

CURRENT STATE OF THE ART IN STATEWIDE TRANSPORTATION PLANNING

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•THE subject of statewide transportation planning is one of intense interest at the present time. Thirteen states now have departments of transportation, and this number is expected to rise. The financial difficulties of railroads and some airlines are forcing states to consider what actions may be required in order to preserve those vital transport services. Citizens and political leaders, as well as professionals, want efficient and coordinated transportation systems so that tax dollars will produce the maximum in terms of transportation services for all people. And finally, there is a growing realization that the nation needs to consider alternatives to its present laissez-faire land development policy and that transportation is an important factor in land development.

The position of statewide transportation planning in 1972 has advanced to about the position of urban transportation planning in 1955. Fortunately, to improve this position, we have the advantage of knowing a great deal more about planning processes, goals, simulation, data collection, and evaluation. However, statewide comprehensive transportation planning is a larger and more complex subject than urban transportation planning. There are more modes. Both public and private organizations provide the services. And freight movement is a vital half of the problem.

Future advances in this subject area can be accelerated if we can reach a general agreement on what statewide comprehensive transportation planning should be, what its products are, what its methods are, and what the most acute problems are. It is as a contribution toward achieving this general agreement that this paper is directed.

This paper is based on work done by the authors on 3 concurrent projects. These include a project to develop a comprehensive statewide transportation planning program for the Pennsylvania Department of Transportation, the preparation of a chapter for the forthcoming 4th Edition of the Traffic Engineering Handbook of the Institute of Traffic Engineers, and the preparation of a position paper on the state of the art in statewide transportation planning undertaken for the Highway Research Board.

DEFINITION OF COMPREHENSIVE STATEWIDE TRANSPORTATION PLANNING

One of the first things that needs to be done in a consideration of comprehensive statewide transportation planning, either from the viewpoint of determining the state of the art or from the viewpoint of developing a new program, is to define what we mean by the term. The following definition is an example, prepared for and reviewed by the Pennsylvania Department of Transportation: Statewide transportation planning is defined as a series of activities that

1. Are undertaken to attain a series of goals or to improve performance in relation to a series of criteria;
2. Consider different groups such as people who travel, private firms that ship, private firms that sell transportation services, people who are in any way affected by facilities or services, and the general public;
3. Are involved in or involve recommending new or changed construction, operation, technology, price regulation, subsidy, and regulation of operations;
4. Consider modes of truck, rail freight, airfreight, waterways, ports, pipelines, air passenger and general aviation, bus passenger, rail passenger, and highway (automobile);

5. Involve planning by means of an orderly, objective process based on measurement but include inputs by duly elected officials and reviews by citizen groups and also include priority programming;

6. Are closely integrated and coordinated with land use, economic, environmental, and other plans;

7. Consider the entire state, including both urban and rural areas; and

8. Cover time periods ranging to 20 years.

Table 1 gives, for each mode of travel, the particular things that statewide transportation planning is concerned with and (for clarity) those things that it is not concerned with.

Each state will have a definition somewhat different from the foregoing, reflecting, among other factors, its geography, extent of urbanization, state governmental organization, and organization within a department of transportation.

PRODUCTS OF PLANNING

We can summarize the preceding definition by stating that, for most modes, statewide transportation planning is concerned with the following items:

1. Level of public investment;
2. Location (corridor locations for highway, bus, air, and rail and terminal locations for bus, air, rail, trucks, and waterways);
3. Type of facility within each mode (type of highway or type of airport);
4. Level of service to be provided;
5. Timing of investments and other actions;
6. Relation between transportation and (a) land use, (b) the economy, and (c) the environment; and
7. Cooperative, interagency decision-making (as an input as well as a means of effectuation).

The products of planning are recommendations regarding level of investment, location, type of facility, level of service, timing, and relation to certain external factors such as land use, the economy, and the environment.

Table 1. Subject matter of statewide transportation planning.

