



2015 Workshop
Transportation Research Board
“Sustainability in a Time of Resource Scarcity”
Hosted by Los Angeles Metro



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Sunday, June 7th

Field Trip; Sunday, 12:30 pm to 4:30 pm:

Joint Development Tour, FREE:

Learn about Metro's Joint Development Program challenges and understand the solutions that LA Metro implements to meet new sustainability and environmental-related requirements for these types of projects. How has LA Metro implemented its joint development projects at environmentally challenging locations without compromising project goal, schedule and cost? Why are Joint Development projects an integral part of a sustainable transportation system? Joint Development projects span various neighborhoods across Los Angeles, including West Los Angeles, Koreatown, Thaitown, Hollywood, Pasadena, and East Los Angeles. (Not all sites will be visited.) MEET ON PLAZA LEVEL OF METRO BUILDING AT NOON.

Metro Art Tour, various dates:

Open to partners and families too:

Sunday, 10:00 am to 12:00 pm Meet at the street level of the Hollywood/Highland Station of Metro's Red Line

Monday June 7th 10:00 - 12:00; meet at info booth inside Union Station, Alameda Street entrance

Wednesday June 10th 10:00 - 12:00; i meet at info booth inside Union Station, Alameda Street entrance

Saturday June 13th 10:30 - 13:00; meet at info booth inside Union Station, Alameda Street entrance

ADC60 Committee Business Meeting: Sunday, June 7th, 6 to 8pm.

Please feel free to join us at the Mayflower Seafood Restaurant

679 N Spring St, Los Angeles (Chinatown) - Walking distance from Union Station and Metro

Monday, June 8^h

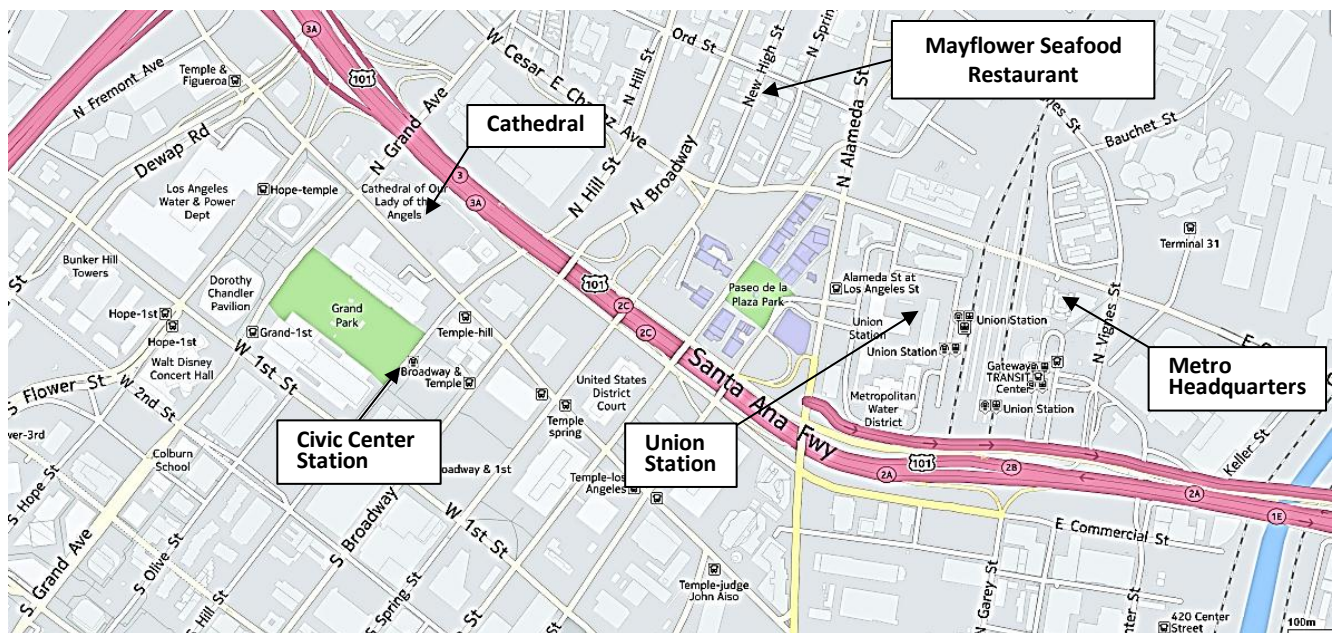
Evening Reception Details

Time: 5:30 pm – 9 pm

Location: Cathedral of Our Lady of the Angels, 555 West Temple Street, Los Angeles

Walking: 1 mile from Metro Headquarters

Transit: Red or Purple lines form Union Station to Civic Center/Grand Park Station



Monday, June 8th

7:30 am – 8:30 am Registration and Breakfast (Third Floor, LA Metro)

8:30 am Welcome Remarks - Stephanie Wiggins, Interim Deputy CEO, LA Metro (Boardroom)

8:45 – 10:00 am Environmental & Career Resiliency in the Face of Emerging Sustainability-Related Issues

Doug Walters, Assistant Division Manager, LA Bureau of Sanitation / One Water LA	Water Resiliency Strategies within the City of LA
Jeffrey Lusk, FEMA Region IX Mitigation Director	Emergency Management Perspectives Regarding Climate Change and Resilience
Antoinette Quagliata, Environmental Protection Specialist, Federal Transit Administration	A Young Professional's View of Environment and Sustainability

10:00 am – 10:30 am Break

10:30 am – 12:00 am Break-Out Sessions

Union Station Conference Room	Winter Maintenance Chemicals	Ashli Desai (Larry Walker Assoc.)	Challenges with Addressing Salts Through TMDLs
		Mehdi Honarvar Nazari (Washington State University)	Managing the Corrosion and Toxicological Effects of Roadway Deicers
		Eric Schmidley (Leidos)	Deicing Salt Environmental Impact: Remedial Strategies and Best Practices For Transportation Authorities
		Laura Fay (Western Transportation Institute)	Best Practices for Winter Road Maintenance
Metro Board Room	Climate Change & Resilience 1	Laura Robinson (Kleinfelder)	Planning for the Worst: Expanding the Risk Spectrum to Develop a Comprehensive Asset Management Plan.
		Peter Hall (AMEC Foster Wheeler)	The Integration of Sustainability and Climate Change Planning in to Infrastructure Projects
		Angelo Elmi, Mahilet Amare, Heliana Higbie (New York City Transit)	New York City Transit Super Storm Sandy Impacts & Resiliency

