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November 30, 2006

Ken Button  
Vice President for Programs  
Transportation Research Forum  
2007 Annual Conference

Dear Mr. Button:

Attached is a copy of our paper, "Preparing Tomorrow's Transportation Workforce Professional," which we are submitting for consideration for the TRF 2007 Annual Conference. We very much appreciate this opportunity and hope consideration will be given to including a presentation on this topic in the program agenda.

Sincerely,

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# **PREPARING TOMORROW'S TRANSPORTATION WORKFORCE PROFESSIONAL**

by

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## **ABSTRACT**

The success and value of transportation, whether rail, air, highway, maritime or any other mode, is ultimately dependent on people. However, there are a number of factors that are currently affecting this mix that should be cause for concern. First, we are facing the retirement of a large number of “baby boomers” that have been the foundation of many transportation organizations. At the same time, low birth rates in the 1970-1980's have resulted in a general shortage of new entrants in the American workforce. In addition to the smaller general workforce, a lower proportion of these young people are pursuing technical disciplines such as engineering that are critical to transportation. This gap in the transportation workforce comes at a time in which the skills needed to work in the transportation field are changing and expanding. Given this backdrop, the transportation industry needs to be looking at how it can attract and retain the workforce it needs in the future. In particular, there is a need to look further back into the “pipeline” to reach students, and provide them with the early education and personal experiences that can attract them to this field.

## **THE CHALLENGE**

Virtually every aspect of today's transportation enterprise is dependent on a finite commodity...people. Whether it is the design, construction, or operation of our infrastructure, vehicles, or logistical systems, people keep America moving. Although this workforce is a critical aspect of our mobility, it is not altogether clear whether there will be a sufficient supply of workers to meet the transportation needs in the coming decades. There are a number of factors affecting this question. Some of these relate to larger demographic and economic influences, while others are more local and specific to particular aspects of the transportation industry. What is also apparent is that simply waiting for these changes to happen is not a viable option. Although, no one can predict with certainty whether there will be a shortage of skilled transportation workers in the future, the consequences could be staggering. Fortunately, actions can be taken to help mitigate those risks.

Questions regarding the quality and availability of the workforce have previously surfaced, particularly during periods of strong economic growth when there was increased competition for workers. Looking at the particular issues relating to the transportation workforce has always posed a number of challenges. Part of this stems

from the extremely large and diverse nature of the transportation workforce. Current estimates place more than 14.7 million workers in the transportation sector (about 11 percent of the total civilian workforce). Transportation also constitutes about 8 percent of the Nation's Gross Domestic Product (National Academy Special Report 275).

On one hand, it is apparent that the Nation's infrastructure and mobility are dependent upon large numbers of civil, structural, marine, computer, operations and aeronautical engineers, to name just a few, but it is equally dependent on technicians, drivers, operators, and construction and maintenance workers. There is also a broad diversity of disciplines working in transportation, reaching from archeologists and engineers. Very simply, although transportation is sometimes referred to as a single discipline, it is in fact an industry that is a conglomeration of multiple fields that are working together under the common objective of providing for the movement of goods and people.

However, at its core, there are certain specialized skills and knowledge that are unique to this industry that form a foundation of what is often called the "transportation discipline." These skills include an understanding of how transportation systems work...their planning, their design, and their operation...as well as their integration into society and the environment. This knowledge has evolved and grown through decades of research, experience and practice. It is an asset that is held by the transportation workforce of today, yet it is one that must continually be nurtured and replenished to assure its strength in years to come. More so than in the past, there are a number of factors that are making that task more difficult.

### **"The Perfect Storm"**

There are three main factors that are influencing and challenging the transportation industry's ability to find and retain the workforce it needs. These factors are converging to essentially create a "Perfect Storm" that may soon be hitting the industry. To understand these factors, one needs to go back nearly 50 years to the end of World War II. During this period the national birth rate peaked (U.S. Census Abstract 2000) creating the generation we know as the "baby boomers" (see Figure 1). This generation has moved through its maturity as a demographic "bulge", swelling demand for schools in the Fifties and Sixties, and feeding the workforce shortly after that. That generation is now approaching retirement age, a concern to not only the transportation sector, but virtually all industries.

Within the transportation sector, it is estimated that 40 to 50 percent of the current workforce will be eligible for retirement in the next 5 to 15 years. (National Academy Report 275 2003) These numbers parallel what is being faced throughout the workforce. As an example, in 2004, 32 percent of the federal workforce was at retirement age, and 21 percent were eligible to retire (Report to the President 2000). These losses will obviously create vacancies that need to be filled, but more importantly, these retirements mark a huge drain of institutional knowledge. When one considers that each retiring employee takes with them approximately two to three decades of experience, it is easy to see how organizations can expect to lose literally thousands of years of experience in the near future. This loss defines the first of the three factors that are affecting the changes we are facing in the transportation sector.

