Changing Perspectives on Transportation Engineering Education

Allen R. Cook, Charles E. Barb, Jr., and Leonard B. West, Jr.

The role of the university, and especially of civil engineering programs, in the education of transportation professionals is assessed in a discussion that focuses on paratransit training needs. A survey of 110 university representatives of the Transportation Research Board indicated that paratransit education is lagging behind in addressing the broader issues of paratransit. It was also found in the survey that most transportation faculties are small (50 percent have one or two people) but that most offer graduate programs. Paratransit may be a harbinger of trends toward a short-term, service-oriented approach to transportation development by people who lack or do not need the traditional transportation engineering and planning skills. Case-study analysis of five leading, experienced paratransit organizations disclosed that individuals with entrepreneurial skills and a motivation to innovate were key factors in the success of local paratransit systems. A set of paratransit curriculum materials that consists of five case-study documents and supporting documents (a case-study overview, a set of selected readings, a paratransit resource guide, and a curriculum guide) is described. These materials are intended for use by faculty, students, and professionals interested in paratransit, can be used in a variety of course formats or by students alone, and are intended to address some of the educational needs in the paratransit field while presenting the broader dimensions of it. Finally, a brief commentary on educational issues is presented.

The role of the university curriculum, and civil engineering programs in particular, in the education of transportation professionals is discussed in this paper relative to one of several changing dimensions in the field. Transportation engineering programs evolved initially from mandates in railroad and later predominantly in highway facilities planning and construction. This entailed the long-range planning and development of transportation systems for a growing nation. In the past decade, however, new dimensions have appeared that may dominate the field of transportation development in coming years. Three dimensions of particular interest are the implications of paratransit development, the implications for transportation development when available resources are finite or declining, and the implications for transportation development if capable individuals are not as attracted to the field as in the past. Paratransit development is the focus of this paper, but it has relevance to the other dimensions as well.

Paratransit systems—carpools and vanpools, dial-a-ride services, and jitney operations—represent new directions in transportation planning. Fundamental to this evolution is the change in viewpoint of the transportation professional from one of looking on transportation as facilities—roads and vehicles—to be planned, developed, and managed to looking on transportation as mobility services to be planned, developed, and managed. As Wachs (1) has commented on another aspect of this evolution,

> During the mid-1970s transportation planners have retreated to a position of uncharacteristic modesty from which they are taking stock of what has happened during the last two decades and are preparing to formulate new approaches for the "post-automobile era." Grandiose proposals for sleek tube trains and monorails are hardly heard any longer, and in their place have emerged a host of "paratransit systems" including jitneys, dial-a-ride systems, vanpools, and other simple transport innovations which are certainly unglamorous by the standards of the 1950s.

In fact, paratransit innovations have proved to be far from simple to implement, and this is one of the challenges for transportation educators. There are other challenges as well.

The professional implications of paratransit are discussed in this paper, starting with the results of a survey of 110 university representatives of the Transportation Research Board on the present state of transportation education, including paratransit, in the United States. This is followed by observations derived from five case studies of leading paratransit organizations and a discussion of an extensive set of curriculum materials developed for university instruction in paratransit. The paper concludes with a commentary and a brief review of our efforts to design a transportation curriculum to address some of the above dimensions and concerns.

SURVEY OF TRANSPORTATION RESEARCH BOARD UNIVERSITY REPRESENTATIVES

This survey was conducted for purposes of providing a guide to the development of curriculum materials on paratransit and for assessing their likely impact on instruction. A questionnaire was developed and mailed on November 1, 1977, to the 160 university representatives designated by the Transportation Research Board (TRB). A follow-up mailing was sent to TRB representatives who had not responded by November 22. Mailgrams were sent to 25 representatives who still had not responded by December 1. A total of 110 questionnaires were returned, 70 percent of the total number of representatives.

