

recommendations on training, it was deemed desirable for ICET to explore a number of other training possibilities. These possibilities narrowed down to a new concept called "minicourses" and the better-known correspondence method of course delivery. Audio-visual-based training packages were considered to be quite effective, but ICET felt that the cost of providing these materials to a large number of technicians spread across the country—some in remote areas—made them comparatively expensive.

The difficulty and, again, the expense of keeping materials current and an apparent duplication of effort in developing materials on the same subject matter warranted an examination of the concept of a minicourse constructed as an inexpensive manual. ICET prepared drafts of 24 different minicourses structured to correspond to specific work elements. The courses were reviewed by practicing engineers and technicians in state, federal, and private engineering offices. In the feedback received from these reviewers, they supported the concept of the minicourse approach but cited numerous problems with the course drafts. The nature of the problems reflected the need for considerable expertise in selecting and presenting the topical content in ways that were valid in different states and employment situations. This expertise could only be developed over a considerable period of time.

ICET, supported by approval of the minicourse concept but lacking in expertise to develop the training materials in-house, contacted the International Correspondence School (ICS) of Scranton, Pennsylvania. It was found that ICS had been using the job-task-inventory approach to training (similar to work elements) for many years as a means of increasing educational effectiveness and efficiency. Because of the apparent compatibility between the ICS program and the training requirements needed to support the ICET certification program, the AASHTO task force recommended that NSPE and ICET work with ICS to establish a major training resource for all transportation engineering technicians employed in both the public and private sectors. NSPE followed through and signed an agreement with ICS to implement the task force's recommendation.

ICS is currently cross-referencing all of its existing training materials to the applicable ICET work ele-

ments so that they will be prepared to advise prospective students as to which of the ICS courses would be most appropriate when technicians are seeking certification in a particular field. ICS is not envisioned as the sole source of training materials for students who are preparing for ICET certification. But it has been identified as a readily available source of training information for many of the work elements.

From the very beginning, the development of the technician certification program has benefited from the support and participation of a substantial number of individuals. Private as well as public-agency employees have participated because the construction and maintenance of the national transportation system is a massive project that involves millions of people and billions of dollars. Technicians are the backbone of the transportation system; an estimated 750 000 of them are employed in highway-related activities alone. Motivating this work force—e.g., in the identification of areas in which additional training may be needed to support career-development plans—is extremely important.

The Certification Program for Transportation Engineering Technicians has definite potential for improving the work performance of technicians and ultimately improving the national transportation system overall. The decision to take advantage of the program rests with technicians and their employers.

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## Training and Education in Transportation: Future Directions

Lester A. Hoel and Michael D. Meyer

The dramatic changes in the environment in which transportation professionals operate in the United States and the impact of these changes on transportation education and training are examined. Within a decade, the definition of the urban transportation "problem" has been expanded from one focused solely on congestion to one that includes at the very least the relationship between transportation and the following factors: energy, air quality, equity, safety, congestion, land use, noise, and more efficient use of scarce resources. These new problem definitions and the skills necessary to deal with them effectively have added to the responsibilities of transportation educators and represent forces of change in U.S. educational programs. Actions that could be taken to prepare for

the future professional needs of the transportation sector are recommended.

The environment in which transportation professionals operate has changed dramatically during the past 10 years. During this time, we have seen the definition of the urban transportation "problem" expand from one focused solely on congestion to one that includes at the very least the relationship between transportation and

the following factors: energy, air quality, equity, safety, congestion, land use, noise, and more efficient use of fiscal resources (1, 2). In the private sector, we have seen an increasing interest in the application of technical and management skills to problems in the air, rail, and trucking industries.

This paper examines what impact these changes have had and will have on transportation education and training in the United States. The results of a survey that asked representatives of universities about existing and future education and training programs are presented. Special emphasis is placed on what directions these programs must take if the future needs of the transportation sector are to be addressed. The paper concludes by recommending increased interaction between educators and practitioners to identify and prepare for the education and training needs of transportation professionals.