## The Supply Side

Alone, the number of baby boomers retiring should be of serious concern, but the second factor makes this loss even more critical. As seen in Figure 1, it was higher than normal birthrates between 1951 and 1961 that created the baby boom generation. However, as that generation came of age, the rate at which they had children not only dropped back to average, but to a level lower than average. Whereas the baby boomers definitely represented a “bulge” in the national demographics, the generation following 20-25 years behind has actually produced a “dip.”

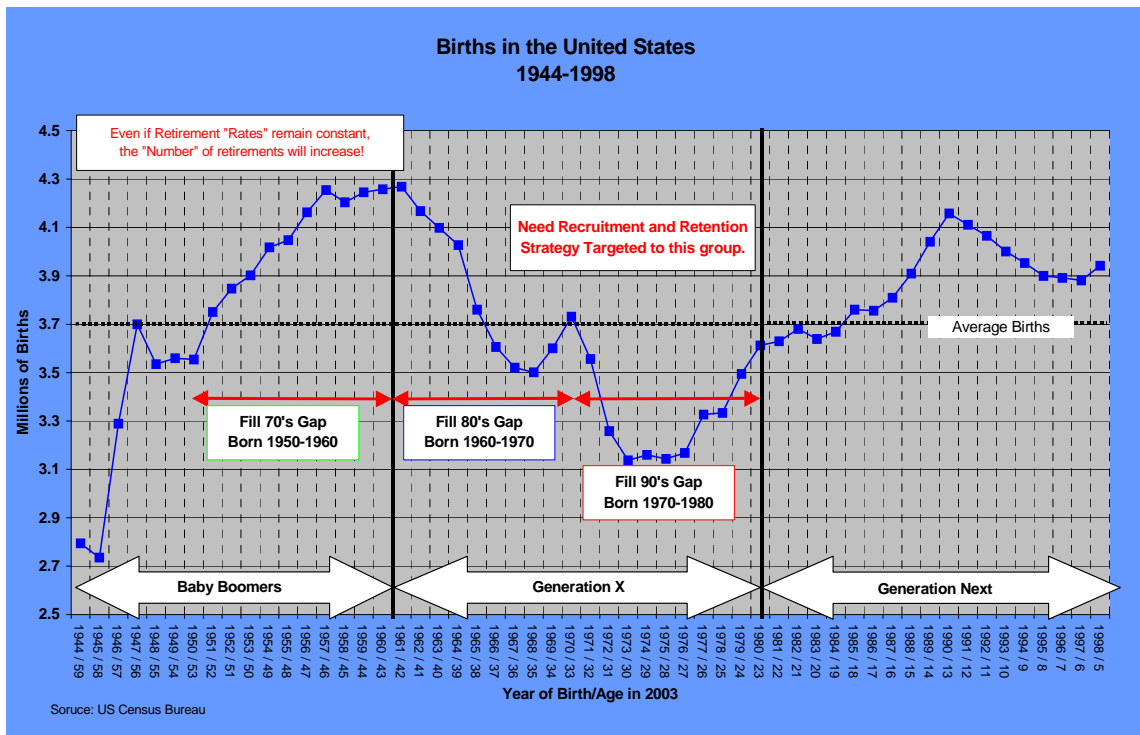


Figure 1

This “Generation X” and subsequent “Generation Next,” as they have been labeled, are the populations that are now filling behind the baby boomer retirements. Their numbers are limited and will become even more so in the coming decades (see Figure 2). As a result, at the same time the industry is facing record levels of retirements, the available pool of workers to fill behind those vacancies is tightening. Again, the confluence of these two factors is affecting not only the transportation industry, but also most sectors of the economy.