Mode	Is Concerned With	Is Not Directly Concerned With
Highway	System design in principle (mainly configuration, spacing, and geometric type) for all systems; corridor location for principal arterials; investment levels by type, location, and timing (both intraurban and statewide)	Route location; engineering design; corridors of secondary highways; traffic engineering and control
Bus (intercity)	Systems of routes (design and interline coordination); service levels (headways); generalized terminal location; pricing; bus size	Detailed terminal location; scheduling; internal management and operations
Air passenger and air freight	Systems of air routes and airports; generalized airport location, size, and investment; pricing; airspace use; utilization of airports by plane type and activity	Detailed airport location; scheduling; internal operations; safety; air traffic control
General aviation	Systems of airports; generalized airport location, size, and investment; airspace use; pricing; utilization of airports by plane type and activity	Detailed airport location; scheduling; internal operations; safety; air traffic control
Rail passenger	Rail passenger systems; generalized station locations; pricing; service levels (headways); investment; grade-crossing protection	Scheduling and operations; safety
Rail freight	Extent and design of system; investment; terminals, especially trailer- and container-on-flat-car (TOFC and COFC); system speed and pickup frequency; rail-truck coordination; pricing; grade-crossing protection	Scheduling and operations; safety
Truck	TOFC-COFC terminal locations; expressway location; truck size; safety; pricing	Operations; details of TOFC-COFC locations; safety
Waterway	Investment and maintenance costs; systems as related to rail and highways	Operations; recreational use
Port	Investment; coordination with rail and highway; interport coordination; generalized locations	Design, management, and operations
Pipeline	Impact on rail, waterways, and ports	Safety, management, and operations

TYPES OF PLANNING

How are recommendations developed? Planning recommendations are developed by demonstrating that the recommended actions will produce greater benefits or improved performance in terms of stated goals or standards than would be the case if other actions (or no actions) are taken.

Broadly speaking, there are 3 ways by which these demonstrations can be made.

1. A first-generation approach: the needs-standards approach—In this approach, standards are set for each of the separate modes of transportation. These may include standards of physical design (roadway geometrics), standards of service levels (capacity in relation to demand or frequency of public transportation service), and safety standards. The difference between the standards and existing (or future) conditions is the need. Generally, needs exceed financial resources, and therefore priority projects are identified, which become the program for construction.

The advantages of the needs-standards approach, which is basically the approach used in the 1970 National Transportation Planning Manuals of the U.S. Department of Transportation, are its simplicity, directness, and credibility and the fact that it can be done. The disadvantages of this approach lie in the fact that the standards tend to be mainly physical standards and the benefits to users and nonusers are not directly measured. As a result, comparisons of intermodal investment productivity cannot be made directly.

2. A second-generation approach: the single-mode simulation-evaluation approach—The single-mode simulation-evaluation process is derived from the urban transportation planning process. It typically contains 4 major elements plus the elements of data collection and programming implementation. The major elements are (a) the statement of goals or criteria, (b) the preparation of plans to improve performance in relation to those goals or criteria, (c) the simulation of present or future performance (or both) of the planned system, and (d) the evaluation of the results.

One basic distinction between the needs-standards approach and the simulation-evaluation approach lies in the nature of the goals. Standards tend to be physically dimensioned, relating to the facility itself, while the goals used in simulation-evaluation relate to performance as observed by people, whether as users or nonusers.

The advantages of the single-mode simulation-evaluation approach are that (a) it evaluates plans directly in terms of user and nonuser goals related to construction and operating costs, cost of travel, time, and safety; (b) it deals with and represents systems directly and thus leads to greater understanding; and (c) it offers the ability to add up costs (e.g., time) on the same basis for several modes and thus permits intermodal comparisons. The disadvantages of this approach are that (a) it is complex and difficult and (b) it is not currently operational for most statewide transportation systems—the exception being highway traffic simulation.

3. A third-generation approach: the multimode simulation-evaluation approach—In this approach, the demands for transportation, of both people and goods, are estimated for all parts of a state (13). The demands are then allocated among modes, and simulation is undertaken for all modes, much as in the single-mode process described above, except that allowance is made for feedbacks, as planned changes in service levels affect the choices of mode.

The advantages of this approach are that it deals with all modes of transportation simultaneously and presumably would permit more effective planning and coordination across all modes. The disadvantages of this method are (a) it is extremely complex, (b) necessary data are inadequate, (c) there is so little experience with this method, and (d) it is probable that the results would be quite generalized because the process is so comprehensive.

