

such vehicles varied from 64 axles at low traffic stations to 194 at stations carrying 2,000 or more trucks daily, with an average rate of 120 at all stations. The rate of axles weighing 16,000 lb or more varied in like manner from 99 at the low-count stations to 288 at the high traffic stations with an average rate of 187. Likewise the rate of axles weighing 14,000 lb or more increased from 128 at the low count stations to 395 at stations carrying the larger commercial traffic, the average at all stations being 258 axles per 1,000 commercial vehicles.

CONCLUSIONS

The study of the information in all regions indicates a consistent trend for all three axle weight groups. Although there were some inconsistencies between actual and estimated

numbers of axles in the lower volume section of the curves for some regions, the trend curve appears to be satisfactory in the middle volume and higher volume sections. Tables accompanying this study present the complete variations as reported and as based on trend curves.

The investigation of the data indicates need for a study concerning the variation in the frequencies of heavy axle loads in relation to traffic in the proximity of urban areas. Such a study is not practicable at present due to the limited data available, but regular or special surveys in the future must be so designed as to obtain this information fully. The indices of correlation computed for the trends in each region indicate, however, that for rural areas, a sufficient degree of reliability was attained to justify the use of this information for design purposes.

PLANNING PUBLIC TRANSPORTATION ON URBAN EXPRESSWAYS

BY LESLIE WILLIAMS, *City Planning Engineer,*
American Transit Association

SYNOPSIS

The author sets forth in this paper the broad public interests which would be served and the types of public transportation service which could be rendered by operating public transportation vehicles—motor buses, trolley coaches and electric cars—on urban expressways.

He also indicates the facilities necessary to permit public transportation to provide an adequate and safe service and advocates the incorporation of turnouts, off the travelled roadways, for free-wheel rubber-tired transit vehicles and rails and transfer stations in the central malls where traffic volume warrants. He suggests that these improvements be financed, as are highways, through taxation because such provisions are essential features of the highway, built for the convenience and safety of the public, and persons using public transportation, presumably, pay their fair share of the taxes used for highway improvements.

The author points out that by combining expressway design features, including turnouts and transfer stations, a highway is produced, which, on a passenger miles basis, is safer and generates more capacity per construction dollar spent.

The paper contains a warning to the effect that opportunities for reducing urban traffic congestion and for promoting sound community development will be lost if urban expressways are not located so that public transportation can make full use of them.

The Federal aid act of 1944 which provides \$125,000,000 a year for 3 years for highways within urban areas, has brought to

the fore many questions in the design of urban expressways. Before detailed design can be undertaken some far-reaching questions of

public policy must be studied and decisions made. One of these important questions concerns the extent to which special provision should be made for the use of urban expressways by public transportation vehicles. In this paper this question is analyzed, data bearing on the problem are reviewed, and the types of facilities that have already been provided and are being proposed are discussed.

2. Modernized public transportation service.
3. Strategically located and properly operated off-street automobile parking, truck and bus terminals.
4. Comprehensive system of major thoroughfares, freeways and parkways.
5. A master plan to guide the arrangement of land for residential, business, industrial, recreational, cultural and public



Figure 1. Heavy Traffic on East Side Drive, New York (photo from Ewing Galloway)

Four million dollars worth of economic wealth and an inestimable loss of human resources were suffered from traffic congestion and traffic accidents in the year immediately preceding the War, while people and goods were moving over the streets and highways of the United States.

Highway and city planning engineers believe substantial relief can be achieved by a planned combination of the following:

1. Improved traffic engineering enforcement and education.

purposes—including public ways and terminals.

Since traffic congestion is an existing and not an impending problem, and substantial relief can be secured only over a period of years; palliatives, correctives and preventives should be applied so as to bring early benefits to the greatest number of highway users.

Congress has taken the initiative and set aside \$125,000,000 each year for three years for modern motorways within urban areas. Should these "expressways" be located largely

on the approaches to cities, skirting golf courses, parks and other open reservations, it is doubtful if they will generate enough private pleasure car traffic to warrant a fraction of the construction costs involved. They would be, in effect, "express parkways" or public ways devoted to recreation over which the abutter has only limited rights of access. Such motorways certainly would not serve as public ways devoted to the maximum relief of urban traffic congestion nor to promotion of the most orderly development of the urban area as a place to live and do business.

Leaders in public affairs are interested in public ways designed for safe speed; but they are also interested in these highways being so located that they will generate their maximum usefulness in terms of passengers and goods moved.