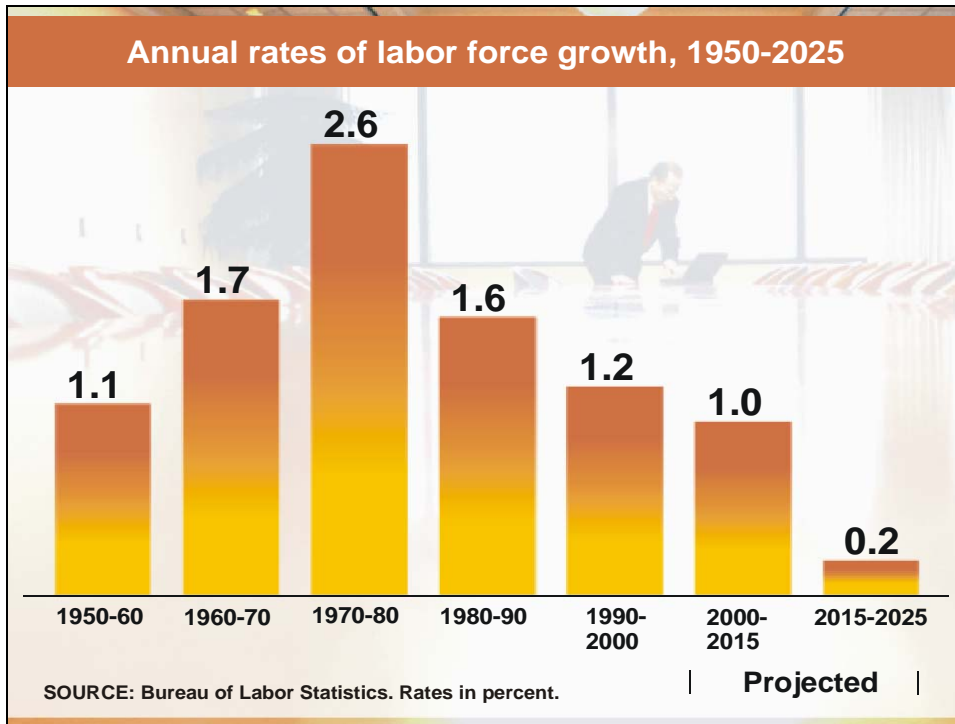


Figure 2

The projections regarding the change in the rate at which the workforce is growing can be affected by any number of factors. As an example, national policies regarding immigration can have a significant impact on the number of students that come to the United States for graduate and post-graduate education, as well as the portion of those who desire to stay. Economic changes in particular sectors can also either aggravate or temper these impacts.

As important as the number of available workers is, as important is how prepared that workforce is to meet the Nation's future needs. Of particular concern is the decrease in the number of students that are pursuing technical degrees. There have been numerous studies of this issue, as well as a number of Congressional, Presidential and Industry-wide initiatives to address these concerns (National Academy, Gathering Storm 2006). Once again, to understand these issues, one needs to look at the multiple factors that may encourage or discourage a young person from pursuing a technical degree. These choices begin very early in a young person's development, even before their secondary education begins, and can significantly impact their options as they grow older. It is therefore important to think of the entire "pipeline" of choices that young people must make and how those choices can influence their career choices. A representation of this pipeline is shown below (see Figure 3), highlighting some of the key decision points during a child's development.

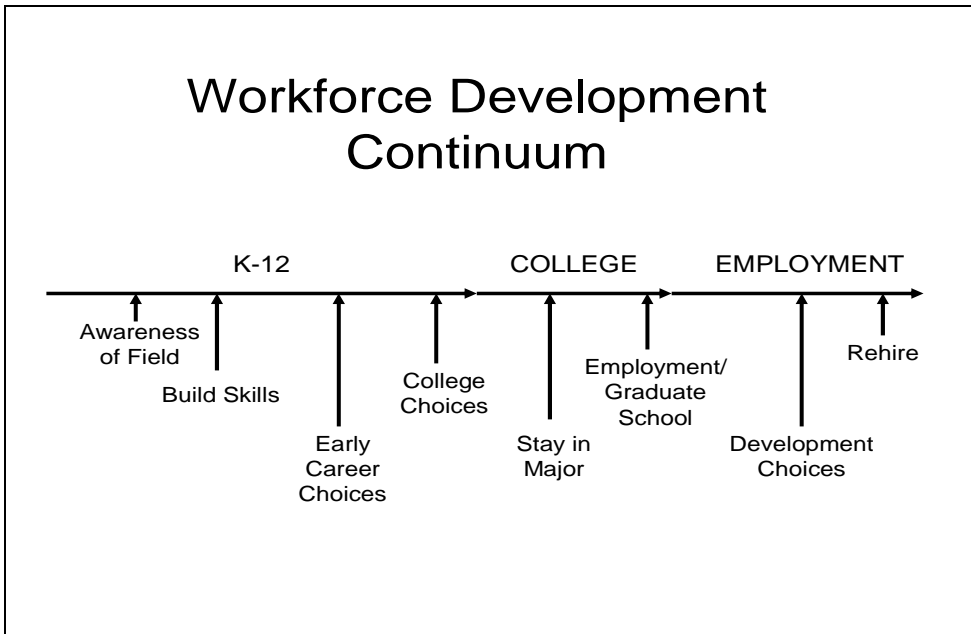


Figure 3

As an example, studies have shown that if a fifth grade student decides they want to do something when they grow up (e.g., be a fireman), there is not a particularly strong probability that they will pursue that decision later in life. However, if a child decides they do not want to do something, there is a much greater chance that they will not pursue that interest. At this age, children are particularly influenced by the opinions of their parents and others they respect. It is easy to see how an off-handed comment such as “girls are not good at math,” could adversely impact a child’s desires and future choices. On the other hand, reaching out to children at these ages can help assure that their minds’ stay open to all possibilities.

Another early decision point is often reached in the seventh grade when students decide if they should take Algebra 1, a prerequisite and foundation course for subsequent advanced mathematics classes. If a student chooses not to begin this path, it will be difficult for them to “catch-up” during high school with all of the mathematics courses needed as preparation for admission to a degree program in science, technology, engineering or mathematics (STEM).

