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U.S. Department of Transportation
Federal Highway Administration



Czech Republic Study Tour

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CHAPTER 1: EXECUTIVE SUMMARY

On September 6-14 2007, the Federal Highway Administration Rhode Island Division Office (FHWA-RI), Federal Highway Administration Resource Center Safety Office (FHWA-RC), Virginia Transportation Research Council (VTRC), Rhode Island Local Technical Assistance Program (RI-LTAP), and the Texas Transportation Institute (TTI) participated in the Central European T2 Meeting and a series of round table discussions. The group traveled to the Czech Republic for the CE T2 meeting; met with Czech Republic Ministry of Transport officials in Prague; toured the privatized CDV research facilities in Brno and Tisnov; toured several locations of roundabouts, bridges, tunnels and different types of asphalt and concrete pavements.

FHWA has a cooperative program with three Central European countries at this time including the Slovak Republic, Hungary, and the Czech Republic. The goal of FHWA's cooperation is to improve their access to road transportation technology, including institutional and program building activities, which can facilitate conditions for sustainable development, technology transfer, and enhance the flow of goods and information among countries for international trade and technology. The primary purpose of the visit was to continue T2 support and offer the team the opportunity to learn about technology transfer activities in the Central European T2 Group. The secondary objective included the opportunity to meet with various officials to discuss potential joint venture partnerships. Some of the benefits include a discussion of "road safety and roundabouts", workforce development and an International Summer Institute, Asphalt Testing Lab cooperation with TTI, Hungarian bridge work, and a proposal for VTRC to work cooperatively in nanotechnology of concrete analysis.



The Central European market offers many opportunities for networking and partnering. For example, the Organization for Economic Cooperation and Development recently published a report on speed management. The parties believe that shared effort in examining the "toolbox" in this document and in potential trial applications would be valuable.

Each team member that participated in the trip has identified market opportunities within their disciplines and developed a working relationship with a Central European contact. Some of the issues identified may take several years to develop. Other issues such as sharing information and newsletters can be implemented immediately. A more detailed discussion on these activities is outlined in this report.

There were discussions among the CE T2 group about revising the agreement to reflect our new partners and a research element for the CE T2 Group. This would have the advantage of providing a wider range of examples of tech transfer functions. A relationship with the US research facilities is a slightly different twist on the traditional LTAP program but it is one that works well in the European community. With respect to the International Office's program, it should also be emphasized that the relationship has great potential to benefit all partners in the program. This is evidenced by the knowledge gained by the study team as described elsewhere in this report.

CHAPTER 2: INTRODUCTION

ROAD INFRASTRUCTURE IN THE CZECH REPUBLIC

Background

The Czech Republic was established after the split-up of former Czechoslovakia into two independent states on January 1, 1993. The Czech Republic is a parliamentary democracy which consists of the Senate or Senat (81 seats; members are elected by popular vote to serve six-year terms; one-third elected every two years) and the Chamber of Deputies or Poslanecka Snemovna (200 seats; members are elected by popular vote to serve four-year terms). The head of the state, the President, is elected for a five-year term.

Czech Republic is bordered by the Slovak Republic to the east, by Poland in the north, by Germany in the west and by Austria in the southeast. Bohemia in the west consists of rolling plains, hills, and plateaus surrounded by low mountains; Moravia in the east consists of very hilly country. The landlocked country is strategically located astride some of oldest and most significant land routes in Europe; Moravian Gate is a traditional military corridor between the North European Plain and the Danube in central Europe.



With a total of 10.2 million inhabitants on 78,668 square kilometers, the Czech Republic belongs to the smaller countries of Europe. Of the country's total population, 90.4 % of the inhabitants are Czechs. The most numerous of the minority population are the Moravians (3.7%), living in the south of the Republic, while Slovaks and others (1.9% and 4%) make up the other ethnics in the country.

The Czech Republic is one of the most stable and prosperous of the post-Communist states of Central and Eastern Europe. Growth in 2000-05 was supported by exports to the EU, primarily to Germany, and a strong recovery of foreign and domestic investment. Domestic demand is playing an ever more important role in underpinning growth as interest rates drop and the availability of credit cards and mortgages increases. The current account deficit has declined to around 3% of GDP as demand for Czech products in the European Union has increased. Inflation is under control.

