Statement of
Honorable Paul R. Brubaker
Administrator
Research and Innovative Technology Administration
U.S. Department of Transportation
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Thank you, Chairman Wu, Ranking Member Gingrey, and distinguished members of the Subcommittee. I have the privilege of serving as the Administrator for the Department of Transportation's (DOT) Research and Innovative Technology Administration (RITA), and I am grateful to have the opportunity to come before you today to testify on RITA's role in coordinating and facilitating research into fuel efficiency and sustainability in our transportation infrastructure.

With his signature on the Federal-Aid Highway Act of 1956, President Dwight D. Eisenhower committed the U.S. Government to investing in the development of a transportation system that would revolutionize the American economy and way of life for decades to come. However, no one could have anticipated the sheer volume of passenger and freight movement that the transportation infrastructure must support yearly. Our roads handled nearly three trillion vehicle miles in 2005 alone—a 74 percent increase from 1990. As America's economy and population continues to grow, it will push even greater demand on our highways, interstates and roads in the decades to come. A safe, reliable, and sustainable transportation system is key to our nation's continued prosperity.

New construction, operational improvements, and routine maintenance of our transportation infrastructure have an enormous cost, and are straining federal, state and local resources. America has 162,373 miles of National and Interstate Highways, with nearly one-third needing extensive upgrades. Innovative, sustainable materials and systems provide us with the opportunity to construct new bridges and overpasses, expand capacity and make necessary operational improvements, with less resources and better long-term durability. Various factors, such as lagging national and state materials standards, technical barriers and budgetary constraints, have impeded the progress of the development and use of innovative materials, coatings, and planning processes that can increase the sustainability of our transportation infrastructure. It is clearly in our nation's best interest to have a transportation infrastructure that supports greater fuel efficiency, and is more sustainable. The Department of Transportation is committed to collaborating with stakeholders in government, industry and the academic community to overcome these challenges.

Today, I will be discussing current research and programmatic activities of RITA and the University Transportation Centers (UTC) program within the areas of energy efficiency and infrastructure sustainability; the processes that guide our priorities in these areas; and the challenges to the research, development and national deployment of innovative materials and technologies.

Research and Development Activities in Energy Efficiency and Infrastructure Sustainability

Since its creation in 2004, RITA has sought to effectively prioritize transportation research programs, identify innovation gaps, and coordinate research and technology efforts within the Department, and throughout the transportation community. While there are challenges to effectively promoting both the research and development, and widespread deployment of more energy efficient and sustainable materials and technologies, there has been a lot of progress as well. The Secretary of Transportation's seven priorities for national transportation have driven Departmental research and development in the areas of energy efficiency and sustainability—specifically by focusing on Reduced Congestion, Energy Independence and Environmental Sustainability.

Under the guidance of these priorities, the Federal Highway Administration's Turner-Fairbank Highway Research Center (TFHRC), ,and the University Transportation Centers, have made great progress in researching and developing innovative materials and technologies that offer the potential for increasing the sustainability of our transportation infrastructure.

University Transportation Centers

First, I would like to discuss a few of the University Transportation Center (UTC) research and development activities in the areas of energy efficiency and sustainability. The UTC Program is a great example of an effective partnership that brings together state transportation agencies and private sector stakeholders with the academic community to find solutions to pressing transportation challenges. UTCs are mandated to address regional issues that impact their states, and bridge the institutional divide—providing outstanding opportunities for technology transfer and deployment.

DOT seeks to tap into the vast pool of expertise, and existing research portfolios, of our nation's academic community by funding UTC transportation research—including energy efficiency and sustainability.

There are several great examples of the important work UTCs are engaged in:

- The Missouri University of Science and Technology at Rolla conducted a field test of a bridge deck made with fiber reinforced composites. Using composites precludes the use of steel bars as reinforcement, which will significantly extend the service life of the bridge, and eliminate the need to replace steel reinforcements at some point in the future. Missouri S&T is involved in numerous projects to study fiber reinforced composites, and their potential for upgrading aging bridges.

- The University Transportation Center for Materials in Sustainable Transportation Infrastructure (MiSTI) at Michigan Technological University conducts research in the areas of recycled and beneficial use materials in transportation infrastructure. For example, Portland cement production is a significant contributor to total

global green house emissions. Reducing Portland cement consumption is the simplest way to reduce this green house gas production. MiSTI is researching new methods of constructing concrete highways and bridges using less Portland cement, which will greatly reduce the environmental impacts of Portland cement production.