These examples simply illustrate the multiple factors that can influence whether a student pursues an undergraduate education in a STEM field. The net effect is that the United States is falling farther behind other countries in the percentage of students that are pursuing these degrees, as seen in Figure 4.

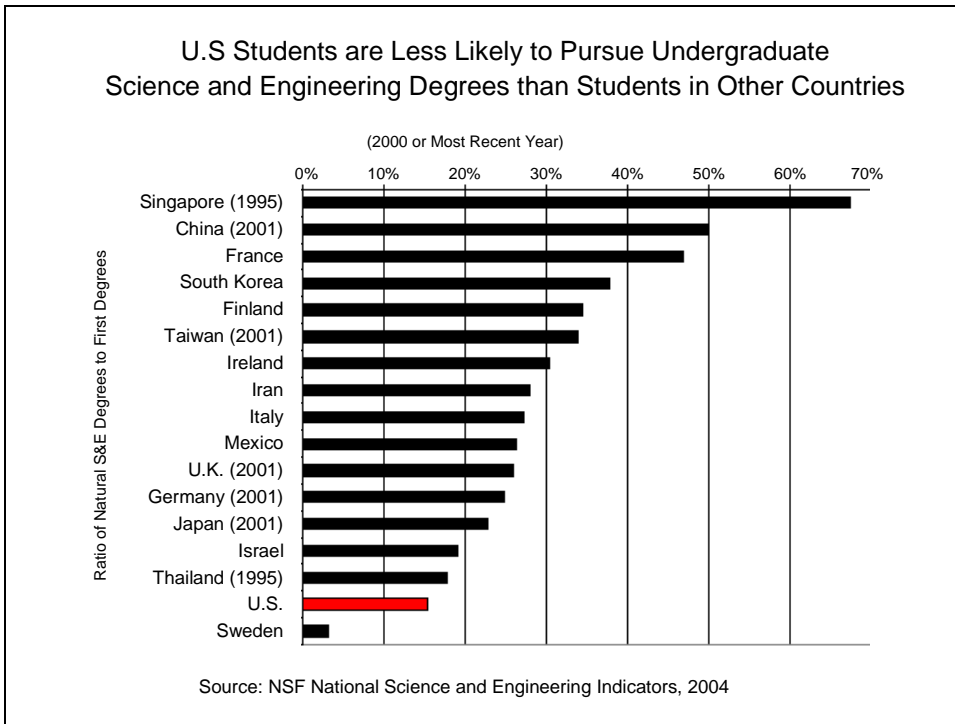


Figure 4

This competitive edge is impacting not only the flow of students into undergraduate programs in STEM fields, but also the output of those choosing to pursue advanced degrees. The following (see Figure 5) is simply one more indicator of the speed at which the rest of the world is moving ahead in their development of students in these fields.