The Czech Republic imports \$87.7 billion annually.¹ Machinery and transportation equipment account for 46% of the imported commodities and make up the largest share. Raw materials and fuels are the second largest commodities at 15%. Currently, Czech Republic imports 66.2 % of the commodities from the EU (Germany 31.9%, Italy 4.6%, Slovak Republic 8.5%, Poland 5.7%, Austria 5.1%, and UK 4.8%).

State Transport Policy in the Czech Republic²

Transport is one of the key sectors of the Czech Republic's economy with significant potential for international relations. Demand for the transport of passengers and goods has been growing constantly and the objective of the Czech administration is to create legislative and economic conditions for

¹ CIA Fact Book 2007

² Transportation Policy Czech Republic 2005-2013

providing public transport services as well as for business activities in the transport sector, and to establish a transport infrastructure to meet growing transport demands. Preparation of the legislative and economic tools for transport regulation and infrastructure development is a major focus. They also focus on meeting sustainable development requirements and, at the same time, consider the financial capabilities of public budgets in the Czech Republic. The transport policy of the Czech Republic for the period starting with its accession to the European Union until 2013 follows the European Union programming period framework and emerges from the analysis and evaluation of the Transport Policy of the Czech Republic published in 1998. This policy formed a part of the transport sector strategy in the pre-accession period of the Czech Republic to the EU. The major objectives were met in the pre-accession period of the Czech Republic to the EU, including full adoption of EC legislation and the Czech legal system, harmonization of transport systems, and reform of the public administration (establishment of regions). Implementations of the objectives in the field of transport infrastructure, however, are questionable especially in view of the limited financial resources available.

The transport policy declares that the county and its executive structures must implement international linkages, and contracts on what they intend to implement (safety, sustainable development, economy, ecology, public health), and what can be implemented (financial aspects) in the field of transport. The transport policy has been drawn up in the context of international obligations adopted by the Czech Republic in connection with its membership of the UN, OECD and European Union, however, in consideration of the specific conditions and needs of the Czech Republic.

Road Safety

The Czech Government Council for Road Traffic Safety was established by the Government of the Czech Republic on December 1, 2004 through Government Decree No. 833, dated September 1, 2004. The Minister of Transport, Aleš Řebíček, was appointed as Chairman of the Council.

The Czech Government Council for Road Traffic Safety acts as a permanent advisory body to the government and a senior coordinating entity in the area of road traffic safety. The objective is to provide the maximum level of support to the improvement of safety on the roads – specifically, as part of fulfilling the National Strategy for Road Traffic Safety. The Council coordinates the activities of central government administrative bodies, the Parliament, individual regions, municipalities, non-governmental, non-profit organizations, as well as business entities active in this area.



Road Transport Infrastructure in the Czech Republic (Km)

	2000	2001	2002	2003	2004	2005
Total road and motorways network	55,410	55,427	55,422	55,447	55,500	55,510
European road network, type E	2,596	2,600	2,599	2,599	2,601	2,601
Motorways in operation	501	518	518	518	546	564
Expressways ¹⁾	299	300	305	320	336	322
Other roads	54,909	54,909	54,904	54,929	54,953	54,945
I. class roads	6,031	6,090	6,102	6,121	6,156	6,154
II. class roads	14,688	14,636	14,668	14,667	14,669	14,668
III. class roads	34,190	34,183	34,134	34,141	34,128	34,124
Local roads	72,300	72,300	72,300	72,927	72,927	72,927

Source: ŘSD,
ČSÚ

1) Length of expressways is included in the length of I. class roads

Connection to the European Road Network²

The state border of the Czech Republic is 2290.2 km long. The Czech Republic has a common border with five countries:

- Slovakia 251.8 km (11.0%)
- Germany 810.3 km (35.4%)
- Poland 761.8 km (33.3%)
- Austria 466.3 km (20.3%)

Traffic distribution on all road border crossings in 2005² is as follows:

Country	Number of Crossings	Road	Rail	Air
Slovakia	16	662,947	45,603	X
Germany	34	811,495	15,558	X
Poland	28	661,032	3,915	X
Austria	16	479,277	10,878	X
Total	94	2,614,751	75,954	204,360

Citizens abroad by border crossings in 2005² is as follows:

Country	Number of Crossings	Road	Rail	Air
Slovakia	16	7,754,160	610,486	X
Germany	34	9,321,245	177,031	X
Poland	28	6,511,998	44,591	X
Austria	16	6,472,245	120,844	X
				2,432,486

Purpose and Scope of Study Team Trip

FHWA has cooperative programs with three Central European countries at this time including the Czech Republic, Hungary, and the Slovakia. The goal of FHWA’s cooperation is to improve their access to road technology, including institutional and program building activities, which can facilitate conditions for sustainable development, foreign direct investment, and enhance the flow of goods for international trade.