### EVOLUTION OF TRANSPORTATION EDUCATION

It has been only a few decades since state highway departments were concerned almost exclusively with rural, intercity roads. Indeed, it is only in recent times that state highway agencies—many of which are now state departments of transportation (DOTs)—have been concerned with broader issues than simply the construction of major highway facilities. Examples of these new issues include highway maintenance, increasing passenger flows on existing highways, and citizen involvement in decision making. Furthermore, highway and transportation agencies are also being asked to systematically identify a wide range of possible direct and indirect social, economic, and environmental effects of proposed actions (3).

The changes that have occurred in the organizational environment of highway agencies are indicative of the changes that have occurred throughout the transportation sector. These changes pertain not only to the types of projects being considered but also to the analytic methodologies that are used, the objectives that are met, and the actors who are involved in the process. For example, one of the most significant changes in urban transportation in recent years has been the shift toward planning that is service oriented rather than facility oriented, involves relatively inexpensive actions, and seeks the most efficient use of existing facilities (4). This new planning emphasis not only causes problems of methodology but also creates a need for greater coordination and cooperation among the many agency staffs that have a significant role to play in the transportation planning process.

The major changes that have occurred in the methodological framework of urban transportation since 1945 can be summarized by phase, as follows:

1. Conceptual development ( World War II to the 1950s)—(a) new techniques, (b) impact of transportation on land, and (c) sequential demand models first available;
2. Operational development (1950s to the early 1960s)—(a) large-scale transportation studies, (b) Bureau of Public Roads manuals and codified models, (c) Federal-Aid Highway Act of 1962, and (d) complex land use models;
3. Stability (1960s)—(a) consolidation, (b) analytic approach to urban transportation planning, and (c) land use and travel demand;
4. Upheaval (late 1960s to the present)—(a) revolt against highways, (b) public transit, (c) greater importance of external factors, (d) relation of transporta-

tion policy to other urban policies, and (e) nonoptimal solutions; and

5. Transition (the present)—(a) institutional change, (b) long-range and short-range interaction, (c) incorporation of other planning concerns, and (d) types of projects and strategies.

This chronology reflects the changing skills and styles of analysis that have been needed in different eras to address the issues as they were defined at the time. During the years after the Second World War, most programs in transportation education focused almost exclusively on the teaching of engineering design and project construction. The systems-analysis tools that were being developed during that period had not yet been introduced in a major way into the academic programs of transportation students. The product of undergraduate programs in transportation engineering was a person capable of designing, constructing, and operating the physical facilities that were being developed throughout the country.

Later, as regional transportation studies became an increasingly important component of the urban transportation planning (UTP) process, new skills and techniques were required to implement the computer-based methodologies and analytic approaches necessary to successfully complete such studies. Many universities began active research programs in these topics and incorporated much of the material in new courses on transportation systems analysis and transportation planning, at both the undergraduate and graduate levels. During this period, many schools expanded their focus from basic engineering design to include new topic areas in transportation planning and analysis (5). The transition from engineering-design programs to programs emphasizing a systems-analysis approach occurred more rapidly at some institutions than at others, and the dichotomy in program objectives became very evident during this phase.

During the late 1960s and early 1970s, public opposition to many highway construction projects, increased funding for public transportation, and an increased awareness of the external impacts of transportation facilities created a need for transportation professionals with special skills and attitudes. There was a need for people who understood public relations, who could investigate the environmental impacts of transportation facilities, who were able to manage and operate (as well as construct) public transportation services, and who understood the political environment in which transportation agencies operated. In response to these new needs, many universities adopted a multidisciplinary approach to transportation education, and some developed special training programs for professionals who had been educated in an earlier era. These programs were less oriented toward design and computer modeling and tended to emphasize transportation planning in its broadest sense. During this phase, transportation research and training were often carried out in an institute or center context (6).