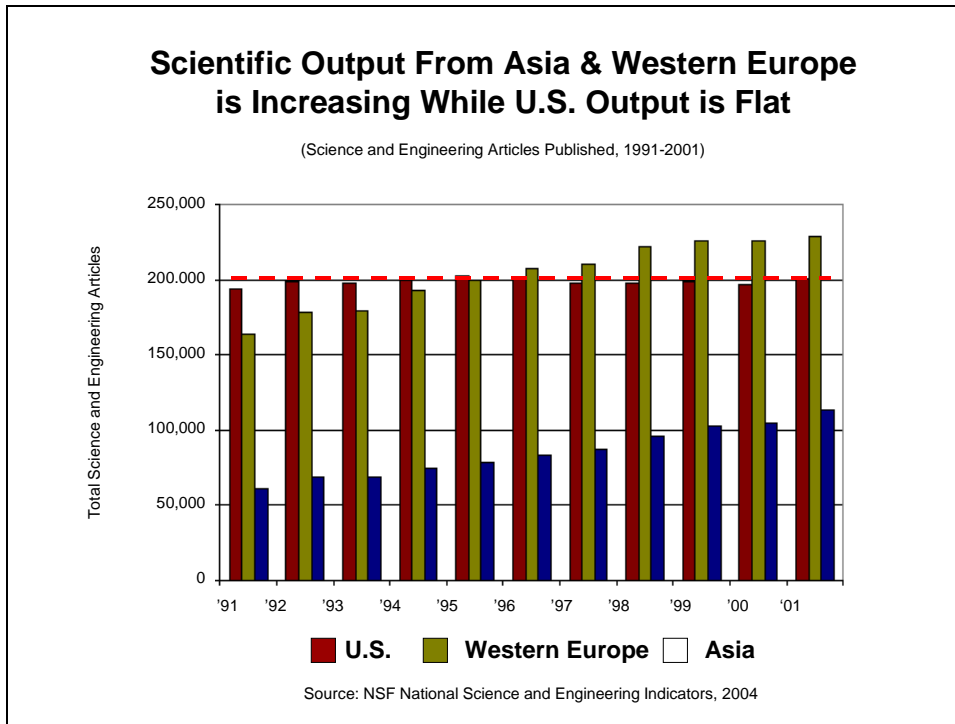


Figure 5

### Transportation's New Skill Set

The third factor that is influencing our workforce needs is the changes within the transportation field itself. The growth of asset management, modeling, logistics, operations, and material technologies are all examples of areas where new expertise is required within the transportation community. Development and implementation of new technologies and practices in these areas have broadened the number of disciplines that contribute to global mobility, and have enriched the possibilities for even greater innovation. However, supply of this expertise is often even tighter than that which is experienced in more traditional transportation fields such as civil engineering.

The skill set required to work within the transportation field has also broadened. In a recent National Cooperative Highway Research Program Project 20-24(48) (Warne, NCHRP 2003), transportation managers and executives were asked to identify those core skills which were important to success in key positions within their organizations. Some of the skills identified included the ability to communicate effectively with the public and to work with teams of diverse individuals. These “soft skills” have become much more critical as the complexity of transportation decision-making has also increased. Further, they reflect the need for employees that can work across disciplines and cultures, resolve differences of opinions, and communicate to their peers and the public. These are often skills and traits that are harder to develop late in life, and are rarely the focus of formal educational curriculum. Considering this changing set of skills, the workforce challenge facing transportation today is not simply one of replacing existing professionals as they retire, but it is instead about finding and developing people with a new skill set that can take transportation into the next century.

In summary, the transportation industry is facing three major workforce challenges; (1) the loss of substantial knowledge through the retirement of many skilled workers; (2) increased competition for a smaller pool of qualified workers; and (3) a changing skill set needed in this industry. The convergence of these factors could very well present the transportation community with a “Perfect Storm” that may threaten its ability to meet future mobility needs. However, there are steps that can and are being taken to try to address these concerns and meet the industry’s future workforce challenges.

## **MEETING THE CHALLENGE**

In the coming years, as the available workforce decreases and the skill set to work in the transportation field expands, responses must be examined and a plan needs to be set out to forestall any possible shortage in the Nation’s transportation workforce. The plan for attack must address the two gaps that are and will continually face the transportation workforce; manpower and skills.

### **Addressing Manpower Needs**

Responses to the decreasing number of people entering the transportation workforce can be likened to an hourglass. The hourglass not only represents the flow of actions that start at a very young age, but also the connection between various strategies. In the initial phase, measures need to be broad and focus on raising the general public’s *awareness* of transportation issues. As one moves down the hourglass, the efforts need to become more focused and intense. It is during this phase when concentrated *recruiting* efforts need to be directed at high school juniors and seniors, as well as college freshmen and sophomores. Finally, once that threshold is reached, and one passes through that decision point, opportunities once again flow into the open. This is the phase that needs to focus on the *globalization* of the transportation market and looking to a broader spectrum of people to bring into that market.

The following section of the paper will focus on these three elements and what resources and approaches might be used to increase the number of people going into the transportation workforce.

**Public Awareness** - One of the greatest challenges of attracting young people to the transportation field is simply making them more aware of what “transportation” is and is not. Their views regarding transportation are likely shaped by many different inputs, but at the earliest ages, parental input can be particularly strong. Just as children pickup morals, values, and mannerisms from their parents, they also are influenced by their parents’ views of the transportation industry. These views may not always be obvious, but may affect them throughout their lives. Some examples of areas where parental attitudes (and actions) can affect their children’s behaviors include driving under the influence of alcohol, wearing seatbelts, and aggressive driving. However, less obvious may be their reactions to closed lanes, modal choices, maintenance crews, potholes, or congestion.

Therefore, at the earliest ages when young people are forming their first opinions about transportation, one of the main pathways for providing them with information is through adults. In order to instill a positive attitude of the transportation industry in these children, actions may first need to be directed towards the parents and other adults that interact with these children, such as teachers. As a child becomes older, information can be focused more directly to them. Therefore, there are two aspects of public awareness that should be considered in trying to increase the number of students that may eventually wish to enter the transportation field: first, improving adults' opinion of transportation and, second, informing the youth.

It has been said that when transportation is doing its job, it is least noticed. When traffic flows unimpeded, when goods arrive on time at a low cost, or when intermodal transfers are seamless, driver, passenger and customer become less attuned to the transportation system. What the public does know are the stories they see on the news or read in the papers about hours of congestion on highways or airplane crashes that took people's lives. These may be amplified by their own experiences. The question is what approach should be taken to increase the public's knowledge about the transportation world, particularly its benefits that may be less apparent on a day-to-day basis. The following are thoughts on four ways to reach to public in a positive manner and to get them more engaged in the transportation community.