The primary objective of the Study Team’s CE T2 trip was to identify, develop and adopt best practices from the Czech Republic concerning safety programs, regulatory standards and traffic policies. In addition, the team wanted to coordinate with the Czech Republic in methods of gathering data to define safety problems and develop or refine solutions. Finally, the team intended to observe emerging technologies and emerging traffic safety programs to support the FHWA’s Vital Safety Goal.

The second purpose of the visit was to offer the Rhode Island team the opportunity to learn about technology transfer activities in the Central European T2 Group. The third objective included the opportunity to meet with various officials to discuss research opportunities and potential joint venture partnerships in different disciplines. Some of the benefits include a discussion of “road safety and roundabouts”, workforce development and an International Summer Institute, Asphalt Testing Lab cooperation with TTI, Hungarian Workforce Development Plan for Maintenance, and a proposal for VTRC to work cooperatively in nanotechnology applied to concrete analysis.



Each team member that participated in the trip has identified market opportunities within their disciplines and developed a working relationship with a Central European contact. Some of the issues identified may take several years to develop. Other issues such as sharing information and newsletters can be implemented immediately. A more detailed discussion on these activities is outlined in this report.

Past Cooperation

The goal of FHWA's cooperation is to improve their access to transportation technology, including institutional and program building activities, which can facilitate conditions for sustainable development, foreign direct investment, and enhance the flow of goods for international trade. The Slovakia-Rhode Island Technology Transfer Partnership, or twinning relationship, was first initiated in 2001 at a meeting facilitated by FHWA between Peter Barek, Director General of the Road Infrastructure Section, Ministry of Transport, Post and Telecommunications of the Slovak Republic and officials from the RIDOT, Rhode Island Division of FHWA, Rhode Island LTAP Center, and the University of Rhode Island Transportation Center (URITC). The meeting was held at the 2001 National Local Technical Assistance Program (LTAP) Symposium in St. Petersburg Florida.



This initial meeting was followed by a FHWA sponsored visit to Rhode Island by a delegation of Slovak Road Administration officials in July 2002. During this trip, the Slovak delegation met with officials from RIDOT, FHWA Rhode Island Division, the Rhode Island LTAP Center and the URITC. The Slovak delegation also attended the 2002 National LTAP conference held in Burlington Vt. As a follow-up to the Rhode Island meetings, the Slovak Road Administration (SRA) invited its US twinning partners to meet with the SRA to gain first hand knowledge of the Slovakian transportation program's objectives, practices and procedures. Our cooperation with Slovakia continues at this time, and the intent of the SRA and FHWA meeting was to develop a stronger and more productive partnership.

Since then the CE T2 group has met each year to discuss issues and follow up on action items several more visits have occurred by CE T2 members to the United States. A US study team last visited Slovakia in May of 2004. The primary objective of the Rhode Island Study team's CE T2 trip was to identify, develop and adopt best practices from the Slovak Road Administration. In addition, the team wanted to coordinate with the Slovak Road Administration in methods of gathering data to define safety problems and develop or refine solutions. In 2007 two Slovakian Engineers from the TRC visited the Rhode Island DPW.

CHAPTER 3: INTERNATIONAL LTAP PROGRAMS

Rhode Island, a typical US LTAP center, has participated in the Local Technical Assistance Program (LTAP) since January 1991 and been participating in the International LTAP Exchange twinning arrangement since 2001. Under this program, the Rhode Island Technology Transfer Center (RI T2) serves as a distribution point for technical information that can help local transportation officials. The methods of technology transfer include workshops, newsletters, videos, site visits, and other forms of assistance.

The Center's primary customers are the highway, public works, engineering and municipal staffs of the state's 39 municipalities, the Rhode Island Department of Transportation and other state agencies. The T2 Center Director guides the Center's activities with input from a group of advisors. The advisors include local public works officials and employees from rural and urban municipalities, representatives of the FHWA Rhode Island Division Office, the Rhode Island Department of Transportation, other T2 Centers and private industry.

