

## SECTION I HUMAN RESOURCE MANAGEMENT DILEMMA

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### EQUIPMENT MAINTENANCE AND EQUIPMENT MANAGEMENT PERSONNEL

Thomas H. Maze, *Iowa State University*

#### Introduction

The 1980s were a period of tremendous change as new technology crept into most facets of life. For example, computer usage in the 1970s was restricted to either highly technical activities or activities that were number and record intensive (e.g., payroll and accounting systems). Today, computers are commonplace. Most school children know how to operate them and it is common for even the computer on the secretary's desk to rival the power of computers that, in the 1970s, "filled a room and required a specially-trained operator."

The purpose of this paper is to review the changes of the last decade, as they relate to equipment managers at state departments of transportation and local highway agencies. Then, by reflecting on these trends and forecasting their logical personnel resource implications for the 1990s, the paper attempts to highlight the human resource issues that are likely to be faced in the future.

#### Equipment and Equipment Management Change

To observe some of these changes at work in the equipment management area, all that has to be done is open the hood of a new-production automobile.<sup>1</sup> Several items of new technology that will be apparent at the surface are likely to be front wheel drive, several computer modules, fancy sensors, and wires and hoses going everywhere. Under the surface, the engine is likely to contain multi-port fuel injection, a turbo charger, four valves per cylinder, high energy ignition systems combined with clean-burn technology, electronic engine controls, electronic transmission controls, anti-lock brakes, and automatic seat belts or air bags. All of these gadgets are new technology and they are becoming commonplace in modern equipment.

Change is likely to accelerate even more quickly in the 1990s. As an example of accelerating change, automobiles in the 1950s had an average of roughly 20 electrical circuits. Today's vehicles average more than 160 circuits. Typical vehicles in mid-1990s will average more than twice the number of circuits that vehicles currently possess.<sup>2</sup>

The change in truck and tractor technology has not been quite as vigorous as the change within light duty equipment. However, the technology forcing elements of the National Ambient Air Quality Standards<sup>3</sup> are likely to result in most diesel engines produced in and after 1994 to be electronically controlled. It is also likely that many engine manufacturers will offer engines operating on alternative fuels (the most popular alternative fuels include methanol, ethanol, compress natural gas, and liquid petroleum gas).

Technology has created clear change in the type of skills that are necessary for maintenance personnel to possess. However, change has been as revolutionary in equipment management. Managers now have computer technology to help them make better decisions and provide better control over human and material resources. Also changes in management styles, skill requirements, and breadth of knowledge have been as robust in management.

Some of the mega-trends that are expected to impact the human resource requirements and skill levels at the: 1) mechanic and technician level, 2) shop supervision/management level, and 3) top equipment managers level include:

- Changes in technology to make equipment more efficient to operate, but require different mechanic/technician skills;
- Growing competition for a declining base of skilled and competent mechanics/technicians;
- A change in the mission of highway agencies from system development to system management;
- Growing use of new management technology and new management techniques;
- Stagnate budget levels; and
- Expanded environmental and safety regulation.

#### Mechanic and Technician Level Resources

Technology has changed the skill requirements for mechanics and technicians, and future technology is likely to create even more change. When interviewed, the manager of J.I. Case's customer service operation reported that they can no longer rely on years of experience as an indication of skill when recruiting mechanics and technicians.<sup>4</sup> Experience with past equipment does not automatically qualify a mechanic/technician to work on modern equipment.