1. **Changing Attitudes Within the Industry** – One means of creating a more positive public attitude towards transportation, is for the transportation community to develop a more positive attitude about itself and it's mission. The transportation workforce needs to think of itself as a business that is working together to provide a common good to a customer. The "good" that the workforce is providing is a means by which people and goods are transported in a safe, efficient and effective manner. The customer is the traveling public and the consumer, and whether the mode is land, air or water, every person working in the transportation industry should understand their connection to the public. Every day, the transportation workforce is working to provide people with a better quality of life, and emphasizing that message within the industry can instill both a greater sense of pride and a greater commitment to service. Ultimately, that is an attitude that can be seen by the public and will make the industry a more attractive option for employment.

When transportation workers think in terms of what the traveler wants and needs and take actions that reflect that customer focus, the impact on public opinion can be even greater. For example, a national survey of highway user attitudes indicated that pavement smoothness was one of the things drivers valued the most. As a result, many states are now giving incentives to and imposing penalties on paving companies for the smoothness of their completed road projects. Although this is just illustrative of the type of strategies that can be directed at improving the driver's experience, there are many other opportunities for demonstrating a customer focus within the transportation industry.

2. **Reaching the Media** - The transportation community needs to focus on how they are connected to the media. If that connection is based primarily on reacting to major traffic jams, extended construction projects, airport delays, or crashes, there is little chance that transportation will be portrayed positively. Although it may not be possible to eliminate such stories from the news coverage, effort needs to be made to build connections to the media that are more proactive. As those relations build, positive stories about transportation issues of importance to the public may have a greater chance of finding airtime or print space. Keeping the public informed of these benefits is key to improving their attitude.

Creating positive opportunities for the media to cover transportation stories is another strategy. As an example, during National Transportation Week, local agencies might plan media events such as inviting the surrounding community to tour the site of a new bridge or road. Programs such as Adopt-a-Highway or activities to beautify the roadside can also offer the media a human-interest story and encourage people to become more engaged in their transportation systems.

3. **Making Transportation Fun** – As noted, even at early ages, children are being influenced about transportation and developing their own attitudes and ideas. The transportation community needs to make a greater effort to attract the attention of these young people by developing programs and projects that are specifically targeted at stimulating their interest. When children are traveling in a vehicle, there is a natural opportunity for them to learn more about transportation. The challenge is to develop material that is actually fun, as well as educational. As an example, free booklets could be provided at rest areas or visitor centers that include stickers about roadway markings and other interactive materials. The booklets could also include “car games” that families could play together (e.g., counting license plates from different states or different highway signs), but also contain information about why road signs are certain colors, and interesting facts about the major roadways in that area. Similar booklets could also be made for distribution in airports to stimulate interest in planes and flying. This is just one of a multitude of ideas that would start a conversation between parents and children about transportation, and may stimulate the children’s attention to the transportation field.
4. **Bringing Transportation to the Schools** - Lastly, transportation touches virtually all aspects of our lives, and likewise has a relationship to virtually every subject taught in school. This is not to suggest that transportation should be taught as a separate subject, but instead integrated as a part of existing subjects. For instance, much of the Nation’s development was strongly linked to transportation. Emphasizing that in U.S. history classes could build an appreciation and knowledge of transportation, and provide a better understanding of its tie to the quality of life of Americans. There is also a need to develop hands-on programs to get children involved in transportation projects. Again, this could be part of a larger effort during National Transportation Week in which transportation organizations and companies could sponsor outreach programs and tours for elementary and middle school aged children.

The preceding was simply a sample of ideas that could be applied to raise an awareness of transportation. The major goal of such awareness efforts is to improve the public's opinion of transportation and to gain the interest of the youth. This will create a basic foundation of transportation knowledge that can be drawn from later and used to attract more people to the transportation field.

**Recruiting** - While creating a strong base of awareness is important in a child's early development, it is also important to sustain that interest by keeping students continually engaged in transportation related issues and activities as they mature. A key timeframe for providing a focused effort on attracting students into transportation comes between junior year in high school and graduation from undergraduate university programs. During this period, students are likely to make decisions regarding which colleges to attend, majors to concentrate in, and, eventually, what career fields to work in. In the past, much of the industry's focus has been placed on the final phase in which students are recruited by employers for specific jobs. However, with a smaller available pool of candidates, the transportation industry needs to define "recruitment" more broadly, and see it as a chain of activities that lead to graduates that are seeking employment in transportation. Formulation of a recruitment strategy to achieve these results needs to, again, look at the choices a student is making at each phase of their development.

The later years of high school are a time when students are deciding if and where they will be continuing their education, or if they will be going directly into the workforce. With the expansion of the community college system, there is a greater array of choices for students, particularly those that want to pursue technical fields. Working with community colleges, some transportation organizations have helped develop and teach curricula that will prepare students for employment. These programs offer strong advantages to both the employers and the students being recruited into transportation fields.