The Central European T2 Group LTAP activities are similar to those in the United States only their customers maybe different. The study team met with the Central European T2 Group, which includes the T2 Centers from the Czech Republic, Hungary, and the Slovakia Republic along with their US twinning partners, Virginia, and Rhode Island respectively. The meeting among the European Centers appears helpful in providing examples of what each T2 Center is doing. Interestingly, the European LTAP model has its roots with the Transportation Research Centers in each country. This makes sense since they each undertake technology transfer and work for the Ministries. Thus, a research element for LTAP is recommended in the USA in support of the national transport agenda.



There were discussions among the CE Centers about revising the T2 agreement to call it the US-CE T2 group and adding TTI to the group. It was also noted that the group should continue to try and meet face to face when the opportunity permits itself. TRB and the National LTAP Annual meeting are an excellent place for this group to network. In addition, Webinars should be explored. The role of the US partners in the CE T2 Group is in the early stage of being defined. At the moment, the bilateral interactions between the twinning partners will be expanded to included group interactions. With respect to the twinning relationship, it should also be emphasized that the program has great potential to benefit all partners in the program.

Specific LTAP Proposals from Czech Republic:

1. Share best practice by considering Webinar Technologies with the partners of the US-CE T2 Group.
2. Share T2 Newsletters and materials with the group and translate information where possible. Link websites with partners and provide some computer support.

3. Promote participation at National TRB and LTAP meetings by inviting CE T2 countries to attend. Consider hosting International CE T2 Group Meeting in US.
4. Update US-CE T2 Agreement and attend next meeting in Kosice, Slovakia October 10-15, 2008.

CHAPTER 4: SAFETY PROGRAM

Traffic safety is an important criterion in Czech Republic for evaluating the design needs of the roads and bridges and in qualifying them for repairs and reconstruction. The Czech Republic justifies the construction cost against the significant economical losses resulting from traffic accidents. High Accident locations are called “Black Spots” in the Central European terminology, and are analyzed for each motorway.

In 2005, 41,600 people were killed on the roads in the EU. This is far from the joint target of no more than 25,000 fatalities a year by 2010. About two thirds of the accidents and one third of the road fatalities are in urban areas. The risk of being killed in a road accident is six times higher for cyclists and pedestrians than for car users in the EU.



To make citizens more aware of their traffic behavior, education and information campaigns are of high priority in the Czech Republic. Special road safety campaigns and special initiatives for training young people were discussed with the CDV and the Ministry. They are currently reviewing their laws and legislation on driver’s licenses and education. There is also a “Fit to Drive” Congress in Prague schedule in May 2008. One interesting topic was the use of Driver Simulators by High School students to meet the required hours of behind-the-wheel driving for the road test. Rhode Island indicated an interest in purchasing the \$10,000 simulator to evaluate its use in Rhode Island schools.

The stakeholders have suggested using the EU National Framework known as “Sunflower” to compare the affects of safety initiates in the EU vs. some US states such as TX, VA and RI. This model could be used to support activities such as enforcement devices in towns and cities for high red light running or speeding rates.

The Czech Republic has a dedicated program promoting the use of roundabouts as a low-cost traffic congestion improvement solution at intersections. We observed numerous roundabouts and they appeared to be well accepted by the public and local governments. The Team found that roundabouts are an excellent option rather than signalized intersections to mitigate bottlenecks at these urban intersections. The team also discussed how work zone signing was used in the rebuilding the roundabouts or repaving of the surface. A copy of the Czech MUTCD Manual was obtained.

The Czech Republic has a standardized crossing design program to assist blind persons in crosswalks. The team observed numerous crosswalks where this standard was used and feels that it has application in the United States. The Team found the design to be low cost and easy to implement in the US and recommends a test application be tried.

Speed and speed-related fatalities are a substantial contributor to the safety problem in both the U.S. and the Czech Republic. The Organization for Economic Cooperation and Development recently

published a report on speed management. The parties believe that shared effort in examining the “toolbox” in this document and in potential trial applications would be valuable.

Specific Safety Improvement Proposals from Czech Republic:

5. The use of the inexpensive simulator for driver technology is a promising idea that should be evaluated. Rhode Island indicated a willingness to evaluate such a simulator.
6. The team recommends that some research and analysis be performed in the United States on the EU standard Crosswalk for the Blind. Stripping Examples and Pedestrian Crossing Education could be topics for future discussion.
7. Cooperation should continue on the “Sunflower“ Project Model. What would be the impact of the model in the United States on the accident rates and severity? Is video surveillance a good tool for safety and security in urban transport?
8. It is recommended that the parties exchange views on the OECD speed management toolbox and to consider a joint trial approach.

