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Congress Plans Updates for Aging Transportation Infrastructure

Capitalizing on materials technology is a key aspect of meeting United States transportation needs and decreasing greenhouse gas emissions, according to some members of Congress. As the U.S. transportation infrastructure ages and the effects of carbon emissions become clearer, Representatives are asking Congress to consider legislation that would update the country's surface transportation system to meet the needs of the 21st century.

During the first half of 2008, bills to revitalize public transportation systems and incorporate modern techniques like filtration systems and pervious pavement have made progress in the House of Representatives, and both the House and the Senate have held hearings on related matters.

Two such bills have been passed by the House of Representatives and referred to the Senate,

- HR 6003: The Passenger Rail Investment and Improvement Act of 2008

Over five years, this bill would authorize over $14 billion for Amtrak grants, state intercity passenger grants, and high-speed rail. An advisory board charged with recommending research, technology, and implementation activities would determine the investment priorities. (This bill has also been passed by the Senate and sent to the President.)

- HR 6052: Saving Energy through Public Transportation Act of 2008

This bill aims to reduce U.S. dependence on foreign oil by promoting public transportation. It authorizes the Secretary of Transportation to make grants for operating costs and facilities used in public transportation, and equipment or facilities that increase fuel efficiency. (This bill has been referred to the Senate.)

Another bill has been approved by the House of Representatives Committee on Science and Technology and referred to the full House,

- HR 5161: The Green Transportation Infrastructure Research and Technology Transfer Act

This bill would invest in university programs focused on the research and development of green transportation infrastructure and technology transfer activities. In particular, it aims to reduce groundwater contamination caused by runoff from roads and parking lots.

According to Representative David Wu (Dem-Ore.), Chair of the U.S. House of Representatives Subcommittee on Technology and Innovation, laboratories around the country have been developing innovative materials and technologies that reduce the energy cost of transportation infrastructure and promote sustainability.

"The potential benefits of these innovative materials and technologies are impressive," Wu said in the opening statement of a hearing on sustainable, energy-efficient transportation infrastructure held by the subcommittee. "What's even more striking is that many of the technologies we need to bring about these fuel savings already exist."

In many cases, state and local governments have been slow to adopt technologies that could affect the sustainability and condition of the U.S. transportation infrastructure, like high performance paving materials that reduce friction and need less maintenance. Legislation like HR 6052 and HR 5161 would promote the use of such technologies and provide funding for their development and implementation.

"Adequate investment in our transportation and other public infrastructure is critical to our nation's economic growth, our competitiveness in the world marketplace, and the quality of life in our communities," said Representative James L. Oberstar (Dem-Minn.), Chair of the House Transportation and Infrastructure Committee, during a statement on the budget resolution conference report for fiscal year 2009. "Despite the importance of these investments, many of our nation's infrastructure needs are going unmet."

A rapidly increasing U.S. population coupled with an increasingly global economy is stressing the country's passenger and freight travel, according to a report by the National Surface Transportation Policy and Revenue Study Commission released in December 2007. The report cites the need for an investment of at least $225 billion annually in the U.S. transportation system for the next 50 years to modernize the current system. Currently the U.S. is spending less than 40% of this amount.

In the meantime, China plans to build 42,000 miles of new interstates by 2020, according to the American Road & Transportation Builders Association. India is expected to build 25,000 miles of expressways and the European Union will add nearly 10,000 miles in the same time period. In May 2008, Russia's Prime Minister Vladimir Putin approved a $570 billion program to renovate the country's transportation infrastructure and build over 10,000 miles of roads during the next seven years. If the current trends continue in the United States, it will add just over 1,100 interstate miles by 2020.

The Federal Surface Transportation Program, which authorizes the federal programs for highways, bridges, public trails, enhancements, highway safety, and transit, is amended every several years through authorization acts. The most recent act, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, was the largest surface transportation investment to date, totaling $244.1 billion for 2005–2009. This act expires October 1, 2009.

KENDRA RAND

Finnish-Japanese Support Collaborative Research in Functional Materials

The Academy of Finland (AF), the Finnish Funding Agency for Technology and Innovation (Tekes), and the Japan Science and Technology Agency (JST) invite researchers to submit proposals for collaborative research projects within the field of functional materials.

The aim of the collaboration is to support long-term, systematic research cooperation, and researcher mobility, as well as the creation and reinforcement of research cooperation networks between Finland and Japan. The goal is to fund a minimum of three Finnish-Japanese research projects per annum financed by the Academy of Finland and JST, Tekes and JST, or all three organizations. Finnish researchers can apply for funding from the Academy of Finland, Tekes, or both.

The primary goal of the funding is to foster greater collaboration between Finland and Japan in the field of functional materials through researcher visits or joint seminars.

Functional materials are here defined as materials with properties designed to serve a specific purpose in a controlled way. Functional materials have physical and chemical properties that are either stable or sensitive to changes in the environment in a planned and controlled way. Such changes include changes in temperature, pressure, electrical and magnetic fields, wavelengths of visible light, absorbed gas molecules or acidity. The materials may be completely new, or they may replace existing materials. Functional materials can also be hybrid, that is, composites of different materials.

One example of functional materials is the group of sensory materials that can be integrated with other materials so that, for instance, a building material or packaging material reacts to changes in the humidity or temperature of the environment. New materials designed to survive in extremely demanding conditions, for instance in fuel cells or motors, can also be described as functional materials.

