It is possible to continue both longitudinal and transverse utility lines in place without change except where there might be interference with footings. Future changes and additional crossings of utilities are readily possible. However, the high cost of this type of structure would seldom warrant its use purely from the standpoint of accommodation of utilities. Nevertheless, in a heavily built-up area, the caring for utilities must be an important consideration in the determination of the type of expressway to be used.

a-2. On Fill - The use of expressway sections constructed on fill is usually dictated by such considerations as balancing cut and fill, surface drainage conditions, or other economic factors. However, the use of fills may be advisable in some cases to avoid extensive revisions of public utilities. This applies particularly where large sewers, storm drains or water mains cross the expressway alinement. Reinforcement of such utilities may be required in these cases to sustain the additional loads due to expressway fill. The existence of such utilities obviously becomes an important factor in locating the expressway.

Fill or embankment design, while less damaging to utility services, is usually less desirable from the viewpoint of the neighborhoods traversed.

b. Expressways at Grade.

Construction of expressways at grade will permit the continuance of existing utilities across the expressway without interruption except as follows:

1. Where utilities are in a street which is depressed to pass under the expressway.

2. Where a street passes over the expressway and it is deemed desirable to relocate the utility facility over the expressway in the grade separation structure and approaches.

3. Where utilities are overhead and come within the provisions of general rules (d), (h), (i), of subsection (3) hereof.

c. Depressed Expressways.

c-1. In Open Cut - Open cut design, since it seems to offer the most advantages in a built-up metropolitan area, will probably be the cross section often used It will be the most damaging to existing utilities, most of which are subsurface, and the ability to extend future utilities across the expressway. Where streets cross over the expressway, provision can usually be made to carry gas, water or sewer pipes and electrical conduits in the grade separation structure, sometimes with minor necessary adjustment of grades. Such utility lines must be adequately protected by proper structural measures. Storm drain pipes when flow grade lines permit can sometimes be carried across the structures in a similar manner by a change of cross section from circular pipe to elliptic, to occupy the reduced headroom available in the bridge structure. Where sewers and storm drains or other utilities are too deep or large to be relocated in the bridge structure, it may be necessary to redesign and rebuild extensive portions of the existing systems. Such cost would usually be a proper charge against the expressway project.

c-2. In Tunnel - In tunnel sections, it is especially desirable that ventilating and lighting or other necessary utility facilities be so located that they may be maintained and repaired without delays or interference with traffic. Tunnel sections will usually occur only where deep cover is available, and conditions as to utilities will not ordinarily be less favorable than in open cut sections.

ECONOMICS OF EXPRESSWAY

1. Economic Need of Expressway.

Most cities when laid out, were not planned for motor vehicle traffic and the result is that many suffer with traffic congestion on main thoroughfares. This congestion is magnified by the use of the streets for parking of vehicles.

One consequence of the congestion is uneconomical operation of motor vehicles for the inhabitants of the city as well as for those who live outside of it but for whom the city is the economic and social focal point.

Another consequence is blighted

areas within the city, arrested development and even retrogression of the prosperity of the city, placing in jeopardy the heavy private and public investments in buildings, streets, sewers, water mains and other facilities inherent to the function of a city.

One or more controlled access expressways within the city and connecting with the main thoroughfares leading into it, properly located and designed, will usually be found to be the basic means needed for alleviating these ills. Owing to the free flow of traffic that may be obtained on such an expressway it will carry speedily and economically a greater volume of traffic than can be carried on city streets with the same roadway width. This in itself will stimulate the prosperity of the city, but it may be of more permanent importance that it will be a starting point for city planners to modernize the city by the construction of off-street parking areas, bus and truck terminals and the many other things needed for the continued prosperity of the city. However, when contemplating the construction of a controlled access expressway in an urban area, it should first be determined whether or not it is economically warranted and next if the funds for its construction and upkeep are or can be made available.