Respondents

There were a total of 110 responses from North American colleges and universities, 106 from the United States: and 4 from Canada. Seventy-two percent of all TRB university representatives were in civil engineering departments, and the response rate was highest from engineering faculty members. In response to the question, How would you characterize your predominant professional interest?, transportation planning was most frequently cited. The response to this question is given below (note that multiple interests were cited by some respondents):

Predominant Professional Interest	Response	
	Number	Percent
Transportation planning	52	47
Traffic engineering	37	34
Highway and transportation facilities design	32	29
Other transportation interest	15	14
Other	10	9

Eighty-one percent of the responding schools offer graduate degrees in their transportation programs, and 52 percent offer doctorates. The average number of people on the transportation faculty in the departments of TRB university representatives is 3.1. Half of the

departments contain only one or two people. The distribution of faculty size is given below:

Number on Transportation Faculty in Department of Respondent	Institutions	
	Number	Percent
1	24	25
2	24	25
3	15	16
4	14	15
5	6	6
6	3	3
7	1	1
8	1	1
≥9	7	8
Total	95	100

Attitudes Toward Paratransit Education

Table 1 tabulates responses to the question, How important is paratransit education for the following student categories? The respondents rated the importance of paratransit education on a scale from 1 (not at all important) to 5 (very important). Among the TRB university representatives, paratransit education is seen as more important for graduate and undergraduate students. It was considered most important for graduate students in transportation and students in urban planning and least important for undergraduate civil engineering students and students in business administration. The view that paratransit instruction is more appropriate at the graduate level conflicts with the views of Grecco and Satterly (2, p. 119), among others, who have indicated a need in the transit industry for college-trained managers with bachelor's degrees.

In response to the question, How important is instruction in the following aspects of paratransit?, all of the indicated aspects of paratransit service were considered moderately important (see Table 2). Somewhat more importance was attached to instruction in the modal types and their service characteristics and to implementation issues. Bimodal distributions of responses to implementation issues and the category that includes policy, regulations, labor, and insurance may indicate a recognition by substantial numbers of respondents of the importance of these broader aspects to service development.

In response to the question, What is the appropriate course format for paratransit training?, 60 percent of the respondents felt that the topic should be included as part of a transportation planning lecture course, and 43 percent felt that it should be the subject of a separate seminar or special-topics course. Only 21 percent felt that it should be a separate lecture course.

Twenty-four of the 110 university representatives reported little or no interest in paratransit education. Some major universities simply did not find it to be a topic that is of importance to their academic programs or of local community interest. One professor at a large, urban, eastern university made the following comment:

> Paratransit is one of the components of urban transportation. In large cities it is much less important than standard transit. We are treating it accordingly; transit and traffic engineering design and planning all get more attention.

A professor of business administration commented that paratransit "is not really of academic interest" but training is provided as "a part of our service to the state in providing local technical assistance."

State of Instruction

In response to the question, Please describe paratransit education in your department, 37 of 110 respondents (34 percent) indicated that they knew of no paratransit instruction at their institution. Most of the reported instruction was in existing lecture courses and graduate seminars. In 85 percent of the courses, less than 20 percent of the course content was devoted to paratransit, and most instruction was limited to descriptions of mode types and service characteristics.

Most of the college and university programs that have substantial activity in paratransit are in civil engineering and management. However, significant programs were discovered in nontraditional programs at small schools. For example, in the Department of Safety at Central Missouri State University, paratransit topics are integrated in a number of transportation-safety courses in programs designed for graduate students seeking employment in transportation-safety education and in the insurance industry.

Observations

Recognizing that the selection of TRB university representatives as the recipients of the questionnaire does not ensure that all university faculty interests and attitudes have been represented, we make the following observations on the survey results:

1. Although most transportation faculties are small (50 percent have only one or two members in transportation), 81 percent of the responding institutions offer graduate work.
2. Paratransit instruction is viewed as most important for graduate students in transportation and students in urban planning and less important for undergraduate civil engineering students. The TRB university representatives from some major universities that are engaged in transportation training do not consider the subject academically important for their students.
3. The educators demonstrated little awareness of a need to equip people with the skills needed to implement and manage paratransit services. They tended to see paratransit instruction as least important for students of business administration (or they had no opinion). Similarly, there was little evidence that the educators recognized the full dimensions of the human-services aspects of paratransit service. The questionnaire tended to support the previously discussed hypothesis that most transportation faculty focused their training on facilities development and planning and were not aware of the concerns of paratransit practitioners.
4. We are unaware of previous surveys of TRB university representatives. They appear to be an overlooked resource for guidelines in the analysis and development of transportation curricula.

