

State Departments of Transportation: A Perspective

Alan L. Porter, School of Industrial and Systems Engineering, Georgia Institute of Technology

Thomas D. Larson, Pennsylvania Transportation Institute, Pennsylvania State University

Since 1959 state governments have been reorganizing their transportation function. This paper provides a current perspective on the movement to state departments of transportation. Public wishes and federal mandates first shaped the evolving state role in transportation into one centered almost exclusively on highways. By the late 1960s, the monumental scale in highway building, particularly of the Interstate system, appears to have precipitated an erosion of the values placed on highways, especially at the national level. State values and priorities are highly individualistic, however, so the movement to state departments of transportation has been an uneven one. Since some 28 states have now formed transportation departments, this is an opportune time for a comparative analysis of states according to whether they have departments of transportation. Our statistical and quasi-experimental analyses indicate that states with departments of transportation differ significantly from those without, in terms of both socioeconomic development and modal emphases. The future of the movement appears uncertain and may well depend on future federal policies.

A majority of the states have now established departments of transportation, but the movement that began with Hawaii in 1959 appears to have peaked in about 1973 with six new departments of transportation created that year and tapered off to five in 1974 and one in 1975. As of March 1975, there were 28 state departments of transportation and 15 more were being considered. Our purpose is to provide a current review and analysis of the state department of transportation movement and, we hope, an improved perspective on a major effort at reorganizing state governments. Our approach is first to develop a broad context; federal influences are highlighted as being central to this context. Secondary data sources are then used in a comparative analysis of states that have formed departments of transportation and states that have not.

BACKGROUND

In studying the department of transportation option, states have examined their total range of transportation

activities, conceptualized an organizational form to match these functions, and rationalized this with political realities (1,2). The department of transportation movement has attracted numerous observers from academia. For example, Ashford (3) commented on the role of state government in transportation and argued persuasively that states should move to departments of transportation. Larson (4) reviewed the historic roles of the state in transportation and pointed out functional areas in which a broader perspective is needed. RuBino (5) examined state departments of transportation in existence through 1970. He identified two general types of organization—hierarchical and equal potential—and implied that state transportation agencies have not developed the strong executive structure appropriate to the state transportation function. Tomazinis (6) examined the role of states in urban mass transportation, focusing on whether the states are prepared to deal with urban transit, since their experience is dominated by highways and has a rural bias. Bennett and DeWitt (7) identified the reasons that states have moved toward departments of transportation, concluding that the reasons are persuasive and the move will probably continue.

Even as this change in state government is in process and its merits or demerits are being debated, the context is changing. At the national level, for example, the Federal-Aid Highway Act of 1973 contains provisions best implemented through a department of transportation, i.e., substitution of transit for interstate segments. But more important—indeed, the basis for the federal action—is the changing state of society. There appears to be genuine public concern for having a broad-minded approach to transportation. While no one fully understands how, or whether, a state department of transportation can provide a wider range of options, there is a strong sense that out of organizational change may come improvement.

By 1900 several forces were directing state and federal attention toward highway transportation to the virtual exclusion of other modes. Railroads, city dwellers, bicycle clubs, automobile clubs, mail carriers, and school boards all added to the clamor for good roads. Indeed, there was national concurrence with the statement made at the 1894 Minnesota Good Roads Conven-

tion, "To sum up, a perfect highway is a thing of beauty and a joy forever" (8, p. 7).

Both state and federal governments translated this public support into action. By 1929 all 48 states had highway departments and had funded them through a very efficient tax collector, the gas pump. The Federal-Aid Road Act of 1916 created a federal/state road-building partnership that was primarily aimed at meeting rural needs. The Federal-Aid Highway Act of 1934 created a funding process that institutionalized highway engineering and highway planning. This act also set penalties to prevent state governments from spending gas tax money except for highways. The Federal-Aid Highway Act of 1956 established a federal highway trust fund and 90 percent federal funding for a system of Interstate and National Defense Highways.

With the passage of the 1956 act, which launched "the greatest public works project in the history of the world" (9, p. 18), state and federal support for highways reached a lavish high-water mark. And it is important to note that scarcely any questioning or contrary voices were heard from the American public during this half-century. In fact, a Gallup poll taken in May 1956 showed that 76 percent of the American public agreed that there was a need for express highways between cities.