For those students considering admission to fulltime undergraduate programs, this is a time when focused information could help attract students to transportation related fields. It may not always be apparent to graduating high school students what employment opportunities exist in areas such as transportation, or how various majors relate to those fields. By involving practicing transportation professionals in counseling, outreach, and university recruitment, students learn more about the opportunities and challenges in transportation, and in doing so, get a clearer sense of their choices. During this same period, advanced placement (AP) high school courses in areas such as physics, chemistry and mathematics, offer a vehicle through which transportation related problems could be introduced and solved. As an example, in AP Physics these projects could range from calculating loads on bridges, to understanding aerodynamic forces on planes.

Even after a student enters a university, there are still many decisions points that remain, many of which carry over from high school. During this period, students are exploring majors, evaluating what others are doing, and assessing their own aptitudes. Unfortunately, this is also the period where many students drop out of STEM majors and enter other fields. However, one of the largest challenges at this stage is simply the lack

of undergraduate transportation programs. Even introductory courses in transportation that offer some opportunity for exposure to the transportation field are limited and often not emphasized.

The first years of college are a period where exposure to the challenges, complexity and importance of transportation can help plant the seed for the future. When transportation organizations are recruiting for college juniors and seniors, they should make a point to also build a presence with the freshmen and sophomores. Introductory classes are one such opportunity to reach incoming college freshmen. Some of these classes are designed to provide a broad overview of different engineering and technical disciplines, and would provide an excellent opportunity to emphasize potential areas of study in transportation. This is particularly important since a student will usually declare a major and start to examine career fields for the future within the first two years of college. By sustaining contact with the university, there may also be opportunities to help build more transportation programs and better publicize the existing courses.

While increasing the number of students studying transportation and related courses is a positive step, it does not necessarily guarantee a proportional growth in the transportation workforce. Drawing students into the industry involves extra recruiting measures. In addition to classroom instruction, students need to gain an idea of the opportunities the field has to offer upon graduation. Career fairs, industry speakers, and site tours are a few of the excellent avenues that may be utilized when trying to inform students of the careers offered in transportation. By asking students at career fairs if they have considered a job in transportation, company representatives can expand their thinking about opportunities in the field. College club meetings are another occasion where company representatives can expand on what students learn in the classroom and discuss different careers in transportation. Such recruiting efforts should not be limited to transportation and civil engineering clubs, but look at other transportation-related careers. For example, discussing advanced automation applications with Electrical Engineers, or planning scenarios with Public Policy or Political Science majors.

The thing that all of these concepts have in common is that they require a proactive approach to reach students at an earlier age. The key strategy for transportation organizations is to simply not wait. By thinking of “recruitment” as an ongoing process, the industry can increase the opportunities to affect these student’s perceptions, and potentially attract more of them into this field.

**Expanding the Market** – Although focused recruitment efforts will expand the pool of students that may be available for transportation jobs, this source alone may not sufficient to meet the needs of the industry. To fill this gap, the transportation industry may need to look for a broader spectrum of people to hire especially at a time when the industry is expanding and the demand for skilled workers is rising. Two possibilities for addressing these needs are globalization and expansion of the diversity and composition of the transportation workforce.

It has become apparent that as communication technology continues to advance, the transportation industry is also becoming more global. First the nature of trade itself has become more global, and as such, the knowledge needed to provide for the movement of those goods and ideas, has also expanded. The expertise for operating these systems is not only distributed throughout the world, but to an increasing extent, it is also being developed at universities and companies around the globe. This development opens new opportunities to recruit globally, and in so doing, create a workforce that has experienced the globalization of the economy first-hand. Facilitating the immigration of highly technical professionals is clearly a path that is available to fill the gap in the United States' (U.S.) workforce. However, globalization comes at a time when U.S. laws have made immigration a more challenging process, thus, tempering this possibility.

Another approach to expanding the pool of workers available to meet transportation's needs is to look beyond traditional disciplines and consider the skills that other fields can bring. As an example, students in business, social sciences, and even the arts may possess the analytic skills that would be an asset to the transportation. In addition, they may bring different perspectives and approaches to problem solving, communications, and innovation. These new skills may be exactly what are needed to address the transportation challenges in the coming decades.

### **Addressing the Expanding Skill Set**

The rapid growth and expansion of new technologies and practices in transportation have left a gap in the skill set of the current transportation workforce as well as a need to expand the curriculum for future transportation workers. As noted earlier, transportation managers are recognizing that a broader set of skills are needed to assure program success, and these skill sets apply to both the current workforce as well as new entrants.

There is little doubt that technology sharing and research will continue to bring new innovations to the transportation field. As such, the transportation workforce will be challenged to sustain their technical skills and staying abreast of the latest advances. A key to this process will be new approaches to knowledge management and knowledge sharing that will encourage a greater exchange of information and experiences among professionals. By forming and supporting Communities of Practice, emphasis can be placed on both the growth of knowledge, as well as the ongoing development of technical skills. The goal in this regard should not be to focus on training in specific technical areas, but instead, creating an environment that fosters life-long learning and innovation. Since there is no way to predict all the technical advancements that will be made in the coming decades, it is instead important to develop employees that can adapt by encouraging their curiosity and desire to learn.