CHAPTER 5: WORKFORCE DEVELOPMENT PROGRAMS

The team found that the current workforce development issues we are experiencing with our aging workforce can also be found in the Czech Republic. A recent Prague Post newspaper article noted the following:

“Even though the development of the expanding high-tech sector grabs most of the country’s current attention, attracting people to low-tech jobs is becoming a burning issue for many businesses. Many firms are finding it increasingly difficult and time-consuming to recruit suitable applicants in the traditional trades, such as welders or plumbers. Thanks to strong economic growth, unemployment has reached levels not seen for almost a decade, with the jobless rate now standing at only 6.4 percent. “We have now reached a point where, in core industries, too few take up apprenticeships to become electricians, metalworkers or welders, and too many leave these schemes,” said Sebastian Holtgrewe, spokesman of the German-Czech Chamber of Industry and Commerce. Taking on foreign workers can only be an “interim solution,” he added. “It is important for the Czech Republic to modernize its education system so that it is able to fulfill the demand for qualified employees in manufacturing and engineering.”



One suggestion was to internationally link the academic activities included in FHWA’s Summer Transportation Institute Program to allow the students to experience some of the international aspects of transportation and to develop the skills and confidence necessary to address problems and produce solutions not just in the United States but also globally. These activities could stimulate interest in language learning and provide students with a direct experience. The objective is to expose students to the transportation industry and helps the students to identify and start developing the skills that will produce a diverse and well qualified workforce for the 21st Century.

Students will learn about the systems and people that support the roadways and transportation networks in the world. They will have the opportunity to work on hands-on activities and projects with other countries. International leadership and teamwork skills will be developed through projects, challenges, games and activities.

Specific Workforce Development Proposals from Czech Republic:

9. It is recommended that FHWA internationally link the academic activities included in FHWA’s Summer Transportation Institute Program to allow the students to experience some of the international aspects of transportation.
10. Recognizing that the skills set to be utilized in transportation are similar for international countries, it is recommended that the URI STI program for Island middle school students work with CDV to develop an international element to careers in transportation.
11. The potential exists to begin exchange programs with the International Research Institutes.

CHAPTER 6: TRAFFIC MANAGEMENT PROGRAMS

The Czech Republic has a general Speed limit that is different from the European Union standard on its lower level roads but the same on its expressways. Like in the United States, speeding continues to be one of the most significant contributing factors to fatal crashes. One of the major issues for speed related crashes is the impact of following too closely or aggressive driving. Driver headway is an important question with much attention being given to unsafe headways or 'tailgating'. Recent studies have measured and modeled safe distances, demonstrating how following distance depends on a wide range of factors. These include variations in following distance for any particular driver and the relationship with following distances of drivers of differing nationalities and ability and the state's laws or requirements.



International collaboration and cooperation is needed to test and evaluate the effectiveness of low-cost, speed-activated tailgate warning system (Tailgate) on speeding and safe following distances. A study is proposed to simulate in a laboratory and then install speed-activated display that warns drivers of tailgating. The device would provide a warning and/or a simple message (e.g., TAILGATING, TOO FAST; SLOW DOWN, etc.) to specific drivers only (i.e., those exceeding a particular threshold). The device could work with existing VMS signs or a newly developed small roadside device. This collaboration would involve the Czech Republic Research Center, URI, and TTI where the device could be installed and evaluated.

Specific Traffic Management Improvements Proposals from Czech Republic:

12. International collaboration and cooperation is needed to test and evaluate the effectiveness of low-cost, speed-activated tailgate warning system (Tailgate) on speeding and safe following distances. A study is proposed to simulate in a laboratory and then installed speed activated display that warns drivers of tailgating
13. It is recommended that the group work with the Slovak Research Institute to share information on Transportation Management in Mountainous Areas; Traffic management speed control for trucks etc... for tunnels.

CHAPTER 7: ENVIRONMENTAL OPPORTUNITIES

In the European Union, over 60% of the population lives in urban areas.³ Just under 85% of the EU's gross domestic product is created in urban areas, and therefore, the cities and towns are the drivers of the European economy. They attract investment and jobs, and the EU feels it is imperative that the quality of life in these areas should be as high as possible. One particular example that stands out is the Charles Bridge in Prague. This 650 year old bridge is in it self a tourist attraction.

