

thoroughly explored and found to be inadequate to meet requirements.

Alternatives include steps listed below under "Opening New Streets and Improvement of Existing Streets". An analysis should also be made of local ramp and interchange facilities to the expressway which, together with service roads, may be capable of arrangement to distribute the traffic load and to ease the burden on local streets that will be seriously affected. Thus, it is often possible, by means of expressway service roads, to collect and disperse local traffic over a number of local streets rather than to concentrate the load on one or more main arterials. This may also avoid grade separations of important feeder streets.

Assuming that all possible lesser steps to relieve present and anticipated congestion are taken and that traffic demands will still exceed the capacity of local intersections, one or more grade separations may be indicated. However, unless the benefit cost ratio, calculated for each such separation, is two to one or greater or other major local controlling factors prevail construction of such grade separations may well be postponed or avoided because of excessive cost and marginal benefits.

OPENING NEW STREETS AND IMPROVEMENT OF EXISTING STREETS

Plans for the development of a controlled access urban expressway should include consideration of street improvements that may be required in tributary areas to provide suitable expressway access and egress and ample street capacity to meet local traffic demands.

1. *Opening New Streets.*

Steps listed in the next section, "Improving Existing Streets" should be thoroughly explored to determine if limited improvements and better management of traffic and of traffic facilities will provide the relief required.

Service roadways parallel to an urban expressway, and usually but not always within its right-of-way, should be con-

structed where necessary to afford street frontage and access to adjacent property and to facilitate local collection, distribution and interchange of expressway traffic.

Right-of-way and design requirements of an expressway may necessitate the closing of some local streets and the substitution of new ones.

Adaption of local streets to expressway service roads and to interchanges and access ramps may require new street connections for more direct access and traffic reservoir capacity or to segregate, detour or by-pass traffic.

Future development and expansion of local industrial, commercial or residential traffic generating areas may require construction of or provision for new streets to serve as feeders to the expressway.

Additional streets may be needed to add traffic capacity to the existing street system or to permit the establishment of balanced pairs of one-way streets so that heavy increases of local traffic, generated by the expressway, may be accommodated.

2. *Improving Existing Streets.*

Streets reasonably adjacent and parallel to the expressway can often be improved and adapted to function as service roads to the expressway. Rights-of-way, preferably 100 feet wide or more, and greater widths on streets of unusual importance, should be provided on all major streets carrying local expressway traffic. Provision should also be made that major streets through all new subdivisions conform to these width standards. Such streets should carry at least two lanes of moving traffic and one lane for loading and parking at the curb in each direction and be provided with sidewalks of reasonable width. Where funds or other circumstances do not permit initial widening, set back ordinances may be passed to develop necessary widths of rights-of-way in the future as new buildings are constructed or old ones remodeled.

Other steps that may be taken to the extent necessary to insure that the local street system has adequate capacity to accommodate increased local traffic

loadings developed by the expressway include:

a. Arrange service roads to permit collection and distribution of expressway traffic via as many local streets as necessary or possible.

b. Widen, resurface, repair or replace old pavements on major feeder streets.

c. Straighten and eliminate jogs and offset streets and extend and connect interrupted streets.

d. Adjust street grades to modern standards.

e. Channelize street intersections and abnormal pavement areas.

f. Increase radius of curb returns to facilitate right turns at intersections.

g. Establish one-way streets to increase their traffic carrying capacities.

h. Correct improper parking and loading and develop off-street parking and truck loading facilities.

i. Arrange sidewalk improvements to accommodate pedestrians and bus loading at points of concentration.

j. Anticipate and provide for convenient interchange of transit passengers between busses operating on the expressway and on local streets by arranging suitable bus loading zones or turn outs on both.

k. Encourage greater use of mass transit vehicles.

l. Coordinate the timing of traffic signals at street intersections.

m. Arrange for strict local enforcement of appropriate traffic, parking and loading regulations and other traffic controls required.

PUBLIC UTILITIES

1. General Considerations.

Public utilities provide services which are essential to the every day activities and welfare of all residents of an urban area. Whether utilities are privately or publicly owned and operated, interruption or costly changes in such facilities are of concern to the public who must pay the ultimate cost either directly or indirectly.

The location of existing and future public utilities is therefore an impor-

tant factor in expressway design, from the preliminary location studies onward to the preparation of final plans. In relation to design, each location will present its own set of conditions and will constitute a problem demanding original investigation. It is important that the replacement in at least equal condition of all utilities affected by the expressway and their proper maintenance during construction, be treated as an essential element of the expressway design.

The future expansion of utility lines as well as future changes in population, traffic patterns and land use and development must be foreseen so far as such foresight is possible. It is a proper function of expressway design to work closely with planning bodies and all other agencies whose activities bear on future urban development, so that provision for possible future expansion may be included in present construction. There is probably a point of diminishing returns in speculations as to growth that appears distant in time, but it must be remembered that an expressway is an enduring improvement, which should be designed for a long period of usefulness.

2. Responsibility for Utility Changes made Necessary by Expressway Construction.

The principle usually incorporated in franchises and in street and highway codes authorizing utilities to occupy space in city streets or highways is that the utilities are granted permission to occupy their positions subject to the provision that, in the event the future improvement of the street or highway necessitates the removal or relocation of the utility, the resultant expense must be borne by the utility company. This principle was also applied to expressway construction at first.

In connection with expressway construction, the amount of utility disturbance is apt to be considerably greater than in the case of ordinary street or highway improvement. Expressways are most often above or below existing street grades thus materially affecting existing utilities or setting up barriers to the systematic expansion