12:00 pm – 1:00 pm Lunch (Catered in-house)

1:00 pm – 2:30 pm Break-Out Sessions

Union Station CR	Alternative Use of Transportation Properties and Infrastructure	Paul Arends (Michigan DOT)	Michigan DOT Solar Photovoltaic Applications
		Andrina Dominguez (LA Metro)	Combating Food Deserts with Transit Assets
		Niek Veraart (Louis Berger)	Transit Right-of-way as a Resource: Increasing the Efficiency of a Multi-Use, Multi-value Asset for Agencies and Communities.
Board Room	Green Infrastructure and Rating Systems 1	Jennifer Walker (Watearth)	You've Built it Now What? Operations and Maintenance of Low Impact Development
		Joshua Proudfoot (Good Company)	Transportation Energy: What happens if Climate Change Regulations Shape the Market?
		Aaron Toneys (Good Company)	Carbon Footprints for Public Agencies and Infrastructure Projects

2:30 pm – 3:00 pm Break

3:00 pm – 5:00 pm Break-Out Sessions

Union Station CR	Contaminant Management & Pollution Prevention	Jorgen Bergstrom (GEL Geophysics)	Determination of Lateral and Vertical Extent of Landfilled Flyash Using Geophysical Methods
		Chris Breemer & Ashleigh Fines (APEX)	Oregon Statewide Study of Traffic Related Soil Contaminants for Waste Management Planning
		Chris Noland (Kleinfelder)	Evaluation of a Historic Burn Ash Site for a San Diego Highway Improvement Project
		Helen Corley (AMEC Foster Wheeler)	Discover, Remediate and Cover: An Ordnance-Contaminated Highway Construction Site in Jacksonville, NC
Board Room	General Sustainability	Ben Lichty (CA High Speed Rail)	Sustainability at California High-Speed Rail Authority
		Margaret Cederroth (Parsons Brinkerhoff)	Chicago Sustainable Urban Infrastructure Guidelines.
		Brenda Dix (ICF International)	MTC's Climate Initiatives Program: Meeting the Bay Area's GHG Emission Reduction Goals

5:30 pm – 9:00 pm Reception, Los Angeles Cathedral of Our Lady of the Angels.

Tuesday, June 9th

7:30 am – 8:30 am Breakfast

8:30 am – 10:00 am Breakout Sessions

Union Station CR	Recycling & Waste Management 1	Angela Pakes Ahlman (Recycled Materials Resource Center)	Benefits and Challenges of DOT Use of Recycled Materials for Highway Construction.
		Masoumeh Tavakol (Kansas State University)	“Green” Asphalt Mixtures in Kansas
		Peter Hall (AMEC Foster Wheeler)	Development of a Global Waste Footprint Program to Drive Sustainability and Waste Management
Board Room	Climate Change & Resilience 2	Cris Liban (LA Metro)	Tools of Preparation: Climate Change Resiliency at LA Metro
		Mikhail Chester (Arizona State University)	Climate Change Impacts on Transit Systems
		Timothy Grose (Cambridge Systematics)	Parched: The Impacts of Drought on Transportation

10:00 am – 10:30 am Break

10:30 am – 12:00 am Break-Out Sessions

Union Station CR	Environmental Tools	Cyrus Parker (N. Carolina DOT)	Communicating the Hazard on Transportation Projects
		John Donatucci (Kleinfelder)	Green and Sustainable Remediation Alternatives
		Jeff Keaton (AMEC Foster Wheeler)	Project Definition Trap: Benefits in Operation are Unwanted Costs in Design and Construction
Board Room	Green Infrastructure	Keith Pilgrim (Barr Engineering)	Advancements in the Removal of Metals and Dissolved Phosphorus for Stormwater Runoff from Impervious Surfaces: Introducing the Spent Lime Filtration Treatment System
		Jennifer Walker (Watearth)	Green infrastructure case studies for Urban Renewal
		Alisha Goldstein (US EPA)	Selection and Implementation of Green Infrastructure Projects to Achieve Multiple Benefits

12:00 pm – 1:30 pm Lunch (On your own – Enjoy what downtown LA has to offer!)

1:30 pm – 3:00 pm Break-Out Sessions

Union Station CR	Water Quality, Conservation, Management	Jennifer Walker (Watearth)	Nuview School Green Parking Lot Retrofit: 100% Infiltration of Runoff
		Lee-Anne Milburn (Cal Poly, Pomona), et al.	Transportation Corridors as Flow Corridors for Resource Management: Roads as “Streams” and their Role in the “Greenways to Rivers Arterial Stormwater System (GRASS)
		Patrick Wong (W2 Design)	Expo Rail Operations and Maintenance Facility: Water Conservation Case Study
Board Room	Green Infrastructure & Rating Systems 2	Tom Lewis (Louis Berger)	Applicability of Envision & a Life Cycle Approach Towards Transportation Infrastructure Development & Sustainability
		Anneke Davis & Lisa Reid (CH2MHill)	New Updates in FHWA’s INVEST Version 1.2
		Lisa Reid & Anneke Davis (CH2MHill)	Integrating FHWA INVEST at the Illinois Tollway

