

IMPLEMENTATION—A PART OF THE RESEARCH PROJECT

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•IMPLEMENTATION—putting research results to work—is also research and should be considered a part of the research project. There is a great waste of good research results because of the widely held opinion that research ends before implementation begins.

A review of the history of highway research suggests at least one reason for the separation of research and implementation. During the years prior to World War II, most research emphasis was on materials, pavement design, and the like—basically experiments and experience. A review of the Highway Research Board Proceedings even up to the early 1960s reflects a predominance of reporting on experiments.

Many criteria in use today were based on the results of successful experiments and on experience and practice. Call it what you want to, there was a great amount of work that would now be called implementation. Most of the criteria that have stood the test of time were based on field experience (implementation). On the other hand, most of the experimental research not proved in the real world of field experience never found its way into practice.

Research results are implemented through specifications, criteria, procedures, and practices. The results of research do not reach one of these stages until they have been proved in the real world of practice.

During the early "get the farmer out of the mud" years, it was natural that research on pavements and structures would predominate. During the past couple of decades, and particularly during the last decade, research has become more and more complex. Even the pavement and structures research is more complex and requires more than the experimental approach. Research in planning, traffic, and economics as well as in social and environmental problems involves highly complex research techniques. The advent of the electronic computer changed research completely.

Several years ago it was possible for practicing engineers to understand and apply the results of research in the rather limited scope of highway technology. Today it is unlikely that anyone can keep up with all new highway technology. The man in the field with a full-time job to do simply does not have the time and the opportunity to keep up with new technology. Let's be honest. When we separate research and implementation we are expecting the practitioner to read and study a myriad of research reports, separate the good from the bad, translate the results into practice, and sell the administration, FHWA, and others on the use of this new technology. This is not a realistic approach.

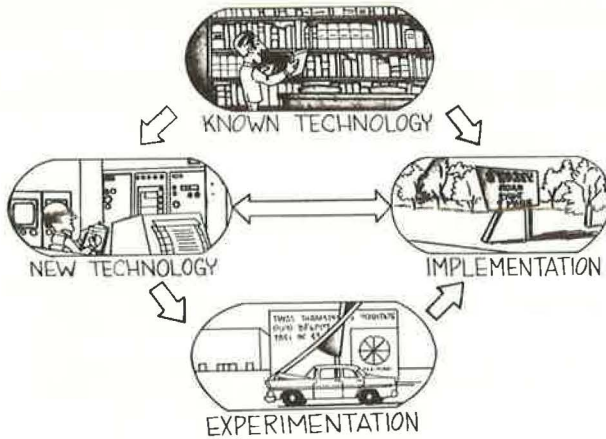
Experience has shown that there are two effective ways to bridge this gap. One is to bring the practitioner into the research project; the other is to make implementation a part of the research and charge the researcher to invade the field of practice. It generally makes him a better researcher.

Both of these methods are used by the Texas Highway Department and the Texas Transportation Institute. The success and acceptance of our research is proportional to the involvement of field personnel in the conduct of the research. However, making implementation a part of research is generally difficult because there are strong prohibitions on the use of "research" funds for implementation. Funding procedures isolate research from practice.

Let's look at the full research cycle (Fig. 1) and I will explain why I feel so strongly that implementation is a definite part of research.

New technology should be based on the foundation of all available known technology, lest we keep inventing the wheel. New technology is validated experimentally through

Figure 1. Cycle of research.



controlled tests, experiments, or studies in which the variables can be isolated, controlled, or varied. This generally is a false environment in comparison with the real world in which the research results will finally be used. Therefore, after experimental validation, the research results should be validated in the real world, with real-world variables and interactions, and the loop should be completed to permit the findings from real-world implementation to be fed back for refinement of the new technology. And it is no mystery that one learns something when he tries to put research to work.

Important factors in implementation are the review and appraisal of research findings that are put into practice. In the application of findings to real-world conditions, adverse side effects often occur that were not anticipated in the research phase. As we all know, experimental work must necessarily be done in a controlled environment. These adverse side effects become apparent to the man in the field in the form of accidents, maintenance, and delay to travelers. These are costly results of unanticipated conditions that occur in application of new technology. The public has the problem, the man in the field has the problem, the administrator has the problem, but the researcher never knows the problem exists. He is isolated from aiding the review and appraisal of the adverse side effects and the measures required to correct these adverse side effects.

This isolation of the researcher can and must be eliminated by providing for his continued services during the time the findings of research are put into practice. A mechanism must be provided for ensuring that the researcher's expertise be available to the practitioner during the review and appraisal period of implementation.

We have reached the point where the researcher must translate the result of research into practice (in cooperation with the practitioner who has been involved in research). He must invade the area of practice.

For best results, the cycle of research should be completed: Implementation should be considered as part of the research effort.