This is probably the reason why Eric Johnston, President of the Chamber of Commerce of the United States, stated about a year ago:

"These new urban highway plans must contemplate, if they are to be comprehensive and to serve the best interests of the whole community, provisions for the more efficient handling of both the individual automobile and the community's transit facilities—electric railways, buses and other means of transportation"

Since the passage of the Federal Aid Highway Act of 1944, plans for a new type of highway have emerged from the drafting boards of highway planners—a highway combining the design features of an expressway with provisions permitting mass transportation to render its maximum express service in urban areas

It behooves us, however, to ask ourselves three questions

- (1) What public interest will be served by the operation of mass transportation vehicles—motor busses, trolley coaches and/or electric rail cars on expressways?
- (2) If a public service can be performed by operating express transit vehicles on expressways, what facilities should be included to promote safe and adequate mass transportation service without interfering with the safe and expeditious movement of other vehicles?
- (3) What are the comparative costs of providing separate and combined express-

ways for private passenger cars and mass transportation vehicles and who shall pay the cost for facilities promoting safe and expeditious movement of the public riding in transit vehicles?

It is the purpose of this paper to deal primarily with the broad public interests which would be served, and to show by means of pictures the types of facilities that have already been provided and are now being proposed so that public transportation can render a service on expressways not now possible on existing highways, and at the same time not interfere with the safe movement of other users of the highway. Until the first two questions have been settled, any discussion regarding the costs of facilities for public transportation or who should pay such costs would be irrelevant. When it is granted that a real public interest will be served by the operation of express transit service on expressways, and when the types of facilities have been determined that will be required to accomplish this, then will be the time to discuss costs

In March 1944, when the late Charles Gordon, Managing Director of the American Transit Association, appeared before the House Committee on Roads to suggest that the Federal Aid Highway Act of 1944 contain provisions to permit mass transportation to render its maximum service on express highways in urban and suburban areas, it was pointed out by highway engineers that operation of mass transportation vehicles on expressways was not a matter of principle but one of design details

Thomas H. MacDonald, Commissioner of Public Roads Administration stated at a later date that "the interests of public transportation and the over-all street and highway transportation can never be divergent—they must always be parallel. Indeed, in many cases they are coincident." Commissioner MacDonald is correct because public ways are built for the purpose of moving people and goods and the containers in which they are moved are purely incidental

Federal and State highway planning surveys are revealing that in cities the size of Kansas City, Missouri and Providence, Rhode Island, the public takes more than half of its total daily trips in public transit vehicles

Cordon counts of the mode of transportation

of persons entering business districts clearly show the public transit vehicle as a mass public carrier of major consequence.

Last year and the year before, public transportation demonstrated itself as a prime mover of people in cities. Approximately 24,000,000,000 rides were taken on public transit vehicles by the people in our cities.

Studies, such as "Transit's Prospects for Postwar Traffic" by Charles Stephenson for the American Transit Association, estimate that public transit will be called upon to carry

tion vehicle he wants as high-grade transportation as can be given at a reasonable cost. The construction of the proper facilities for the safe and speedy operation of mass transit vehicles in expressways will bring greater benefits to a greater number of persons living in the urban area, for public transit is already handicapped by operating on existing streets in providing the types of service that people are demanding.

In Spokane, Washington, automobile traffic greatly increased when gasoline rationing was

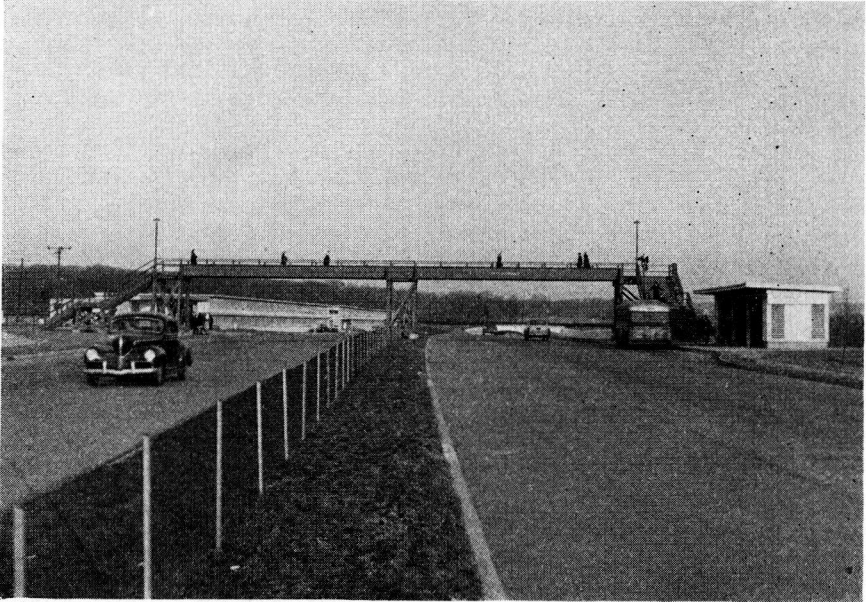


Figure 2. Bus Turnout at the Pentagon Network (photo from National Park and Planning Commission)

approximately 50 per cent of the total daily riding by the public for a number of years to come in the competitive urban region.

Comparison of past and expected passenger car registrations reveals an interesting trend. Between 1920 and 1940, automobiles increased about 250 per cent; however, the expected increase in the next 20 years over that of 1940 is approximately 33 per cent.