Now it appears that transportation education is once again in a transition period, during which the changing definitions of transportation problems will require new skills and knowledge of future transportation professionals. We may be entering an era when the transportation system is in place, and the challenge may be to improve its utilization and physical condition. Many factors that are external to the transportation system itself but that directly affect it may contribute to fundamental changes in the system as we know it. It is too soon to say how, if at all, the focus of some transportation education programs will change to reflect

this. Early indications are that the general area of transportation system management, in both the public and private sectors, will be receiving increased attention in academic programs. If this trend materializes, management will soon join planning, systems analysis, operations, and engineering design as another characteristic aspect of transportation academic programs in this country.

The discussion illustrates the relationship between the changing environment of transportation and the transportation education process. The changes described are general in nature and do not reflect the wide diversity in academic programs and research efforts. In addition, we are looking at major trends while at the same time recognizing the need for professional skills in each of the major areas—planning, systems analysis, operations, engineering design, and management.

It is difficult to draw general conclusions about transportation education in the United States. Each university has its own philosophy of what constitutes an appropriate education in transportation and its own limited resources for providing this education, and each operates under different pressures. However, it is important to recognize that the transportation field has undergone major changes during the past decades and will likely change even more dramatically in the future. Transportation education will no doubt respond as it has in the past, with new courses, new mixes in programs of study, new research topics, and special educational and training programs. Demonstrating leadership in the academic community in identifying and addressing future transportation issues and imparting to students the qualities needed to meet new and exciting problems are continuing challenges in transportation education.

#### UNIVERSITY PERSPECTIVES ON TRANSPORTATION PROGRAM DEVELOPMENT

There are many examples in the literature of actions that individual schools have taken in developing transportation programs and surveys that have been taken of employers and practitioners to determine whether engineering graduates exhibited the required competence. In the first case, authors have focused on the relation between research and multidisciplinary educational programs (7), the broadening of civil engineering (especially transportation) education to expose students to the planning and policy aspects of engineering (8, 9), the need for interdisciplinary solutions to engineering problems (10, 11), and the functions and components of specific programs in transportation (12). A second area of discussion has been the continuing educational needs of the engineering professions (13-15).

Both of these areas are important and deserve further attention from the transportation profession, but neither really addresses the issues of what type of professional the transportation education process should produce and what forces are at work within universities that limit their ability to do so. The first step in addressing this issue was taken at the 1973 Highway Research Board Conference on Multidisciplinary Education in Transportation. The purpose of the conference was to discuss the problem of providing such multidisciplinary education and to provide a means for educators to communicate their approaches and experiences to one another. The five general conclusions reached by the conference, which highlighted many of the problems faced by transportation educators, serve as a useful

point of departure for this discussion. The conference participants concluded the following (16):

1. A new profession and discipline of transportation had come into existence during the past 20 years. The nature of the discipline was multimodal, relied on a variety of methods and techniques, and was based on several theoretical bodies of knowledge.

2. Transportation education, although it had responded to many changes in the past, was still not satisfactorily addressing many of the problems that were facing the discipline.

3. Transportation educators were better prepared than their predecessors but still could not agree on the overall goals of a transportation education program nor on the means to be used in achieving them.

4. The two major disciplines in transportation—engineering and the social sciences—were frequently at odds with one another. One of the reasons for this was the lack of communication between the two groups.

5. University administrations did not recognize any special place for transportation in the university structure. Administrators pointed out the need to respect already-established disciplines, maintain university structure, consider university budgets, and remember the broadly conceived objectives of the academic community.

Several conference participants also proposed key components of graduate transportation education programs that would expose the student to a broad range of issues. More importantly, however, some participants presented an outline of the type of student the education programs were trying to produce. Harris (17), for example, suggested that students should be well equipped to achieve three objectives:

1. Establish a basis for further acquisition of knowledge if this proves a professionally desirable step.
2. Deal intelligently with skilled professionals in the field and especially know how to avoid the imposition of bad advice; and
3. Understand the limitations of their own knowledge and the extent to which they are unable to wisely make major decisions and judgments.

