U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON TECHNOLOGY AND INNOVATION

HEARING CHARTER

Green Transportation Infrastructure: Challenges to Access and Implementation

Thursday, May 10, 2007
2:00 p.m. - 4:00 p.m.
2318 Rayburn House Office Building

1. Purpose

On Thursday, May 10, the Subcommittee on Technology and Innovation of the Committee on Science and Technology will hold a hearing to examine options for construction technologies and materials available for transportation infrastructure that contribute to stormwater management and control of non-point source water pollution. Federal and local government officials and industry representatives will also address barriers to widespread implementation of these technologies.

2. Witnesses

Ms. Gloria Shepherd is the Associate Administrator for Planning, Environment, and Realty at the Federal Highway Administration (FHWA) of the U.S. Department of Transportation (DOT).

Mr. Benjamin Grumbles is the Assistant Administrator for the Office of Water at the U.S. Environmental Protection Agency (EPA).

Mr. Sam Adams is the Commissioner of Public Utilities for the City of Portland, Oregon. His jurisdiction includes the Bureau of Environmental Services and the Office of Transportation.

Mr. Dan Huffman is the managing director for national resources for the National Ready Mixed Concrete Association (NRMCA).

Mr. Hal Kassoff is the senior vice president for sustainable development at Parsons Brinckerhoff, a leading construction firm.

3. Brief Overview

- Transportation infrastructure such as roads and parking lots contribute to pollution of ground and surface water because they are impervious surfaces and collect a high concentration of contaminants. Stormwater washes pollutants off of hard surfaces and concentrates runoff into streams, lakes, and bays without filtration that could mitigate the effect of the contaminants. In addition, these hard surfaces concentrate rainfall during storms and empty the flow of water immediately via storm sewers intro streams, rivers,

and lakes, unlike the slow, natural filtration when rain falls on undeveloped ground. The results—flooding, increased sedimentation and erosion, and pollution of ecosystems.

- Engineers have developed numerous technologies that can be incorporated into transportation infrastructure which contribute to controlling stormwater and mitigating non-point source water pollution. These green infrastructure technologies help absorb and filter excess runoff, rather than funneling runoff into large sewer pipes that empty directly into detention ponds or water treatment facilities, which can easily become overwhelmed during heavy rainfall.
- There has not been widespread implementation of green transportation infrastructure by governments or private industry. There are technical, social, and regulatory barriers to implementation which are being addressed to some extent by the Federal government and private non-profit organizations, but additional efforts are necessary.

4. Issues and Concerns

What future research is necessary, both in the area of technology development and testing and evaluation? A common argument against the use of green transportation infrastructure by governments and private industry is the lack of data (or the lack of awareness of data) supporting the claims that these technologies control runoff and reduce non-point source pollution. Additional testing and evaluation as well as more robust public awareness campaigns could ease concerns that green infrastructure technologies are ineffective. Testing and evaluation should also cover the traditional criteria used to judge transportation infrastructure: safety, reliability, and cost. Currently, the EPA depends on outside groups for data collection, and as a result, data tends to be incomplete and only covers specific projects, not overall technology performance in a variety of settings. Because EPA uses performance-based standards to determine whether technologies effectively contribute to preventing water pollution, the lack of data makes it especially difficult to get approval to use new technology from some regional administrators.

The American Association of State Highway and Transportation Officials (AASHTO) maintains a database of all proposed research projects proposed by state departments of transportation in the field of environmental protection. The proposed research is intended to meet specific needs of transportation officials, and covers broad topics such as noise, energy, wildlife protection, and water management. In the area of stormwater management, states have proposed over 30 different research projects that would provide further data and feedback on the use of green transportation infrastructure. The results would be a valuable tool for helping convince state and local transportation officials and private industry of the effectiveness of these technologies. Unfortunately, research funding is limited, and many proposed projects are not carried out.

