PLANNING INFORMATION SYSTEMS: AN OVERVIEW

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Planning information systems are integral parts of planning processes. These systems consist of data, machines, and sets of manual-machine procedures for developing, managing, and analyzing data, yet the key to designing and implementing them is the planning processes that they must serve. This is not to say that planning processes themselves can be defined abstractly without regard to the types of data that are available (or can be collected) or the analysis procedures that are available (or can be developed). It is to say that it is futile to design and develop planning information systems without close attention to the planning processes to be served. Planning information systems must be deeply rooted in the planning processes, which must be developed with careful regard to available (or potentially available) data, machines, and procedures.

Functions to be served by transportation planning information systems are long-range transportation planning, short-range transportation planning, continuing transportation planning, and service to staff and other agencies. Initially, there is an emphasis on preparation of long- and short-range transportation plans, but eventually there is a need for continuing planning processes as well as a need to serve the staffs of planning and outside agencies. Inevitably, special projects are proposed that necessitate the preparation of special reports. Planning information systems must be capable of handling these special needs without upsetting the normal work flow; this should not be overlooked in the design of planning information systems.

The procedures required to serve the transportation planning processes are data collection, data management, and analysis including forecasting, simulation, and evaluation. It is important also to provide for procedures that relate to research activities—research on the usefulness of the data being obtained for planning purposes, the determination of new data requirements, and the development of new procedures.

The data needs for transportation planning processes are land use activities, person and goods movements, and transportation facilities and terminals. Information is needed on the objects and object groups that are the subject of concern in the planning process, on characteristics of these objects and object groups that will aid in determining future demands and supply requirements, and on characteristics that will aid in evaluating alternatives for meeting future supply requirements. The information on the objects, object groups, and characteristics must be identified in terms of their places in time and space. Also, special information is often needed for special projects and research activities—information that is not required for the normal planning processes.

PLANNING PROCESSES

There are many different types of planning processes. Three criteria—subject matter, geographic area, and time horizon—may be used to categorize these processes. In regard to the time horizon, there are long-and short-range and continuing planning processes. The geographic areas of concern are (a) the entire country, as in national planning; (b) large areas of the country, as in regional or corridor planning (for example, the Northeast Corridor Transportation Project); (c) states, as in statewide planning; (d) metropolitan areas, as in metropolitan planning; and (e) small areas within metropolitan areas, as in local planning.

Each of these types of planning is concerned with serving the needs of the population of some particular geographic area. The subject area of concern can be transportation,

health, education, environment, recreation, social development, economic development, or land development.

In each of these areas, planning is concerned with serving some aspect of the total needs of a given population. Because there are so many different types of planning, it is important to provide coordination among them. Long- and short-range planning should be related, as should metropolitan and statewide planning and land development and transportation planning. An important element in each planning process is the provision that it can be related to other planning processes.

The specific subject area of concern here is transportation, but there are many types of transportation planning, for example, transit, rail, air, highway, TOPICS, statewide, and urban. Each of these types of transportation planning has unique subject areas of concern, geographic areas, and time horizons.

For each type of transportation planning, some objectives will be different, and some objectives will generally apply to all types of transportation planning. The overall objective in most cases is to determine recommended future requirements for transportation facilities. More specifically, the objective is to determine the following:

1. Recommended levels of investment in transportation facilities;
2. The division of investment between the major modes of transportation for movement of people and goods;
3. The location and size of transportation facilities; and
4. The sequence and timing of investments.

These objectives are generally applicable not only to different types of transportation planning but also (with appropriate modification) to different types of planning in other subject areas such as health planning. This parallelism of objectives provides a useful basis for structuring coordination among the different types of planning so as to make it easy for government, industry, and the public to choose between alternative proposals for investments in a large number of different fields, for example, to choose between investment in a new highway as opposed to a new hospital.

For a more specific idea of the planning processes for which transportation planning information systems are designed, let us consider the long-range urban transportation planning process. In this process, current and time-series data are used as follows (1):

1. Forecast future total metropolitan population, employment, and other economic factors;
2. Forecast future distribution of land uses and trips throughout the metropolitan area;
3. Split future trips among different modes;
4. Assign future trips to proposed future networks of transportation facilities (plan testing);
5. Evaluate performance of alternative proposed future networks of transportation facilities; and
6. Determine a recommended plan for future transportation facilities together with proposals for timing and sequence of investments.

REQUIRED PROCEDURES

Once the planning process has been defined, it is necessary to design and develop the manual-machine procedures required for collection, management, analysis, graphic display, and tabulation of data. For data collection, a wide variety of procedures are required for performing field surveys, sampling, processing secondary data, geocoding, general coding and file building, logical checking, editing, and summarization. The procedures for geocoding and general coding must be carefully developed to ensure flexibility in data manipulation and compatibility among the different sets of data so that they can be easily related to one another. Also, they must be based on a set of uniform definitions for data elements.