Metal alloys tailored at the structural level are also such materials.

The funding available from Tekes is primarily intended for the strengthening of cooperation within existing projects or new projects included in the autumn 2008 application round. In applications submitted for the second round of this autumn's Functional Materials program, funding must be applied for as part of an actual project and according to the program timetable (www.tekes.fi). The maximum amount of funding is EUR €30,000 per annum for a three-year period.

For more information to apply through the Academy of Finland, access Web site www.aka.fi.

The JST Web site is www.jst.go.jp.

CSIR Launches Book on Sustainability Science

A book which explores sustainability science from a developing world perspective was launched at the South African Council for Scientific and Industrial Research (CSIR) in August. "Exploring Sustainability Science: A South African Perspective" is the product of research collaboration between the CSIR and several other South African and international research institutions. Edited by CSIR principal scientist Mike Burns and CSIR Research Fellow Alex Weaver, the book proposes a framework for ongoing sustainability science research within the region. The book has been endorsed by the Director-General of the Department of Science and Technology, Phil Mjwara, and CSIR President and CEO, Sibusiso Sibisi.

Sustainability science is defined as use-inspired basic research that seeks to learn about the interactions among humans (including their cultural, political, economic, and demographic characteristics), their technologies, and the environment. Responding to the sustainability challenges of southern Africa, it specifically concerns the production and deployment of scientific knowledge to address urgent issues of social and economic development. It simultaneously concerns the production and deployment of knowledge regarding the capacity of the environment to enable and sustain social and economic development and it is, therefore, the science of understanding and influencing (for example, through policy) complex human-environment relationships.

Burns said that science has become isolated from the important aims of practically advancing sustainable development in practice. "Scientists have tended to confine themselves to their own research agendas, avoiding the difficult and value-laden issues of sustainable development that society faces," he said.

"At the start of the new millennium, as the implications of unsustainable development become increasingly apparent, the mode of science practice and, therefore its policy and practical impact, must change. This need is clearly illustrated by the food crisis experienced across much of the developing world and the violent protest this has triggered." While the world's food production system is complex, Burns said that it is remarkable that its current failure could not have been anticipated and avoided through integrated policy responses, informed through science.

According to Burns, acknowledging that this situation reflects a failure of contemporary science, researchers are now re-defining their role, having used the 2002 Johannesburg World Summit on Sustainable Development to initiate this. It was at this world summit that the idea of "sustainability science" was born.

Weaver, co-editor of the book, said, "Since the complexity of the challenges of sustainable development extends beyond the boundaries of single disciplines, individual research institutions and indeed the field of science, it is essential that sustainability science should be promoted as a transdisciplinary endeavor. This would seem to be a fundamental requirement as expressed, for example, in South Africa's ten-year science and technology Innovation Plan, which envisions the possibility of the country's transformation to a knowledge-based economy through transdisciplinary collaboration within the country's National System of Innovation. This system includes the institutional structures and relationships that exist, or need to be forged, in the field of science and technology, encompassing collaboration between universities, science councils, other research partners (local and international), and, importantly, knowledge users. Sustainability science provides an approach to research and linking knowledge with action that enables the effective functioning of this system of innovation."

"The book is 'transdisciplinary' in the sense that new insights are presented for responding to the challenges of sustainable development resulting from experimentation and the exchange of different disciplinary ideas for promoting sustainable development in southern Africa. Important in this regard has been the interaction between philosophers, systems modelers, regional and urban planners, political scientists, anthropologists, and ecologists. Clearly, there is a multitude of research challenges for sustainability science in southern Africa extending far beyond what is presented in this volume, which is focused largely on the particular areas of expertise of the contributing authors. Considering how these challenges might be addressed, the researchers proposed a framework for ongoing sustainability science research within the region," Weaver said.

Liesbeth Botha Named Executive Director of SA CSIR

In August, Liesbeth Botha joined the South African Council for Scientific and Industrial Research (CSIR) as Executive Director of CSIR Materials Science and Manufacturing.

Botha sees her role at CSIR as an opportunity to integrate research, innovation, and the commercialization of technology.

Together with the management team and stakeholders of CSIR Materials and Manufacturing, Botha will shape the future strategic plans to enhance research focus, address the challenges currently facing South Africa, and improve technology transfer.

Botha was a professor in electronics and computer engineering at the University of Pretoria for 13 years. In 2002, she joined Stellenbosch University (SU) as professor in electrical and electronic engineering and manager of the university's innovation program. Botha was a member of the Vice-Chancellor's management team at the university. In 2005, she became the executive director of Innovation and Commercialization. In this role, her responsibilities included innovation on the campus (and especially technological innovation such as the e-Campus initiative), and innovation to the outside world through the commercialization of intellectual capital of SU. She was a director of Unistel Group Holdings (Pty) Ltd., the holding company for SU's investment in spin-out companies; USB-BO (the SU Business School's company); Venfin, a venture capital company that invests in technology companies; SWIST, a private company that provides Telecommunications and IT solutions; and Unistel Technologies (Pty) Ltd.

Correction

In the August 2008 issue of *MRS Bulletin* **33** (8) (2008) p. 757, "Design Parameters for Superhydrophobicity and Superoleophobicity," Anish Tuteja, Wonjae Choi, Gareth H. McKinley, Robert E. Cohen, and Michael F. Rubner, Equation 8 should read as $D^* = 1/\phi_s = [(W + D)/W]^2$.