- University of California – Davis' Institute of Transportation Studies is evaluating modified binder mixes, comparing overlays with mixes using a new process for rubberizing asphalt binders. The results were extremely promising. Caltrans is reviewing the results and the recommendation to move to pilot projects and how to incorporate results. This research should lead to more use of rubberized asphalt, and longer lives for pavement maintenance and rehabilitation overlays, which will save money and reduce use of crushed stone.

- At the Georgia Institute of Technology, research has developed three acceptable mixtures for self-consolidating concretes for use in precast bridge girders. The use of these self-consolidating concretes will result in better quality bridge girders which require less construction labor and time on site, significantly reducing project costs. The improved materials properties will also result in more reliable, longer-lived bridge spans with reduced maintenance and repair costs.

U.S. DOT

Departmentally, there has been very good progress in pushing innovative materials technologies as well. Turner-Fairbank Highway Research Center is conducting research into developing methods for using more fly ash, a by product of coal combustion, in concrete mixtures for road paving. Fly ash is typically landfilled after it is produced, and using more of it in concrete mixtures recycles fly ash with little environmental impact. Pavements made with fly ash offer the potential for providing lower-cost, more durable pavement, which uses less energy to manufacture. Turner-Fairbank is also working on testing procedures, construction guidelines, and supportive software applications to promote greater use of fly ash in paving applications.

While Turner-Fairbank is exploring ways to use more fly ash in concrete mixtures, the FHWA is involved in a demonstration project for an advanced concrete material called Ultra High Performance Concrete (UHPC). This project is a part of the President's National Nanotechnology Initiative, and has broad energy efficiency and sustainability implications for transportation construction and maintenance. UHPC is composed of a special mixture of minerals and fibers that is lightweight, impermeable and resistant to freezing. This material offers the potential to reduce energy consumption across the lifecycle, as it is a precast concrete that can be constructed away from the worksite, and subsequently transported—reducing the impact on driving costs, reducing congestion created by construction projects, and lowering maintenance costs. In 2006, the first highway bridge built in North America with UHPC was opened in Wapello County, Iowa—this bridge was the result of a collaboration of FHWA, Iowa DOT, the Iowa State University Bridge Engineering Center, and private industry.

Partnerships such as this, and other collaborative relationships, are essential to our success in effectively facilitating research and development, and deploying research results in these areas. The multi-state, multi-agency, public-private makeup of our national transportation infrastructure necessitates cooperative research in order for us to be successful innovators.

Coordinating the U.S. DOT Research, Development and Technology Portfolio

While there have been very good outcomes from RITA's current research and development activities and investments, we are actively seeking to improve these processes. The U.S. DOT, through RITA, is instituting a new, Research Planning and Investment Coordination (RPIC) process for coordinating, facilitating and reviewing the Department's research and development programs and activities. It will allow the Department to:

- Align research investments with National transportation goals;
- Track performance and net benefits of Departmental RD&T dollars invested;
- Create visibility and transparency for all directed and discretionary research funding;
- Identify potential redundancies and eliminate unnecessary duplication; and
- Leverage available research resources including those within the U.S. DOT, at the UTCs, in the State DOTs, and in the private sector.

The goal is to achieve greater transparency and bring into one database all of the RD&T data that are currently scattered among many agencies, as recommended in the GAO report *Transportation Research: Opportunities for Improving the Oversight of DOT's Research Programs and User Satisfaction with Transportation*.[i] When completed, the database will allow policy makers, researchers, and other users to search for RD&T information by research topic, funding level, grant description, contractor, state, and more. It will be a critical tool for coordinating research investments, and for sharing knowledge.

Additionally, we believe strongly in promoting *Communities of Interest (COI)* among the Department's modal administrations, external partners and relevant transportation stakeholders. COI allow agencies, organizations, institutions and individuals to exchange information and resources through multiple knowledge systems. COI offer an excellent opportunity for organic peer review and collaboration, expanding the pool of expertise readily available to enhance progress across priority RD&T areas.

