

Recruitment and Retention of Engineers and Managers in Transportation Agencies

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I will begin today by looking at the necessity for being concerned about recruiting and retaining engineers and managers. I'll look at some future trends as predicted by the American Association of State Highway and Transportation Officials (AASHTO) and touch on a guide that a task force from this group has put together. Lastly, I'll discuss the training plan our department has developed.

Why all the interest in this subject, anyway? Haven't we managed all right so far? Why are we concerned? Several factors have caused some alarm in those who have noticed. Every survey predicts that the demand for technologically trained people will increase in the future. The National Science Board has reported that in 1986 the U.S. balance of trade in high-technology goods became, for the first time, a negative. The United States bought more high tech goods than it sold. Throughout history, technological innovation has been the primary force behind economic development and success. This relationship is universally recognized and well-documented. For example, a recent Brookings Institute study attributes 44 percent — nearly half — of America's increase in productivity over the last forty years to technological innovation.

But these are changing times for America. Where our technological and economic supremacy once went unchallenged, we now find that no longer to be the case. The pattern of the last fifteen years — slowing productivity growth combined with growing competition from foreign producers, especially Asia and Western Europe — has led to record trade deficits, a decline in real earnings of American workers, and a stagnant standard of living. Restoring America's competitive position in the global marketplace is one of the most demanding challenges facing America's leadership today.

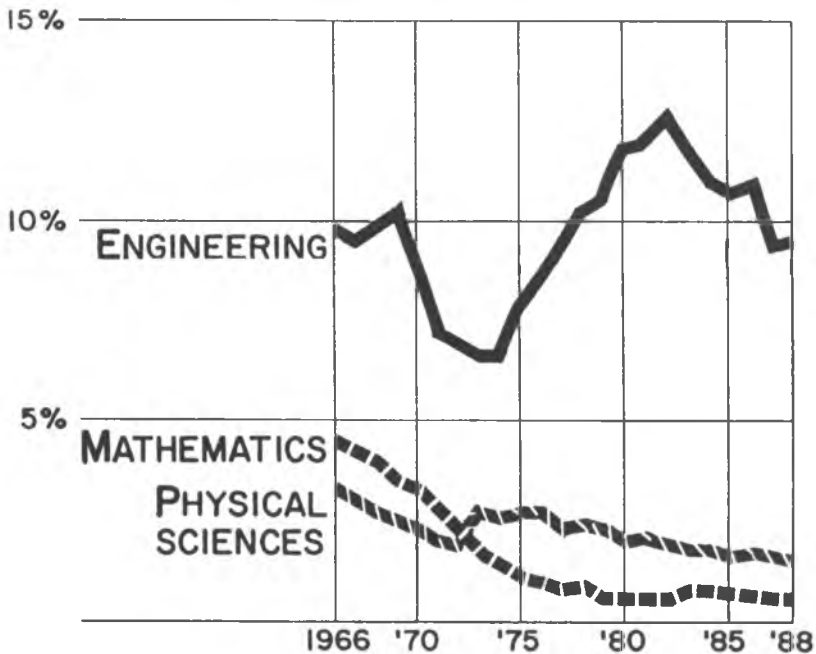
For the last ten years, employment of scientists and engineers has grown at the rate of 7 percent annually. This is twice that of the total work force. After 1995 the need will increase further as scientists and engineers who entered the market in the 1950s and 1960s following the Sputnik launch, reach retirement age. Many engineers will be needed in the academic area to teach and do research, as the high retirement rate will prevail here as well. The *Wall Street Journal* stated in November of 1988 that at that time there were eighteen hundred faculty vacancies in U.S. engineering universities and colleges.

The crumbling infrastructure in the country is going to require large numbers of trained people to build or rebuild structures, water and waste systems and, of course, transportation systems. The National Science Foundation has predicted

that by 2006, there will be a shortfall of 675,000 engineers and scientists. That is nearly the population of the city of Indianapolis.

All this will be needed at a time when fewer and fewer people are entering the fields of math, science and engineering. As shown in Figure 1, less than 10 percent of freshmen entering college plan to major in engineering. This has brought about a further reduction in faculty, worsening the shortage of engineering teachers. Women are 40 percent of the work force, but they earn only 7 percent of the engineering Ph.D's. Blacks, Hispanics and American Indians are 20 percent of the population but earn only another 7 percent of the Engineering Ph.D's. In addition, only 70 percent of entering freshmen finish a degree in engineering, and only 50 percent of trained engineers work as engineers.

Figure 1: Percent of College Freshmen Who Plan to Major in Engineering, Mathematics and Physical Science



Another factor in the shortage emerges when we look more closely at the makeup of that less than 10 percent that do enter engineering. Many of these are foreign students — here on temporary visas. The *Engineering Times* stated in December of 1988, "Students on temporary visas now account for 46.8 percent of all doctoral candidates in engineering, and the numbers are increasing." These people will return to their respective countries, tightening our engineering pool even more.

While Japan trains 1,000 engineers for every 100 lawyers, we train 1,000 lawyers for every 100 engineers, according to an article in *U.S. News and World*

Report. Will these trends continue? A study titled, *Opportunity 2000*, produced for the U.S. Department of Labor, identified eight major trends that will affect the future work force — not just engineering.