But single-minded attention to optimizing vehicular flow led to inevitable clashes between highway builders and those concerned with other urban activities. These clashes provided the first evidence that an era of uncritical public acceptance of highways and automobiles was ending and that governmental devotion to highways must likewise end.

With the Federal-Aid Highway Act of 1962, Congress attempted to make highway planning continuous (not project by project), comprehensive (not isolated from nontransportation objectives), and cooperative (between federal, state, and local communities)—the 3Cs—but the results were at best mixed. The institutional strength of state highway departments, supported by a continuing public clamor for more and better roads, the absence of an effective mechanism for the articulation of broad community values and goals, and the mechanical complexity of the 3C planning process all conspired to subvert the lofty ideals voiced in the legislation and in the policy documents prepared by the Bureau of Public Roads (10). Comprehensive transportation plans were most often massive freeway plans justified by average daily traffic counts projected into an apparently unchanging future.

Major institutional change came with the creation of the U.S. Department of Transportation (DOT) in 1967. DOT moved to promote balance in planning. It championed landmark legislation, e.g., the Rail Passenger Service Act and the Urban Mass Transit Assistance Act of 1970. It also inevitably accelerated the state department of transportation movement. Prior to 1967, there were only two state departments of transportation, Hawaii (1959) and New Jersey (1966); now there are 28.

Our purpose in the following section is to provide a comparative analysis between states that have created departments of transportation and those that have not. It is worth noting that transportation is not the only area of state government in transition. Examples of a new vitality in state government since 1960 and a new willingness to address complex issues can be found in state planning, budgeting, welfare, education, and all functional areas (11).

COMPARATIVE ANALYSIS

This analysis addresses factors independent of the institution of departments of transportation, such as so-

cioeconomic characteristics of the states, and possible consequences of creation of a department of transportation, such as shifts in modal funding allocations. Our intent is to answer, as fully as possible, the following questions.

1. Do states with departments of transportation differ from states without departments of transportation in terms of socioeconomic development, state government characteristics, relative importance of highways, and state highway institutions?

2. Does creation of a department of transportation appear to alter modal emphases? Do highways suffer? Does urban public transit benefit?

3. Can we gauge the likelihood that the remaining states will create departments of transportation in terms of their similarities to and differences from states that now have departments of transportation?

The scope of these questions and the limited experience with departments of transportation preclude total resolution, but we have attempted to organize the extensive available data in terms of a simple system framework. We first postulated that socioeconomic factors are basic to a state's behavior and would directly influence the state's government structures and processes as well as the state's transportation perspective. Highway influences and characteristics of state highway departments were next considered. Finally, we attempted to gauge the outputs of the transportation system.

On the basis of preliminary scanning, the 48 contiguous states were divided into three groups:

1. No DOT: the 21 states that have not created a department of transportation: Alabama, Arkansas, Colorado, Indiana, Louisiana, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Dakota, Oklahoma, South Carolina, Texas, Utah, Washington, West Virginia, and Wyoming.

2. Late DOT: the 16 states that instituted departments of transportation between 1972 and 1975 and have thus had relatively little time in which to demonstrate changes in transportation policies and performance: Arizona, California, Georgia, Idaho, Illinois, Iowa, Kansas, Kentucky, Maine, Michigan, Ohio, Oregon, South Dakota, Tennessee, Vermont, and Virginia.

3. Early DOT: the 11 states that instituted departments of transportation between 1966 and 1971, demonstrated high initiative in this movement, and have had some time to demonstrate performance: Connecticut, Delaware, Florida, Maryland, Massachusetts, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, and Wisconsin.

All of the following analyses are based on this classification. The general hypothesis being tested is whether these groups differ in any orderly fashion. Many other ways to classify states in terms of their transportation agencies or other features are, of course, possible. For example, an intriguing possibility would be to disaggregate the states in terms of the type of department of transportation organization (e.g., modal versus functional), but such a classification would be difficult since there are various combined forms of departments of transportation and continuous restructuring within the departments of transportation.

