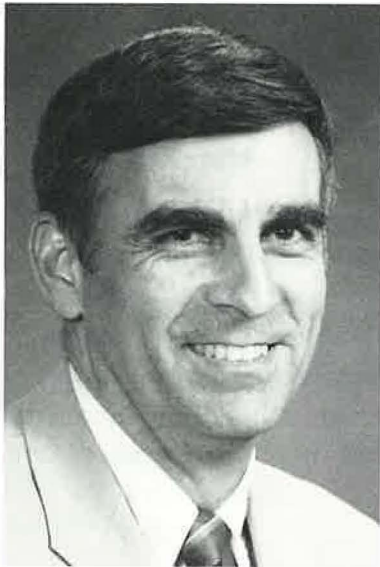


specifications, and test methods. Highway agencies would be able to build or adopt their own versions based on these models.

Conclusion

Using the term implementation in the widest sense provides a perspective against which to assess the payoff of research findings presented at this conference series. The conclusion is that the benefits are visible, that they have significantly influenced the practice of highway engineering in the last decade, and that the foundation has been laid for "paving the gap."



Jon A. Epps, dean, College of Engineering, University of Nevada-Reno, Reno, Nevada.

The University's Role in Pavement Research Implementation

JON A. EPPS

"Paving the gap" between the researcher and the practitioner refers to the transfer of usable knowledge between these groups. "Implementation of research to practice" is a more conventional statement of the focus of this session at the 6th International Conference on the Structural Design of Asphalt Pavements.

Of all existing institutions in the United States, the universities are in the best position to implement pavement-related research. But successful implementation requires a cooperative effort among researchers and practitioners. Thus an examination of the organizations within universities and those in association with funding agencies is presented here, and the general requirements of the research-implementor are discussed along with the need to establish a reward system for researchers and practitioners.

University Mission

Legislation associated with establishing Land Grant Universities in the United States clearly states the mission as (a) teaching, (b) research, and (c) public service. The most important activity of public service is continuing education. Clearly, the major universities in the United States are charged with "paving the gap"; they have responsibilities in research as well as implementation through their teaching and continuing-education programs.

At present about 6 out of the 16 western states in the United States have comprehensive programs that satisfy their mission statements as applied to their programs in pavement design, construction, rehabilitation, and maintenance. Shortages of staff, equipment, space, and a failure to recognize the importance of transportation account for this relatively low percentage. Because of these recognized constraints, western universities will more than likely develop regional transportation and pavement programs.

Organizational Structure

General

A typical university research organizational structure is shown in Figure 1. A majority of the outstanding pavement researchers in the United States are

involved in teaching, research, and continuing education. In order for the teacher/researcher's program to grow at a desirable rate, evaluation of programs and the individual should be performed at the lowest possible administrative level. This assures that the evaluations will be performed by those most familiar with the individual's activities.

Figure 1 suggests that this administrative level is at the dean's level. Ideally, the evaluation should be performed at the department level. However, research activities often taken place within a transportation institute to demonstrate the interdisciplinary capability of the university in transportation. Thus the research institute involves professionals from several departments, which requires that the programs be administered at the dean's level or above.

University Transportation Research Program

In large transportation research institutes, pavement, materials, and construction may be one of several divisions. Smaller institutes typically have programs in pavements, materials, economics, planning, traffic, and structural systems.

Divisions or programs, such as a pavements or materials program, must have a critical mass of staff. Key personnel are identified in Figure 2. Among the more important staff members for pavement and materials research is a full-time technician to provide continuity among graduate and undergraduate students.

Funding sources for these research universities are shown in Figure 3. The most important source, one that provides a steady supply of funds, typically is a state department of transportation through the Federal Highway Administration Highway Planning and Research program. Internal university support in most instances is too small to maintain a program. Other funding sources have historically been very competitive; hence their magnitude can change significantly from year to year.

“Of all existing institutions in the United States, the universities are in the best position to implement pavement-related research. But successful implementation requires a cooperative effort among researchers and practitioners.”

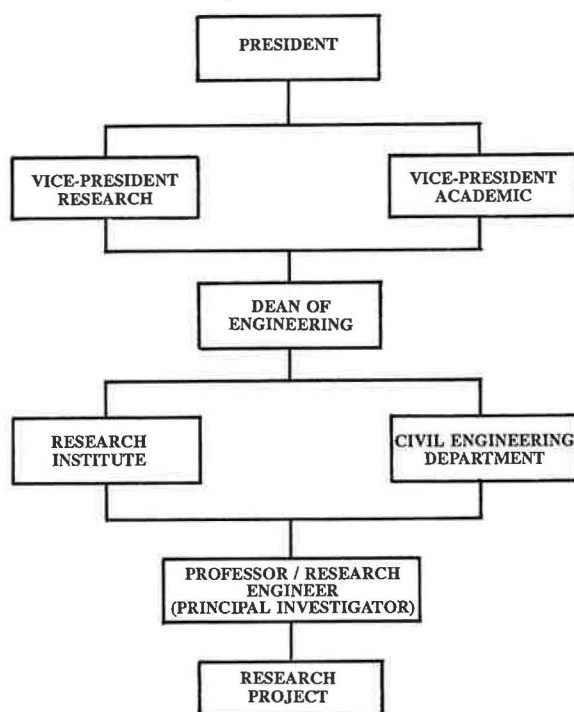


FIGURE 1 Typical university research organization structure.