2. Benefit-Cost-Ratio.

As for any other highway improvement the economic soundness of a project for the construction of a controlled access expressway may be determined by computing the benefit-cost-ratio of the project, or in other words, the relation of the money value of the benefits obtained by constructing the expressway to the cost of its construction and subsequent upkeep. In considering the money value of the benefits it must be kept in mind that the problems involved are not solely fiscal but also social and that their solution, therefore, must take into account the prevailing present and future standard of living, or the ability and willingness of the people to pay.

It should be noted that the benefit-cost ratio deals with what may be considered as the amount of interest which may be expected to be returned on the money invested in the project considered. It does not consider whether or not the funds for the project are available.

3. Benefits.

Some of the benefits gained by those that travel on the highways may include some or all of the following:

a. Saving in cost of vehicle operation due to decrease in travel distance, improved alignment and profile, better roadway surface and uninterrupted progress.

b. Saving in time of travel due to the same causes as above and due to increased speed of travel.

c. Increased safety of travel.

d. Improved physical and mental comforts of travel.

e. Improvement of traffic conditions on present streets.

Additional benefits are obtained by those that live or do business in the city. These may include:

f. Better access to places of business.

g. Increase in real estate values.

h. Improvement of blighted areas within the city.

i. Development of new areas.

j. Increased ratable values.

Some benefits may be negative, such as the loss of ratables to the municipality on account of converting taxable property into a non-taxable public thoroughfare. However, the loss of ratables in a municipality is likely to be compensated for, at least partly, by resettlement in other locations within the municipality if it is not already too densely built up throughout, and it may normally be presumed that the presence of the freeway will enhance property values in its vicinity. There must be considered also the frequently expressed fear of a community of a detrimental effect of an actual or fancied division of the community by the expressway.

The money value of some of the benefits are readily determined, particularly that of saving in vehicle operation on account of reduced travel distance, although it may vary from place to place and from time to time with the cost of

motor fuel, amount of fuel taxes, improvements of motors and fuels that will produce more mileage per gallon of fuel, as well as of changes in cost and efficiency of other items that affect the cost of vehicle operation.

The money value of saving of time is real and increases with the standard of living. This may be exemplified by the hourly wages paid to drivers of trucks and other vehicles, but it applies equally well to the drivers and passengers of other vehicles.

Records indicate that the accident and fatality rates, due to motor vehicle traffic on limited access roads, are materially below those on other highways. The rates in a city, therefore, should lessen when much of its heavy traffic is carried on a freeway.

The improved physical and mental comfort or peace of mind which may be attained by driving on a controlled access freeway rather than on a busy street, will all of its erratic movements of vehicles and crossing of pedestrians, has a money value. As an example may be cited many toll roads. While they largely are being used because they save travel time they are preferred by many because they permit smooth and uninterrupted progress without constant nervous strain.

The immediate purpose of constructing a controlled access expressway in a city is usually to relieve in an effective and economic manner the congestion of traffic on overburdened city streets. Much of the traffic now using the streets will transfer for at least part of its travel from these streets to the expressway and thereby relieve them of a material part of the traffic. This means that many of the benefits enumerated above will be gained not only by the vehicles using the expressway but also by the traffic in the city streets.

The benefits a to e discussed above, apply to those that use the highways, whether they originate inside or outside the city. They represent the "road users" benefits. The remaining benefits, enumerated as f to j, are of particular advantage to the inhabitants of the city. These may be called the "city's" benefits.

The city benefits are enumerated above as better access to places of business; increase in real estate values; improvement of blighted areas within the city; development of new areas; and increased ratable values. For any specific expressway project some or all of these benefits may apply and others may be added It may be the function of city planners to study and evaluate the money value of these benefits, but it is evident that they have a bearing on the future prosperity of the city, and the subject is of direct concern to highway engineers and planners.