In its 650-year history, Charles Bridge has only had only three major renovations. The current overhaul — the fourth — will take more than a decade to complete and could cost \$48.6 million. The first stage took two years to finish and stabilized the bridge by anchoring two of its buttresses. In the next stage, the surface will be removed one large section at a time so that the bridge is never closed. The stones that now pave the span will be reused and this phase of the project will take two to three years and the resulting construction should last for at least half a century. The bridge brings the city so much money that this reconstruction cost is only a small percentage of income from tourists over the years. The bridge has 17 statues that are part of the tourism attraction that will not be repaired or replaced as part of the current project. They are in the custody of the City Gallery Prague, which continually restores them as necessary. Rhode Island noted that they are currently making a linear pedestrian park of their existing historic Washington Bridge with planters and a walkway. The state should consider some of the applications used in Prague as a model.



The group observed this attitude with a visit to a rail link that combined context sensitive design with public transit. To improve the attractiveness of the area and safety of walking and cycling, local and regional authorities have fully integrated these activities into the development of the infrastructure. We observed innovative ways of ensuring sustainable communities in such areas as waste management in getting rid of damaged cars.

Another quality-of-life issue in the Czech Republic is Noise Abatement. The Czech Republic collects information on noise and the local authorities are then able to draw up noise abatement plans and implement measures. We observed several applications of noise walls in the urban area and other features to reduce noise. The authors feel the United States could benefit from an exchange of information with the EU on noise abatement plans.

Porous asphalt (PA) pavements are currently the best



³ Commission Staff Working Paper: Public consultation in preparation of the Green Paper on urban mobility -SEC(2007)1209 25.9.2007.

product for reducing vehicle tire noise and for rapidly removing water from the pavement surface. PA thus reduces the need for noise fences, which reduce lateral visibility, and minimizes surface water on the roadway during rainfall, which in turn, minimizes hydroplaning and splash and spray and maximizes wet skid resistance. Europe primarily uses porous asphalt pavement for noise reduction; whereas, state DOTs in the US primarily use porous pavements to maximize safety. Much information has already been shared between Europe and the US. The authors believe there are opportunities for significantly more sharing of information as more relevant technology is developed in the US and Europe. Both TTI and the CDV are currently studying PA.

Findings of the study team revealed that the CDV has limited asphalt cement and asphalt concrete pavement testing capabilities. If the CDV should desire to conduct a research project in which testing beyond their capabilities is required, TTI would be happy to collaborate with them.

The CDV is conducting state-of-the-art work on the ability of scanning electron microscopy (SEM) reveal performance-related properties of asphalt, particularly as the asphalt ages due to oxidation and possibly other factors. This SEM work could relate well to recently completed and current work at TTI on chemical analyses of naturally and artificially aged asphalts. This technology is also applicable to the investigation of the microstructure of concrete. Nanotechnology is getting lot of attention in many disciplines including concrete and has a high potential for improving the properties of concrete. Investigation under high magnification is needed in this new emerging field.

Hungary has experienced problems with the asphalt layer typically placed beneath Portland cement concrete pavements. These include water intrusion, pumping, and faulting. Further analyses and a better understanding of the underlying causes of these problems are needed by the study team. It is believed that the US may have effectively addressed these issues. There is therefore a potential for relevant technology transfer.

Specific Environmental Proposals in Czech Republic:

14. Rhode Island noted that they are currently making a linear pedestrian park of their existing historic Washington Bridge with planters and a walkway. The state should consider some of the applications used in Prague as a model.
15. The team identified a number of noise abatement activities and encourages the sharing good practice.
16. The CDV is conducting state-of-the-art work on the ability of scanning electron microscopy (SEM) reveal performance-related properties of asphalt, particularly as the asphalt ages due to oxidation and possibly other factors. This SEM work could relate well to recently completed and current work at TTI on chemical analyses of naturally and artificially aged asphalts. SEM can also be used to investigate the microstructure of concrete in an attempt to improve the properties of concrete.

CHAPTER 8: RECOMMENDATIONS

This report presents the results of the Study Tour of Czech Republic. Each group member that participated in the trip has identified opportunities within their disciplines and developed a working relationship with a Central European contact. Some of the issues identified may take several years to develop while others maybe implemented overnight. A more detailed discussion on these activities is outlined in this report.