How should a builder determine which type of green transportation infrastructure technology is most appropriate for their project? How should that technology be integrated into the overall stormwater management system? One of the primary reasons builders resist incorporating green transportation infrastructure technologies into their design plans is the lack of understanding of the different options. Given that even EPA regional offices do not have universal expertise in this area, it is not surprising that builders are reluctant to invest time and effort in familiarizing themselves with green technologies. One of the most complicated aspects of planning designs that incorporate green infrastructure is determining the most appropriate

technologies to use for a particular climate and built environment. A technology appropriate for a major urban center in the Northeast would likely not be effective for a more rural area in the desert Southwest. Additionally, these technologies do not operate independently, but are most effective when they are integrated into an overall stormwater management and sewer system. Since the technologies are relatively new, many builders do not have the expertise necessary to efficiently integrate the design into an existing water management system. EPA is working to educate designers and builders through the use of fact sheets on the various technologies, but additional efforts are necessary to facilitate broader implementation.

What should the Federal government do to facilitate adoption of green transportation infrastructure by state and local governments and private companies? How can Federal agencies coordinate effectively to maximize use of green technologies? Federal action on the issue of green transportation infrastructure has been generally limited to research and development, public awareness campaigns, and demonstration projects. While these efforts are laudable, the Federal government could provide stronger incentives for using these types of technology. Federal agencies can also set a good example by using green infrastructure practices at their facilities around the country, thus demonstrating that these technologies are useful in many climates and settings around the country.

There are also Federal funding sources that could be used to provide incentives for the use of green infrastructure. In March, the House passed H.R. 720, the Water Quality Financing Act of 2007, which authorized the use of EPA grant money—which previously had been limited to funding traditional stormwater management infrastructure such as sewer pipes—for green infrastructure. Federal funding for green transportation infrastructure elements both provides a financial incentive for their use by states and municipalities and indicates Federal recognition of the technology's effectiveness.

Additionally, better coordination between Federal agencies is necessary to allow new technologies into the marketplace without being impeded by Federal regulations. Currently, some EPA regions do not allow the use of innovative technologies in spite of work performed by other Federal agencies, including FHWA, that demonstrates their effectiveness. Improving coordination between R&D agencies and regulatory agencies can help ensure that technology transfer is not hampered by outdated regulations.

5. Background

The information in this section is summarized from the National Cooperative Highway Research Program's 2006 report, *Evaluation of Best Management Practices for Highway Runoff Control*.

Environmental Problems Associated with Runoff

Changes in the amount of land covered by surfaces that are impervious to water, such as roads or parking lots, can have significant impacts on an area's natural hydrology, potentially resulting in flooding, pollution, or aquatic ecosystem destruction. Due to their impermeable nature, roads and parking lots decrease the amount of rainwater that will infiltrate into the ground, leading to an increase in the amount of rainwater that runs over the surface of the ground, referred to as

"surface runoff." An area that is fully paved has on average of 15 to 20 times the amount of runoff as a completely undeveloped area. Thus, streams, rivers, lakes and other bodies of surface water receive a greater volume of runoff under developed conditions than they would under undeveloped conditions. They also receive the peak flow of this surface runoff much sooner than they would under natural conditions, where water would filter through slowly. These changes in volume and timing can degrade the physical characteristics of streams and rivers. Increases in erosion will widen channels, decrease the stability of banks, and widen floodplains. These changes affect the fish and other animals and plants. Additionally, these changes to the watershed can increase the possibility that a stream will experience reduced or intermittent flow during some times of the year, since there is less groundwater to recharge the stream and the flow of runoff into the stream is no longer gradual but instead very sharp. Thus, developed areas have a significant and far-ranging environmental impact.

Runoff from highways contributes to non-point source pollution- the type of non-localized pollution emission that is responsible for over 80 percent of the degradation of the nation's surface water. Stormwater moves over agricultural land, lawns, urban areas, and other types of human land-use, washing chemicals like fertilizers, heavy metals, and harmful bacteria into surface water. Highway and other transportation installations are major contributors to this type of pollution. The most common contaminants in highway runoff are metals, inorganic salts, aromatic hydrocarbons (such as the carcinogenic chemical benzene) and suspended solids that accumulate on the road surface as a result of regular highway operations and maintenance activities.