In addition to higher skill levels, the growing demands for qualified mechanics (and other classes of skilled and semi-skilled labor) in the private sector are likely to place a premium on qualified mechanics and technicians. For example, in trucking, an industry with many of the same human resource requirements as public fleet operators, there is currently a shortage of qualified truck operators and mechanics. In addition, the trucking industry is experiencing a great deal of growth. Trucking growth, measured in ton-miles carried, has been increasing at a rate of roughly 3 percent per year throughout the 1980s.<sup>5</sup>

The trucking industry shortages will be exacerbated by the reduced pool of qualified individuals promulgated by the tougher requirement of the Commercial Drivers License (CDL)<sup>6</sup> and the drug testing requirements that have been imposed on the trucking industry by the U.S. Department of Transportation. Although passing the CDL test and staying drug-free may not seem like an onerous burden for truck operators and mechanics, it's likely that a minority may not wish to meet these requirements or are unable to meet them. The CDL requirements and drug testing will undoubtedly drive some mechanics and operators out of the job market.

When the operator and mechanic shortage get tighter, the trucking industry can raise wage rates for mechanics, attract more qualified mechanics and pass along the additional cost to their customers. Similar mechanisms do not exist for public fleet operators. In addition, although it is difficult to measure, fewer young people are interested in entering ranks of skilled labor. Thus further diminishing the future ranks of qualified mechanics and technicians.

### Shop Supervision Level Resources

Shop supervisors and shop managers need to have technical knowledge of the work conducted by mechanics and technicians, and therefore, these employees are generally promoted from the shop floor. However, as a member of management, they need to have a variety of management and administrative skills. For example, even a foreman should have working knowledge of the union contract (if the employees are represented by a union), fundamental personnel management and administrative skills, and the ability to estimate and plan work. During the 1980s, safety and environment regulation provided an additional layer of rules for shop managers to interpret and apply.

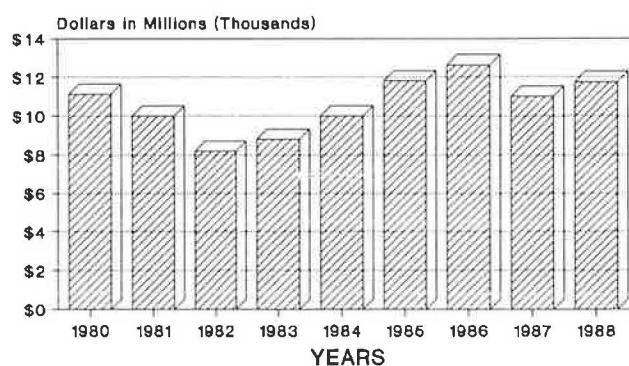
As computerization has become more common, shop supervisors are more frequently required to operate and utilized automated information systems. Greater automa-

tion is also placing a new layer of skill requirements for shop supervisors.

### Top Management Level Resources

Transportation is a central element of the U.S. economy. As the world market becomes more global, transportation will play a more important role in bringing manufactured goods and resources to market. As an example in the growth of transportation, heavy truck traffic on rural interstate highways in Federal Region VII (Iowa, Kansas, Missouri and Nebraska) grew roughly 25 percent between 1980 and 1986.<sup>7</sup>

The increase in truck traffic severely increases the resource demands for highway maintenance, restoration and reconstruction. However, real dollar resources (dollars multiplied by factors to adjust for inflation) available to highway agencies have been generally stagnate throughout the 1980s. Figure 1 shows federal expenditures on highways during the 1980s in constant dollars. Expenditures have been fairly constant despite a five cent per gallon gasoline tax increase in the Surface Transportation Act of 1982. In addition, the American Association of State Highway and Transportation Officials has projected that current annual funding levels for highways, at all levels of government, are roughly \$14 billion below the needed resources simply to maintain highways in their current condition.<sup>8</sup>



**FIGURE 1** Federal highway expenditures in constant (1984) dollars<sup>9</sup>.

The financial shortfall for highway agencies implies that all top managers will have to find methods for completing their work with fewer resources. For top level equipment managers, this suggests the development of techniques that improve work force productivity, the

formulation of motivational strategies, the application of better resource allocation methods, the use of innovative purchasing techniques and better specification writing, better assessment of training needs and effective training programming, and the use of exhaustive equipment management information systems with more analysis performed with the equipment maintenance and operating data to make more informed decisions. However, these skill requirements are generally a mismatch with the skill levels of top managers at state highway agencies. Almost three quarters of all professionals at state highway agencies and most of the top managers are civil engineers.<sup>10</sup> Traditional civil engineering educational programs focus on planning, designing and building of facilities and structures, and not on many of the skills necessary to more effectively manage with fewer resources.