Numerous items were of interest to the Team and the most promising of the proposals are listed. As a meeting wrap up, it was agreed that the partnership agreement would be updated to include new partners and renamed the US-CE T2 Agreement. Each member will share their mailing list structure, share newsletter, and link their websites. These activities have already been accomplished.



There were discussions among the CE T2 group about revising the agreement to reflect our new partners and a research element for the CE T2 Group. This would have the advantage of providing a wider range of examples of tech transfer functions. A relationship with the US research facilities is a slightly different twist on the traditional LTAP program but it is one that works well in the European community. With respect to the International Office's program, it should also be emphasized that the relationship has great potential to benefit all partners in the program. This is evidenced by the knowledge gained by the study team that is described

elsewhere in this report. It was also agreed that this partnership between the parties should be all inclusive, i.e., any of the partners can work cooperatively any time.

Attachment 1

Roundtable Discussions:

TTI Potential Cooperation: Mr. Button discussed numerous activities with the Central European group and found the following areas could have an impact in the United States.

An asphalt plug joint is a joint or transition from the bridge slab to the pavement that is about one foot wide and is filled with a highly flexible asphalt paving mixture containing asphalt rubber. The purpose of this joint is to permit differential movement of the bridge slab and the pavement. Certain European countries, including Czech Republic, appear to have had more success with these joints than agencies in the US. There is potential that a study of the European applications of this technology could bring fruitful information to the US.

Much information on porous asphalt pavements has already been shared between Europe and the US. The authors believe there are opportunities for significantly more sharing of information as more relevant technology is developed in the US and Europe. Two significant studies have recently been completed for Texas DOT, and an NCHRP study is ongoing.

The CDV research on asphalts using scanning electron microscopy could correlate well with recently completed and ongoing work at TTI on chemical analyses of naturally and artificially aged asphalts. When in Czech Republic, we provided CDV with contact information for Dr. Charles Glover, at TTI, who has conducted extensive chemical studies on aging of asphalt.

Based on conversations at meetings, the single most important transportation issue expressed by the CDV, VUD, and KTI was safety. TTI is recognized internationally for their work in the safety area and may have information that will assist these agencies in accomplishing their missions. A better understanding of their particular interests and problems is needed.

2. Workforce Development Issues and LTAP: The team from the Rhode Island LTAP Center met with the members of the Slovak Road Administration T2 Center to compare and contrast the two programs. It was discussed that before the Slovak Center implements a full training program; it must identify its customer. The Rhode Island Center had a similar experience over ten years ago. It was determined that the best way to identify the needs of the customer is to meet with them at their offices and maintenance yards rather than through surveys and correspondence. Once the customer knows and trusts you, then a meaningful relationship can begin.

The practicality of establishing and maintaining a library was discussed. It was determined that while a library is an important part of a T2 Center, with so much information available via the Internet, most individuals will conduct research from their own computer before traveling to a central location. This is a savings in both time and money for the Centers.

There were many more items to be discussed, but time did not allow it. Hopefully, a member of the Slovak T2 Center will be able to attend the National LTAP meeting this summer where the discussions can be continued.

3. VTRC possible cooperation: Dr. Celik Ozyildirim discussed VTRC projects on concrete and the discussions indicated mutual interest in the use of nanoclays to improve the properties of concrete.

Hydrated cement is porous with a pore size distribution that ranges from the nanometers to millimeters. The pores are a pathway for water and other aggressive solutions to penetrate into concrete causing deterioration. The addition of nanoparticulates, such as nanoclays, to concrete can reduce the occurrence and size of pores that can improve its durability and strength through physical and chemical interactions.

The microstructure of the binder is expected to be uniform without apparent lime crystals or the large pores when nanoclays are added. Availability of nanoclays is limited. Nanoclays are used in other industries too; however, the selection of the appropriate clay for concrete needs to be explored. VTRC has already initiated a project with nanoclays. Nanoclays are expected to improve the internal structure of concrete. To detect the improvements due to nanotechnology requires equipment capable of discerning changes at the atomic level. CDV has SEM that can examine the microstructure. A mutual study would reveal the appropriate clay and the expected benefits of using nanoclays. Initial limited work in this area by other researchers has been very promising. Small addition rates (2% or less by weight of cement) has led to large improvements in concrete properties at the fresh and hardened states.