3:00 pm – 3:30 pm Break

3:30 pm – 5:30 pm Break-Out Sessions

Union Station CR	Recycling & Waste Management 2	Winnie Okello (Pennsylvania DOT)	Engineering in a Global Context: Recycled Materials Applicability in Developing Nations
		Fatih Yonar (Istanbul Technical University)	Utilization of EAF Slag in Highway Construction and Possible Environmental Outcomes in Turkey
		Andrew Graettinger (University of Alabama)	Recycled Material Web Map: Connecting Producers and Consumers
Board Room	Climate Change & Resilience 3	Jennifer Gonzalez (Louis Berger)	Transit as a Force Multiplier in Climate Change Resilience, Including Regional Economies as a Key Beneficiary
		Ileana Ivanciu (Dewberry)	Superstorm Sandy Recovery: A Case Study for Environmental Protection Success in Response to Extreme Weather Events
		Peter Hall (AMEC Foster Wheeler)	Integrated City Resiliency Solutions to Manage Critical Assets
		Michael Tumulty (STV Group)	Evaluating Risk in Setting Design Criteria for Protection of Transportation Infrastructure from Coastal Flooding

Monday Morning, June 8th



Welcome Remarks:
Stephanie Wiggins
Interim Deputy CEO, LA Metro



Water Resiliency Strategies within the City of LA:
Doug Walters
Assistant Division Manager, City of Los Angeles Sanitation



Emergency Management Perspectives Regarding Climate Change and Resilience:
Jeffrey Lusk
Mitigation Director, FEMA Region IX



A Young Professional's View of Environment and Sustainability:
Antoinette Quagliata
Environmental Protection Specialist, Federal Transit Administration

Ashli Desai, Larry Walker Associates (LWA): Challenges with Addressing Salts Through TMDLs



With shifting weather patterns and evaluation of the sustainability of future water supplies, management of salts in surface and groundwaters from multiple sources is becoming a priority in many areas. Total Maximum Daily Loads (TMDLs) are required to be developed for surface waters that are impaired due to salts. However, addressing accumulation of salts through TMDLs raises several challenges and in some cases can hinder development of effective management solutions. This talk will provide a general overview of TMDLs and how they are developed with a focus on the development of salts TMDLs in Southern California. The overview will include a discussion of the challenges associated with addressing salts through TMDLs, including the consideration of the impact and influence of groundwater, challenges with *addressing the typical* sources of salts, and the fact that salt management is generally best accomplished through holistic watershed management approaches rather than focusing on single sources. The Calleguas Creek Watershed Salts TMDL will be discussed to provide a case study of watershed salts TMDL and implementation and how TMDLs have been incorporated into the California Department of Transportation NPDES discharge permit.

Mehdi Honarvar Nazari, Washington State University: Managing the Corrosion & Toxicological Effects of Roadway Deicers



Chloride based deicers have increasingly become essential tools for improving the safety and mobility of winter roadways. They may present short- and long-term risks to transportation infrastructure, motor vehicles, and natural environment. This talk will focus on two major cumulative risks of deicers over time, i.e., corrosion to equipment assets and toxicological effects on water quality. This talk will start with a discussion of: Materials used for snow and ice control and Causes and effects of corrosion, followed by a high-level overview of the best practices available to manage the *risk of deicer corrosion to equipment assets*, in terms of: New equipment specification; Repair, rehabilitation and retrofitting of existing equipment; Preventive maintenance practices; and Training. The second part of the talk will briefly discuss the *aquatic toxicity due to chloride based deicers* in natural environment. Chloride salts are highly soluble, migrating quickly into adjacent environments once applied, non-degradable, and difficult to remove from natural environment. The talk will review the toxicological effects associated with the deicers via their interactions with runoff chemistry. It will conclude with an overview of common approaches used for reducing the impacts of chloride based deicers.

Eric Schmidley, Leidos:

Deicing Salt Environmental Impact: Remedial Strategies and Best Practices For Transportation Authorities



Despite significant improvements in salt storage, handling and application practices, the legacy of historical practices coupled with the current volume of salt use has impaired soil, surface water and well water. In some cases this historically released salt is only now manifesting itself at drinking water wells and streams due to its continued presence in soils and slow ambient groundwater flow rates. Economical best practices for the characterization and remediation of salt impacted media have emerged over the years. As salt solutions infiltrate into soils, natural soil conductivity is artificially raised. This increase in electrical conductance can be quickly and accurately measured by an electromagnetic (EM) terrain conductivity geophysical survey, for good correlation to chloride content. Acres of potentially impacted soils can be surveyed in a matter of hours to days, producing highly accurate maps of the gradation of soil conductance and therefore salt impact laterally and at depth.

Laura Fay, Western Transportation Institute: Best Practices for Winter Road Maintenance



Transportation agencies are continually challenged to provide a high level of service on winter roadways and improve safety and mobility in a cost-effective manner, while at the same time minimizing adverse effects to the environment, vehicles, and transportation infrastructure. Understanding the negative impacts of deicers is critical to winter maintenance operations. Increasing contamination derived from the continued use of deicers has detrimental effects on air, water, soil, vegetation, humans, and wildlife that have been observed in the field and verified in the laboratory. Snow and ice control best practices have been identified in the areas of material storage and handling, plowing, application of material, equipment cleaning, use of environmental staff, monitoring, proper training, use of environmental

management systems, efficient snow removal, utilization of appropriate products, application rates and techniques for given conditions, and utilizing weather information and forecasts. By utilizing any one of these identified best practices, an organization can realize cost and material saving, reduced person hours and vehicle emissions, and realize a reduction in the impacts of deicing operations on the environment. By using multiple best practices, through an EMS framework, snow and ice control programs can realize all of the aforementioned benefits and have a system to track the improvements.

Laura Robinson, Kleinfelder:

Planning for the Worst: Expanding the Risk Spectrum to Develop a Comprehensive Asset Management Plan

Utility owners and public agencies use asset management programs to inventory and assess the potential risk of utility assets and infrastructure, including pipelines, structures, buildings and plants. Unfortunately, the typical risk assessment has historically been devoid of a variety of events which pose significant risk to utility systems and infrastructure, including hurricanes, earthquakes and climate change. This interactive presentation will focus on a pilot project prepared for a community which demonstrates the methodology for expanding the risk spectrum through a more comprehensive asset management program.

