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PARTNERS IN TECHNOLOGY

It is a great time to be in Washington with the changes that are taking place. It is a wonderful time to be there in terms of technology. I hope I can make a difference, but clearly one of the reasons FHWA picked me from outside government to work for them is because the interface between research and development and the implementation with the state and local communities has not been as good as it should be. We have a lot of good programs within the highway community and within the transportation agency and we do a lot of wonderful things in this country. But, one of the truisms that we all come to learn is that the United States is terrific on innovation and pretty lousy on implementation. We need to be absolutely sure that we make a seamless transition. That is why the theme of the conference "Partnerships for Quality" is so important and why these sessions are so important.

I like to think that the ultimate partnership in government has been the partnership between the federal government and the states' transportation systems. It is the one that is heralded most often as one that really works. It has been a true partnership not only on the technology side but on the standard side. We have worked together for many years but that doesn't mean that now it can't be done a little better and a little differently. Certainly the relationship between the Academy of Sciences and TRB and the NCHRP programs and manufacturers like Bill Spreitzer's organization and others and ours have been a great partnership. But we really need to do a better job.

I'd like to put research in context and give an overview from my perspective. In the mid-1980s, a series of National Cooperative Highway

Research Projects (NCHRP) was started and was called the "20-24 series." It was primarily popular to management and aided management in the administration of agencies. NCHRP, up until that point, had been on the hard-side research--some planning efforts, but not a lot to help the chief administrative offices in the administration of departments. I participated with Dick Mudge from Apogee Research in putting that management research agenda together. One of the first projects we did was 24-1, which was the use of market research in the management of transportation agencies. The results of that study didn't get a lot of publicity because it produced a handbook on how to use marketing research in running our perspective agencies and it was fairly technical. But I'll never forget some of the main outcomes of that program, one of which was the hiring of Gordon Black Associates, a national polling organization from Rochester, New York (you frequently see their graphs on the front of *U.S.A. Today*.) They polled about 1500 people in different focus groups throughout the country. Leaning primarily to the financial area, they asked questions like what will it take to get more financing and what is the perception of the customer and what are the customers seeing as their needs and how much are they willing to pay. The initial reaction was that respondents were not willing to give any more money. The main reason they weren't willing to give anymore money to transportation agencies was that they didn't think we were spending it wisely now. Somewhat later, they were asked that if they could run a transportation agency the way they wanted to, how much money would they be willing to raise? The results were quite startling. We're used to thinking in terms of a penny or two here and there in our legislatures and maybe a penny or two at the national level. Most people on the street said they would be willing to pay from 50 cents to \$1 a gallon to finance transportation if it were managed in a way they thought was appropriate. When we asked why didn't they think transportation agencies were being managed appropriately now, they responded that we seem to be doing the same old things--it was primarily a reflection of maintenance activities. Looking back, we have been building roads and bridges for years, and bridges are deteriorating--we are fixing them over and over again; we are fixing the same potholes over again. The impression was that we were a pretty stodgy, old-fashioned industry that was doing things the same old way.

When participants responded to the question about how they would run the agency, they said that they don't know but wanted high tech solutions to today's problems. I think that reflects a couple of things: one is the changing demographics of our society--a lot of young people coming into the society who are more computer literate and are used to and accustomed to having technology aid them in their daily lives. They did not perceive (and I think incorrectly because there has been a lot of technology in our industry) that technology was really aiding the highway industry and they did not perceive that we were using it already.

With that background and putting it into context, we then moved into what I consider a watershed time during the last election in which a lot of people were giving insight into the nation's problems. I don't mean this in a partisan way at all, but it seems that in the last national elections, we were going through a major recession, peace was breaking out all over, the people were reorienting their priorities, we were worried about international competitiveness, we had a lot of national doubts about whether we could compete, and we were just uncertain as to the U.S.'s direction. At that same time during the election, it became very apparent that if the U.S. was to succeed internationally, technology would have to be at the forefront. We could not compete on a job-for-job or labor-for-labor point of view--we had to compete on a technology basis. The campaigns picked that up and, of course, when President Clinton came into the White House, he brought in a very strong drive for the use of technology and Vice-President Gore has picked that up. The President's technology initiatives talk about the use of technology, the furtherance of education, and international competitiveness. When Secretary Pena was appointed, we were delighted to hear about his desire to be known as the "Research and Development and Technology Secretary." Each secretary who has come to the DOT has left a special mark on the agency. When Sam Skinner was there, it was the "20-20" and the ISTEA legislation and that was an important and major contribution. Today we have an Administration that has grown up with technology, is driven by technology, and wants to use technology to advance the country's means to create jobs, and to accomplish the very things that Frank Francois keynoted this morning.