## Conclusions

Viewing the human resources involved in equipment maintenance and equipment management at highway agencies at three employee levels, (mechanics/ technicians, shop supervisor/managers and top managers), the likely trends of the 1990s present each level with one or more human resource dilemma. In summary they include:

**Mechanics/Technicians.** The qualifications necessary to work on new equipment are likely to require significantly different skills than those traditionally possessed by mechanics. Technology change mixed with increased demands for mechanics/technician from related industries are likely to make it more difficult to recruit qualified mechanics.

**Shop Supervision and Management.** The efficient operation of an equipment maintenance facility will require shop supervisors and shop management that possess administrative/management and analysis skills. Although technical knowledge of the maintenance procedures is generally believed to be essential for shop managers, solid management, and analysis skills have and will become more important knowledge areas.

**Top Equipment Managers.** Top equipment managers are likely to be faced the problems of providing increased equipment and equipment maintenance productivity with stagnate budgets. As a result, top managers are likely to be faced with obstacles requiring innovative solutions. Obtaining more productivity from equipment and more

efficient equipment maintenance are inherently problems requiring an interdisciplinary approach. The need for interdisciplinary approaches is in sharp contrast to the highly engineering dominated ranks of top management at highway agencies.

## End Notes

1. The example is taken from M.A.T. Bamford, "The Effect of Technology on Equipment and Equipment Management," presented to the International American Public Works Conference held in Orlando, Florida, September, 1989.
2. Bamford, p. 2.
3. For Federal Law, see: 40 CFR 80; also, 40 CFR 86.
4. Glenn A. Endicott and Larry Green, "Training Technicians," *Equipment Management*, March, 1990, pp. 21 - 23.
5. Association of American Railroads, "Railroad Facts: 1988 Edition," Information and Public Affairs Department, Washington, D.C., 1988.
6. Federal Commercial Motor Vehicle Safety Act of 1986 requires that all operators of vehicles with a gross vehicle weight of more than 26,000 pounds or a capacity of 16 or more passengers have a Commercial Drivers License by the summer of 1992.
7. Maze, et. al., "The Changing Role of Freight Transportation and Intermodal Freight," Midwest Transportation Center, Iowa State University, Ames, Iowa, 1990.
8. Francis Fancois, "Panel 1: Transportation Overview," Reported in "Transportation Infrastructure: Panelists Remarks at New Directions in Surface Transportation Seminar," prepared by the U.S. General Accounting Office, Report No. GAO/RCED-90-81B, 1990, pp. 32-37.
9. "Rebuilding the Foundations," Office of Technology Assessment, Congress of the U.S., Washington, D.C., 1990, p.8
10. Transportation Research Board, "Transportation Professionals: Future Needs and Opportunities," *Special Report No. 207*, Washington, D.C., 1985.

## TRAINING OF EQUIPMENT MAINTENANCE PERSONNEL: APPROACHES AND APPLICATION

Robert Samuelson, *Iowa Department of Transportation*

### Introduction

As of January 1, 1990, there were more than 112,000 miles of roads and streets in the state of Iowa. Despite being 25th in land area, Iowa has the 7th largest road system in the nation. Jurisdictional responsibility for Iowa's roads is vested in the Iowa Department of Transportation (IDOT), 99 counties, and 956 municipalities. IDOT currently maintains about 10,500 miles with the counties and cities maintaining the remaining.

IDOT is responsible for maintaining the entire primary road system, all state parks and institutional roads, and shares responsibility with the cities for maintaining the primary highways that extend into the