Manheim (18) argued that the transportation professional must have expertise in three major areas: technology, interactions between technology and society, and role perception and capabilities. Pignataro (19) stated that education should prepare a student to become "an effective decision maker without the need for a vast amount of experience upon which to base the decisions." The educational program, Pignataro concluded, must therefore be concerned with the problems and issues that transportation will face in the future. Webber (20) viewed the task of the transportation planner as being one of "fueling" political debate by providing analyses and forecasts of likely alternative outcomes and by asking sharper questions that will engage more public groups in the dialogue.

#### CURRENT PERSPECTIVES ON TRANSPORTATION EDUCATION: RESULTS OF A SURVEY

The views of the product of the educational process reported in the literature clearly reflect significant differences of opinion on what a transportation education should accomplish. Are there such differences in point of view today? What substantive areas of knowledge are graduate students in transportation exposed to in their academic careers? What types of jobs do

students accept upon graduation? What do transportation educators think will be the major transportation policy issues in the next decade? And what constraints do professors face in providing the type of educational program that they think is necessary to prepare the students who will eventually deal with these issues?

To find answers to these questions, an informal telephone survey was conducted with 20 Transportation Research Board (TRB) university representatives (some from nonengineering departments) from schools that have large, well-established transportation programs as well as those that have smaller programs that have only recently been established. The sample was not large, nor were the questions structured to allow statistical comparisons between the schools; yet the survey was helpful in gaining some insight into how educators currently view trends in transportation education.

The questions asked in the survey and the results obtained are discussed below.

#### Required Courses

Respondents were asked, What substantive areas of knowledge are graduate students in transportation exposed to through required courses? Among schools that had a required core of courses, there was almost unanimous agreement on the type of courses included. The primary focus of the core courses was on developing a familiarity with analytic methods and other tools of analysis. In most cases, this meant courses in systems analysis, microeconomics, statistics, and operations research. In the planning-oriented schools, transportation planning was also required, whereas the schools more oriented toward engineering required a course in traffic engineering. What was somewhat surprising, however, was the relatively large number of graduate programs that did not have required courses. In these programs, the students were given a great deal of flexibility in choosing the types of courses that made the most sense for their career objectives. Nevertheless, in many cases students ended up selecting a common transportation core program. The type of courses in the transportation core program have not significantly changed in the past five years. Most respondents stated that any new change in the transportation field is incorporated into the material of existing courses.

One school, however, had developed a completely new program in transportation that included core courses not only in analysis methods but also in management and transportation institutional analysis. This program was clearly the exception.

#### Type of Graduate Desired

Respondents were asked, What type of transportation professional are you trying to produce in your graduate program? The existence of a core set of courses is usually indicative of what the faculty views as the necessary skills of a transportation professional. However, this question caused the greatest amount of hesitation on the part of the respondents, partly because of the ambiguous nature of the question and partly because, as some respondents commented, they had never thought about it before. The answer most often given was that a graduate of the respondent's transportation program should be skilled in the use of quantitative methods but also aware of the arena in which the transportation planner-engineer operates.

Upon further questioning, it was also discovered that most of the transportation graduates end up em-

ployed in the public sector or with consulting firms that conduct most of their work in the public sector. This was not surprising to most respondents, given the little emphasis placed (in educational programs) on the role of the private sector.

#### Problems Anticipated in the 1980s

Respondents were asked, What do transportation educators see as the major problems facing transportation during the next decade? The following list summarizes the problems identified by transportation professors (listed in order according to the frequency with which they were mentioned):

1. Better management and operational control of existing transportation systems,
2. The relationship between transportation and energy,
3. Maintenance of highway facilities,
4. Provision of adequate public transportation services,
5. Intercity transportation, and
6. Improvement in traffic safety.