“University teacher/researchers have played an important role in the implementation of mechanistic overlay design methods, new paving materials, new test methods, quality control, and pavement-recycling operations.”

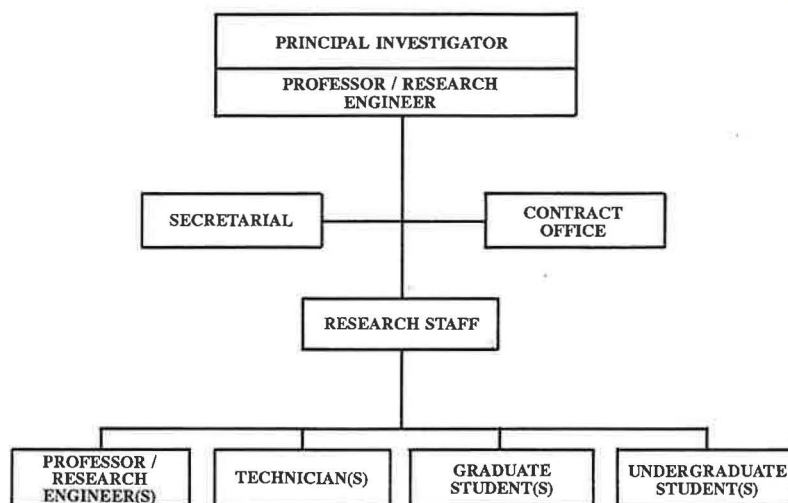


FIGURE 2 Program organizational chart.

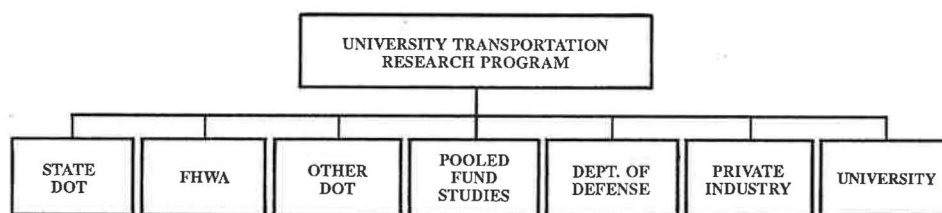


FIGURE 3 Funding sources.

Professor/Researcher

The professor/researcher is the most important staff person. Success or failure of a program and the opportunity for research to be implemented are directly related to the characteristics of this individual. The professor/researcher is the principal investigator on research projects and is responsible for instruction in the formal academic and continuing-education programs. Activities of the professor/research engineer include serving on or chairing national committees or technical societies, presenting technical and applied papers, making presentations at short courses, holding seminars, and consulting. Outstanding professor/researchers are involved in all of these activities. Note that implementation can be accomplished through presentations at short courses, seminars, and consulting.

The activities of the teacher/researcher require excellent communication skills. The individual must be able to define the problem, prepare both technical and applied research reports, and implement results. This may also require that the individual communicate effectively with personnel at all levels, from maintenance worker to state highway administrator.

The professional development of the professor/researcher is dependent on rewards, among other factors. In a university tenure track position, the individual must often meet university tenure and promotion requirements. These requirements can discourage applied research and implementation activities; however, the engineering community should have a say in reminding the universities of their missions.

In addition to tenure and promotion, the teacher/researcher has an opportunity to solve "real-life" problems and interest practicing engineers by presenting state-of-the-art solutions. The individual will thus develop a technology base; management skills; and state, regional, national, and international recognition for himself or herself as well as the university.

Salaries for the professor/researcher are often below those of engineers in practice. Salary structures for professors involved in research and the basis of salary reward systems vary widely. Consulting can become a major source of income for the professor with regional or national recognition.

The reward system for the practitioner is not clear. New ideas in the form of solutions, techniques, and so forth, must be encouraged. Why should one take the risk if failures are remembered while successes go relatively unnoticed? A recognized reward system must be developed for the practicing engineer and contractor.

Research Implementation

Implementation of research requires transfer of knowledge, which implies a giver and a receiver, and requires a cooperative atmosphere. Communication and interpersonal skills may be as important as technical information.

University teacher/researchers have played an important role in the implementation of mechanistic overlay design methods, new paving materials, new test methods, quality control, and pavement-recycling operations. Successful implementation programs have involved the Federal Highway Administration, state departments of transportation, local government agencies, and universities.

Summary

Implementation is the responsibility of the researcher and the funding agencies. The mission of Land Grant Universities clearly involves teaching, research, and continuing education. Thus the teacher/researcher should be included in implementation. With proper organization, philosophy of higher education, and facilities, it is clear that universities are in the best position to implement research and thus "pave the gap."

Implementation of Pavement Research Findings

ROGER L. YARBROUGH

My experience with and practical knowledge of the hot-mix asphalt industry have led me to believe that 80 percent of today's problems with the design, construction, and maintenance of hot-mix asphalt pavements could be corrected if we would only do what we already know how to do, but for various reasons are not doing. We do not need more research and new technology to improve the quality of pavements. What we do need is a better way to implement the knowledge we already have. In my opinion, the greatest challenge for new pavement research today is to use the technology that is currently available more effectively in the design and construction of higher-quality hot-mix pavements. Most of the leaders of the hot-mix industry share this view.

Current Research Activity and Applications

Federal Highway Administration (FHWA) officials have been stepping up efforts to implement research, showing increased concern for quality problems in all



Roger L. Yarbrough, president of the University Asphalt Co., Inc., Urbana, Illinois.