In 1920, there were 13 persons for every registered automobile. In 1940, there were 4.8 persons per registered automobile. It is possible, but questionable, if the ratio in 1960 will be 4 persons for every private passenger car on the road.

When a person rides in a public transporta-

tion vehicle he wants as high-grade transportation as can be given at a reasonable cost. This materially slowed down bus travel in that city and according to transit officials, it now takes about twice as long for a bus to cross the downtown business district as it did before V-J Day.

Observations of traffic movements during public transit strikes showed that the movement of people along our main streets is materially delayed, traffic congestion brings all traffic to a dead standstill for minutes at a time and the level of purchases in business districts drops materially. As soon as strikes are settled and public transit vehicles assume their share of the traffic, delays decrease, congestion eases and city streets function much more efficiently.

Existing traffic conditions and the character of street layouts permit public transportation to provide only a limited type of express service. Limited express service is the operation of motor busses or trolley coaches on a local frequent-stop basis for part of the route and then as "express" for the remainder of the distance. For example, these vehicles operate in-town in the morning on regular service to the express zone and then they stop only to let off passengers while proceeding express to the in-town terminal. Out-town

favorably with the 3,000 passengers carried in the 1780 automobiles in the maximum automobile lane during the peak travel hour.

The opportunities for expanding this type of service and establishing designated-stop express service connecting with major cross-town routes from an expressway offer great possibilities for added public service.

Integration of the schedule of the crosstown vehicles with the express designated-stop service on expressways and the provision of

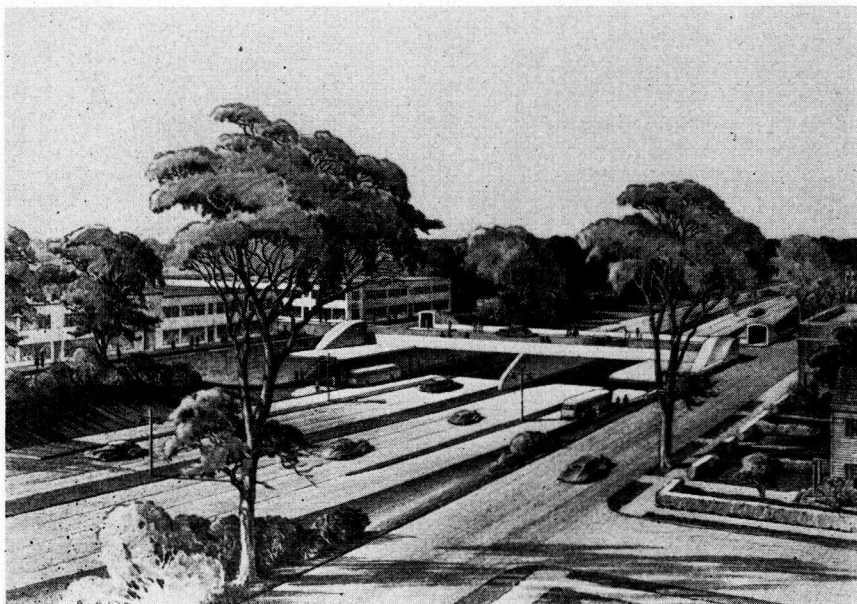


Figure 3. Suburban Center Bus Turnout and Transfer Station (Transportation Committee, American Institute of Planners)

at night, the vehicles stop within the express zone only to pick up passengers and outside the express zone they operate on regular local service. This type of service has been inaugurated in a number of cities, served largely by free-wheel rubber-tired vehicles.

The types of express service people desire are non-stop and designated-stop express service which are almost impossible to provide on existing streets.

An example of the non-stop type of bus service is that provided on the Outer Drive in Chicago, where the service is so popular that double-deck busses transport 7,000 passengers outbound from the central business district in the rush hour, which incidentally compares

favorably with the 3,000 passengers carried in the 1780 automobiles in the maximum automobile lane during the peak travel hour. nearby parking facilities at these transfer points present opportunities for reducing in-town traffic congestion, preserving central city values and encouraging sound suburban development not provided in pre-war road building.

It will be recalled that the National Inter-regional Highway Committee pointed out that the highway program of the past encouraged decentralization to a point economically not justified. The motor ways of the future will be a blessing or a blight depending upon the care exercised in their location and their design in relation to sound land use planning. Without constructing proper transfer stations and bus turnouts,

a great deal of the benefit will be lost and the postwar highway program may be subjected to the same criticisms as were levelled at pre-war road building.

L. Deming Tilton, Director of Planning of the San Francisco City Planning Commission, aptly sums up the reasons for planning express-

automobile is left home in a garage standing on relatively cheap land."

