Angeles Railway Corporation during the same year, the passengers per car mile were 7.1.

The relative operating costs of the trolley coach and the gas bus, and the effect of the difference in operating costs upon the additional investment required for the trolley bus, are shown in the following table, compiled by the Westinghouse Electric Company, representing the average costs of a number of properties.

INVESTMENT AND OPERATING COSTS

Trolley Coach vs. Gas Bus

	Type of Vehicle			
	Heavy Service 40 pass. unit		Light Service 30 pass. unit	
	Trolley Coach	Gas Bus	Trolley Coach	Gas Bus
Seating Capacity	40	40	30	30
Length of route—round trip. mi.	10	10	10	10
Headway in minutes, rush-base	3-6	3-6	5-10	5-10
Rush hr. running time, including layover, min.	45	51	45	51
Units required, incl. spares	17	20	10	12
Annual miles	840,000	840,000	504,000	504,000
Cost per unit	$ 12,000	$ 10,500	$ 9,500	$ 8,500
Investment—vehicles	204,000	210,000	95,000	102,000
Overhead	50,000		45,000	
Total	254,000	210,000	140,000	102,000
Added investment compared with gas bus	44,000		38,000	
Operating cost—cents per mile:				
Way & Structures	.5	.1	.5	.1
Equipment	4.0	5.0	3.5	4.0
Operating garage	4.9	7.7	3.5	6.0
Transportation	5.1	5.7	5.1	5.8
Traffic	.2	.2	.2	.2
Administrative & general	2.5	2.5	2.5	2.5
Operating expense (excluding depreciation)	17.2	21.2	15.3	18.6
Annual operating costs	$144,500	$178,200	$ 77,100	$ 93,700
Annual fixed charges:				
Deprec. vehicles — trolley coach 10 years, gas bus 6 years	20,400	35,000	9,500	17,000
Deprec. overhead—20 years	2,500		2,500	
Interest—6 per cent on half investment	7,620	6,300	4,200	3,060
Total annual charges	175,020	219,500	94,050	113,760
Saving with trolley coach	44,480		19,710	
Percent return on added investment	101		52.0	

Revenues

The expressed intention of the Municipal Bus League that a 5c fare should be given to the great bulk of the patrons is of course a desirable end. In making their estimate of revenues to be derived from the operation, they assumed that 95% of the total passengers would pay a 5c fare and the remaining 5% a 10c fare. The existing operators make concession to certain classes of users which we feel should be given consideration in any proposed fare structure. School children are given transportation at half fare. Special commutation rates are made available to those living beyond the limits of the first fare zone. There is in effect on the Los Angeles Railway system at the present time a so-called weekly pass arrangement which permits the holder of the pass to ride an unlimited number of times. A pass good anywhere in the entire inner zone costs $1.00, or one good over the entire system may be had for $1.50. The average cost per ride taken on passes is about 3c. This would be

raised some if adjustment were made for the transfers eliminated by the pass, but would still be less than the proposed 5c fare. The installation of a 5c base fare would of course lessen the importance of such a provision. Public sentiment however, would undoubtedly require the continuation of the half fare provision for school children. In order to arrive at an estimate of probable revenues, it has been assumed that a 5c fare would apply throughout the present inner zone limits of the Los Angeles Railway and that the fare to points on the local transportation system beyond those limits would be 10c. Based upon an analysis of the fares paid on the Los Angeles Railway system it has been determined that approximately 90% of the total revenue passengers would pay a 5c fare; that 7% would pay a 10c fare and 3% a 2½c fare. These percentages assume that those now making use of the weekly pass would pay 5c per ride and the revenue estimated on this basis would be slightly less if similar provisions should be made available.

Applying these percentages to the total revenue passengers carried during the year 1934 by the systems it is proposed to replace gives the following results:

Per Cent of Revenue Passengers	Number of Passengers (1934)	Fare	Revenue Produced
90	173,291,200	5c	$ 8,664,560
7	13,478,200	10c	1,347,820
3	5,776,300	2½c	144,409
	192,545,700		
TOTAL PASSENGER REVENUE			$10,156,789
Other Revenue—1%			101,568
TOTAL ESTIMATED REVENUE			$10,258,357

The percentage of 10c fares here used exceeds that estimated by the Municipal Bus League. The operating costs estimated herein can be seen to be quite reasonable in comparison with the actual experience elsewhere. The large deficit shown however, results in the conviction that an exclusive bus operation cannot be made to pay its way with a 5c fare and give a service of a standard sufficiently superior to that now provided, to be satisfactory to the public.