Peter Hall, Amec Foster Wheeler: Integration of Sustainability and Climate Change Planning in to Infrastructure Projects



Amec Foster Wheeler has an established process to incorporate sustainability and climate change related planning into environmental and infrastructure projects that can be applied to the entire life-cycle of any activity. A case study will be provided to demonstrate the use of this Project Sustainability and Management (PSM) procedure and will provide an example of its use and applicability for sustainability and resiliency planning in infrastructure and transportation projects and planning. Amec Foster Wheeler has provided sustainability support for the Windsor Essex Parkway Road Construction Infrastructure project which included the application of the PSM framework to integrate sustainability and climate change scenarios into the detailed design, construction and operation of the highway. The project included the

development of Key Performance Indicators (KPIs) for sustainability and we will highlight the application through a project life-cycle. A systems approach, which includes procedures and tools, can be linked to KPIs which can evaluate sustainability performance for a range of infrastructure and transportation projects and can serve as an example for other organizations looking to integrate sustainability and climate change planning into their activities and operations.

Angelo Elmi, Mahilet Amare, Heliana Higbie, New York City Transit: NYCT Super Storm Sandy Impacts and Resiliency



On October 29, 2012, the New York City subway system and New York City Transit’s (NYCT) assets experienced significant damage due to salt water infiltration as a result of the storm surge generated during Super Storm Sandy. When events such as Super Storm Sandy frequently arise, minimizing and, if possible, eliminating potential damage due to these types of events increasingly becomes an issue of concern, particularly when they occur within major urban cities where the population is extremely dense and infrastructure is so compact. This presentation will give a general

will give a general overview of the damage caused by Super Storm Sandy and discuss the various approaches and techniques used to mitigate the impacts it had on NYCT’s assets. This presentation will also discuss how the mitigation measures used are resilient enough to curtail flooding impacts, protecting our system and citizens from future storms such as Super Storm Sandy. Case Studies, highlighting specific projects, will be used as examples of what mitigation methods are being utilized.

Monday Afternoon, June 8th

Paul Arends, Michigan Department of Transportation: Michigan DOT Solar Photovoltaic Applications



MDOT owns and operates solar arrays in various areas of the state. Installations include both ground-mounted systems and elevated parking canopies. The presentation will discuss the design, development, innovative vendor selection, remote monitoring, financial payback, as well as the feasibility of future projects. Many new challenges were encountered both politically and legally, which will be illustrated. Lessons learned and considerations will be offered for those agencies looking to install solar arrays.

Andrina Dominguez, LA Metro: Combatting Food Deserts with Transit Assets



Los Angeles Metro faces challenges in not only ensuring the optimum utility of its limited resources, but also enhancing customer experience for its ridership, including transit dependent communities. Many of the communities surrounding the Metro Blue Line—such as Compton—suffer acutely from poor food options. Metro's Fresh Food Access Initiative began with an initial assessment of stations along the Metro Blue Line and their viability for hosting a farmers' market. Of the possible criteria for site selection, those that best represented what would most equip a Metro farmers' market for success were selected. An agency-wide "Go Metro to Farmers' Market" campaign was concurrently launched in the fall of 2014, which included a website that showed users Los Angeles farmers' markets accessible by Metro rail. Recently, follow-up research has been conducted along the Metro Blue Line to survey patrons about the types of fresh food programs they would most likely support. Next steps for the initiative include the selection and implementation of a pilot project. As Metro's Fresh Food Access Initiative evolves, patrons will be able to utilize the system not only for mobility, but also for lifestyle and health considerations.

Niek Veraart, Louis Berger:

Transit Right-of-way as a Resource: Increasing the Efficiency of a Multi-Use, Multi-value Asset for Agencies & Communities



Transit Right-of-way represents a significant resource for agencies requiring considerable commitment of resources throughout the program life cycle. For communities these right-of-ways represent significant opportunities to create economic and other benefits, especially in areas that are densely developed or where natural resources limit the ability to create new right-of-ways. This presentation/discussion will explore opportunities for agencies to integrate value generating mechanisms associated with the right-of-way. Efficient use of these right-of-ways, while complying with all applicable regulations can contribute to efficiencies for both the agency and its host community, enabling a more efficient use of natural and man-made resources. Examples will be drawn for national and international practice and research and will include but are not limited to bundled linear infrastructure such as energy and telecom, biofuels, solar energy, ecological infrastructure, water resources, as well as site specific resources, such as Transit Oriented Development.

Jennifer Walker, Watearth Inc.:

You've Built it Now What? Operations and Maintenance of Low Impact Development



With the continued and increasing use of green infrastructure or Low Impact Development (LID) to meet local and state requirements as well as the public's desire for more environmentally-sensitive developments, the need for effective operation and maintenance programs is more critical than ever. Although maintenance programs have been inconsistent with traditional stormwater infrastructure, a common concern regarding green infrastructure is whether and how it functions in the long-term. This session addresses typical operation and maintenance requirements for various LID Integrated Management Practices (IMPs) as well as anticipated life-cycles and long-term and annual operation and maintenance costs. A case study and operation and maintenance plan and associated long-term maintenance costs is also presented.

Joshua Proudfoot, Good Company:

Transportation Energy: What happens if Climate Change Regulations Shape the Market?



This presentation will answer these questions for the audience:

- *How much of our greenhouse gas emissions are from Transportation?
- *How far do we have to go to meet our state 2050 goals for emissions reduction?
- *How far will low carbon fuels get us to replacing our current fuels?
- *Where will the fuels come from?
- *Are Electric Vehicles really an answer to replacing fuels?
- *What should the personal vehicle fleets evolve to?
- *What about freight? *How can the way we operate highway systems reduce emissions?

Aaron Toney, Good Company: Carbon Footprints for Public Agencies and Infrastructure Projects



This presentation will focus on the public agency and infrastructure construction carbon footprints. We will review case study examples of carbon footprint results for the Sellwood Bridge (Portland, OR), a ground-mounted PV solar facility, and a fish passage project and conclude with lessons learned from conducting these assessments and scale potential opportunities for emissions reductions.