For data management, standard routines are essential for documentation of data files, storage and retrieval of data, transformation of data, development of working files, and storage of files that are not currently being used but may be needed in the future. For

analysis, routines are needed for performing various statistical analyses, forecasting population and economic growth, forecasting distributions of land uses and trips, simulating the flows of vehicles through transportation networks, simulating transfers of persons and goods at terminals, and evaluating the performance of proposed transportation facilities in terms of volumes carried, user costs, nonuser costs, and impacts generally (for example, in terms of effects on future population and industrial distributions, future land use patterns, and future environment). The simulation procedures should provide not only for handling flows through networks for individual modes but also for handling flows through multimodal networks. In addition, standard routines are required for tabulating and displaying data. These should be highly flexible, rapid, economic, and easy to use so that it is a simple matter to produce rapidly a wide variety of tables, maps, and charts.

Planners, engineers, and others who know the planning problems should be able to use the procedures with minimal or no help from systems analysts and programmers. Sometimes programmers and systems analysts are attached to planning, engineering, and analysis units to narrow the communications gap that often exists between those who know the problems and those who know how to use the computer. This is a good short-term solution, but the procedures should be designed such that the real users have direct access to the planning information system.

With the use of systems that have remote access terminals, this approach becomes even more important. Eventually, the proper role for systems analysts and programmers attached to a data center is to develop and operate a system that has all the required procedures and sufficient capacity. Their role should be similar to that of telephone engineers who provide a system that users have direct access to such as the expanded direct-long-distance dialing systems that we now have in many parts of the country. Also, the procedures should eventually be integrated into a single system that permits easy use of the outputs from one part of the system as the inputs to another.

There are innovations that will likely occur as transportation planning information systems are developed. For example, it appears likely that in the near future we will be able to plan sophisticated man-machine-mapping transportation planning systems similar to those now being developed for highway design. The transportation planner calls for a map, sees it displayed, draws proposals, sees future consequences, and receives an evaluation of these proposals. Then he repeats the process several times, altering his proposals each time, until he obtains the best plan.

Historically, transportation planning has been limited to the use of maps. An interactive man-machine-mapping transportation planning system would have the advantages of older transportation planning methods plus the advantages of the newer methods. There may even be effective methods in the near future for rapid participation of groups of professionals or citizens in the planning process. For example, experiments recently initiated under the name MINERVA (conducted by the Center for Policy Research, Columbia University) are directed at rapid polling by telephone-television-computer hookups. Wherever feasible, planning information systems should be designed such that transition to future systems does not present a problem.

DATA NEEDS

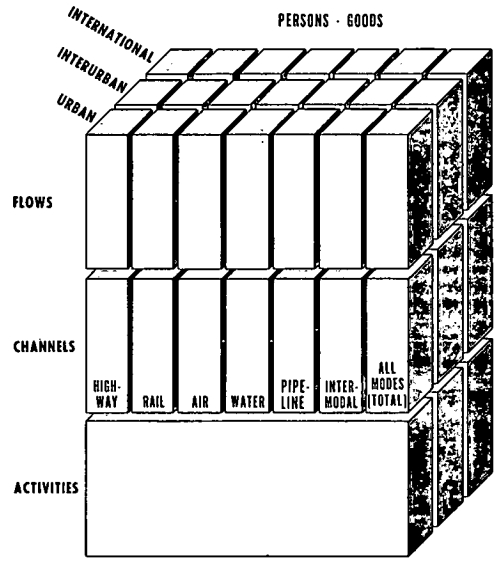
Data needs vary considerably depending on the particular planning processes for which the planning information systems are designed. For example, short-range transportation planning processes ususally require more detailed data in terms of subject matter and geographic level than do long-range planning processes. A similar distinction can be made in regard to the data needs for urban as opposed to statewide and national planning processes. It is possible, however, to distinguish broad types of data needs. Figure 1 (2) shows three dimensions of data needs: activity, mode, and geography. A time dimension should also be included.

The same general classes of data needs referred to earlier are found in the activity dimension. First, there are measures of the sizes and locations of activities that give rise to the flows of people and goods, i.e., measures of critical characteristics of residential, manufacturing, retailing, wholesaling, educational, social, and recreational

activities. Second, there are measures of the sizes and locations of the average daily, weekly, or annual flows of people, goods, and vehicles among the activities; the characteristics of the persons involved help explain the sizes of the flows. Third, there are measures of the sizes and locations of the channels or networks of transportation facilities and terminals that carry the flows of people and goods (their usage, level of service, and other characteristics of the facilities including accidents).

The mode dimension is of particular concern in channel and flow data. It is essential to identify the separate modes used in people and goods movements in such a way that separate modal flow, multimodal flows, and intermodal transfers can be easily determined. It is essential also to describe the networks of transportation facilities and terminals in such a way that flows involving usage of an individual modal network as well as flows involving usage of multimodal networks can be simulated.

Figure 1. Transportation data structure.