One of the first statements that Administrator Slater uttered in his acceptance speech when he was appointed was "We are in the midst of a revolution of transportation technologies that will transform our economy and daily lives much as did the arrival of the railroad, commercial aviation, and the Interstate System." So, clearly that initiative on technology and research and development continues.

You might like to look back on the federal funding situation and take a look in real dollars on what has been spent on research and development over the past 20 years, particularly in the past 12 years. The federal funding of R&D, (and that is all R&D funded by the feds), is about seventy-five billion dollars a year nationally. About five-hundred million dollars of that is for all transportation research. In fact, it was so bad that when we started meeting with defense people and talking about defense conversion earlier this year, and wondered why FHWA and Secretary Pena were not at the table on the technology initiatives being espoused by the Department of Defense, they said, "Oh, we didn't know the Department of Transportation was interested in research and development. We didn't think you were a player." It is no wonder with only \$500 million of the \$75 billion a year being spent nationally was being spent on transportation. Well, things are changing.

In the previous 12 years, as I said, we had a reasonably decent research and development budget on all modes of transportation. That started to trickle off to almost nothing until ISTEA was passed. Most of the research that was being done by the modal agencies was what I would call survivors (as you keep lopping off arms and legs and so forth in your program, you keep conserving the main core strength of the research). For example, at Turner-Fairbanks (where I work), some of the core research dating back to the '60s was limited to a few people cranking along with IVHS, but there was never any appreciable support for it at that time. But, when you get into the ISTEA era, there was quite a noticeable increase in research and development funding. Most of it was in the IVHS area and a lot was earmarked for special projects. The attitude and the philosophy that the Administration brings, as FHWA, if you will, reinvents itself to address the era of ISTEA, is very refreshing from a technical point of view.

Those of you who work closely with FHWA and are with the Kentucky Transportation Cabinet realize that the new freedom and responsibility you have been given to run your programs changes the role of FHWA away from program and federal-aid management and back to a more traditional role like the Bureau of Public Roads when it started. In looking at the history of the Bureau of Public Roads when it was first started, one of the main responsibilities was the dissemination of technology. I'm sure there is no one here who remembers there were road trains established in the 1920s. The equipment that was invented and developed at the federal level was loaded onto a flatbed railroad car and taken community by community across country. The equipment would be unloaded and demonstrated by building a mile of road for county supervisors and road managers. Then they would load it up on the train again and go another few miles and build another mile of road. That was the technology transfer aspect of the Bureau of Public Roads, which came under the Department of Agriculture. It operated much as the agricultural demonstration programs did under another wing of the Department of Agriculture.

With that as background, we are back to basics as we look at FHWA and what our role is in the future. The states have said to FHWA, "We want to do more of the program management, ISTEA gives us that responsibility, but we think research and development can be done on a better basis--on a pooled basis. That way, we won't have redundancies by having the feds take a bigger role in research and development, helping coordinate through the university transportation centers and through others a very vast and complex research community that is now in operation. It doesn't mean we are going to micromanage it but it does mean that we can get a lot more by pooling those efforts on a federal level sometimes than on a state-by-state level."

What are the prospects? As I said earlier, I'm very enthusiastic about the congressional prospects. Most members of Congress who are downsizing their defense industry are desperate to find dual-use technologies

that can be transferred over to the civil side, into the infrastructure side. A day doesn't go by that we don't get calls from national laboratories or defense contractors who have a solution and are looking for a problem. And, it looks like this is the way we are headed in the next year or two. The big national labs will probably be funded and major defense research contracts will be funded, but they are being told, "Go over to the civil and infrastructure side and try to find a problem that you can help them with." It is too complex in Washington to go to Congress and just take money from an authorizing committee on the defense side and give it to a transportation agency, things just don't work that way. But, I think in the near future, we will see a transition going in which transportation problems will be solved with "their money." We will define the problems (and when I say "we," I mean the total transportation community). It has to start at the grass-roots level. If it is going to work in Kentucky, you must identify national laboratory opportunities and defense contractors that can help you. We have to have that support from your members of Congress and then we have to build a pro-active research and development program on the federal level through FHWA to be approved by our administrators and then bought into by the Secretary. Then it can be taken to Congress so that when the potential earmarking takes place, it fits into a neat package.