Jorgen Bergstrom, GEL Geophysics:

Determination of Lateral and Vertical Extent of Landfilled Flyash Using Geophysical Methods



At the request of the North Carolina Department of Transportation (NCDOT), GEL Geophysics (GEL) conducted a geophysical investigation at the closed Bladen County Landfill in Bladen County, North Carolina, to determine the lateral and vertical extent of landfilled flyash within an area of interest in which NCDOT has proposed the alignment of a westbound off ramp for NC 87 Bypass. The investigation included the deployment of a CMD-4 electromagnetic ground conductivity and magnetic susceptibility instrument, and a SuperSting R8 electric resistivity and induced polarization imaging (ERI/IP) instrument. The CMD-4 data was used to determine the lateral extent of the flyash, and the ER/IP data

was used primarily to determine the vertical extent. Four borings located on the landfill were also used to calibrate the ERI/IP data. By combining the CMD 4, ERI/IP, and boring data, GEL developed an isopachus contour map showing the depth to the bottom of the flyash within the area of investigation. Based on GEL's data, NCDOT revised the ramp alignment in order to minimize excavation of waste material, and was able to calculate the volume of flyash removal necessary for the new alignment. This case study will include background information, technical approach, data collection, processing and analysis, and conclusions.

Chris Breemer & Ashleigh Fines: APEX Companies:

Oregon Statewide Study of Traffic-Related Soil Contaminants for Waste Management Planning



Soil near roadways is commonly impacted by a number of traffic-related contaminants, including metals and polycyclic aromatic hydrocarbons (PAHs). The presence of contaminants in soil poses soil management challenges during construction. The Oregon Department of Transportation is undertaking a statewide study to assess the distribution of traffic-related contaminants in soil near roadways. The data gathered during the study will be used to identify the critical factors affecting contaminant distribution in roadway soil and to limit construction waste management volumes and

costs. This presentation will present the study methodology, results to date, and preliminary conclusions.

Chris Noland, Kleinfelder: Evaluation of a Historic Burn Ash site for a San Diego Highway Improvement Project



The 38th Street Burn Site is a documented burn ash site known to have operated in the 1920's and 1930's. Subsequent site investigation by the City of San Diego in the area of the freeway interchange confirmed that burn ash exists on the highway Right of Way. The highway department is proposing to construct several improvements to its existing ramps and freeways in the vicinity of the site. Some of these improvements are located within the area of known potential burn ash contamination. A document review previously conducted by Kleinfelder identified specific areas where the proposed improvements have the potential to encounter burn ash contaminated soils. Kleinfelder subsequently performed a

subsurface site investigation in these areas and provided information regarding impacts of burn ash contamination to the proposed improvements. These data were used to evaluate potential health and safety issues and may be used in the future to assist in contaminated soil disposal during construction. Efficient orchestration of data through use of a Geographical Information System (GIS) involved electronic data collection, such as Global Positioning System (GPS) survey, Electronic Data Deliverables from the laboratory, and the EQUIS(TM) 5 database system, to efficiently and quickly produce reports.

Helen Corley, Amec Foster Wheeler:

Discover, Remediate and Cover : An Ordnance-Contaminated Highway Construction Site in Jacksonville, NC



An inopportune time for a hazard to arise is after construction begins; however, that is exactly what occurred during the US17 Highway Bypass project in Jacksonville, North Carolina. In the summer of 2012 construction began for a new entrance ramp. The project shut down when 618 pieces of WWII and Korean-War Era munitions were discovered. Amec Foster Wheeler's performed Digital Geophysical Mapping to detect buried munitions and explosives of concern (MEC) and other metallic items. Due to the high density of buried metallic debris across several acres, the chosen strategy was soil excavation with soil sifting and MEC removal in just the construction corridor. It was anticipated that this response

would be rigorous, expensive, and have a significant risk from direct contact. It was not anticipated that there would be lead and PCB contamination, interaction with EPA, and a hurricane. In three months, the construction contractor was back to building and, soon after, traffic flowed. However, the remainder of the site remained to be addressed. It was decided to abandon the debris in-place by designing and constructing a cover system to prevent possible human contact. Amec Foster Wheeler engineered the design and teamed with the NCDOT and a subcontractor to safely construct the cover system.

Ben Lichty, California High Speed Rail Program: Sustainability at California High-Speed Rail Authority



California has been among the most progressive states when it comes to implementing codes and incentives for sustainable, high-performance design. In tune with this leadership position, the California High-Speed Rail Authority is working on planning and design initiatives to ensure that when station areas for the new-high-speed system are open within the next decade, they will achieve some of the most progressive performance standards for not just buildings, but should transform station areas into new district-scale healthy, resilient, ecologically rich communities. The Authority has an adopted sustainability policy and has been a signatory of the APTA sustainability commitment since 2013. As part of this program, they completed their first sustainability report, in compliance with Global Reporting Initiative G4 standards,

the first for a high-speed rail program in the US. This work involved extensive interviews and outreach to dozens of internal and external stakeholders. This presentation will review some of the highlights and new direction that emerged from the materiality assessment, as well as lessons learned from the effort.

Margaret Cederoth, Parsons Brinkerhoff: Chicago Sustainable Urban Infrastructure Guidelines



Major urban areas are at a tipping point implementing comprehensive planning, design, construction and maintenance guidance and requirements for complete and sustainable infrastructure. Not all cities rely on assessment methodologies and rating systems, and instead imbed sustainability requirements into all their contracts and projects. The City of Chicago Department of Transportation created a set of Sustainable Urban Infrastructure Guidelines, including a set of requirements for all infrastructure projects to meet. These requirements, and the guidance to meet them, reflect the economic, social, and ecologic resource imperatives for the City. The presentation will overview the process of creating the guidance, its implementation over the past 18 months, and complementary city and department policies.