The Department's plan for achieving a safe, sustainable and more efficient transportation system, *Transportation Vision 2030*, defined an initial list of seven priority, multi-modal *Communities of Interest (COI)* that have a significant impact on the future of energy efficiency and sustainability:

- Multimodal policy and transportation systems research;
- Environmental stewardship and energy independence;
- Physical infrastructure;
- Surveillance infrastructure;
- Human factors research and applications;

- Materials; and
- Intelligent Transportation Systems.

Modal RD&T Collaboration within the U.S. DOT

While each administration has unique, mission-related research areas and topics it must pursue, the *Communities of Interest* model will ensure that priority cross-cutting areas will be addressed through collaborative processes, encouraging better knowledge sharing and leveraging of RD&T dollars. Specifically, Communities of Interest *in Physical Infrastructure* and *Materials* are driving cross-cutting research and development activities in energy efficiency and sustainability across U.S. DOT modal offices.

Intermodal research working groups and online forums are being established on these topics to cultivate ongoing collaboration among Departmental operating administrations, University Transportation Centers (UTCs), and U.S. DOT Centers of Excellence. *Communities of Interest* will help to ensure that related research is coordinated, fostering technology transfer through more effective sharing of outcomes and products.

Facilitating RD&T with External Partners

The U.S. DOT engages in cooperative research with stakeholders across the transportation sector, including other Federal agencies, state and local governments, the academic community, industry, and not-for-profit institutions. RITA has been working to build closer ties between individual UTCs and U.S. DOT programs to ensure that UTC research is targeted toward the critical transportation challenges as mandated.

The National Surface Transportation Policy and Revenue Commission recommended that "funding of RD&T … be subject to careful planning and review by the transportation industry."[ii] The RD&T planning team has reviewed the strategic research documents of key stakeholders and will continue to work with them to ensure consistent and substantive input into the research investment planning process. By providing greater visibility and transparency into the U.S. DOT's research programs, the U.S. DOT seeks to foster greater collaboration and leveraging of resources with state and local governments, the Transportation Research Board (TRB), and other relevant entities.

Challenges to the Broad Deployment of Effective Technologies

The Department's primary role in facilitating the broad deployment of innovative technologies is to provide the necessary support to demonstrate the viability of emerging technologies, and to establish the regulatory framework, standards and architectures to safely and effectively integrate new technologies into the transportation infrastructure.

The Department does not do this in a vacuum—across all of the modal administrations, U.S. DOT experts serve on over 300 technical committees of 48 Standards Developing Organizations (SDOs), seeking to ensure that new technologies and applications may be deployed to enhance transportation safety, security and mobility. These standards become the basis for DOT safety regulations and planning guidance. U.S. DOT experts

also serve on countless research panels and technical exchange committees to enable implementation of significant technological and operational innovations.

Many current construction and operational standards, and state transportation agency contracting procedures do not adequately support or incentivize greater use of innovative materials. Our friends at NIST are currently reevaluating existing standards and best practices, and developing standards for new materials, high-performance and adaptive concrete technologies, to determine how standards and specifications can be revised to reflect national priorities for the use of innovative materials in construction and maintenance.

More difficult is encouraging the deployment of incremental improvements in operational concepts, procedures and technology that do not rise to the level of a standard. In many ways, these smaller steps, often the result of U.S. DOT or state DOT research, are just as crucial to improving safety and efficiency. However, due to their incremental nature, sharing information on these advances across the many levels of government, multiple systems operators, and the contractor and consulting engineering community is difficult. This is where RITA's development of *Communities of Interest* is vital in expanding our processes for knowledge sharing, technology transfer and research implementation. Under the *COI* model, every project is required to have a mechanism for technology transfer and deployment by including state, institutional and industry stakeholders in the planning process.

The multi-state, multi-agency, public-private makeup of America's transportation infrastructure, its providers and users, requires strong institutional arrangements and partnerships to ensure successful cooperation when planning, evaluating or implementing research results. State and local DOTs, transit agencies, port authorities, railroads, trucking firms, carriers and shippers need to be aware of research results, implementing contracting and internal operating practices that encourage the use of new research and technology, as so much of the implementation of transportation infrastructure research is conducted at those levels of government, often through cooperation with the private sector. We believe that Public-Private Partnerships offer a practical, effective vehicle for overcoming many of these barriers.

Conclusion

RITA has made great strides in our young life towards coordinating DOT transportation research priorities, and we are working towards a national transportation research strategy and strategic plan. Innovative materials and Intelligent Transportation Systems will be two of the key priority areas we will address as we continue to advance in this direction.