Another indication of the importance of encouraging express public transit service on expressways is contained in a recent statement by Lloyd Aldrich, Los Angeles City Engineer:

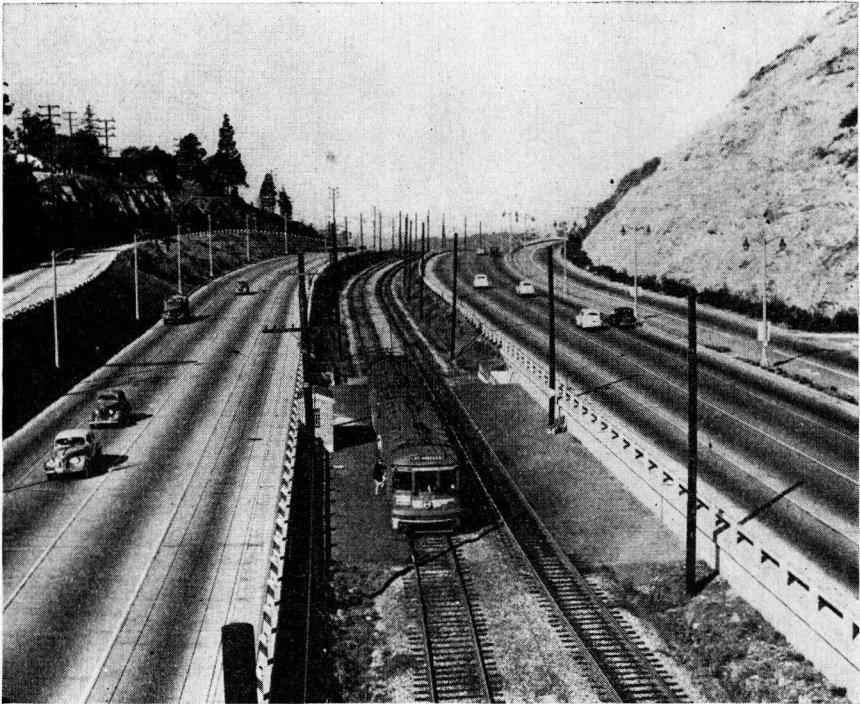


Figure 4. Cahuenga Pass Freeway, Combining Highway and Railway Facilities
(photo from M. Duke Lonfre, Los Angeles, Cal.)

ways, public transit and parking facilities jointly:

"Freeways have their greatest usefulness and value", says Mr. Tilton, "when they are planned and built as a multiple purpose system. The freeway is like a huge pump. If only private motorists use it, a deluge of cars will flow into the congested areas. We must put buckets under the pumps. Downtown parking terminals must be made part of a freeway system. Moreover, we must plan the freeways for rapid transit services. The speed and safety of this modern safety channel should not be denied the citizens willing to ride in a bus. When smooth, comfortable bus service operates on a freeway, the private

"It is now generally agreed," Mr. Aldrich asserted in a letter to the Central Business District Association, "that the proposed parkways should be effectively used by public transit in order to realize the full economic value from their construction."

The ordinary citizen is bewildered. He wonders where the road builders are going to find the money and the space for all the roads and parking terminals which will be needed to accommodate exaggerated estimates of 45,000,000 to 50,000,000 private passenger cars within the next 20 years—and each car travelling twice the mileage of the pre-war private automobile. Both truckers and transit officials are gravely concerned about

their place in the postwar community in view of such statements of private passenger car increases.

The National Interregional Highway Committee recommended to Congress in 1944 that approximately \$350,000,000 be allocated to main urban highways to bring them up to reasonable standards. Congress appropriated \$125,000,000. This amount is considered by highway authorities to be insufficient to meet the traffic needs of cities even with State

afforded it is possible that either rail or motor mass transport can be combined in the expressway program. A number of suggestions have been proposed along this line, placing rail transportation in the landscaped medium strip between the express roadways and providing for stations at important crossings of the expressway."

Estimates have been made which show that it costs twice as much per mile per passenger to construct highways for automobile com

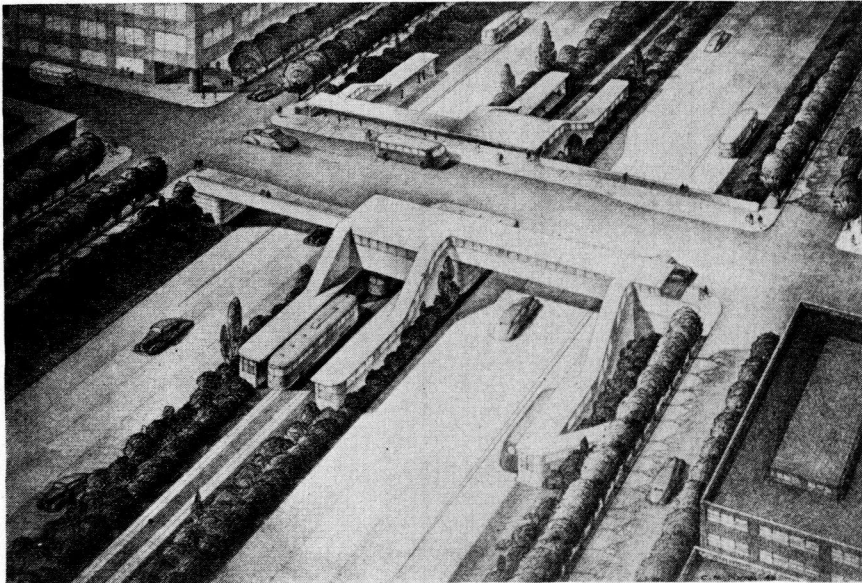


Figure 5. Artist's Conception of Trolley Transfer Station and Bus Stop (American Transit Association)

matching of funds and city and county contributions.