Many respondents readily admitted that they had not given much thought to the transportation issues that would surface in the future because they were busy trying to address problems that had already been identified.

#### Constraints on Curriculum Development

Respondents were asked, What constraints do professors face in developing the type of educational program that they feel is necessary to produce the transportation professionals who will deal with future transportation problems, and are there any recommended courses of action that will help to loosen these constraints? This question sparked lively discussion about educational objectives and how the academic program has been set up to attain them. Most respondents focused on the limited availability of funds, which greatly constrains what they teach and the research they can do. Funds for basic research in transportation are nonexistent, as are funds for significant efforts at changing the transportation curriculum in order to adopt new orientations and incorporate new problem statements.

Although the university representatives came from a wide variety of schools, they all spoke about the overwhelming importance of research in their career development and complained about the shrinking funds for research support, the trend toward higher levels of required research support, the need for professors to search for problems rather than being visionary, the largest source of research funds coming from federal agencies that many felt did not have the right perspective on the issues, the increased demands by state legislatures for more teaching at the undergraduate level but with no additional financial support, and the increased pressure to do outside consulting to make up for the market differential in salary. Several professors also noted the difficulties they had in finding support in other disciplines for interdisciplinary studies of transportation problems.

Suggested courses of action that would address many of these issues included

1. Divide the existing U.S. DOT research funding programs into two major areas: (a) funding of problem-oriented, applications-focused research that is characteristic of existing programs and (b) funding of basic,

innovative research aimed at defining future issues and possible solutions;

2. Develop a new research grant program that would accomplish the second purpose stated in the above proposal;

3. Organize on an annual basis a one- or two-week session in which transportation educators and other transportation professionals would discuss future directions of transportation in the United States;

4. Change the incentive structure in the universities to encourage more interdisciplinary approaches to transportation problems; and

5. Given that most of the previous proposals require some significant changes (and are thus not likely to be implemented), incorporate transportation researchers and educators more heavily in the initial governmental development of research statements.

Because there is such a strong link between research and academic programs, most respondents focused on increasing the flexibility of research programs with the assumption that academic programs would naturally benefit.

#### FUTURE ISSUES IN TRANSPORTATION AND TRANSPORTATION EDUCATION AND TRAINING

As the response to the survey illustrates, the focus of programs in transportation education has changed very little in recent years and, what is more, transportation educators feel that they are too severely constrained in both time and resources to be visionary in identifying future problems and potential transportation solutions. A recent report of the National Transportation Policy Study Commission (NTPSC), however, suggests that future issues in transportation will continue the trend toward rapidly changing problem definitions and, thus, a reliance on nontraditional types of solutions (21). The following 10 issue categories were listed in the NTPSC report as the more important problems to be resolved by U.S. transportation policy through the year 2000:

1. Government policy mechanisms—What mechanisms can the government use to achieve its transportation objectives in the least intrusive manner?

2. Government regulation—What role should the government have in regulating the transportation industry? In addition, issues of air, water, and noise pollution and environmental-impact-statement procedures need to be addressed.

3. Government finance—How should government provide the necessary funds to support transportation systems (if at all)?

4. Highway system management—Which levels of government should be responsible for funding various portions of highway "needs"?

5. International transportation—What transportation policies should the U.S. government follow in international trade?

6. Public transportation—How will adequate public transportation be provided? Who will pay for this service?

7. Transportation technology—How should sufficient levels of research and development be provided so as to ensure technological advancement in transportation?

8. Intergovernmental relations—What institutional relations should exist to encourage effective policy-making and implementation?

9. Energy and transportation—How can transportation systems provide the most energy-efficient move-

ment of people and freight at the least social and economic costs?

10. Economic development and land use—How should decisions on transportation investment be related to impacts on community development (and vice versa)?