Selected socioeconomic factors for the states were assessed first (Table 1). The three groups, no DOT, late DOT, and early DOT, were clearly different, with the latter two being more highly developed in terms of industrialization, population density, urbanization, wealth, and technical capabilities (as indicated by patent

activity). While the late DOT states had higher values than the no DOT states for all six factors, these differences were not generally large enough or consistent enough to be reflected in the levels of statistical significance. Apparently the states that still do not have departments of transportation are not greatly unlike those that have recently instituted departments of transportation.

We next examined a limited selection of some characteristics of state governments (12). There were no remarkable differences among the three groups of states in terms of levels of expenditure, number of elected officials, or total technical expertise in the agency. While the successful institution of a department of transportation is greatly dependent on the characteristics of the state government, the essential characteristics are apparently not reflected in the basic statistical parameters we used. However, states that have historically been more innovative in terms of instituting a series of policy changes (13, p. 883) were by and large quicker to establish departments of transportation.

The state's reliance on highways (in terms of use of motor and special fuels per capita, vehicle registrations and federal highway aid per capita, and absence of controversy over Interstate highway segments) is considerably stronger in states that do not have departments of transportation, intermediate in those that have recently established them, and least in those that established them relatively early. This supports the logical deduction that creation of a department of transportation is more feasible in states that depend less on highways for their transportation needs. Again, as with the socioeconomic factors, the differences between the no DOT and the late DOT states were considerably fewer than those between the no DOT and the early DOT states.

We thought that differences in the extent of highway influence might be reflected in the state highway departments, but this was not the case for the present groupings. Differences among the three groups were relatively small on state highway revenue as a percentage of total state revenue, highway department payroll and number of engineers as a percentage of the state agency's totals, extent of diversions of highway funds, and accumulated tenure of highway department directors and chief engineers. On the basis of this information, one would not infer that the relative strength of the state highway department acts as a significant block to creation of a department of transportation. However, internal political factors are not accounted for in this analysis.

In considering the performance measures (Table 2), we shift attention from factors that may have contributed to the presence or absence of a department of transportation to the factors that may reflect its actions. Historically, the states that now have departments of transportation seem to have devoted at least as much effort to highways as did states that do not now have departments of transportation. The investment in planning was greater in states with a department of transportation, work on the Interstate system progresses as fast, and, although the early DOT states lagged slightly in commitment of non-Interstate highway funds, they more than made up for it by spending more money than that required to obtain matching federal funds. There was a slower rate of obligation of Interstate appropriations by the early DOT states in 1973 than in 1968, counterbalanced by a relative increase in the rate of obligation of non-Interstate appropriations. More notable is the slower rate of completion of Interstate highways, both urban and rural, by the early DOT states in 1973. On balance, it appears that departments of transportation

have been less active in support of the Interstate highway program than their highway department counterparts.

At this point such a conclusion assumes that the institution of the department of transportation is what made the difference. Obviously, this is not the only possible interpretation. Historical forces acting during this period may not have affected all states equally. The increase in federal matching support for non-Interstate programs has different implications for a state that is investing heavily in urban transit and a state that has great need for rural roads. According to a recent survey of chief executive officers of state highway departments and FHWA directors in each of the states, there are also perceived differences in support for public highways, environmental consciousness, and demands for urban transit between more and less economically developed states (17).

Effort directed to transportation modes other than highways varies considerably and systematically, with states that have departments of transportation showing higher effort (Table 3). States with departments of transportation spend more (and intend to do so in the future) on urban public transit and on airports. In sum, states with departments of transportation display a keener attention to nonhighway modes in both past and planned expenditures.

Our findings to this point indicate major differences among the three groups in terms of socioeconomic development and performance in regard to both highways and other modes of transportation. To attempt to separate the effects of socioeconomic factors from those associated with the presence of a department of transportation, it is appropriate first to consider some methodological points. In essence, what we have is a research design in which the groups being compared are not equivalent before the experimental treatment (creation of a department of transportation) takes place. Thus, we must deal with the ambiguity of whether observed differences are due to the treatment or to other changes taking place, e.g., political switches or shifts in public attitude within the states (21, 22).