In addition to the continuous development of technical skills, there are other skills that have become just as critical in the transportation community. Communication clearly plays a more crucial role in the planning, development and operation of safe and efficient transportation systems. Unfortunately, highly technical people have often been stereotyped as lacking such communication and social skills. However, in this day and

age, as the industry globalizes, a new paradigm must be established. Once again, setting this direction begins very early in a student's development, and curriculums need to be expanded to assure the development of these "soft skills" that will be required by the changing transportation workforce.

As an example, technical college programs such as engineering are beginning to incorporate the development of "soft skills" into class curriculums. Although the usual focus of engineering work is problem solving, it is important to teach students how to clearly communicate their ideas and proposed solutions. In the workforce they will likely need the ability to analyze and summarize highly technical material in a manner that can be understood by not only other professionals, but politicians and the public. In such settings, they also need the ability to make persuasive proposals in a manner that instills confidence, but does not discourage others from contributing their own thoughts. Many of these skills can only be developed through practice, and colleges should integrate such opportunities as students present design projects or research papers. The importance of verbal communication and teamwork cannot be overemphasized, and must be modeled in all aspects of coursework. Working in teams also teaches students flexibility and the ability to consider multiple approaches to problem solving, skills necessary for meeting future client needs.

Finally, as more U.S. transportation companies become multinational, it is imperative that students learn to gage the social and cultural environment they will be working in. This can be developed with a base knowledge and respect of other cultures, as well as a strong foundation of ethical behavior. This learning can be fostered in students by introducing them to other cultures and using more examples in classes of projects and issues in other countries. The way in which other countries address environmental and societal needs as well as sustainable design, are simply examples of the benefits that would be gained through such exchanges.

By creating an environment that fosters life-long learning and by emphasizing the development of those skills that are needed to interact with a more diverse community, both current and future transportation professionals will be better prepared to meet the new challenges they will face. Creating the next generation transportation workforce is not only about attracting more people to this field, but also assuring that they have the skills they need to be successful.

## **CLOSING**

This past year, the nation celebrated the 50<sup>th</sup> Anniversary of the Interstate Highway System. Just two years before, America recognized the 100<sup>th</sup> Anniversary of the first powered flight by the Wright brothers over Kitty Hawk. These events remind us of the powerful changes that have occurred in the past century that have completely transformed transportation and the world. These events also provided the stimulus for new generations of men and women to become part of this profession. Although the industry faces many challenges, one cannot help but reflect on the opportunities that will stimulate the imagination of the next generation of transportation professionals. It is incumbent on



today's transportation community to plant the seeds for that development, and lay the foundation for building this new workforce.

## BIBLIOGRAPHY

- Butz, William P. and others, eds. "Will the Science and Technology Workplace Meet Requirements of the Federal Government?" Washington, DC: RAND Corporation, 2004.
- Committee on Future Surface Transportation Agency Human Resource Needs: Strategies for Recruiting, Training and Retaining Personnel, Transportation Research Board of the National Academies. *Special Report # 275, The Workforce Challenge: Recruiting, Training and Retaining Qualified Workers for Transportation and Transit Agencies*. Washington, DC: Transportation Research Board, 2003.
- Committee on Prospering in the Global Economy of the 21st Century: An Agenda for American Science and Technology, The National Academy, The National Academy of Engineering, and the Institute of Medicine of the National Academies. "Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future." Washington, DC: National Academy of Sciences, 2006.
- Committee on the Engineer of 2020, National Academy of Engineering. *The Engineer of 2020: Visions of Engineering in the New Century*. Washington, DC: The National Academies Press, 2004.
- Fox, Marye Anne. Government -University-Industry Research Roundtable, National Academy of Sciences, National Academy of Engineering, and Institute of Medicine of the National Academies. *Pan-Organizational Summit on the U.S Science and Engineering Workplace: Meeting Summary*. Washington, DC: National Academies Press, 2003.
- Jackson, Shirley A. , *Envisioning a 21<sup>st</sup> Century Science and Engineering Workplace for the United States: Tasks for University, Industry, and Government*. Washington, DC: National Academies of Science, 2003.
- Subcommittee on Oversight of Government Management, Restructuring, and the District of Columbia, Senator George V. Voinovich, Chairman. "Report to the President: the Crisis in Human Capital." December, 2000.
- U.S. Census Bureau. *The Statistical Abstract of the United States*. 2000.
- Warne, Thomas R. and others, eds. National Cooperative Highway Research Program (NCHRP) , Transportation Research Board of the National Academies. "NCHRP Recruiting and Retaining Individuals in State Transportation Agencies." Washington, DC:: Transportation Research Board, 2003.