Brenda Dix, ICF International: MTC's Climate Initiatives Program: Meeting the Bay Area's GHG Emission Reduction Goals



In California, the Sustainable Communities Strategy and Climate Protection Act of 2008 changed the way that MPOs think about planning. Aggressive targets for greenhouse gas (GHG) emissions required many regions to densify land use patterns and invest in transportation capacity projects within the urban core; but frequently, this still was not enough to achieve the targets. Thinking outside the box, ICF helped the Metropolitan Transportation Commission (MTC) to develop a suite of investment strategies to measurably reduce GHG emissions. These strategies ranged from electric vehicle deployment projects, a commuter benefit ordinance legislation, smart driving behavior change campaigns, and expansion of car sharing programs. These unique programs could not be modeled in MTC's activity based travel model so ICF developed a series of off-model excel calculator tools to estimate emissions reductions. This presentation will provide an overview of the GHG emissions reduction programs and an explanation of the detailed inputs, calculations, and outputs of one off-model calculator.

Tuesday Morning, June 9th

Angela Pakes Ahlman, Recycled materials Resource Center:

Benefits and Challenges of DOT Use of Recycled Materials for Highway Construction



The use of recycled materials in highway construction has the potential to achieve significant benefits affecting the triple-bottom line (environment, prosperity and society). Such benefits include reducing the need for mining virgin materials, materials processing and transportation (in-situ applications), reducing environmental impacts, reducing waste disposal, and reducing life cycle costs. The Recycled Materials Resource Center has undertaken two projects in order to better define the benefits of using recycled materials. The first was to analyze the environmental benefits of incorporating recycled material in the reconstruction of the north-south corridor of Interstate 94 in Kenosha County, Wisconsin, using

Building Environmentally and Economically Sustainable Transportation-Infrastructure-Highway (BE2ST-in-Highways). The second addressed the difficulties of state departments of transportation (DOTs) in conveying the benefits of using recycled materials due to difficulty in tracking the quantities of recycled materials used in state DOT projects. A suitable method of tracking materials was recommended after studying how seven DOTs currently track their recycled materials quantities. Subsequently, an analysis of the life-cycle benefits and cost savings was conducted using PaLATE, a Life Cycle Assessment (LCA) tool.

Masoumeh Tavakol, Kansas State University: "Green" Asphalt Mixtures in Kansas

According to the National Asphalt Pavement Association (NAPA), 93 percent of more than 2.6 million miles of paved roads in the United States are surfaced with asphalt mixtures. Each year about 60 million tons of reclaimed asphalt pavements (RAP) are produced that need to be managed in a manner which is economically efficient and also environmentally friendly. Use of RAP in repaving in asphalt pavements provides the opportunity to conserve natural resources and saving landfill spaces. The Kansas Department of Transportation (KDOT) has placed approximately 10 million tons of hot-mix asphalt (HMA) over the past five years and has been historically using 15% RAP. Since 2008 due to increase in binder prices, KDOT has considerably increased the amount of RAP usage. However, the effect of higher percentage of RAP materials on long-term pavement performance is not still completely understood. In order to evaluate this effect, different laboratory-produced mixtures have been evaluated to establish RAP use guidelines in Kansas. The guidelines will ensure long-term performance of these "green" asphalt mixtures. This presentation will discuss the research and development of "green" asphalt in Kansas.

Peter Hall, Amec Foster Wheeler:

Development of a Global Waste Footprint Program to Drive Sustainability and Waste Management



Amec Foster Wheeler developed a worldwide program for BP which is identified the current and future risks and liabilities associated with the wastes BP generates through its key operation activities in upstream, refining & marketing. In addition to developing a database of waste and associated regulatory legislative frameworks, the study developed a risk model to prioritize key waste streams and waste reduction practices worldwide. The program is being conducted with a global AMEC team including key resources in AMEC UK, Canada, US and in China. The waste management footprint assessments were based in part on: • The activities BP conducts that generate waste • Nature of the legislative frameworks within the countries BP operates • Availability of suitable waste management infrastructure to effectively manage the waste

materials produced as a result of operations. This global waste management footprint study, which will support global standards and practices, examined BP's operational activities across 32 countries and used a series of data harvesting methods to develop 24 waste footprint factsheets that provide waste management risks for each country assessed.

Cris Liban, LA Metro: Tools of Preparation: Climate Change Resiliency at LA Metro



Transportation systems must build and maintain assets that can withstand the evolving effects of climate to ensure a state of good repair without compromising service. Competing organizational interests pose a challenge to this goal, which makes the prioritization of assets key in improving resilience. A resiliency indicator framework provides Metro a means for agency prioritization and evaluation of adaptation implementation strategies. Metro has developed such a resiliency indicator framework that builds on existing work, and includes a review of current literature, development of technical and organizational indicators, and creation of the framework's spreadsheet tool that has been used by the agency. As the agency expands its evaluation of agency-wide risks, this tool for climate change risk assessment will become most valuable for integration into the infrastructure of asset management and operations planning from a multimodal perspective.

Mikhail Chester, Arizona State University: Climate Change Impacts on Transit Systems



Extreme heat in the American Southwest is expected to occur with greater frequency and severity in the coming decades and public transit systems have not necessarily been designed to withstand their impacts. Using California and Phoenix, Arizona public rail systems we investigate how increasing temperatures and extreme heat events can impact public transit directly as well as the people who rely upon them. Using downscaled climatological forecasts to mid-century we assess the risk to reliable electricity supply to rail infrastructure by integrating models of constraints on electricity generation with demand forecasts. In addition to the potential impact of electricity outages on transit, we assess individual accessibility issues during extreme heat. We consider how transit stop distribution, transit stop design, and service frequencies lead to individual exposure to extreme heat which may induce morbidity and mortality health outcomes. This exposure may be exacerbated by the increasing demand for public transit services and disruptions in service resulting from localized electricity brownouts and blackouts.