Intuitively, one might consider that a matching procedure would resolve this ambiguity. That is, if one picked subgroups of the early DOT states and of the late DOT or no DOT states that were similar in certain characteristics at time 1, then any differences between the two subgroups at time 2 would be attributable to the institution of a department of transportation. However, as Campbell and Stanley (22) explain, this is not a secure approach since it is subject to a statistical artifact of regression to the mean. A standardized change-score analysis (23) appears to be appropriate to account for differences among the three groups of states before the institution of departments of transportation. Such an analysis indicates that the early DOT states showed a greater decline in the rate of obligation of Interstate appropriations in 1973 ($t = -1.91, p < 0.04$) and in the percentage of rural ($t = -2.72, p < 0.01$) and urban ($t = -1.80, p < 0.04$) Interstate highways completed as of 1973. However, their higher expenditure for airports (total and per capita) was not significantly different from that of the no DOT and late DOT states.

We are able to refine the results through multiple time-series analyses (24). Basically this procedure notes the behavior of the data series up to the point of the intervention, then seeks to determine whether the series behavior changes shortly after the intervention. We looked for changes in slope for such measures as rate of obligation of Interstate appropriations and percentage of completion of rural and urban Interstate highway systems. We performed such analyses for the group of 11 early DOT states, for the 37 late DOT or

Table 1. A comparison of socioeconomic factors.

Factor	No DOT	Late DOT	Early DOT
Manufactures, value added per capita, \$	860	1170	1530
Population	2 530 100	4 731 300	5 895 100
Urban population, percent	59.4	60.0	73.1
Income per capita, \$	2583	2764	3151
Patents per capita	0.012	0.016	0.037
Population per square kilometer	16.8	30.7	160.3

Notes: 1 km² = 0.4 mile².

Differences among the three groups are all significant at the level of $p = 0.01$. Differences between the no DOT and late DOT groups are not significant except for manufactures, value added per capita ($p = 0.08$), and population per square kilometer ($p = 0.06$).

All data shown are for 1966 except manufactures, value added per capita (1976), and patents per capita (1968).

Table 2. A comparison of some performance measures concerning state highways.

Factor	No DOT	Late DOT	Early DOT
Interstate highway funds obligated (14) ^a			
1968	336	346	316
1973	285	285	222
Non-Interstate highway funds obligated (14) ^a			
1968	329	332	276
1974	277	260	263
State funding above minimum matching requirements (1954-1970), % of total expenditures (15)			
Interstate highways	6.9	8.7	12.1
Non-Interstate highways	26.6	34.6	44.9
Designated urban Interstate highways completed, % ^b			
1965	47.5	55.6	48.5
1973	80.1	82.5	72.1
Designated rural Interstate highways completed, % ^b			
1965	39.5	46.6	44.6
1973	80.8	84.0	71.1
Total state highway planning expenditures (16)			
1966	1 165 000	1 876 000	2 190 000
1974	1 694 000	2 558 000	3 354 000

Note: Differences among the three groups are significant at the $p = 0.05$ level for total state highway planning expenditures in 1966 and in 1974 and at the $p = 0.01$ level for Interstate highway funds obligated in 1973, non-Interstate highway funds obligated in 1968, and state funding above minimum matching requirements for non-Interstate highways. Differences between no DOT and late DOT are significant at the $p = 0.08$ level for total state highway planning expenditures in 1966 and in 1974.

^aFigures shown reflect the amount of appropriated federal funds obligated by the states. An index of 200 indicates the obligation of all funds from the previous year; an index of 300 indicates obligation of all funds for the current year; a figure above 300 indicates the percentage of funds obligated for the coming year.

^bData supplied by the Interstate Report Branch, Federal Highway Administration.

no DOT states, for three trios of early DOT states grouped by year of instituting the department of transportation, and for individual early DOT states.

The results were ambiguous. The group of 11 early DOT states showed a relative dip in both obligations of Interstate funds and rates of completing Interstate systems compared with the 37 other states. Two of three trios of early DOT states showed statistically significant reduction in the obligation of Interstate highway funds shortly after their departments of transportation were instituted. However, for the individual states, the shifts in these highway performance measures did not follow institution of a department of transportation in a neat fashion; e.g., the substantial drop in Rhode Island's rate of obligation of Interstate highway funds appeared to begin in the year before its department of transportation was created.