One way of generating the maximum usefulness from each highway dollar spent is to build into the facility means to produce the greatest transportation capacity in accordance with local needs.

Colonel Wm. S. Chapin, Highway Consultant, who is now in charge of expediting New York City's \$285,000,000 highway program, stated at a recent meeting of the American Society of Civil Engineers:

"The expressway cannot any longer be considered as a highway facility completely separate from the other problems affecting the growth of a modern city. In cities where separate rapid transit facilities cannot be

muters as compared with highways with provisions for busses or electric cars in the design.

Such estimates are based on the increased passenger capacities obtained by operating busses and/or electric cars on expressways.

For example, the relative passenger carrying capacities of a 6-lane expressway in one direction are as follows:

	<i>Passengers Per Hour</i>
<i>Private Automobiles (only)</i>	
3 lanes at 1500 autos per lane per hour at 1.75 passengers per car	= 7,875
<i>Motor Buses and Autos</i>	
2½ lanes of autos at 1.75 passengers per car	= 6,125
¾ lane of 40 passengers buses at 150 per hour	= 6,000
	12,125

Trolley Cars & Autos

3 lanes at 1500 autos per lane per hour at 1.75 passengers per car	= 7,875	
1 lane of trolleys in central mall at 150 single cars per hour	= 9,000	16,875

These are conservative estimates using single vehicles on headways common on existing streets and providing a seat for every passenger.

The public transit vehicle is an economical user of street space. A 40-passenger bus with all passengers seated requires only 7 sq. ft. per person whereas the private passenger

standpoint, a supersafe public way. On a passenger mile basis, one can ride more safely on an expressway than on an existing street in a private automobile. It is, however, safer to ride in a public transit vehicle on existing streets than in an automobile. In 1944 the death rate per 100,000,000 passenger miles was 0.22 in public transit vehicles, whereas the death rate was 13 times greater in automobiles. Therefore, combining the safest mode of urban transportation with an expressway equipped with modern safety facilities

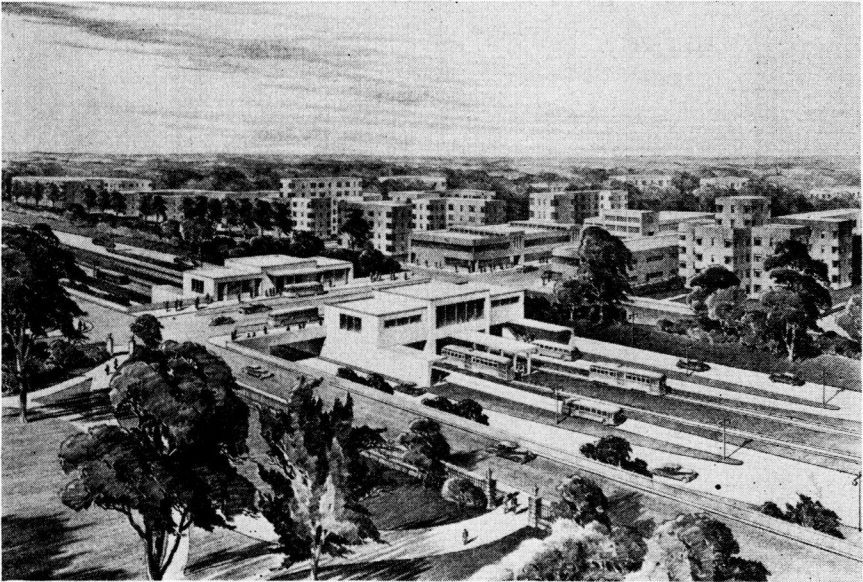


Figure 6. Combined Rail-Rubber Transport Station for a Large Satellite Community (Transportation Committee, American Institute of Planners)

car rider requires about 60 sq. ft. of street space. Since it is not the square footage of street space so much as the linear lane lengths that are involved, it might be well for us to bear in mind that the same 40 passengers in the bus require a little over 1 ft. of linear lane length of highway, whereas each private passenger car rider requires 10 linear lane-feet; and this is exclusive of the area of influence involved at various speeds.

Permitting public transit to operate express service on expressways and providing the proper facilities so that it can do this safely without interfering with the movement of other vehicles, creates from a passenger mile

it is possible not only to reduce congestion but also to contribute to the reduction of accidents within our cities.

Permitting public transit to operate on expressways and providing properly designed transit turnouts and transfer stations will encourage sound suburban development by causing a break in the mode of travel which in turn will cause the establishment and prosperous growth of a compact community center.