I will just briefly cover some of the new efforts that are underway. You have read about some of the new money coming from the technology reinvestment project, the so-called ARPA projects or the defense projects in which defense contractors were encouraged to get into cooperative agreements with the government to develop specific projects. That was done very successfully during the heyday of the defense industry. Now they have taken the 'D' off the DARPA and made it ARPA. They are already on the street with solicitations, and maybe some from here in Kentucky have made proposals already. Those came in this summer. There is about five-hundred million dollars worth of money dedicated to that process. It encourages the private sector to team up with the public sector to put a proposal together and send it to the Department of Defense. They are then evaluated by teams and they are going to be awarded, I think, later this fall.

For example, composite technology: the use of composites as developed by the military for the B-2 bomber--carbon fiber products, reinforced plastics, that kind of thing. Obviously, the military has done a terrific amount of work with that and there are some opportunities in looking at bridges and structures for the use of that kind of technology. Several proposals have been submitted and we are part of the teams evaluating those projects with ARPA.

Additionally, there is the surface transportation R&D plan that was required by Congress that the Volpe Center in Cambridge put together on behalf of the U.S. DOT. It was submitted to Congress about a month ago. I recommend that if you want to see where the national R&D program is going (from a U.S. DOT perspective), get the two volumes of that plan because that is a good overview.

Finally, we were asked by the Secretary and FHWA Administrator Slater to take a look at the '95 budget and recommend areas where we could, if we had more money (and going back to the scenario where money had been coming down, down, down all during the '70s and '80s), use either facilities from the military, or if it were appropriated directly to the DOTs, where you could usefully spend it. A high priority area for infrastructure renewal was highlighted, for example. We spent a lot of time talking about how the high-technology end of IVHS could increase the through-put on urban highways, maybe 20-35 percent. But, let's not forget that there is the hard side of the business where we have lane miles of roads and bridges closed everyday. If they were open for traffic, it could increase the through-put in those areas 20-35 percent.

Learning how to and applying pavement technology and bridge technology that has 40-50 year pavement life rather than 25-year pavement life, and bridge lives that are longer is clearly important to the productivity that Frank talked about this morning.

In the partnership area, in arranging partnerships, there are many opportunities. There is the University Transportation Centers program that started with 10 universities and is now at 13. I know you are very active with that program at the University of Kentucky. It is a good program. I think it has worked very well. Some people in the early days were hung up as to whether this would create additional associate professors and graduate students rather than really good, useful research. From my perspective, I don't really care so long as it provides opportunities to train professionals to come into our business. We know there is a shortage looming ahead and when UTC creates transportation professionals to come into the federal, state, and local governments to do transportation, that is satisfaction enough. I don't think we should micromanage the UTC program to the point that we have to have bonafide research results by spreading \$13 million over 13 universities. That is very hard to do from the Washington level and there is a danger that we are tending to micromanage it. We force the universities to come up with a very detailed research and development program, then we go back and audit it afterwards. We spend a lot of money on paperwork. We ought to trust the universities, the local officials, and the states to put a program together, we don't have to tell them how to do it. That money should be used to advance transportation in ways that the states see fit to do it.

There used to be a term named highway planning and research, which is now called SP&R, that mandates that two percent of every state's apportionment go into planning and research. More importantly, it now mandates that a quarter of that go into research only. Prior to ISTEA, states could move HPR around and put it all into planning if they wanted to. There was a drive in Congress to make sure that some of this found its way into research. There are new regulations that are being promulgated through a notice of proposed rule-making this month (we hope to have it out by the first of the year) which will give new

flexibility to the states. We don't want to touch a piece of paper if we don't add value to it in the process. This rulemaking will guide a state-run research and development program based on certain initial criteria, with a voluntary oversight program, a peer review program, if you will, and an audit at the end to verify results. This will put a lot of new money into the states for research and development to be managed the way they need to do it.