1. The number of workers will fall. I've discussed how fewer engineering students will have to be stretched to fill more jobs.
2. The average age of workers will rise. This of course will mean more lost to retirement each year.
3. More women will be on the job. I've discussed that the percentage of women entering engineering is not high.
4. One-third of new workers will be minorities. Again, I've touched on the low percentage that enter engineering.
5. There will be more immigrants than at any time since World War I. The question is, will these be highly trained individuals, or not?
6. Most new jobs will be in service and information. Will college freshmen even want to consider engineering?
7. The new jobs will require higher skills. Education and further training must be paramount.
8. The challenge for business will be immense. Especially so for the "business" of engineering.

I said in my introduction that I would discuss a publication of an American Society of State Highway and Transportation Officials Task Force. This task force was formed to come up with some suggestions for recruitment and retention of engineers, because civil engineering students entering and graduating colleges and universities are following the trends already outlined. In 1984, for example, 10,500 Bachelor's Degrees in civil engineering were granted. In 1988 that number had dropped to 7,900. This at a time when the need for civil engineers in highway agencies is projected to grow at the rate of about 4.9 percent per year. It was felt that something had to be done, so the task force has formulated this guide. Practical advice is given on:

1. How to evaluate existing recruitment programs. What is your organization doing now? What is good about it? What needs to be changed? Why is the program being done the way it is? There is help here in these respects.
2. How to organize a coordinated recruitment effort that will meet both present and projected needs. The key word here is "coordinated." Any haphazard program is not going to yield good results. Coordination could also refer to working with other agencies and professional societies that are interested in seeing that the best enter the field of engineering and that they finish the field of study and graduate into the work force well qualified. Some groups that come to mind include the Institute of Traffic Engineers, the American Society of Civil Engineers and the National Society of Professional Engineers.
3. Where to find recruits in an evaporating pool of qualified personnel and how to compete for them. You can have a well organized recruitment program, but you need to know where to go to make your recruiting successful. You need to know how to target the schools you will contact and lay the groundwork for people to see and cultivate on the college campus.
4. How to find people within the agency who have the communication skills needed to become top-notch recruiters. Not everyone is qualified to be a

recruiter. Would you recognize one if you saw one face to face? This matter was addressed.

5. How to determine the level of commitment necessary from management and staff to maintain a successful recruitment and retention program. All this does take work. A lot of work. In this section of the guide there is some help in understanding the amount of time and energy involved.

My own agency utilizes several methods of recruitment. We send a personnel recruiter to eight college campuses, four of which are out of state. We give an entry wage incentive for grades and experience. We recruit by mail. We utilize engineering development. We maintain contacts with civil engineering staff and placement personnel on campus. We provide guest speakers for student engineering organizations. We also sponsor summer intern programs. All of these are tried and tested methods. Some work sometimes and others work other times. All have a place, however, because diversity is necessary.

The AASHTO guide also discusses the problem of retention. This seems to me to be a very important aspect of having adequate staff (perhaps even more important than recruitment). What keeps a person happy at doing what he or she is doing? On the other hand, what makes a person unhappy enough to leave an agency? Is it more money, more prestige, better working conditions or something else? The idea, "Train and Retain," is stressed repeatedly.

I wanted to spend some time on what the Missouri Highway and Transportation Department is doing at this point. We are in line with other transportation agencies in employing large numbers of civil engineers. We need to keep them. Figure 2 shows how we are doing at retention — some years fairly well, some years not so well. To meet the need of some sort of tool for retention, we produced a brochure, *Engineer Development in Missouri*, which sets down some facts about a program that began in January of 1989.

This program initiated a three year training plan that promotes direct involvement in structured work assignments, puts the engineer on track for professional registration, allows the engineer to play an active role in planning for career moves and helps meet the department's goal to enhance the professional development of each engineer.

Our focus on retaining engineers begins with a two prong plan. When an engineer is employed, he has a career path meeting and he embarks on an organized orientation process. During the career path meeting, he discusses what his individual training needs might be. He is informed about career options, told about advancement opportunities and reviews a checklist of development areas. The orientation process is more lengthy. The initial orientation occurs on the first day, and lasts only that day. For the first three months, the new employee orientation continues. District orientation goes on through six months, and headquarters orientation takes place at one year.

Throughout this orientation, and for an additional two years, specific training and skill development is carried out. Any person completing the items in a specific area has a broad picture of the working of that department. Each year the trainee fills out a program critique, which is discussed with a division liaison person, so that any alterations may be made and progress evaluated. All of these things, we feel, help an employee feel that he is a valued and valuable member of a team. This is an important element in job satisfaction, which, in turn, leads to job retention.

Figure 2: Current Engineering Retention in Employment

Year Began Employment	Number of Graduates Hired*	Number Who Have Resigned	Percentage Retained
1989†	48	1	97.9
1988	51	5	90.2
1987	29	5	82.8
1986	49	14	71.4
1985	54	14	74.1
1984	79	28	64.6
1983	41	29	29.3
1982‡	1	0	100.0
1981‡	0	—	—
1980‡	6	5	16.7
1979	16	12	25.0
1978	16	12	25.0
Total	390	125	67.9

* Hired from college campus recruiting and all other sources.

† Hired to date.

‡ All or part of year under an employment freeze.