A number of our cities owe their origin and growth to the crossing of routes, where a break in transportation occurred and business transactions took place. In the latter half

of the last century cities grew very rapidly, and satellite communities sprang up around suburban railroad stations in the outskirts. From 1900 to approximately 1920 the electric trolley car enabled the central cities to expand. Coinciding with extensive hard surfacing of roads in suburban areas and with the phenomenal growth of the automobile, cities literally exploded. Motor vehicle traffic poured into formerly quiet crossings, causing congestion and accidents. This discouraged the growth of community centers at the crossings of routes and caused a scattering of residential and business developments which proved to be uneconomic and very wasteful.

The expressways of tomorrow if properly located and equipped with public transit stations and/or bus transfer turnouts will cause a break in traffic; and the change of mode of transportation at these points will form the basis for modern community centers.

If parking lots are provided at these transfer stations, some motorists will travel by express public transit to the concentrated business centers and thereby aid in the solution of the in-town traffic and parking problem. Multiple-use expressways with public transportation and parking facilities will bring quicker and greater relief from traffic congestion with the funds available than can expressways lacking these public transit and parking essentials.

The operation of express transit service at reasonable cost to these outlying transfer points will also enable the lower-income worker to move away from crowded city conditions and still have good, fast and cheap transportation to and from work. Sound suburban developments will be encouraged and the blighted fringe around the central business district will probably be relieved, which will enable the central business area to expand, permitting central business interests and investors to meet the motor age and at the same time redevelop and rehabilitate the remaining areas for proper residential living.

The design standards for expressways adopted by the American Association of State Highway Officials offer no bar to the operation of modern busses, the construction of bus turnouts or the incorporation of rail facilities in the central mall of transfer stations and major interchanges.

A broad insulated right of way with flat continuous shoulders is recommended. These features lend themselves readily to the planning of bus turnouts, waiting platforms, accelerating and decelerating lanes and protecting islands.

A central mall of varying widths is specified which offers opportunities for the incorporation of rail facilities and stations for electric car service where needed.

Curvature, grades, widths and number of lanes are designed for speeds and maneuvers well within the performance of modern busses, without interfering with the free and safe movement of other vehicles.

These highways are to be limited-access highways with few, if any, crossings at grades thus permitting practically uninterrupted direct movement ideal for the operation of non-stop and designated-stop express public transit service free from interferences of local traffic.

It has been stressed that expressways must be located to serve the urban population, business and manufacturing centers. Expressways, located in accordance with these determinants and designed to permit public transit to render its maximum service, will provide express service not only for home-to-work travellers in all income brackets but more convenient, comfortable and fast service for more people from satellite towns to the central shopping areas and also for crosstown service from residence to employment and for social purposes.

The financing should be clearly worked out as a public investment, and no public funds should be placed into expressways which will not pay dividends to the people of the area.

Every phase of financing should be included such as.

- 1 Federal, State and county grants-in-aid for highways and urban redevelopment.
- 2 Proportionate sharing of the cost by neighboring communities.
- 3 Equitable distribution of highway user taxes.
- 4 Federal and State loans.
- 5 Local bond issues.
- 6 Benefit taxation
- 7 The use of excess condemnation when the highway is planned in relation to future

land uses—the highway should not be designed without such consideration.

The public's health, safety, convenience, and general welfare would be promoted by the operation of express transit service on expressways through cities, providing that these expressways are so located and so designed as to provide the maximum of benefits to the greatest number of people.

The chief reasons for building expressways are to.

reduce and not produce traffic congestion, alleviate and not aggravate traffic accidents, preserve and not imperil central area values, encourage and not discourage sound suburban development

The incorporation of public transit turnouts and transfer stations and the operation of express transit service on these expressways will accomplish these aims. Anything less will have far-reaching social and economic implications seriously impairing our national economy, because our cities are a basic national resource demanding as much forethought as the conservation of our forests, soils and other natural resources.

The average American is not currently inclined to sanction or condone the spending of huge sums of public money to experiment with magnificent obsessions for transforming his community into *Autopia*.

DISCUSSION

MR. O. K. NORMANN, *Public Roads Administration*. Upon what is that 25 per cent increase in the use of motor vehicles based?

MR. WILLIAMS I did not mean a 25 per cent increase in the use of motor vehicles. You are probably referring to my statement regarding the increase in automobile registrations from approximately 30,000,000 in 1940 to 40,000,000 in 1960, whereas there was an increase of 250 per cent in automobile registrations from 1920 to 1940.

My statements are based on a U. S. Public Roads Administration estimate that there will be 40,000,000 cars in use by 1960 as printed in a report entitled "Modern Highways" published by the Conference Committee on Urban Problems of the Chamber of Commerce of the United States, and prepared by Mr. G. Donald Kennedy, Vice-Chairman of the National Interregional Highway Committee and Vice-President of the Automotive Safety Foundation with acknowledgment in particular to Mr. H. S. Farbank, Deputy Commissioner of the U. S. Public Roads Administration.

Projection of the automobile registration curve by the U. S. Public Roads Administration, as shown in the October 1944 report of the ICC Bureau of Transport Economics and Statistics, indicates approximately 40,000,000 automobiles in 1960.