Although these issues were identified as topics that must be addressed by the federal government, most of them will have a significant impact at all levels of government and will thus require some attention at these levels as well. Furthermore, it is clear that the resolution of these issues will require concerted efforts by government, industry, and academia and will also rely heavily on the ability of transportation professionals to draw on a diverse background of skills and insights that cut across most traditional disciplines. An educational program that prepares a student for the types of issues to be faced, the ways in which the issues can be addressed, and the role that he or she has in both the technical and political processes that are used to resolve the issues is an important first step in the development of a group of transportation professionals who will effectively participate in future transportation decisions. Also important in this regard is the provision of opportunities for professionals who received their education and training in one area to reeducate themselves, given that the transportation problems as seen by society have become quite different from those discussed in graduate school years.

The issues outlined in the NTPSC report will clearly be important topics for research and thoughtful consideration, but do they represent topical areas that should receive substantial exposure in educational programs? Perhaps they are not specific course or subject material, but they do represent new areas of application for existing analysis methods and in many cases will require new methodologies that must be developed to address a changing perception of what the real problems in transportation are. Although we do not purport to have any significant insight on future problems in transportation, we do offer the following list of substantive areas of investigation that could well be incorporated into academic (and research) programs.

#### Project and Program Implementation

The transportation profession has focused almost exclusively on the design and evaluation aspects of transportation projects and programs in the past. Given the politicization of the transportation planning process in the 1970s and the new types of transportation strategies being considered, understanding the barriers to successful program or project implementation and developing implementation strategies that will take these barriers into account are becoming important skills for the transportation professional. An effective approach to teaching this material should include exposure to political science and organizational studies, although most transportation educators could, without formal training in these disciplines, do a good job in highlighting many of the important implementation considerations.

#### Institutional Analysis

The institutional type of analysis is closely related to many of the concepts discussed as part of the implementation issue. Although it is a relatively new area of study, institutional analysis will become more important in the next decade as the focus of transportation issues turns to decision making and implementation. In

essence, institutional analysis is a study approach that uses elements of economic, political, and organizational theory to identify administrative and political factors that affect the formulation and implementation of policies, programs, and projects. The value of such an approach to a transportation professional is that it is helpful in (a) understanding current institutional interactions and thus being able to identify key structural variables that constrain innovation and/or implementation, (b) identifying strategies of institutional change that would not only be effective on a limited scale but would also greatly contribute to the understanding of larger-scale innovation, (c) contributing to the formulation of an effective implementation strategy for transportation programs and projects, and (d) predicting the effects on organization output of a change in organizational structure.

### Operational Planning

The methodological balance in transportation planning has started to shift away from the analysis methodologies related to large-scale facility construction toward analysis approaches that examine the operational characteristics of transportation systems. This shift is likely to continue in the next decade. Operational control strategies and operational planning will thus become important areas of education and research.

### Management

Many current U.S. transportation policies are related in some way to the management of transportation properties. Management skills are needed not only in public-sector agencies but also in transportation firms in the private sector. Many graduates of transportation programs end up in management roles and are often unprepared for the type of work that they must do. Budget, administration, decision-making authority, and functional responsibilities are issues that underpin many of the problems in the transportation sector, and yet these are issues that many transportation graduates know very little about.

### Role of the Private Sector

One of the surprising results of the survey was that most transportation graduates of the surveyed programs ended up in public-sector or public-sector-related jobs. Further questioning made it apparent that the transportation students were not at all exposed during their academic experience to the role of the private sector in transportation and in other sectors of the economy. The focus was clearly on methodologies but, more importantly, on methodologies that would be applied in public-sector contexts. This is the issue area in which changes in the transportation environment will probably be most dramatic. The private sector already has an important role to play in transportation and economic development in this country, and its role is likely to increase during the next decade. Thus, the transportation student who learns about planning methodologies and the heavy reliance of planning procedures on federal planning regulations but who does not understand the motivation of private developers and their influence in the political decision-making process is in for a rude awakening on his or her first job.