One of the organizations that comes under the Turner-Fairbanks research lab is the National Highway Institute. They have traditionally taught over a hundred courses a year, through five hundred sessions to state DOTs and other local units of government on a host of technical highway subjects. They also have worked closely with the University Transportation Centers and with the Pan American Highway Institute which has been getting a lot more attention transferring technology to South and Central America--one of the large emerging markets for our country.

Frank mentioned HITEC--it is under the Civil Engineering Research Foundation of the American Society of Civil Engineers. We have funded this through ISTEA at \$3 million over four years as seed money to get it going. In 1994, they will be ready to receive applications that address implementation and evaluation of new technology. All of us who have run agencies are haunted by the possibility of somebody walking into our office with a product he thinks can really make our highways last longer, be stronger, and operate better. But, he can't get it accepted because the feds won't reimburse him for something not federally accepted in the standards. Your engineers won't specify it if it is not reimbursable and he can't get there from here. For years, we have needed an advanced evaluation and accelerated evaluation process where entrepreneurs can bring their products to market more quickly. The intention of HITEC is to create a forum of users (i.e., states and feds), of contractors and academia who can help evaluate products and evaluate projects in an accelerated way. Therefore, if the state does want to specify the new product, they can have some assurance that it has gone through a thorough process of evaluation and that it has sort of a good housekeeping stamp of approval. This way, they are reducing risk. We don't take many risks in our business unfortunately because we are a very conservative industry, but we need to have some assurance so that public officials will take those risks more frequently.

I mentioned the Research Coordinating Council, within the U.S. DOT--the modal administrators of R&D have met once a year in the past to coordinate research. Well, you can imagine how much gets done once a year. The purpose of the meeting was to make sure there were not redundancies, but I don't think it worked very effectively. Under the new Administration, they are taking a careful look at the DOT Research Coordinating Council.

About a year and a half ago, TRB created the Research and Technology Coordinating Committee, which is composed of one-third govern-

ment, one-third academia, and one-third private sector officials. It meets twice a year to go over the FHWA research and development program to make sure it is real life and to make sure the issues that need to be researched are addressed. They have just arrived at a point now where they are beginning to make strong recommendations. Some of the more important work they have done is to encourage more consideration of sustainable, long-term transportation within the resources that are available.

We have a very aggressive FHWA Strategic Plan. It is an effort to take a careful look at what we have been doing in the past and what our goals and objectives are in the future. Clearly, the technology transfer and research and development parts of this plan are very important.

I don't want to leave the podium without mentioning the Dwight D. Eisenhower Fellowship Program which is a very good program. (I know some U.K. students are participating.) Some of the fellowships are small, short in duration--three or four months to work on a specialized project at Turner-Fairbanks in McLean. But others pay anywhere from a year to four years of education for a masters degree up to a PhD level--a 100 percent funding including a living stipend. The biggest one we gave out this last year was \$101,000 for a four-year PhD program. The minimum fellowship was \$16,000--we announced 25 of these this year. I would certainly urge those of you in the academic community to keep online with those programs. For any students who are interested, this is a terrific opportunity to grow transportation professionals.

Let's talk about technology transfer. Cal and I were discussing this last night and he suggested changing the term technology transfer to technology exchange, and I think he is right. We ought to call it exchange because transfer tends to infer one-way transfer rather than two-way transfer. I talked to two past-directors of the Turner-Fairbanks laboratories to get some guidance when I took my new job in December and both of them said the first item on the agenda was that I should not do any new research at all. I would just go into the back room and dust off all those reports that have never been implemented. I am sure that here at the University of Kentucky and at research institutes all over the country, we have stacks of good research and development that, unfortunately for us, have been picked up more quickly by the Europeans and the Japanese than in this country. Job one (if there is a job one in this business) is to make sure we implement the research that has already been done--SHRP research is a good example.

Practitioners in the field are very slow to implement new work. They don't like to take the risks, that cost more money, but if we are going to have our system last longer and serve your customers, we just have to find a way to have a seamless transition of this technology. It has to be from the very basic local level all the way back to the federal level. We should all dedicate ourselves to making sure that research is implemented.