ASSESSMENT OF THE STATE OF THE ART

Given the preceding framework definition and categories of planning methods, we can make a quick assessment of the current state of the art in statewide transportation planning.

Our first observation is that all states, as required by the National Transportation Planning Manual, have completed, or shortly will complete, statewide transportation plans based on the needs-standards approach. These plans will cover, at least, Interstate highways, primary and secondary highways, urban extensions, TOPICS, urban public transit, general aviation airports, and air carrier airports. Most states will not have done any work in goods movement transportation (rail freight, canals, pipelines, or trucking) or in certain elements of long-distance person transportation (bus and high-speed rail). (An exception is the work done on the well-known Northeast Corridor Project.) Nevertheless, states will have done very substantial work at the first-generation level of planning. This provides a most important base that should be given recognition as a completed component of a statewide transportation plan.

In terms of second-generation planning, the record of accomplishment is by no means so extensive. The best record is in the highway field. Conversations with Philip Hazen of the Federal Highway Administration indicate that, as of mid-1971, 14 states have made some type of traffic assignment to statewide highway networks and 8 are in the process of developing or applying assignment techniques.

Probably the states that have gone the farthest in highway traffic assignment are Connecticut and Rhode Island. Connecticut has carried its assignment process through the testing of several alternative plans and has adopted a comprehensive statewide transportation plan with a tested highway element.

Conversations and correspondence with officials of many states indicate that the simulation-evaluation process has not been used at the state level in the planning of other systems of transportation. It is also clear that nothing has been accomplished yet in the way of third-generation, multimodal simulation and evaluation although at least 1 case has been reported in a foreign country (14).

FUTURE DIRECTIONS—A CASE STUDY VIEWPOINT

Given the current state of the art, the next question is, What should be the direction of future work in comprehensive statewide transportation planning? One way of getting a sense of direction is to interview state governmental officials not only in transportation agencies but also in planning and regulatory agencies. We did this in Pennsylvania and found that there was a surprising unanimity of viewpoint among officials despite their widely varying responsibilities.

The following concerns have been selected from a longer list of concerns expressed by Pennsylvania officials.

1. A strong need was felt for a systematic process for planning of rural highway systems.
2. Past transportation planning processes were criticized for slowness and, therefore, for the result that decisions were made in the absence of planning.
3. Costs of data acquisition are high, and obsolescence of data is rapid.
4. Pennsylvania officials felt very strongly that planning recommendations should be credible so that they would be accepted both within government and by the public at large.
5. Great concern was felt that the transportation improvements should play an effective part in promoting the economy of the state.
6. All officials interviewed, regardless of their responsibilities, felt that highway planning deserved the greatest amount of attention. Rail freight transportation and air passenger transportation vied for second place, some officials thinking one mode was in greater difficulty and some the other. (One official pointed out that all common carriers of passengers were in financial difficulty.) Planning for ports and for rail passenger transportation was felt to be somewhat less critical, although still important, while planning for pipelines, canals, and trucking received a low priority.
7. There was general agreement that a prime problem of planning is to develop a strong, mutually reinforcing relation between transportation plans and state land development plans. There was general agreement that transportation plans ought to serve land uses and encourage desirable patterns where possible; the need for a clear statement of state land development goals was urgently felt.

8. Since regulatory agencies must make their decisions based on today's problems rather than those of the future, a request was made to have long-range planners concern themselves with current fiscal problems of the private modes, as well as with long-range system plans.

The preceding represents a partial set of views of one particular state. Other states will have different emphases to give to statewide comprehensive transportation planning. But based on these and other conversations, there does exist a widespread interest in the subject of statewide transportation planning coupled with a desire for speed in planning and for relevancy in terms of the actions that state governments will have to make.

GENERAL RECOMMENDATIONS

It will be seen that there is a conflict between the desire on the part of top-level officials for plans to be ready quickly and the present state of the art in statewide transportation planning. A great deal of work needs to be done to bring statewide transportation planning to the level where it can in fact provide the kinds of outputs that are desired, and to do so with the speed that officials and public demand. For many modes, data are completely inadequate. Performance goals have not been clearly defined. Simulation and forecasting processes are not yet polished. A great deal of work must be done during the next few years. The following statements give the authors' recommendations regarding the key work items that should be undertaken.