PARATRANSIT CASE STUDIES

From 1977 to 1979, Cook and Barb developed a series of training materials to assist college and university instructors in paratransit education (3-7). These materials included five case-study documents of leading, experienced agencies that encompassed much of the present scope of paratransit activity. This included agencies active in the promotion of commuter work-trip ride sharing, in coordinating and providing paratransit services for human service agencies, and in providing rural transportation.

Table 1. Response to question, How important is paratransit education for the following student categories?

Student Category	Score Response (no. of respondents choosing rating) 5	4	3	2	1	Mean	No Opinion
Graduate students in transportation	33	32	21	10	3	3.82	11
Urban planning	19	31	26	14	4	3.54	16
Public administration	14	16	26	13	7	3.22	34
Social work	10	17	23	14	8	3.09	38
Business administration	2	9	23	27	9	2.54	40
Undergraduate civil engineers	4	7	32	39	20	2.40	8

Table 2. Response to question, How important is instruction in the following aspects of paratransit service?

Aspect	Score Response (no. of respondents choosing rating) 5	4	3	2	1	Mean	No Opinion
Mode types and service characteristics	39	31	24	7	4	3.89	5
Implementation issues	37	18	28	10	6	3.71	11
Demand modeling for paratransit	18	33	34	11	7	3.43	7
Policy, regulations, labor, insurance	25	19	24	16	9	3.38	17
Social service	15	26	37	19	4	3.29	9

A previous paper on these case studies (8) focused on technology transfer from the federal-policy level to the level of effective local implementation and concluded that there were three key prerequisites: (a) the presence of an effective local mandate for paratransit development (typically the alleviation of traffic congestion and financial savings for local government agencies and private citizens), (b) the presence of an enthusiastic and effective "patron" who is willing to take the initiative to get paratransit services in operation, and (c) staff that have entrepreneurial skills and the motivation to manage and operate these services.

From an educational perspective, particularly with regard to the traditional orientation of civil engineering and transportation faculties toward facilities planning and design, the following observations resulted from these case-study experiences:

1. Paratransit represents a "process of innovation", described above in terms of technology transfer. As an innovative concept it is occasionally resisted by existing institutions—e.g., conventional transit authorities, state departments of transportation, and metropolitan planning organizations. Efforts to incorporate the Knoxville Commuter Pool within the city government eventually failed, in part because some opponents felt that the commuter pool was in competition with the local transit authority. In the case of Brockton, Massachusetts, Dial-a-Bat, local human-services agencies needed to be "sold" on the concept of transportation coordination by Brockton Area Transit.
2. Virtually all of the key personnel in the five paratransit agencies studied had backgrounds in fields other than transportation engineering or planning. Two urban planners were largely responsible for the Seattle-King County Commuter Pool, and experienced businessmen developed and managed the Knoxville Commuter Pool and the services of North Carolina's Choanoke Area Development Association (9, p. 9). In Knoxville, the early decision to recruit experienced managers rather than students and faculty of the University of Tennessee, which was responsible for the demonstration grant that resulted in the Knoxville Commuter Pool, was cited as a key factor in the commuter pool's success (9, p. 9).
3. In keeping with the earlier comment on transportation as a mobility service rather than a facility, it was evident in the case studies that the clients for paratransit services were recognized as individuals with individual needs. Dial-a-Bat's "manager of mobility" was more than a service manager; she knew her customers and was sensitive to their needs and problems. In Knoxville, efforts were under way in 1978 to develop a micro-computer-based commuter information system that would keep track of individual clients. To cite another example, the Cape Cod, Massachusetts, Regional Transit Authority used "rider identification passes" in evaluating the effectiveness of service and in marketing their paratransit services (10).
4. The management of a paratransit operation requires a formidable array of management skills and considerable knowledge of federal funding programs and opportunities, local regulations, vehicle technology, and accounting. In part, this arises from the small scale of most operations (unless a paratransit agency is fortunate enough to be supported by a patron agency that has a knowledgeable staff, as in the case of Dial-a-Bat, which relied on Brockton Area Transit to resolve insurance, labor, and other problems). With regard to Section 147 (Federal-Aid Highway Act of 1973) rural bus demonstration projects, Burkhardt (11) has commented:

> There is more than just a little whimsy to the thought that one should take all the candidates for director of a rural transportation project to the largest lake nearby and hire the one who can walk all the way across. The director (or manager, or whatever this person's title) should possess the most extraordinary talents one can buy, because much of the success or failure of your project hinges on the efforts of this one individual.

Unfortunately, Burkhardt also noted that project directors were "often grossly underpaid."

5. Finally, it was recognized that all of these case studies were, to a considerable extent, personal accomplishments of people who were willing to surmount the obstacles to the implementation of paratransit services.

PARATRANSIT CURRICULUM MATERIALS

The paratransit curriculum materials developed by Cook and Barb (3-7, 12-15) are intended for an audience that includes faculty and graduate students in transportation, urban and regional planning, social service planning, and public administration; federal, state, and local government staff engaged in transportation and human-services planning; and others interested in the development of paratransit services.

We felt that the most effective means for presenting the broader dimensions of paratransit was through the case-study approach. Each case study was structured by using the following analysis framework:

1. Service overview covers the local mandates, the target markets, and the service characteristics. Service characteristics include paratransit modes, service configurations, incentives to patrons to use the services, and productivity measures.
2. Service planning and barrier resolution describes the planning and implementation process. Since para-

transit was an innovative concept in the 1970s, barrier-resolution activities (regulatory, insurance, and labor) were essential parts of the planning process.

3. Organization explores the staffing and management aspects of the local case study.
4. Operations and record keeping describes the information resources required for planning, operations, and marketing of paratransit service.

Each case-study document includes introductory background information on the local setting and concludes with a commentary on the significance and transferability of the local experience. The overview (12) introduces each case study and provides background information on each of the above dimensions in support of the case-study discussions.

The curriculum materials include Selected Readings in Paratransit (13), an annotated collection of 32 significant articles and reports published between 1965 and 1979. The Paratransit Resource Guide (14) is structured to provide the reader with sources of information, (including personal contacts) on paratransit development at the federal, state, and local levels, with emphasis on federal agencies and national information resources. This guide includes definitions of paratransit, pertinent federal policies, annotated introductory overview literature, other information resources (e.g., the Transportation Research Information Service and the National Technical Information Service), legislation, federal agencies with personal contacts, professional organizations and other associations interested in paratransit development, consulting firms and research organizations, foreign sources of information, and a paratransit educator resource list.

The Paratransit Curriculum Guide (15) provides curriculum suggestions for instructors that address a variety of student audiences in different course formats. It also organizes the material by topic area for the convenience of students who are studying the subject on their own. Finally, the curriculum guide includes an annotated set of seventy-two 35-mm slides that provide background material on the case studies.

In summary, these curriculum materials are an attempt to educate students in the broader dimensions of paratransit and provide them with the means for efficiently gaining, and keeping up to date on, knowledge in this fast-evolving field. Limited teaching experience with these materials has demonstrated the effectiveness of the case-study approach. Students have used them as models for researching local transportation problems and institutions. Finally, the Paratransit Resource Guide (14) has increased the ability of the graduate student to understand the paratransit field and get involved in related research activities.