The early DOT states do exhibit some enhancement of nonhighway mode activities and some decline in certain highway programs, particularly Interstate, between the mid-1960s and early 1970s compared with the other

Table 3. A comparison of some indicators of performance concerning various transportation modes.

Factor	No DOT	Early DOT	Late DOT
State transportation costs devoted to nonhighway modes (18), %			
1971	16.2	14.9	30.8
1989	23.8	27.1	45.7
State transportation costs devoted to urban public transit (18), %			
1971	5.8	9.8	22.0
1989	9.7	18.5	35.4
Expenditures of UMTA funds (19), \$	2 218 000	14 374 000	21 936 000
State expenditures for airports, \$			
1967	489 000	1 266 500	3 951 000
1973	697 000	2 829 800	14 609 000
Projected needs for 1974-1990, assuming no categorical funding restrictions (20), \$			
Urban public transit	206 000 000	568 560 000	1 392 560 000
Airports	250 000 000	320 000 000	387 500 000

Note: Several differences among the three groups are significant: state transportation costs devoted to nonhighway modes in 1971 ($p = 0.05$) and in 1989 ($p = 0.01$), state transportation costs devoted to urban public transit in 1971 and 1989 ($p = 0.01$), state expenditures for airports in 1967 ($p = 0.05$) and in 1973 ($p = 0.01$), and projected needs for 1974-1990 for urban public transit ($p = 0.01$). The difference between no DOT and early DOT is significant for state transportation costs devoted to urban public transit ($p = 0.05$).

states. But we cannot attribute these relative shifts in programmatic support to the actions of new departments of transportation. Another plausible explanation is that certain forces, possibly altered social values and political priorities in regard to transportation needs, that emerged in some states enhanced the likelihood both of creation of a department of transportation and of shifts in support from highways to other modes.

SUMMARY

The state department of transportation movement springs from a rich context. Historically, state governments were guided and directed by the federal government in creating highway departments, in funding them from highway-user revenues, and in providing a rural program emphasis. Under detailed federal tutelage and with massive public support, a highway-oriented transportation role emerged for state governments. A change in national emphasis led to the establishment of the U.S. Department of Transportation and the passage of numerous federal laws oriented toward broader transportation concerns. There has been a concomitant lowering of the national priority for highways. But the states are unique in their transportation needs and priorities, and the issues here deserve careful study.

We return to the three questions posed earlier.

1. Do states with departments of transportation differ from those without? In terms of socioeconomic development, they definitely do. In terms of the statistical characteristics of state government, they do not do so prominently. In terms of relative importance of highways, they definitely do. In terms of the characteristics of state highway departments, they do not differ to any substantial degree.

2. Does creation of a department of transportation alter modal emphases? We cannot say that creation of a department of transportation causes the changes noted, but we can remark on the differences between the early DOT states and the others, including a greater increase in airport funding in states that have departments of transportation in operation. Do highways suffer? Some decrease in Interstate highway activity appears to have

taken place in states that established departments of transportation between 1966 and 1971. Does urban public transit benefit? After taking levels of state socio-economic development into consideration, we conclude it does not; the urban states tend to have the departments of transportation.

3. Can we gauge the likelihood that the remaining states will create departments of transportation in terms of their similarities to and differences from the states that now have departments of transportation? Will the differences noted be reflected only in the timing of the creation of departments of transportation or will they not be instituted at all? It is possible to speculate directly on the logical candidate states for establishment of departments of transportation. Leaving aside Alaska, the following listing reflects an ordering in terms of economic development and reliance on highways and hence an assessment of the degree of similarity between a given state and the present states that have departments of transportation: (a) states both relatively high in economic development and low in projected highway needs as a percentage of transportation needs for 1989: Washington, Indiana, Colorado, Missouri, Texas; (b) states relatively high in economic development and moderate in projected highway needs: Minnesota, Nevada; (c) states relatively low in projected highway needs: Alabama, Louisiana; (d) states with mixed characteristics: New Hampshire, South Carolina; and (e) states relatively low in economic development and high in projected highway needs: Arkansas, Mississippi, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, Utah, West Virginia, Wyoming.

It appears that the rate at which states are forming departments of transportation is decreasing and, hence, it is not unlikely that many of the states in the latter categories of the listing above will elect not to create departments of transportation within the immediate future, unless they are further prompted by changes in federal policies.

