

Surface drainage systems serving State highways and county roads in rural areas are simply constructed. These systems include inlets, short stretches of conduit, paved or sodded ditches, and hillside gutters. Culverts and culvert pipes serve to carry surface drainage beneath the roadway to the opposite side. The drainage from such systems is discharged into existing ditches, creeks, and rivers and sometimes into ponds, lakes, and bays. Storm systems serving urban highways and roads are generally made a part of the urban storm sewer system. Costs are often shared by the local public agency and the highway agency, based upon a formulated costs-benefits agreement. In some areas such costs are the total burden of the municipality. The funds necessary for such facilities are usually obtained from highway appropriations.

(b) *Distribution*

Unlike many other capital investments, systems of sewers are very difficult to measure and evaluate in terms of total capital investment. The reasons for this can primarily be attributed to the general lack of maintaining uniform records of such facilities by the various public and private agencies who were responsible for their construction. Another important factor is that it is difficult for a survey team to make an accounting of existing facilities. Several factors contribute to this; the most important factor is that sewers are generally buried and out of sight. It is often difficult, for survey teams, to determine the conduit sizes involved, the materials of construction, and the total lengths of systems. If such data were generally available from public agencies, and readily accessible upon request, it would be possible to make reasonably accurate summaries of existing storm sewer systems in the United States, on both quantitative and replacement-cost bases. Considerable costly time and effort would be required, however.

As an approach to making an approximate determination of existing storm sewer facilities and future needs in the United States, the American Public Works Association distributed a storm drainage questionnaire in 1965 to all urbanized places in the country with a population in excess of 10,000 persons. Replies were received from 627 of these. In addition, a storm sewer questionnaire was distributed by APWA in early 1966 to the central city of each of the 216 standard metropolitan statistical areas of the United States. Eighty replies were received. A third APWA questionnaire on storm sewers was sent in early 1966 to the regional planning commissions of these same metropolitan areas. Where a regional planning commission did not exist, the questionnaire was directed to the planning department of the central city within the metropolitan area. Seventy-nine replies were received.

As a result of the three surveys made by APWA, as described above, it is estimated that based on 1965 costs the total capital investment in storm sewer systems in this country is more than \$22 billion. This estimate includes an appropriate allowance for the investments in combined sewers. The distribution of the capital investment in such facilities by States is given in table I. Totals by geographical regions can also be made. These estimates of capital investments in storm sewer systems, when divided by the corresponding unit construction costs (dollars in millions per square mile), result in an approximation to the square miles of sewerage area. In the table expressing capital