Transportation engineering in a changing world--whence have we come and whither will we go?

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The Burton W. Marsh Distinguished Service Award recognizes an individual who has contributed to the advancement of the Institute of Transportation Engineers (ITE) over a period of years in an outstanding fashion. Burton W. Marsh was "Mr. ITE. For more than 57 years Burt was one of the mose active ITE members, providing sage and friendly counsel and always willing to pitch in and do more than his fair share. He was a pioneer in urban traffic engineering and recognized early on the importance of traffic safety programs that incorporated the driver, the vehicle and the roadway elements. Burt's wife, Mary, also contributed to ITE's growth in its formative years by hosting numerous ITE members on their visits to Washington, DC, USA, and by promoting the "family" nature of ITE.

To be selected for the Burton W Marsh Distinguished Service Award is indeed a great honor. It is also a cause for reflection about "how I got here" after nearly fifty years of being a part of the transportation engineering profession, mostly as a researcher and educator, and, of course, as a member of the Institute of Transportation Engineers (ITE).

In a profession that may be dated from 1930 when ITE was founded by-- among others-Burton Marsh, the last fifty years represent 70 percent of the total span. It is awesome, in the original sense of this word, to realize this, and it is no surprise to note that the profession and ITE have changed vastly. This rumination will summarize my views on these changes: how the society for which we ultimately work has changed its demands and expectations, and how the profession has responded to these changes. Finally, there will be a look ahead to what the future might bring.

FIFTY YEARS AGO

In 1950 when I began graduate study in transportation and traffic engineering at The University of California-Berkeley, there were three primary courses within the civil engineering department: highway design, traffic engineering and transportation policy and administration. Students then had to find courses in other departments to finish out the required program leading to the Master degree. Professors Ralph Moyer, Don Berry and Harmer Davis comprised the main faculty, with Professors-to-be Robert Horonjeff and Norman Kennedy assisting. Horonjeff would soon broaden the curriculum into the air transportation area and Kennedy began to look at mass transit problems. Young researchers included Carl Monismith, who has become a foremost expert in pavement materials; Jim Kell a past president of ITE focused on traffic engineering and-from 1955-myself.

Elsewhere in the United States, the famous Bureau of Highway Traffic, then at Yale University, was the best-known and most prolific producer of traffic engineers; Norman Kennedy was one of its diploma holders. Few other universities had graduate programs in transportation engineering. This changed after 1955, thanks in part to the Automotive Safety Foundation (ASF), which financed an 8week intensive summer program at Berkeley for 25 young professors from all over the United States.

Literature available to us at that time included the 1950 Highway Capacity Manual (HCM), a slender volume compared to the elephantine HCM 2000 version. One highway engineering book still in circulation showed animal-drawn construction equipment! By 1952, Professors Berry and Kennedy had produced some traffic engineering course notes that became the ancestor of many editions of Fundamentals of Traffic Engineering. The first good traffic engineering text by Ted Matson, Wilbur Smith and Fred Hurd did not appear until 1955.

Large cities and most state highway departments had at least one traffic engineer; many were staffed with several. Their major concerns were mobility and safety. Maximizing mobility was not questioned, and was generally understood to mean mobility for motor vehicles. This reflected what society expected at that time. The history of the rise of motor vehicles and the decline of mass transit and railroads, accompanied by a drastic change in urban form, which began after the First World War and accelerated after World War II, is well known. If traffic engineers could increase the capacity of streets, good; if they helped to provide new freeways and expressways, even better. If they reduced collisions-that was okay, but evidently of secondary importance. And, of course, as we were taught by Professor Moyer, the benefits must exceed the costs, where intangible costs such as the impact on the environment were unthought of and, hence, excluded. But even before the end of the 1950s, some citizens organized in neighborhoods to address traffic intrusion problems. In Richmond, CA, USA, pioneer Marty Wallen implemented one of the first American traffic calming schemes.

SOCIETY CHANGES ITS VALUES AND CONCERNS

The Interstate and Defense Highway Program of 1956 reached public awareness a few years later when the first major segments of freeways appeared. Their reception was not always unanimously favorable. "NIMBYism" was to be expected, but there was also an outcry about unattractive designs. In many states, including California, landscaping was not classified as a "highway purpose" to be financed out of fuel tax revenues. This policy was changed when it became evident that such a rule might stall new freeway construction indefinitely.