4. Cost.

The cost of a controlled access expressway covers the cost items of right-of-way, construction and maintenance of the expressway and its appurtenances, including traffic interchanges between the expressway and the street system. It includes also the cost of operation of movable bridges, lighting system and other items that may be incorporated in the expressway.

The street system connecting to the interchanges must be studied to insure that it will be able to absorb any added traffic, involving perhaps local reconstruction of the street system. At the street end of interchanges additional lane space may be needed as a reservoir to avoid congestion. The cost of these items should be included in the estimate of cost of the expressway when determining the benefit-cost ratio.

In the study of the location of an expressway in an urban area it is generally necessary to investigate several possible locations, including interchanges. The benefit-cost ratio probably will vary for each location, and that which shows the highest ratio is economically preferable. In making these studies, future rather than present traffic volumes should be considered and sufficient right-of-way should be included in the cost estimate for serving the future traffic, although possibly the construction of some lanes and interchanges might be postponed until traffic volume will warrant it.

5. Sources of Funds.

If the providing of a controlled access

expressway is to be undertaken by the municipality itself the primary sources of revenue will usually be the portion of the State's "road users'" revenues allocated by the State to the municipality and to the county in which it is located. Road user revenues are derived essentially from State taxes on motor fuel; from motor vehicle registration and other fees; and from Federal Aid for highway purposes. As these funds are likely to be insufficient they generally must be supplemented by local taxes or assessments or by a bond issue.

If the expressway is within the scope of the State highway system the sources of funds will be the portion of the road users' revenues allocated to the State highway department for State highway purposes. As the presence of the expressway may be of benefit not only to road users but perhaps to even a greater extent to the city and the county in which it is located the funds may properly be augmented by contributions from these local sources.

6. Studies and Research.

The modern means of studying the economics of highways is comparatively new and the concept of controlled access expressways through a city is even more recent. Therefore, while we can with a fair degree of confidence outline the method of preparing an economic study of a projected limited access expressway and arrive at reasonably accurate conclusions, there are several matters for which intensified additional studies and research are indicated. Some of these matters are the development of a rational method of determining the money value of the benefits of an expressway to the inhabitants of a city together with actual data of the money value of benefits obtained; and up-to-date costs or values of vehicle operation, travel, time, accidents and mental comfort of travel.

EFFECT ON TAX RATABLES

Of vital interest to municipalities participating in the planning of expressways is the effect of an expressway on tax revenues. Of immediate concern is the amount of property taken off the tax rolls. This removal is a loss to the municipality, at least in the immediate sense. With this loss in mind, there is a tendency to restrict widths of right-of-way and seek locations in parks or other public lands. Such a view, however, is sometimes short-sighted when consideration is given to the future effect of such restriction on tax revenues. A restriction of right-of-way may result in the construction of a type of expressway which will act as a barrier, or "Chinese Wall" dividing the community and in some cases causing a deterioration of adjacent property values. An ample right-of-way permitting extensive open areas and landscaping providing a park like atmosphere usually enhances adjoining property values more than enough to offset any apparent saving through restriction of right-of-way.

The above-mentioned benefit, the esthetic value, applies both to areas directly served and to intermediate areas through which the expressway passes. In these intermediate areas the benefits are community benefits; in the areas directly served they are both user and community benefits. Therefore, property values are enhanced in the areas served both by the improved transportation service provided and by the more attractive, open atmosphere created.

The effect of the expressway on the tax revenues is dependent upon the physical character of the facility and to the amount of transportation or traffic service provided.

A few attempts have been made to measure the effect of expressways on tax revenues, but these studies have been too few to be convincing or conclusive. They do demonstrate, in a general way, the validity of the above assertions. Increases in property values above the normal trend have been shown. Or in periods of a general decrease, the areas served by expressway facilities.

The gain in Tax Receipts during a 22 year period of affected areas along Bronx River Parkway in Westchester County, New York State, was more than $22,000,000 over the Tax Receipts if