Runoff Mitigation Methods

To be an effective tool in countering the negative impact of rainfall runoff, mitigation measures must reduce the speed and volume of flow and treat or reduce pollutants. Mitigation techniques rely on structural and non-structural best management practices (BMPs) to address these goals. Structural measures are installations like infiltration basins and trenches, detention and retention ponds, constructed wetlands, vegetated swales and filter strips, and filtration systems. Generally they are above ground and rely on passive methods to accomplish treatment goals. Some highly urbanized areas use underground, proprietary systems. Non-structural measures are designed to control runoff and pollution problems at their source; they include practices such as street sweeping and reductions in fertilizer applications.

Stormwater managers generally choose their treatment technique by evaluating the amount of land available, the cost of implementation and operation and maintenance of the technology, and the treatment objectives. Attenuation methods, or reducing the size of the peak runoff flow, can be accomplished by intercepting the rainfall with vegetation and avoiding overly efficient conveyance systems (such as large storm drains) and detention ponds. All of these serve the purpose of slowing the water as it travels to the ground or surface water. Reductions in stormwater volume can be accomplished with retention, infiltration and evapo-transpiration (the water lost through evaporation and plant processes).

Low-impact development is a comprehensive design strategy intended to maintain the natural hydrology of an area even after roads and other infrastructure are installed. It embodies the

principles of conservation, minimization of impact, and maintenance of natural watershed hydrologic timing. Ideally, low impact development should be designed to replicate pre-development conditions as much as possible.

Current Federal Programs

While most of the decisions regarding implementation of green transportation infrastructure are made at the state and local level, there are Federal programs addressing the issue of non-point source water pollution control in transportation infrastructure. The Green Highways Partnership (GHP) is the primary Federal vehicle for encouraging the use of green transportation infrastructure by state and local governments and private industry. EPA and FHWA are the chief Federal participants in the partnership, which includes an expanding list of state departments of transportation, trade organizations, municipal governments, and non-profit organizations. The Partnership's activities focus on planning and design, construction, and operations and maintenance of green transportation infrastructure, and include pilot projects that demonstrate cost-effective, environmentally-sound transportation infrastructure technologies that meet state performance requirements. GHP includes a specific program on watershed-driven stormwater management which includes the development of best practices and performance standards, and the collection of data and modeling results to better understand the benefits of green technologies.

FHWA, through the Surface Transportation Environment and Planning (STEP) Cooperative Research Program, also conducts research to improve air quality and climate, wetlands, and water quality and ecosystems as part of its environmental research initiative. Stormwater-control related projects include basic research into the contribution of impervious surfaces to runoff, and development of methods to rapidly assess the effects of highways on adjoining ecosystems.

Additional research projects are supported through the Transportation Research Board (TRB), a FHWA-funded arm of the National Research Council (NRC). As part of the National Cooperative Highway Research Program, TRB has sponsored evaluations of best management practices for highway runoff, long term data collections on the effect of highway construction on habitats, and other projects related to the effect of transportation infrastructure on non-point source water pollution. The EPA Office of Water participates in TRB committees, and assists in the translation of research results into usable manuals and guides for state and local agencies.

The EPA Office of Water also supports the use of green infrastructure through the National Menu of Stormwater Best Practices, a web-based database of stormwater management options for local authorities. EPA developed this database beginning in 2000. The database includes information and builder specifications for a variety of green transportation infrastructure technologies. The Office of Water has also begun cooperating with environmental non-profit organizations to promote the use of these practices among local governments. They provide additional support to state and local governments through the development of fact sheets that specify which technologies are suited to various environments around the country.

6. Challenges to Implementation

Though research has shown significant benefits in terms of stormwater management and control of non-point source water pollution, technologies such as bioswales and pervious pavement have not been adopted in many jurisdictions or by private entities. There are numerous barriers to full adoption of green infrastructure, including technical problems, regulatory challenges, and general industry resistance to changing practices.

Technical challenges

The installation of green transportation infrastructure can be impeded by problems of high cost and availability of space for technologies. For measures that are installed directly on the roadway, unless new infrastructure is being constructed, there are high costs associated with removing old materials and installing new surfaces. Additionally, the disruption to traffic and business is extremely costly. In many urban areas, there is also not space on the roadside or around parking lots to install measures such as bioswales, limiting local governments' choices of technology.