But more serious were some facilities whose location and visual impact never could be mitigated by landscaping: the Embarcadero Freeway in San Francisco, the Alaskan Way Viaduct in Seattle and others. They were enjoyed by the motorists upon them, but not by those who had to see them from below or alongside. They led to "freeway revolts" that drastically changed how highway designers approached new projects. But it took decades, and the diminution of funds for transportation plans, to erase many proposed freeway routes from the map and to shift the emphasis toward making existing facilities perform better.

Then, as smog reached dangerous levels in several air basins, air pollution became a major concern, to be followed later by other forms of deleterious impacts on the environment. Endangered flora and fauna, historic landmarks, water quality-these and others became new factors to learn about and to include in planning and design decisions.

Mass transit systems had been pretty much ignored in traffic engineering literature except for their nuisance value. The 1965 HCM referred to buses only as taking up the space of several passenger cars and reducing street capacity at bus stops. The idea that transit might contribute to the movement of people did not seem to be of interest. By the mid-60s, public policy began to look to the mass transit systems to somehow increase its share of person trips, and thereby reduce motor vehicle travel and its air pollution impact. In 1962, three-C (comprehensive,

cooperative, continuing) metropolitan transportation planning became a requirement, and transportation professionals began to consider mass transit's characteristics and capabilities. The transit industry had seldom hired qualified professional planners before, and had to catch up in order to join the planning process. As it turned out, the air pollution problem was mitigated much more by changes in motor vehicle design than by diversion of trips to mass transit. The latter mode, however, has been an important factor in maintaining accessibility to central business districts of major cities.

By 1970, the safety problem came to the forefront again. Results have been spectacular in statistical terms; the trend in accident rates has been downward ever since. Traffic engineers can take major credit, but much was also achieved by changes in automobile design and inclusion of seat belts and air bags. And the oil crises of the 1970s added fuel efficiency to the agenda. A more recent public concern has been fiscal parsimony-a pervasive opposition to raising taxes and fees in step with inflation. Transportation professionals are challenged to find ways to do more with less.

A whole new area of urgent concern is the safety of transportation systems from terrorist attacks. It is too early at this writing to guess whether there will be any long-range impacts on the transportation engineer's work, but it certainly illustrates the message of this article: preparedness and willingness to adapt.

THE TOOLS AND MATERIALS WE USE

Fifty years ago there were no computers except in a few research laboratories. It is not surprising that traffic estimation models, just to cite one example, had not been developed; it would have been impossible to use them. Sorting and analyzing large amounts of data, such as traffic flows and accident records, was slow and tiresome. Solid-state electronics were still in the future, and traffic signal equipment was clumsily mechanical. Communications links for coordinating signals were primitive; fiber optics were unknown. Our colleagues in enforcement had no radar meters or efficient parking ticket writing machines. Paving materials research was just beginning to bear fruit.

Today, many new powerful options are available to aid in planning, design, traffic management and enforcement. One needs only to look at the capabilities of computers to store and process huge amounts of data as one example of how far we have come-and how much further we can expect to go.

There is a vast expansion of knowledge resulting from research at universities and other institutions. One area worth emphasizing is the field of human factors. Among all branches of engineering, transportation is unique in the role that humans play as vehicle operators, passengers, bystanders (pedestrians) and shippers of freight. There has been enormous progress in understanding the capabilities of drivers and pedestrians, and in quantifying trip generation and modal choice.

CHANGES IN EDUCATING TRANSPORTATION PROFESSIONALS

Graduate programs in transportation engineering and planning have proliferated since the 1950s. It is not surprising that their content has changed. At large research universities, such as Massachusetts Institute of Technology and Berkeley, the program has become more theoretical, teaching students how to model traffic phenomena, how to use statistical methods and how to

analyze total systems. How-to-solve-problems courses and laboratories are more likely to be found at colleges that do not offer the Ph.D. A valuable innovation of the 1980s at Berkeley, for example, is the dual degree program in engineering and city and regional planning; the holders of these two Masters degrees are having very successful careers.

Many traffic engineers have obtained the basic knowledge of this specialty not from graduate work but from attendance at "short courses" lasting one or two weeks. Quite a few universities offer them and they are always popular. (They are also found in other countries.) Content is constantly being updated to keep abreast of new developments.