REFERENCES

1. Routes of the Future: The DOT Idea. Interdepartmental Transportation Task Force, Minnesota State Planning Agency, St. Paul, Jan. 1973.
2. Organizing Penn-DOT: The Functions and Organizational Structure of the Proposed Pennsylvania Department of Transportation. Institute of Public Administration, New York City, Dec. 1967.
3. N. Ashford. The Developing Role of State Government in Transportation. *Traffic Quarterly*, Vol. 22, No. 1, 1968, pp. 455-468.
4. T. D. Larson. Towards a More Effective State Role in Transportation. *Proc., Transportation Research Forum*, Vol. 13, No. 1, 1972, pp. 257-269.
5. R. G. RuBino. A Quest for Integrated and Balanced Transportation Systems in State Government. Transportation Center, Florida State Univ., Tallahassee, Research Rept. 5, June 1971, rev. Sept. 1972.
6. A. R. Tomazinis and others. The Role of the States in Urban Mass Transit. Transportation Studies Center, Philadelphia, Appendix, July 1971.
7. J. W. Bennett, Jr., and W. J. DeWitt III. The Development of State Departments of Transportation—A Recent Organizational Phenomenon. *Transportation Journal*, Vol. 12, No. 1, 1972, pp. 5-14.
8. Bulletin No 2, Office of Road Inquiry, U.S. Department of Agriculture, 1894, pp. 7-8.
9. R. W. Barsness. Highways and Motor Vehicles: A New Era in Public Policy. *MSU Business Topics*, Vol. 21, Spring 1973, pp. 15-26.
10. Urban Transportation Planning. Federal Highway Administration, U.S. Department of Transportation, Policy and Procedure Memorandum 50-9, Nov. 24, 1969.
11. A. W. MacMahon. Changing Roles for the States. In *Administering Federalism in a Democracy*, Oxford Univ. Press, New York, 1972.
12. A. L. Porter and T. D. Larson. A 1975 Perspective on State Governments' Role in Transportation. Georgia Institute of Technology, Atlanta, Industrial and Systems Engineering Working Papers J-76-3, 1976.
13. J. L. Walker. The Diffusion of Innovations Among the American States. *American Political Science Review*, Vol. 63, Sept. 1969, pp. 880-899.
14. Progress of the Federal Aid Highway Program. Federal Highway Administration, U.S. Department of Transportation, 1968.
15. L. Sherman. The Impacts of the Federal Aid Highway Program on State and Local Highway Expenditures. Massachusetts Institute of Technology, PhD dissertation, 1975; Office of Transportation Planning Analysis, U.S. Department of Transportation, 1975.
16. Total Current Planning and Research Projects. Federal Highway Administration, U.S. Department of Transportation, 1974.
17. A. L. Porter, T. J. Kuehn, G. D. Hurley, and J. J. Best. State Highway Department Practices: A Survey. *American Highway and Transportation Magazine*, Vol. 54, No. 1, 1975, pp. 13-16.
18. 1974 National Transportation Study. U.S. Department of Transportation, Table III-R-5, 1975.
19. Estimated Federal Expenditures on Domestic Transportation Capital Improvement and Operating Programs. Office of Transportation Planning Analysis, U.S. Department of Transportation, April 1974.
20. 1972 National Transportation Report. U.S. Department of Transportation, 1972.
21. T. D. Cook and D. T. Campbell. The Design and Conduct of Quasi-Experiments and True Experiments in Field Settings. In *Handbook of Industrial and Organizational Research* (M. D. Dunnette, ed.), Rand McNally, New York, 1975.
22. D. T. Campbell and J. C. Stanley. *Experimental and Quasi-Experimental Designs for Research*. Rand McNally, Chicago, 1966.
23. D. A. Kenny. A Quasi-Experimental Approach to Assessing Treatment Effects in the Nonequivalent Control Group Design. *Psychological Bulletin*, Vol. 82, No. 3, 1975, pp. 345-362.
24. G. V. Glass, V. L. Willson, and J. M. Gottman. *Design and Analysis of Time-Series Experiments*. Colorado Associated Univ. Press, Boulder, 1975.