U.S. DOT Activities

Development Of Portland Cement Concrete Pavement (PCCP) Mixtures Containing High Fly Ash Contents
FHWA/Office of Infrastructure R&D, Pavement Materials & Construction Team

Verify, integrate, and refine software, guidance and test procedures to facilitate the use of high fly ash content concrete mixtures for highway paving. The products of this research will contribute to both greater use of fly ash in highway paving applications and improved performance of the pavement.

Greatly Increased Use of Fly Ash in Hydraulic Cement Concrete (HCC) for Pavement Layers and Transportation Structures
FHWA/Office of Infrastructure R&D, Pavement Materials & Construction Team and Contractor(s) to be Identified (Solicitation in Process)

To more than double the use of fly ash in HCC and halve the use of portland cement. The high payoffs are decreases in energy content of the cementitious phase, amount of CO2 given off, and amount of fly ash land-filled – also elimination of the need for more cement production and imports and the productive use of an otherwise wasted material. Once technology is in place, initial costs may be lowered in those areas where fly ash haul distances are less than portland cement and due to energy and disposal savings. Extended service life is also a realistic objective due to the recognized quality of fly ash in making concrete better – with less permeability, porosity, and microcracking, and the potential capability to heal due to extended hydration reactions.

Recycled Materials Resource Center
University of New Hampshire

Expand the extent of use of industrial by-product materials in highway construction through training, technology transfer, and research to support agency use of recycled materials.

Warm Mix Asphalt
FHWA/Office of Pavement Technology with support from the Office of Infrastructure R&D

Efforts to implement high priority findings from the international scan completed last year and field demonstration projects to better understand the use and benefits of the technology. Warm mix asphalt technology will allow for increased levels of recycled asphalt materials in the production of hot mix asphalt.

Use of Reclaimed Asphalt Pavement
FHWA/Office of Pavement Technology

Advancement of increased usage of recycled asphalt (RAP) in asphalt mix design. These efforts are focusing on support efforts with states to use much higher levels of RAP (> 25%) in hot mix asphalt applications. FHWA has helped in sponsoring workshops with industry, we have formed an Expert Task Group that has worked hard to conduct demonstration/pilot projects, and we have conducted on site support of high RAP mixes through the use of our mobile lab.

In-Place Pavement Recycling
FHWA/Office of Pavement Technology with support from the Resource Center

FHWA recently supported a workshop in Utah on in-place pavement recycling and we are working with industry and state representatives to update training and design references on the use of this technology.

Use of Industrial By-Products
FHWA/Office of Infrastructure R&D with Recycled Materials Resource Center (Designated Program)

FHWA in partnership with EPA recently helped support a workshop in Denver on the use of industrial by-products as a material resource to design and produce pavements.

Green Highways Partnership
FHWA/Office of Pavement Technology

FHWA has continued to support the Mid-Atlantic Green Highway Partnership which includes the use of Recycled/Re-Use Materials as a major theme within the partnership. This partnership has encouraged the delivery of pilot projects using recycled materials on a few highway projects in the Mid-Atlantic area.

UTC Activities

University Transportation Centers across the nation engage in a wide variety of research projects. Here is a sampling from some of these centers.

Fibers from Recycled Tires as Reinforcement in Hot Mix Asphalt
Texas Transportation Institute (Texas A&M University)

High-quality long-lasting hot mix asphalt (HMA) pavements are essential to the sustainability of the U.S. economy. Previous research and construction projects have demonstrated that virgin synthetic fibers can provide excellent reinforcing aids in asphalt paving mixtures. Fibers from scrap tires offer an excellent low-cost alternative supplement to virgin fibers. As no good use has been found for these by-product fibers from the tire grinding process, they are currently being disposed of in landfills or, in some cases, incinerated.

The proposed researchers have successfully incorporated virgin synthetic fibers into HMA and demonstrated the benefits in the laboratory and even in the field, on a limited basis. Virgin fibers can improve the resistance of HMA to cracking and rutting. This promising work needs to be continued to determine the value of using fibers from the tire recycling process in HMA. Equipment is available to incorporate fibers into HMA.