### Decision Making

The final area of academic pursuit, which some have placed at the top of their priority list and others think

it inappropriate to even address in an educational program, related to two questions: How are decisions made? How should decisions be made?

The focus of current transportation education is on the understanding and use of analysis and design methodologies that will be used by the student once he or she leaves the university. This is indeed a most appropriate focus for an educational program. However, the danger of an overemphasis on methodology is that the first question students are taught to ask is what analysis techniques will be useful to address the problem rather than what the underlying problems are that need to be addressed, what decision-making process will be used to make a final decision, what information is needed in this decision-making process, and then what type of analysis techniques will be used to provide the necessary information.

### Summary

These six areas of investigation could be usefully applied at all levels of transportation planning and analysis—federal, state, regional, and local. Although these areas do rely on interests and expertise not usually found in programs in transportation education, they do represent major new areas (methodological and otherwise) that will be facing transportation and transportation education and training in the 1980s.

### CONCLUSIONS AND RECOMMENDATIONS

Transportation education and training in the United States have changed over time to reflect the different problem perceptions and methodological developments that have occurred throughout the history of transportation. In most cases, however, this change has occurred slowly and only then in response to the changing environment of the profession. Furthermore, change has not been uniformly adopted by all universities, and this has resulted in different schools viewing themselves as producing different types of transportation professionals. Some transportation programs remain oriented toward engineering design and operations, whereas others focus more on systems-analysis applications and still others are more oriented toward planning.

This paper has shown that dramatic changes have occurred in the emphasis of transportation problems during the past and has suggested that even more dramatic changes are likely to occur in the future. Will some programs in transportation education now head in another direction to reflect this rapidly changing environment? Some programs are indeed starting to change their focus by incorporating greater concern for system management into the curriculum, but it is still too soon to identify this as a major trend.

The survey of TRB university representatives resulted in the following observations:

1. The substantive areas of knowledge that graduate students were required to take in those programs that included required courses were almost exclusively related to developing a familiarity with analytic methods and other tools of analysis. In most cases, this meant courses in systems analysis, microeconomics, statistics, and operations research.
2. The most common means of incorporating new ideas, methodologies, and problem statements into the educational program was by modifying existing courses. The types of courses in the core of most transportation programs that were investigated, however, had not significantly changed in the past five years.
3. Transportation educators agree that a graduate

of their program should be skillful in the use of quantitative methods but should also be aware of the arena in which the transportation planner or engineer operates.

4. Most of the transportation graduates of the programs surveyed end up in public-sector or public-sector-related jobs.

5. The major transportation issues identified as those that need to be faced in the 1980s are similar to some of those identified in the NTPSC report (21). The several omissions can be explained by an unfamiliarity with these types of issues among those surveyed.

6. Several constraints—both intrauniversity and external—hinder the development of an educational program that can produce professionals who have the necessary background to address the new transportation issues. A lack of funds and of appropriate research projects was viewed as being critical in this regard.

Finally, we feel that the following are some of the major issues to be faced by the transportation profession in the next decade that can be addressed in an educational program: problems of project and program implementation, institutional analysis, operational planning, management skills, the role of the private sector, and the decision-making process.

This paper has raised questions about the focus of programs in transportation education in this country and the ability of the academic community to identify issues of substance that are likely to dominate the transportation field during the next 10 years and beyond. Clearly, however, every school is different in what it is trying to accomplish and the constraints it faces in doing so. Therefore, recommended courses of action, no matter at what level, will probably not address the issues that some schools are facing and might even be in conflict with the goals of other schools. The concerns raised in this paper, however, can be addressed by opening a dialogue between educators at different schools and between educators and practitioners on the types of education programs needed in the transportation field. Although there are many ways in which such a dialogue could be encouraged, we feel that more effort by transportation research organizations such as TRB and by academic institutions in sponsoring symposiums or conferences that focus on these issues is a necessary beginning.

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