A projection of Charles Stephenson's curve estimating the social demand for private automobiles as shown in his paper prepared for

the American Transit Association entitled "Transit's Prospects for Postwar Traffic" coincides with the projection of the PRA curve of automobile registrations in ICC's report entitled "Postwar Traffic Levels".

MR. NORMANN: It increases from 10,000,000 to 30,000,000 and then all the indications are that people are going to be driving cars more than they ever did before. The mileage per car is steadily going up.

MR. WILLIAMS: In the same report, Mr. Kennedy again quotes PRA as estimating there will be twice as much traffic as before the war, but in Massachusetts it is estimated there will be only 50 per cent increase in motor vehicle mileage by 1965; however highway authorities are quoted as stating that the streets of our central cities are already saturated. If we cannot do very much about increasing mileage in our central city areas, then that mileage must take place in the rural and suburban areas unless the cities are radically changed.

Consider a city like Providence, R. I. If everyone in that area should travel by automobile into the central business district, Providence would have to move down Narragansett Bay while it is converted into *Autopia*.

MR. T. H. OWENS, *Dallas, Texas*: On the basis of highest production, prior to the war, and also on the estimated life of present

automobiles, how long will it take to get us back to the number of automobiles used in 1941?

MR. WILLIAMS: According to Charles Stephenson in his paper entitled, "Transit's Prospects for Postwar Traffic" it will apparently be some time before automobiles will come back in the numbers they were before the war, especially if present conditions do not improve. However, we have been led to believe that more automobiles have gone off the road than is actually the case. I think it will take several years before pre-war automobile registration levels are reached

MR. BURTON MARYE, *Virginia Highway Department*: Speaking of Virginia and cities therein, I agree that we are not in position to build one facility for passenger cars and one for mass transportation.

We have to make them all-purpose facilities. Let us assume in the beginning, that each class of vehicle is paying its fair share of highway and street costs, the private car, the truck, and the bus. This means that all should be entitled to the use of the facilities. Now we speak about building special accommodations for only one class of vehicle—the bus. What share, if any, of facilities that are built for one special class of vehicle, should be paid for by the transit companies? After all, the transit companies render a great public service, but they are not philanthropic organizations.

MR. WILLIAMS: That is a fair question. I can speak freely on this subject because I work not only in the transit industry but also as a public official. The real answer is, can we afford not to do these things if public transit finds it cannot operate efficiently without them?

My personal opinion is that these highway facilities should be financed the same as other highway facilities are financed, but I would like to say that the time has not come to discuss who is to pay for these facilities. Until we are all in agreement, that public transit should be permitted to operate on expressways and that proper facilities should be provided not only for their safe operation but also for the safe use of the highway by other users,

any discussion of who is to pay the cost, while pertinent, is somewhat premature.

If you were running one bus per hour and that bus ran as a local after it got off the expressway, its first stop would probably be off the expressway and its stopping arrangements would not be part of this freeway discussion. However, if you were to run busses on the expressway at 150 per hour in the rush hour, you can imagine how the ramps would be choked and what the situation would be at the cross-streets if they were designated stops of the express transit service along the freeway. You would have to consider some type of stopping facility off the travel lanes to provide efficient and safe operation.

However, the question of cost is one that has to be decided sooner or later and it will be decided in the public's interest.

In Los Angeles, I understand, the transit operator will make arrangements for defraying some of the costs of the expressway bus turn-off facilities to be used by public transit in that city.

Bus stops are planned on the major highways planned to go through San Antonio, Texas. I think it has been agreed to defray all costs of all facilities in these highways, including bus stops, out of highway funds.

MR. WINGERTER, *San Antonio, Texas*: As I understand it, one of the main purposes of the Interregional Highways is to reduce traffic congestion in cities. It is proposed to connect major cities of 100,000 population or more with fine highways, but in our smaller communities the inter-city highway volume alone is not enough to justify building those highways. Therefore we face the secondary objective of reducing traffic congestion in downtown areas in our city.

According to our city traffic engineer, there are about three ways to reduce traffic congestion downtown. One is to provide more parking facilities. The second is to take the parking off the streets where it is now hindering the traffic. The third, and upon this point I can find no disagreement, is the encouragement of public transportation. The more people that you can encourage to ride in public transportation vehicles, the less the traffic congestion problem becomes.

To get down to the crux of the matter, theoretically it would be ideal from your stand-

point if people could ride the busses and street cars free. It would be preferable theoretically, if there were no taxes on public transportation. The more people that you can entice to ride transit vehicles, the less your problems become, so I think you should be thinking in the direction of making it as easy as possible for the public to use public transportation by keeping transit fares and transit taxes as low as practicable.