CONCLUSIONS AND RECOMMENDATIONS

Paratransit development relates to the other dimensions of transportation development noted at the beginning of this paper. The promotion of commuter-work-trip ride sharing is an effort to conserve finite resources, in this case gasoline. In all areas of surface transportation service, funding is an increasingly finite resource. This constraint is inherent in transportation system management (TSM)—"making efficient use of existing transportation resources and providing for the movement of people in an efficient manner" (16, p. 42978). Such activities often include paratransit proposals.

The increasing complexity of the tasks that confront transportation professionals seem to be coming at a time when such careers are not particularly attractive to engineers and planners. Salaries are not competitive with those in other fields, and the tasks may not seem rewarding as a professional career. The case studies did indicate that persons with a variety of backgrounds could be successful in the paratransit field.

The concerned transportation educator, it seems, must address the following aspects and issues:

1. Certain evolving trends need to be studied for their relevance to transportation education. The training implications for people who are on the management staff of transportation services need particular consideration. Should training efforts be directed to undergraduate or graduate students and in what disciplines? Should emphasis be placed on postgraduate training and short courses be addressed to practicing professionals? If most transportation faculties are small and dispersed, how are specialized local training needs (e.g., those for paratransit managers) to be met?
2. An even broader analysis is needed, one that starts with an historical analysis of the evolution of transportation engineering education and continues with an evaluation of where we are today, where we should be, and where we are heading. Many professional transportation planners are unfamiliar with the paratransit planning process, the options available, and the principal issues and concerns. Past training, particularly for those with an engineering rather than a planning background, may make it difficult for some professionals to effectively contribute to the process. However, it is often the professional transportation planner who is called on to plan or evaluate the potential for the development of paratransit service. Wachs (1), noting the significance of the appearance of paratransit solutions on the transportation scene and recounting present difficulties with conventional long-range planning, decries the present inability of planners to formulate planning methodologies and development strategies compatible with the times. Gakenheimer and Meyer (17), for example, note conflicts between long-range planners and the TSM perspective of short-range, operational planning. Cutler and Knapp (18, p. 1), commenting on the problems involved in coordinating human-service-agency transportation, imply that transportation planners might have limited perspectives: "Transportation planners view coordination as the defining and redefining of routes and schedules." A program for retraining transportation professionals might deserve serious consideration.
3. There may be a need to retrain faculty as well. Part of the problem may be present faculty members who are trained in the now-obsolete tradition of long-range transportation facilities planning, which emphasizes the systems approach and sophisticated demand models based on past trends that are unlikely to continue in the future. The paratransit curriculum materials discussed in this paper are addressed to faculty as well as students. In view of the limited ability of most small transportation programs to offer much instruction in paratransit, these materials are also designed for self-study.

At the University of Oklahoma, we have come to recognize three tracks for graduate-level transportation education:

1. Transportation engineering, with emphasis on traffic engineering and maintenance management;
2. Transportation planning, to prepare graduate students for staff positions at the municipal, state, and national levels; and

3. Transportation management, to prepare students for management positions in urban and regional transit authorities or service agencies.

The second and third tracks would be open to students who have a background in a nonengineering field such as urban planning. We are also promoting training programs in traffic engineering that are suitable for the local personnel responsible for this work in practice.

In conclusion, the new programs at the University of Oklahoma do not address all of the needs and concerns involved in transportation professional training, nor can this program solve the problem of the unattractiveness of many positions in urban and state transportation organizations. But if the program can succeed in attracting higher-caliber students to the transportation field, regardless of their undergraduate background, it is believed that a significant contribution to the profession will have been made.

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Reviving Railroad Education in the United States: Programs for the 1980s and Beyond

Edwin P. Patton, C. John Langley, Jr., and Michael S. Bronzini

The results of a survey on the modern educational needs of the railroad industry, conducted with more than 90 senior-level members of the railroad industry, government agencies, suppliers, consultants, associations, and universities, are discussed. The consensus view is that the industry's educational needs can best be met by a combination of focused and practical seminars and short courses for present and prospective professional employees, support for enrichment of the railroad content of university course offerings in transportation, a university railroad research program,