Timothy Grose, Cambridge Systematics: Parched: The Impacts of Drought on Transportation



Nationwide, almost 600 counties received drought disaster designations in 2014 (USDA)—including all of California, Arizona, and most of Texas. As the century progresses, droughts are projected to become even more intense in the southwestern US (NCA). Although more publicized for effects on water supplies and agriculture, drought also stresses transportation infrastructure and operations—contributing to premature deterioration and, through impacts on vegetation, exacerbating stormwater runoff and wildfire threat. This presentation will focus on these risks, leveraging the findings of FHWA-sponsored Resilience pilots in Texas and Arizona and concluding with a discussion of implications for other areas, including Southern California.

Cyrus Parker, North Carolina Department of Transportation: Communicating the Hazard on Transportation Projects



Transportation projects often have many stakeholders making decisions that should take into consideration the impact of contaminated properties. These stakeholders are often not aware that the project impacts contaminated properties and the impacts they may have on the decision. North Carolina DOT has developed a set of symbols and line styles to communicate the hazards of contaminated sites for our drawings. This allows everyone that views the drawings, from the planners to the builders, and everyone in between to know there are sites of concern on the project. The symbols will be introduced and several projects will be discussed where these simple, but effective, symbols have been used.

John Donatucci, Kleinfelder: Green and Sustainable Remediation Alternatives



GSR Remediation Kleinfelder, as part of the remedial alternative evaluation process, performs a comparative analysis of remedial alternatives for green and sustainable remediation following US EPA's and DTSC's guidance for greener cleanups. Green remediation is intended to decrease the environmental footprint of the cleanup action, rather than trade cleanup objectives for other environmental objectives, and includes as goals: 1. Minimizing energy use and maximizing renewable energy use. 2. Reducing GHG emissions. 3. Decreasing impacts to water resources. 4. Reducing, reusing, and recycling materials and waste. 5. Minimizing land use and protecting ecosystems. On over 30 projects, Kleinfelder utilized a GSR evaluation tool known as SiteWise, to perform sustainability assessments, which was developed by the Navy, the Army Corps of Engineers, and Battelle, to calculate various environmental metrics for remedial alternatives. Input values to SiteWise are broken down into phases of work, including: remedial investigation, remedial action construction, remedial action operations, and long-term monitoring; and are further divided into categories including material production, transportation, equipment use, and residual handling. SiteWise includes detailed input values and evaluates eight sustainability factors. A demonstration of the SiteWise model for a case study, including data input, and graphical and numerical results, will be presented.

Jeffrey Keaton, Amec Foster Wheeler:

Project Definition Trap: Benefits in Operation are Unwanted Costs in Design and Construction



Pavement systems may provide examples of a project definition trap created by the way infrastructure projects are financed if “design and construction” is separated from “operation and maintenance”. Typical geotechnical investigations performed for pavement design consist of widely spaced borings that ignore geology or treat it as uniform or random. Some geologic settings contain zones of expansive materials that can degrade pavement quality faster than adjacent zones without expansive materials, but the overall pavement condition index of a highway segment may be controlled by the expansive soil zones. More extensive geotechnical investigations that include geophysical surveys could identify and characterize expansive soil zones. These expansive soil zones could be treated or removed and replaced with non-expansive material during construction, resulting in pavement systems with more

uniform conditions and better overall performance. Project managers may reject more extensive geotechnical investigations because they add cost to a design and construction “project”. Operations managers may experience budget problems because expansive zones were neglected during design. Thirteen subcategories in the Envision™ Rating System for Sustainable Infrastructure are involved in this example; the primary subcategory is LD3.3 Extend useful life. Secondary subcategories relate to Leadership, Quality of Life, Resource Allocation, Natural World, and Climate.

Keith Pilgrim, Barr Engineering Company: Advancements in the Removal of Metals and Dissolved Phosphorus for Stormwater Runoff from Impervious Surfaces: Introducing the Spent Lime Filtration Treatment System



Spent lime is an abundant waste byproduct of drinking water treatment, and the primary component of spent lime is calcium carbonate. This material has been found to be useful for the treatment of stormwater runoff from impervious surfaces. Calcium chemically prefers to be bound to phosphate over carbonate, and phosphate is readily converted to calcium phosphate in the presence of high concentrations of calcium carbonate (spent lime). When spent lime is used in a stormwater treatment cell, a pH environment is created and this also facilitates the removal of metals, including copper, lead, and zinc. The use of spent lime for stormwater treatment provides performance and maintenance advantages over existing treatment cells that filter stormwater. A spent lime treatment cell was designed and

constructed by Barr Engineering Company on behalf of the Ramsey-Washington Metro Watershed District in St. Paul, Minnesota. The design and performance of this treatment system will be discussed as part of this presentation. The potential application of spent lime for the treatment of highway runoff will also be presented.

Jennifer Walker, Watearth Inc.: Green Infrastructure Case Studies for Urban Renewal



This presentation covers Green Infrastructure case studies from the Gulf Coast to the arid western U.S. and California’s Mediterranean climate and addresses all phases of the projects from planning and modeling to landscape selection, design, construction, monitoring, and operations and maintenance. Public outreach and education is also included for many of these redevelopment and retro-fit projects. Green Infrastructure, hydro-modification, bioretention, vegetated swales, permeable pavement, green streets, stormwater harvesting and manufactured products are included. While most of the case studies are for urban, site-specific projects, regional modeling studies estimating the benefit and cost-

benefit of large-scale implementation of Green Infrastructure are also covered. The case studies include projects funded by grants as well as projects funded by public agencies. The case studies include: green parking lots, roadway Capital Improvements Program (CIP) projects constructed as green streets, new roadways in developing areas, watershed-wide implementation within urban and rural watersheds, and integration of water conservation into stormwater management. This presentation concludes with a discussion of lessons learned from the various case studies. Additionally, recommendations to increase the implementation and effectiveness of Green Infrastructure and Low Impact Development are included.

