

An Introduction to Microcomputers in Transportation: Implications for the Future

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In each era of evolution of computer technology, a style of transportation practice has evolved (planning, management, analysis) consistent with the available technology. The microcomputer era is a period of truly personal computational support for the professional--the era of the professional's personal computer. A great explosion of power to support personal styles of use will be seen. Hardware innovation has come first; however, new developments in software will be the stimulus to innovative support of human problem-solving capabilities. These capabilities, provided initially in microcomputer-based environments, will change professional work styles in fundamental ways.

A key feature of the microcomputer revolution is the impact on the capacity, and readiness, of transportation professionals to be more exploratory, more responsive, and less firmly entrenched behind a single set of numbers. The adaptability of microcomputers to transportation problems is a consequence of the types of software used, such as the spread sheets, as well as of the hardware.

Microcomputers will be used in many ways--the office microcomputer will be used by a single user, professional, or staff; the multiuser office microcomputer will be shared; the microcomputer at home will be used at night and during the weekend and for general familiarization and support; and the portable microcomputer will be used in the field and while traveling to support the minicomputer or mainframe computer. All of these are candidate elements of a transportation organization's processing support.

In general, a number of microcomputer units, probably of different types, will be interconnected. These interconnections may be permanent, as when a microcomputer is wired as a terminal to a mainframe computer or minicomputer, or temporary, as when the microcomputer is used sometimes as a stand-alone work station and connected sometimes with a telephone or other link to a multiuser microcomputer, to other microcomputers, to a minicomputer, or to a mainframe computer. In such distributed-processing systems, individual users access the system through microcomputers or terminals, and draw on various levels of computer resources throughout the system when needed. Substantial evolution can be expected toward this kind of multi-site, multistation, multiuser system during the next few years. Thus, the microcomputer as hardware is not an issue; the microcomputer will become simply a means for delivering desk-top access to the resources of the networks of services. The microcomputer is, from a hardware perspective, a way-station on the road toward an evolutionary distributed-processing system.

The important issues lie in the domain of software. Traditional computer applications were based on prepackaged programs--programs that were pre-specified for particular applications (e.g., UTPS, cost models). A second type of software is typified by spread-sheet programs, graphics packages, word processors, and others, termed prepackaged application-generating environments or bounded environments. Within such software, a user generates a par-

ticular program or model of a problem. In that sense the user has great freedom; however, the domain of possible programs or models is actually bounded in that the style of what can be modeled and how it is relatively constrained or bounded. Evolutionary environments are a third type of software. These would provide multiple styles of representation and reasoning. The ideal form of evolutionary-environmental software is not yet available. In such an environment a user should be capable of building up complex processes out of elementary ones, of experimenting with alternative processes and evolving them, and of structuring new procedures after experimenting with many alternatives.

Three major phases of evolution of the use of personal, professional microcomputers in transportation are visualized. In the first phase tasks now being performed through other means are transferred to the microcomputer. These include tasks that were previously done on mainframe computers or minicomputers. These tasks are transferred to the microcomputers largely to increase an individual's accessibility to the capabilities or to reduce costs. (Obviously, many large-scale processing tasks cannot be transferred.) This also includes tasks that were previously performed with manual procedures, such as budget preparation, drafting of memos or reports, hand calculations, and use of tables or nomographs to do complex calculations. The key point is that the tasks were performed before their transfer to the microcomputer environment, but now they may be performed more quickly, more responsively, more elaborately, and with many more iterations and adjustments.

In the second phase, innovative approaches are taken to tasks that existed previously in an organization but were not supported by computer capabilities or even, in many cases, by analyses of any sort. In the third phase innovations occur in the organization--in its selection of tasks to be performed as well as how they are to be accomplished, in how it is organized to accomplish these tasks, and in its definition of its appropriate mission. In this phase the availability of powerful, personal, professional problem-solving tools, through microcomputers and other components of distributed-processing systems, allow, stimulate, and encourage significant changes in how individuals in the organization view what they should do and how they can do it. In this context the hardware and software become means, subordinate means, to much higher ends. Substantial increases are achieved in the efficiency and effectiveness with which the organization performs its missions.

Microcomputer applications in transportation are, and will continue to be, particularly interesting and exciting. The technology is exciting; however, its implications for the practice of transportation as a profession should be even more exciting. Significant evolution can be expected in the hardware and distributed-processing strategies, in the types of software available, and in the definition of the roles and missions of transportation organizations.

On January 16, 1983 the Task Force on Microcomputers in Transportation sponsored a Workshop on

Microcomputers in Transportation in conjunction with the Transportation Research Board 62nd Annual Meeting. The workshop included an introduction to microcomputers for new and potential users of microcomputer hardware and software and a discussion of the adaptability of microcomputers to transporta-

tion problems. A variety of microcomputer software programs were demonstrated. The papers presented at this workshop appear in this record and include applications of microcomputers in various areas of transportation—planning, transit, traffic engineering, railroad engineering, and civil engineering.