Getting down to the matter of tax, payments and cost, all public transportation companies are carefully regulated. All costs are passed on to the public. Exorbitant profits are prohibited, so it is merely a question of proper division of cost. Going back to my own city of San Antonio, we secured a new bus franchise about two years ago. During the franchise negotiations, a civic leader and I were discussing what amount would represent a fair annual charge upon our transit company for the wear and tear on the city's streets caused by our buses. I asked him this question: "What percentage of the city streets are we using today?" He replied: "About 10 per cent." I then asked, "What per cent of the total travel do our busses represent on those streets?" "About ten per cent."

In other words, we should in fairness pay one-tenth or 1 per cent of the total of the street maintenance of the City of San Antonio. Actually the City of San Antonio has been spending about \$300,000 a year on street maintenance. On the above basis our share would be \$3000 per year, yet we have paid the city \$200,000 per year in franchise taxes, so we find ourselves in the position of having paid already more than our fair share of street maintenance costs.

I should like also to point out that we are using about 10,000 gallons of gasoline per day at 4 cents per gallon tax, which means we are paying the State \$400 a day gasoline tax in addition to our city payments. Up to date we have had no returns from the gas tax other than a little State maintenance on State highways passing through our city, so, answering the gentleman from Virginia, I think that we have probably more than paid our share of highway costs.

And I suggest that highway engineers are serving their own ends when they help transportation companies keep both taxes and transit fares down.

MR. WILSON T. BALLARD, *Maryland State Roads Commission*: In Baltimore one of the major elements of the super-highway problem which we are endeavoring and hoping to solve, centers around the question of the effect on the property values within the city. The central commercial area is surrounded by a ring of decadent property, because a large part of the occupants have moved to the country in the last 10 or 15 years. The condition is causing cold chills to run down the spines of some of our larger store interests. If I understand the speaker correctly, he said that these improved facilities would make possible even a greater movement of such residents into the country, to enable them to enjoy country life and at the same time, work in the city. My question is how are we going to reconcile these two elements and design these super-facilities with the idea that they are going to make it possible to have greater enjoyment of country life and at the same time accomplish what a large number of people in Baltimore want to accomplish and revive receding property values.

MR. WILLIAMS: In the first place, commercial interests find it difficult to develop their activities in those slum areas around the business district because of present high land values.

My point is that we have had a sprawling out of suburban areas, and not compact satellite community development around the crossroads as in the pre-automobile era when the wealthier of the population could commute back and forth from the suburbs by railroad.

Highway building encourages decentralization, but by incorporating proper transfer stations in the expressways we plan to build, we can encourage the formation of neighborhood units around the transfer points. Then with express transit we enable some of the people who now live in the decadent central ring to have access to suburban life even though they be low-income workers. This movement will enable the concentrated commercial activities, now hemmed in, to expand into a decadent fringe of possibly lower values and thus adjust themselves with an eye to the motor age.

The people who remain in the slum ring, close to the business district, can be rehoused

and also be given more amenities for living decently.

It seems to me that we are providing two opportunities. First, an outlet for building in suburban areas on a neighborhood unit basis; and second, an opportunity for in-town areas to be rehabilitated and redeveloped on a

sounder financial basis, which has not been possible up to the present.

The question is how to build future expressways in urban areas so as to generate their maximum usefulness in promoting better community living, for highways are not an end in themselves but only a means to an end—namely civic improvement and betterment

DEPARTMENT OF SOILS INVESTIGATIONS

C. A. HOGENTGLER, *Chairman*

REPORT OF COMMITTEE ON CLASSIFICATION OF MATERIALS FOR SUBGRADES AND GRANULAR TYPE ROADS

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SYNOPSIS

This report covers three methods for the classification of subgrade materials for highways and airfields. One prepared by a group representing highway organizations; one prepared by representatives of the Corps of Engineers, U. S. Army; and the third prepared by representatives of the Civil Aeronautics Administration.

The classification presented by the highway group is based on the sieve analysis, the liquid limit and the plasticity index. The seven main groups presented are modifications of the A-1 to A-7 groups in the Public Roads Administration classification, which eliminate overlapping. In addition, suggestions are made for the subdivision of several groups and a "group index" is introduced for the relative evaluation of soils within a given group. Under average conditions of good drainage and thorough compaction the value of a material as subgrade may be assumed as an inverse ratio to its group index.

In the "Soil Classification for Airfields," utilized by the Corps of Engineers, U. S. Army, the materials are divided into two principal types, fine and coarse-grained soils. These types are subdivided, the coarse-grained primarily on the basis of grading, and the fine-grained on the basis of compressibility and composition. Typical descriptive names are assigned to each group. General characteristics which are of importance in relation to the behavior of soils as subgrade or base course materials are presented in classification charts.

The classification presented by the Civil Aeronautics Administration is based on the mechanical analysis, plasticity characteristics, expansive qualities and California bearing ratio of the soils. Ten groups have been established, four of which include the granular soils, while the remaining six are nongranular soils. Since soil characteristics and supporting power can be so greatly affected by excessive moisture and frost, identifying F and R symbols are used to reflect the soil properties under such conditions and are helpful in determining from design curves the thickness required for flexible (F) and rigid (R) pavements.