APPENDIX A: RHODE ISLAND TEAM MEMBERS

Study Team:

Federal Transportation Agency: Daniel J. Berman

He has worked for the Federal Highway Administration for 32 years in transportation engineering and planning, at both the Regional level of FHWA and also at several Division Offices. He has crossed the country several times in these assignments and brings an in depth knowledge of FHWA's programs. Mr. Berman was the first Project Manager for the \$14.5 billion Central Artery/Tunnel (CA/T) Project in Boston, Massachusetts and successfully completed the Ted Williams Tunnel on time and within budget. In his current position as Assistant Division Administrator, he coordinates FHWA's policies with state officials and serves as the Division focal point for technology transfer and Strategic Planning. Dan works with a variety of agencies such as the Rhode Island Department of Transportation, the state's design consultants, statewide environmental and public interest groups such as Save the Bay and CLF, federal officials such as EPA and OIG, congressional staff representatives, various Indian tribes and the governor's office. He has developed many partnerships with these diverse groups and can offer a broad view of FHWA's Safety Goals and current activities.

Virginia Transportation Research Council: Celik Ozyildirim

Dr. Ozyildirim is a Principal Research Scientist with the Virginia Transportation Research Council in Charlottesville, Virginia, a division of the Virginia Department of Transportation (VDOT). He received his Ph.D. in Civil Engineering from the University of Virginia. He has been conducting research in concrete technology for over 30 years. He is active in American Concrete Institute (ACI), American Society for Testing and Materials (ASTM), and Transportation Research Board (TRB). He is a Fellow of the ACI. He is past chairman of TRB section on concrete and member emeritus of TRB Committee AFN10, Basic Research and Emerging Technologies Related to Concrete. He is also an instructor in civil engineering at the University of Virginia. He is a registered professional engineer in Virginia.

Local Public Works: Jeffrey Cathcart

Mr. Cathcart has worked as the LTAP manager and Public Works consultant for over 16 years and has over twenty 22 years experience in municipal and the private public works industry. He has conducted well over 125 public works education and safety seminars for the Rhode Island T2 Center and is considered an expert in public works safety management. Jeff brings technical expertise in the areas of design, construction and contract administration to the team.

University Texas Transportation Institute: Joe W. Button

Mr. Button is a Senior Research Fellow with the Texas Transportation Institute (TTI), Texas A&M University and has been with TTI since 1968. He served as head of the Materials & Pavements Division from 1995 to 2006, which had a ~\$7 million annual research budget covering all areas of pavements. Button has served as principal investigator of more than 80 asphalt pavements-related research projects. Sponsors of his research include the NCHRP, FHWA, SHRP, DOE, NHTSA,

ICAR, Texas DOT, and other state DOTs and universities as well as private industrial firms. He has developed new test procedures, equipment and analysis techniques; prepared specifications and materials acceptance criteria for highway agencies; conducted forensic studies; and written construction guidelines to improve asphalt pavement quality and probability of success. He has developed and taught short courses in pavement maintenance, asphalt technology, and benefits of asphalt additives. He has authored or co-authored 85 published papers plus about 100 research reports. He has presented his work at 80 research conferences at state, national, and international levels (including 39 invited lectures). His degrees consist of M.S., Civil Engineering, Texas A&M University, 1984; B.S., Chemical Engineering, Texas A&M University, 1972; A.S., Chemistry, Panola College, Carthage, Texas, 1965.

Federal Transportation Agency: Patrick Hasson

Patrick Hasson is the Safety and Design Technical Service Team Leader in the FHWA Resource Center. In this position, Mr. Hasson leads a national team of professionals specializing in highway geometric design, roadside design, safety engineering and safety programs. Mr. Hasson and his team provide extensive training, technical assistance and expert advice to State Departments of Transportation, local officials, national organizations and others. He spent two years in the Road Transport Research Program at the Organization for Economic Cooperation and Development. Prior to these assignments, Mr. Hasson worked on a variety of transport projects and programs with the FHWA, including activities associated with the transportation impacts of the North American Free Trade Agreement. Mr. Hasson holds a BS in Engineering from the University of Maryland and an MS in Engineering from Cornell University. He is a registered Professional Engineer.

APPENDIX B: CONTACTS IN CZECH REPUBLIC

Prague

Brno

Key people the team met with in Czech Republic:

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