Organizational Recommendations

Content—At the outset of its comprehensive transportation statewide planning program, each state should carefully define the contents of its own planning program, indicating the modes of transportation to be planned, the areas to be covered, the level of detail of resulting plans, and the basic techniques to be used.

Organization—A single organizational unit reporting as a staff agency directly to the head of the department of transportation should be created to handle planning for all modes of transportation in each state.

Coordination—Definite, regular lines of coordination should be established between the planning arm of the state department of transportation and other agencies, both public and private, whose work is closely related to transportation. It is extremely important that close technical working relations be established between state transportation planners and planners working for private carriers.

Process Recommendations

Performance Criteria—Early in the comprehensive statewide transportation planning program, agreement should be reached on standards and goals to be used in evaluating transportation systems. Most states are already estimating needs on the basis of standards such as those prescribed in the 1972 National Transportation Needs Studies Manuals. However, the use of goals that measure performance as observed by people—users, nonusers, and organizations—does not appear to have been accepted in statewide transportation planning. We recommend that statewide transportation planning move in the direction of establishing goals that directly measure performance of different types of transportation in relation to a broad set of user, community, supplier, and environmental goals.

Performance Measurement—It is recommended that statewide transportation planners start at once to measure the existing performance of transportation systems in terms of user, community, supplier, and environmental goals. This will require substantial data collection.

Data Collection—Extensive sets of data need to be collected for all types of person and freight movement among cities by all modes of transportation. Except for the highway mode, data are completely inadequate for performance evaluation, simulation, and general planning work.

Simulation Models—Simulation models should be improved for automobile and motor carrier systems, rail freight systems, and air carrier systems.

Land Development and Transportation—Better methods are needed for simulating the mutual impact of transportation facilities and land use.

Multimodal Evaluation Techniques—Improved methods are needed for more rational allocation of both public and private funds among the several transportation modes. These improved methods should be capable of dealing not only with construction, maintenance, right-of-way acquisition, and user costs but also with impacts of the transportation systems on land use, the environment, and the economy. Initially, statewide transportation planning will concentrate on single modes, but ultimately public and private investments must deal with all modes simultaneously.

Alternatives—The comprehensive statewide transportation planning process ought always to propose and test alternative plans rather than single plans.

Modal Priorities

Highway Planning—Highways, because they carry such high proportions of person and freight movements in all states, should continue to get the highest priority of planning attention but not at the expense of failure to plan for the other modes of freight and passenger transportation.

Rail Freight Research—There exists a great need for a study of the potential economies inherent in optimizing the extent and pattern of existing railroad trackage. There appears to be extensive duplication of trackage resulting from the existence of competing railroads. Many feeder tracks receive only marginal use. Planners should, at the minimum, determine the potential order of magnitude of savings resulting from the pooled use of rail trackage and from the planned coordination of rail and truck systems.

Air Passenger Study—A study of air passenger systems, without regard to airline ownership, should be undertaken at a state or preferably multistate level. Air passenger service should be viewed as a systems problem, including the ground journey at each end of the passenger movement, rather than simply as a one-airport-at-a-time problem.

Bus Passenger Study—Intercity buses carry an important proportion of all person-miles of intercity passenger travel and a large amount of the mileage where trips are less than 100 miles in length. The Interstate System has increased the speed of intercity passenger travel by bus. This mode of travel deserves planning attention.

CONCLUSION

Comprehensive transportation planning at the statewide level can become, in this decade, one of the most productive activities that state departments of transportation can undertake. Important decisions are being made in highway, air, rail, and other forms of transportation; these have a close tie-in with the economy, the environment, and land use. Better decisions can be made if more facts and better planning processes are employed. Greatly improved methods for data collection, planning, and simulation and evaluation have been developed since 1950 in urban transportation planning and in other fields. An intense effort is now needed to modify and expand these for use in statewide transportation planning.

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