Various climates can also present unique challenges to implementation. In areas where very cold weather is common, technologies that retain water for slow filtration are susceptible to freezing. Freeze/thaw cycles can shorten the lifespan of infrastructure, as well as limiting its ability to effectively filter pollutants from runoff. Further research will help develop better guidelines as to which technologies are most appropriate for various climates.

Regulatory challenges

Federal, state, and local government agencies have taken an active role in promoting the use of green transportation infrastructure, but paradoxically, those same entities have often erected regulatory barriers which prevent widespread implementation. On the Federal Level, the U.S. Environmental Protection Agency (EPA) has begun promoting the use of green infrastructure, including transportation infrastructure, through its Office of Water. In March 2007, Assistant Administrator Ben Grumbles released a memo to regional administrators encouraging the acceptance of green infrastructure to protect water quality (Appendix I). The EPA also recently signed an agreement with a number of environmental organizations to assist state and local governments in implementing green infrastructure projects.

However, though the Office of Water has been a strong advocate for green infrastructure projects, there are regulatory barriers internal to the EPA that prevent those projects from moving forward. Through the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program gives EPA the authority to regulate sources of water that release pollutants into ground and surface water. The program is administered on a regional level, and regional administrators have discretion over defining a green infrastructure technology as a source of water that is covered by NPDES. If technologies such as pervious pavement or bioswales, which filter runoff before it flows into the ground or surface water, are considered "point sources" that inject water directly into the ground. EPA regulations require permitting procedures that act as a significant disincentive to use these technologies.

For example, when the City of Portland was preparing its "Clean River Plan" for the Willamette River in 2000 and 2001, the city planners wanted to incorporate bioswales as part of the runoff management plan. However, the EPA regional administrator was not familiar with research results which indicated that bioswales effectively filtered pollutants from runoff, and required extensive permitting and monitoring systems under the NPDES authority, thus creating a financial disincentive for the use of bioswales. Conversely, in other regions, EPA regional administrators have taken a leadership role, reducing the bureaucratic barriers to implementing projects using green infrastructure. The Office of Water's initiative has a goal of standardizing implementation procedures across the various regions.

State and local authorities can sometimes also be at fault in preventing implementation of green transportation infrastructure, but unlike Federal laws that specifically disallow the use of green technologies without extensive permitting, state and local authorities tend to fail to explicitly allow their use. As a result, governments or private companies within the jurisdiction who propose the use of green transportation infrastructure are not given approval simply because the innovative technologies have not been previously considered by the regulating authority. The problem is then self-perpetuating, as these local governments block all potential demonstration projects, and then continue to deny builders on the basis that there have been no successful demonstration projects. Of course, many cities have acted as leaders in the green transportation infrastructure initiative, but the challenge remains to universalize its use across local jurisdictions.

Social Challenges

Finally, there are social challenges to widespread implementation of green transportation infrastructure. The transportation construction industry is highly decentralized, and stakeholders range from state governments to private developers. As a whole, the industry tends to be risk-averse, and hence reluctant to adopt technologies that may be considered experimental or unproven because of concerns about high cost, reliability, maintenance, or simply confusion about the best products to use. The slow adoption of these technologies has also led to a shortage of trained contractors who are able to properly design and install integrated systems, making implementation more difficult and costly.

Numerous companies, non-profits, and industry organizations have developed programs to specifically promote environmentally-friendly advances in construction techniques and technologies with varying levels of success. Market-driven techniques are most effective: demonstrating that green transportation infrastructure is attractive to consumers as part of a corporate citizenship initiative has been an effective means of encouraging implementation. For example, Turner Construction Company, one of the largest construction companies in the United States, recently worked with Wal-Mart to develop a "green supercenter" which incorporated green transportation elements such as bioswales and pervious pavement as part of an overall sustainability initiative that was formulated to build community goodwill. The EPA and FHWA, through the Transportation Research Board (TRB), have also dedicated some resources towards training programs, but the scope of these programs is limited because of budgetary constraints.