It is convenient to focus separately on each of the three elements of the geographic dimension: urban, interurban, and international. Different types of flows and networks are involved in each case. In urban areas, there are large volumes of short trips, whereas interurban and international trips are longer and fewer in number. Again, we should be able to relate easily the data for these separate geographic areas.

In discussing the required procedures for planning information systems, we referred to the need to work toward the development of integrated procedures. There should be a parallel concern in the data area for the development of integrated compatible data sets. The sets must be viewed as integral parts of a single whole, and they must be structured such that they can easily be used with one another. As indicated earlier, the necessary compatibility among the different data sets is achieved through uniformity in definitions for data elements and in coding schemes, particularly those for geographic coding.

The need for long lead times to obtain and process data is important. Based on past experience in the urban field, periods of 2 to 3 years appear to be normal; this increases the period required for development of initial tested plans to 4 or 5 years. Data are obtained during the 2- to 3-year time periods in the urban field only with considerable concentrated effort. It is essential to establish individual data programs early with sufficient resources and strong management to avoid long delays in planning processes, and, wherever possible, these should be established from the outset to facilitate the later development of continuing data.

Every effort should be made to obtain all possible data and data processing tools by cooperative arrangements so that it is not necessary for each separate planning agency to start from scratch to produce all data and processing tools on an ad hoc individual basis. Through cooperation at urban, state, and national levels, it is possible to obtain some of the required data and data processing tools from and through agencies such as the U. S. Bureau of the Census and the U. S. Department of Transportation.

CONCLUSIONS

Computers and computerized procedures have been used extensively in transportation planning. The most extensive applications have been at the metropolitan level where long-range transportation planning processes have been developed and implemented for

more than 200 metropolitan areas during a period of about 15 years. More recently at this level, attention has been given to development of information systems to support continuing transportation planning activities. Accomplishments at state and national levels so far have not matched those at metropolitan levels; the period involved here has been shorter, about 3 years.

Future applications of computers and computerized procedures to transportation planning will be substantially increased if apparent commitments to planning activities are realized. We appear to be committed to (a) continuing urban transportation planning for all metropolitan areas, (b) initial and continuing statewide transportation planning for all states, and (c) initial and continuing transportation planning at the national level. This type of planning activity is essential to support effective policy-making and program development at all levels of government, not only in the area of transportation but also in other areas such as land development. Within the transportation field, this planning activity is essential for effective evaluation of alternative proposals for investments in various modes of transportation at all levels in terms of performance of the transportation systems; costs and benefits to users and nonusers; and impacts on population and industrial distributions, land development, and the environment in general.

Present allocations of manpower and money will have to be increased severalfold if we want to achieve, within a reasonable time, the levels of planning activity we seem to be committed to. At present, there is a disconcerting vagueness about these activities. The following steps should be taken to clarify our plans.

1. Define objectives for transportation planning activity at all levels of government including planning processes;
2. Establish target dates for accomplishment of milestones in these activities; and
3. Provide funding at appropriate levels to implement the planning programs.

There have been claims that transportation planning costs are too high. Based on experience at the metropolitan level, these claims appear to be unfounded. The study referred to earlier (1) found that metropolitan transportation planning costs have averaged less than 1 percent of the capital costs of the recommended plans. Costs for initial and continuing planning at statewide and national levels and continuing planning at metropolitan levels are not likely to exceed this 1 percent figure.

To implement the foregoing planning programs will require organizational changes, particularly at the state level. For example, many states still do not have departments of transportation, while others do not have planning units. In addition, there should be mechanisms for coordination of transportation planning activities with other planning activities within each unit of government. Also, there is a need for federal-state-urban cooperative arrangements for a number of purposes. For example, there are data that are required at both state and national levels that can only be developed economically at the national level. There is a need for development of uniform computerized procedures that can serve all states (but that allow variation from state to state in planning program content and emphasis).

Although there is a need for emphasis on the development of improved computerized procedures for transportation planning (particularly the development of integrated packages and systems), greater emphasis should be placed on the development of the necessary data bases. This will prove to be a formidable obstacle in establishment of effective and timely planning processes. Every effort should be made to research and develop new methods that are less costly and time-consuming ant that will yield continuing data. However, even with the best possible methods a long lead time will still be required to obtain and process essential data because the volume of required data is so great and the processing requirements are so substantial. To realize our planning information systems within a reasonable time, we must put great emphasis on defining the planning processes and procedures in sufficient detail for determining data needs. (Previous experience at the metropolitan level shows that this is possible.) Then we must try to obtain the needed data as quickly as possible.

Finally, more attention should be given to determining the costs and benefits of planning information systems, or even of planning processes. One method is to develop an interim plan early in the planning process before the computerized planning information

system is established. The merits of this plan can then be compared with those of a final plan produced after the computerized system is established. Something like this was done by the Tri-State Transportation Planning Commission in preparing long-range transportation plans for the Connecticut-New Jersey-New York metropolitan area. More work along these lines should be done so that we can establish clearly the benefits of our more sophisticated approaches to planning processes.

ACKNOWLEDGMENT

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