A laboratory study will be developed and implemented to examine the utility of by-product tire fibers in HMA for paving purposes. Researchers will incorporate the waste fibers into HMA, prepare and test HMA specimens in the laboratory, evaluate the benefits of fibers in different types of HMA. If tire fibers appear beneficial in HMA, the researchers will recommend modifications to materials specifications and field construction guidelines that can be used by state departments of transportation and other highway specifying agencies. This project may lead to additional research for TTI if the use of by-product tire fibers in HMA appears promising.

Use of Recycled Materials in Bicycle and Pedestrian Trails
Texas Transportation Institute (Texas A&M University)

The proposed research will investigate the feasibility and benefits of paving bicycle/ pedestrian trails with recycled material. The proposed study will also perform field tests of paving bicycle/pedestrian trails with recycled material. A preferred mix of recycled materials will be used in a test section of an off-road bicycle trail and then evaluated by the researchers and trail users.

The proposed research would include site-identification, planning and coordination of a field experiment. Minimal lab testing would be required to establish and characterize the mix design for the materials chosen for evaluation. Field test sections will be evaluated for bicyclist/pedestrian satisfaction, constructability, cost, performance, environmental impact, and aesthetics.

The increased use of by-products in construction applications will provide numerous environmental and economic benefits. Positive environmental effects include reduced

sold waste and reduced use of natural resources. Positive economic benefits should include (a) reduced construction costs; (b) creation of alternate materials for non-existent, poor, or depleting aggregate resources; (c) savings in energy prices versus disposal; (d) creation of new jobs through new manufacturing and marketing opportunities; and (e) extension of creative rationale to other by-products.

Implementation of a System for Evaluating Waste/Recycled Materials in Transportation Projects
Texas Transportation Institute (Texas A&M University)

Enormous quantities of waste materials are generated every year in Texas and recycling these waste materials is necessary to preserve the country's natural resources. A waste and recycled material evaluation system has already been developed which takes into account technical, economic, societal, and environmental aspects of waste and recycled material utilization in roadbase.

Under this research project, the evaluation system will be field tested and implemented in various administrative levels including one or two TxDOT districts and one or two city of county projects. This will help reduce the volume of waste and recycled materials going into landfills by permitting reuse in transportation projects. The implementation will also help reduce the energy required to produce virgin aggregate involved in more than 110 million tons of recycled aggregate base for AC and PCC pavements in addition to several other environment related benefits.

RFID Applications in Transportation Operation and Intelligent Transportation Systems (ITS)
Oregon Transportation Research and Education Consortium (Portland State University)

It is anticipated that great applications of Radio Frequency Identification (RFID) technologies in transportation operations are foreseen in next few years. The lower cost producing and the long-lasting energy supply enables RFID technology with potential applications in many areas including transportation and logistics. Under the RFID equipped vehicle and highway system, almost all components (vehicles, highways, traffic signals, signs, symbols, pavement markers, etc.) can be provided with the long-lasting and cheap RFID tags or labels. RFID system typically includes an RFID device containing data, an antenna transmitting signals, a Radio Frequency (RF) transceiver generating signals, and a reader receiving RF transmissions. This research is intended to investigate the potential RFID applications in transportation operations through literature review and survey; and identify the possibility of incorporating RFID into the Intelligent Transportation System (ITS).

Evaluation of Traffic Simulation Models for Supporting ITS Development
Oregon Transportation Research and Education Consortium (Portland State University)

The deployment of various ITS facilities will likely change the functions and structures of the existing urban transportation network components. The continuing expansion of ITS user service definitions is adding more and more travel and traffic control elements

to the already complex network configurations. The dynamic interactions between the traffic control and management components and the traffic flows are becoming more complicated than ever before. In this context, the use of a traffic simulation model is becoming the most cost-effective way to analyze the complicated ITS networks. Many traffic simulation models are available for analyzing operations and management. While each type of traffic simulation model seems to have its own merit and shortcomings, there is a need to comprehensively evaluate and document all of the existing models and identify those models that are most suitable for application to different ITS network and development scenarios.

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[i] Government Accountability Office, "Transportation Research: Opportunities for Improving the Oversight of DOT's Research Programs and User Satisfaction with Transportation", August 2006, http://www.gao.gov/new.items/d06917.pdf

[ii] *Transportation for Tomorrow: Report of the National Surface Transportation Policy and Revenue Study Commission*, p. 31, http://www.transportationfortomorrow.org/final_report/