The fares in effect elsewhere throughout the nation substantiate this fact. Some of these are as follows:

FARES CHARGED IN TEN LARGEST CITIES WITH AN ALL BUS SERVICE

City	Population	Fares	
		Cash	Tokens
San Antonio, Texas	231,542	10c	3 for 25c
Trenton, N. J.	123,356	10c	
Canton, Ohio	104,906	7c	8 for 50c
Saginaw, Michigan	80,715	10c	3 for 25c
Lansing, Michigan	78,397	10c	3 for 25c
Binghampton, N. Y.	76,662	10c	4 for 30c
Troy, N. Y.	72,763	10c	13 for $1.00
Springfield, Ohio	68,743	7c	10 for 50c
Pontiac, Michigan	64,928	10c	3 for 25c
Kalamazoo, Michigan	54,786	10c	3 for 25c

The bus fare for the Chicago surface lines is 7c, with three tokens for 20c. In Philadelphia, bus fares are 8c and 10c. In Detroit, Cleveland and St. Louis, bus fares are 10c.

Summary of Operating Revenues and Expenses and Income Deductions

In addition to the operating expenses previously estimated, it would be necessary to provide funds to care for interest on borrowed money. The facilities required might be obtained by various methods. Municipal bonds might be issued in order to obtain the funds with which to purchase the various items; busses might be purchased under equipment trust bonds or it might be possible to purchase busses and other equipment on an ordinary lease contract. Funds may also be advanced by the City Council from the moneys raised by taxation. The proposed ordinance, if enacted, would require that the Council do furnish the funds necessary to begin operations. Whenever the revenue producing departments are unable to make the interest and principal payments upon bonds issued by them, a general tax levy must be made to provide for these payments. The terms of the ordinance require that all obligations be paid off within a ten year period.

Those who would sell equipment either under a lease contract or under equipment trust notes would restrict the time in which payments must be made to a period sufficiently less than the estimated life of the equipment to assure them that in the case of failure to pay, they would be able to secure all funds due them, through repossession and disposal of the equipment elsewhere. The usual first payment on equipment bonded or purchased under lease contract runs around 20%. The interest provisions approximate 5½%. In 1933 the Indianapolis Railways purchased slightly over two million dollars worth of street cars and trolley busses to be paid for at 6% interest in monthly installments over a six year period. It does not seem reasonable to assume that the payment period on busses could be extended over as long a period as that of street cars and trolley busses, each of which are assumed to have a longer life. If a 20% down payment were made on busses, and even if it were possible to purchase busses for as little as the $6,000 per bus estimated by the Municipal Bus League, the initial payment required for the number of busses we have estimated would be required to replace existing facilities at the present time would be in excess of two and one-half million dollars. From the terms of the ordinance, it appears that the Council would be required to furnish this down payment, unless municipal bonds were sold to acquire the funds. This amount of course would not care for any of those other facilities it would be necessary to provide before operations were begun.

Assuming that purchasers of bonds could readily be found, or that manufacturers would be willing to sell equipment on a contract basis at interest rates not affected by the unhappy financial outlook of the proposed operation, it would still be necessary to carry an interest load of approximately 5% of the amount invested. The maximum payment period, even if municipal bonds were sold, would be ten years, and as pointed out, this period would be shorter in case of equipment trust bonds or lease contracts. Assuming that bonds were sold, then, to provide all necessary funds, the allocation for annual re-payment of principal would be 10% of the total investment, in addition to which interest on the deferred amounts must be met. Five per cent of the investment required for 1934 patronage with busses at $6,000 would be $874,260, and with $9,000 busses would be $1,201,065.

The interest on borrowed funds would have to be added to the loss from operation in order to arrive at the total deficit. The estimated revenues, expenses and interest deductions are summarized in the following table, which shows an annual deficit on the basis of 1934 traffic as follows:

SUMMARY OF ESTIMATED OPERATING REVENUES AND EXPENSES AND INCOME DEDUCTIONS FOR A BUS OPERATION TO PROVIDE TRANSPORTATION FOR THE PASSENGERS CARRIED BY LOCAL TRANSPORTATION SYSTEMS IN 1934

Passenger Revenue	$10,156,789
Other Revenue	101,568
Total Operating Revenue	$10,258,357
Operating Expense	12,988,400
Loss from Operations	$ 2,830,043
Annual Interest Requirements:	
Assuming $6,000 busses	$ 874,260
Assuming $9,000 busses	1,201,065
TOTAL ANNUAL DEFICIT:	
Assuming $6,000 busses	$ 3,604,303
Assuming $9,000 busses	3,931,108

If the money borrowed were to be repaid in ten years and equal annual amounts were set aside for this purpose, there would be required each year a sum of $1,740,520 on the first basis referred to, and on the second basis the sum of $2,402,130. The amounts accruing in the depreciation account might be used for this purpose. This account would not however, be sufficient to cover the entire amount and additional money would have to be provided from some other source, presumably through taxation. Apparently this amount in addition to the operating deficit shown in the preceding table would have to be met from general taxes.

It has previously been pointed out that the only portion of the City to be served by the proposed system is that area herein referred to as the central district, which is approximately bounded by a circle having an eight mile radius measured from Seventh and Broadway. The estimates developed make no allowance for improvement in transportation facilities in any areas of the City outside of that circle, and it has been pointed out that some areas which would still have to depend upon existing facilities might be affected detrimentally if the proposed system were inaugurated. It is doubtful if those in other parts of the City, which would not be benefited, would be inclined to participate through taxation in the support of a system restricted to the central area.