ITE: WHERE IT ALL COMES TOGETHER

ITE today bears as little resemblance to the organization of 1950 as the practice of the profession today does to that of those simpler years. Then, it was a purely engineering society of about 1,000 members-perhaps 90 percent civil and the rest electrical or industrial (operations research). It required engineering registration as a condition for the Fellow grade of membership.

ITE has now evolved into a multidisciplinary organization with Councils dealing with new topics including goods movement, transit, planning and Intelligent Transportation Systems. Fellows can qualify if they hold licenses or registration in non-engineering disciplines. ITE changed its name in the early 1970s to reflect the broadening of interest, although it has never replaced "engineering" in its title with another word, perhaps "professionals," so that planners, economists, human factor specialists and others might feel more at home. The contents of the technical programs of its Annual Meetings and technical conferences have grown in excellence and variety. Its publications program, especially handbooks and manuals, is a major contribution to the profession.

From the earliest days, local meetings have been most important. For many young members they were the principal evidence of ITE's existence. Dedicated volunteers organized programs, stimulated attendance, recruited new members and maintained contact with ITE headquarters. They were, and still are, the people that nurture ITE and keep it growing.

Local sections were soon grouped into Districts, which offered annual meetings of greater scope. Again, volunteers were needed and found to run these Districts. And, of course, from the start the national (later international) organization required volunteer officers and directors in order to function. Guided most effectively in recent years by Tom Brahms, past and present professionals have given pro bono of their time and efforts to make ITE the highly regarded society that it is.

Without ITE, there would be no "home" for transportation professionals. We would have to make do with other engineering or planning societies for whom transportation is only one of many interests. ITE provides the space and opportunity for personal development, continuing education, a forum for the dissemination of knowledge, an "official" voice speaking to policy makers and even a social milieu. As it continues to grow-- and so it will with the support of present and future members-it must strive to retain the personal atmosphere that is presently one of its important attributes.

BE PREPARED FOR MORE CHANGE

The past is prologue to the future, and those transportation professionals young enough to still have decades of practice before retirement, must be prepared for many more changes in their

work. Knowledge is always expanding. Technological progress is inevitable and rapid, and will bring us tools and analysis methods that we might label as science fiction today. And the priorities of the public may well shift again, but in what direction?

Opportunities for more automation of traffic control equipment, of entire highways and rail transit lines and of enforcement will abound. Environmental health will continue to be a major policy issue-- carbon dioxide emissions are only the latest addition to the list of global concerns. The size mix of motor vehicles will become more diverse with introduction of minicars and long truck trains. What safety problems will this bring? And who can forecast the way the terrorist threat will play out and what, if anything major, we will need to do to militate against it?

In sum, there will be a host of new problems crying for solutions, and it will be up to the transportation profession to work on them, while in the process acquiring new skills and knowledge. To quote James Russell Lowell, who said it much better than I could:

"New occasions teach new duties Time makes ancient good uncouth; They must upward still, and onward, Who would keep abreast of Truth."

WOLFGANG S. HOMBURGER, P.E. (H) is a devoted educator author and leader in the transportation profession. During his more than 40-year tenure at the University of California at Berkeley Wolf served as a lecturer, research engineer, acting director and assistant director of the Institute of Transportation Studies. In these capacities, and in courses that he developed and taught, Wolf helped to prepare hundreds of transportation professional for careers in transportation. Wolf served ITE in a variety of capacities at the section, district and international levels, including as District 6 Director. Wolf has been most perceptive to recognize emerging issues and make ITE's leadership aware of the issues and help to work toward addressing them. His column, "From the Ivory Tower," that he wrote during the 1970s for Westernite, raised such issues. Wolf has written and/or edited a number of widely used textbooks and references, including Fundamentals of Traffic Engineering (now in its 15th edition), Introduction to Transportation Engineering, Transportation and Traffic Engineering, and Residential Street Design and Traffic Control. These books have been distributed throughout the world. Wolf has been a visiting lecturer in the United Kingdom, Venezuela, Costa Rica, Australia, New Zealand and Switzerland. In 1996, the ITE International Board elected Wolf as ITE's 50th Honorary Member, its highest recognition of notable and outstanding professional achievement.