Alisha Goldstein, U.S. Environmental Protection Agency:

Selection and Implementation of Green Infrastructure Projects to Achieve Multiple Benefits



This presentation will cover how to go about selecting and designing green infrastructure projects for right of way project based on various site selection criteria to achieve multiple benefits. Selection of suitable sites should consider regional planning initiatives and associated goals such as enhancing neighborhood connectivity, provision of public space and parks and traffic safety concerns. Designing green infrastructure practices also is a critical factor to ensure the success of a project. Factors the planner and designer should consider will be discussed and include the following:-1. Flow management, 2. Soils, 3. Plant selection, and 4. Maintenance features. Case studies will be used to illustrate these points and to express that green streets is a synergy of stormwater management practices, safer and more and walkable streets, cooler and more pleasant public spaces and a catalyst for private and public investments and efficient use of natural and man-

made resources. Examples will be drawn for national and international practice

Tuesday Afternoon, June 9th

Jennifer Walker, Watearth Inc.: Nuview School Green Parking Lot Retro-fit: 100% Infiltration of Runoff



This case study covers a Low Impact Development (LID) retro-fit of an existing parking lot to infiltrate/evaporate 100% of stormwater from the parking lot reconstruction and solve existing structural flooding issues on the site. The project is located in the arid western U.S. in Riverside County, California. The retro-fit includes the following LID features: porous asphalt, infiltration trenches, vegetated buffers to block low-blowing dust from nearby open space, other dust blocking design features, and extreme event overflow elements into an existing infiltration basin and play field. The proposed LID features also function as hydro-modification management due to the infiltration/evaporation of 100% of stormwater

runoff. Long-term continuous simulation modeling using rainfall gauge data from 1970 – 2006 was performed to confirm the operation and performance. Design storm modeling was also performed. Project phases and lessons learned from all phases of the project, including: planning, modeling, design, landscape design, construction, maintenance, and monitoring are discussed. The project also includes an educational component and interpretive signs. The project had an aggressive schedule to limit loss of parking and facilitate installation of solar structures on the site. Challenges and strategies to address design-build items on LID projects are discussed.

Dr. Lee-Anne Milburn, Dr. Weimin Li, Jon Harnish, Erik Rowan, Fidelitie Chang & Trenton Vail, Cal Poly Pomona Deborah Deets, City of Los Angeles: Transportation Corridors as Flow Corridors for Resource Management: Roads as “Streams” and their Role in the “Greenways to Rivers Arterial Stormwater System (GRASS)”



The road, rail, and other urban transportation systems in the Los Angeles River Watershed are opportunities to improve environmental issues of water quality and water supply through connecting isolated green spaces and stand-alone stormwater management best management practices. The GRASS program (Greenways to Rivers Arterial Stormwater System) analyzed opportunities to create “bluebelts” through the use of roads, boulevards, street right-of-ways and other linear spaces to connect existing and create new opportunities to remediate contaminated soils, filter storm water, and aid in ground water recharge. At the same time, these new bluebelts create spaces amenable to alternative transportation, encourage exercise, and provide “green” spaces for park-poor communities.

Patrick Wong, W2 Design Inc.:

Expo Rail Operations and Maintenance Facility: Water Conservation Case Study



Exposition Metro Line Construction Authority is completing a 15.2 mile, \$2.5 billion Exposition Light Rail Line from Downtown Los Angeles to Santa Monica. As part of the project, a new light rail maintenance facility is in construction to support the additional capacity of the line. The Expo Rail Operations and Maintenance Facility is built on nine acres of land, which required a three party land swap between Metro, City of Santa Monica, and Santa Monica College. The design affords a number of sustainable features including a water conservation and use system. The system captures site stormwater runoff into a 400,000 gallon cistern for industrial uses. The stormwater system is made up of pre-treatment via a water quality unit, cistern, post-treatment via ultra violet disinfection and a series of pumps and piping to industrial water demands. In addition, the system incorporates an electronic monitoring system that will actively control storage volume based on a rainfall forecast and system performance to minimize wet weather impacts to the storm drain system.

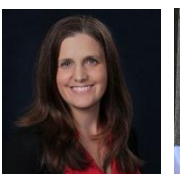
Tom Lewis, Louis Berger:

Applicability of Envision and a Life Cycle Approach Towards Transportation Infrastructure Development and Sustainability



Sustainability rating and evaluation systems including but not limited to LEED have been developed and more broadly used for vertical structures, developments and neighborhood assets. These ratings systems have established best practices and created valuable drivers for “triple-bottom line” sustainability. However the “horizontal” (transportation) infrastructure connecting these assets have not been the focus of similar sustainability approaches on anywhere near as broad a scale, notwithstanding their critical role in connecting and enabling the sustainability of these vertical assets. A key example is transit which is actually featured as one criterion in LEED sustainability. Envision represent an integrated life cycle based approach to evaluate sustainability of infrastructure. This presentation/discussion will include examples of how Envision can be applied to different horizontal infrastructure types, including an assessment of related elements such as asset management, O&M, funding and investment.

Anneke Davis and Lisa Reid, CH2MHill: New Updates in FHWA's INVEST Version 1.2



FHWA revised its sustainability rating system (INVEST) by releasing INVEST Version 1.1 in January 2015; a further revision, Version 1.2, will be released in June 2015. INVEST is a practical, web-based, collection of voluntary best practices, called criteria, designed to help transportation agencies integrate sustainability into their programs and projects. INVEST considers the full lifecycle of projects and currently has three modules to self-evaluate the entire lifecycle of transportation services, including System Planning (SP), Project Development (PD), and Operations and Maintenance (OM).

This presentation will introduce and review the changes implemented in INVEST, for both Versions 1.1 and 1.2, based on the feedback received from numerous users and agencies. INVEST 1.1 and 1.2 reflect substantial revisions to the web-based tool, technical revisions to criteria, and the addition of a new module.

Lisa Reid and Anneke Davis, CH2MHill: Integrating FHWA's INVEST at the Illinois Tollway



FHWA developed its Infrastructure Voluntary Environmental Sustainability Tool (INVEST) to help make the nation's transportation systems more sustainable – economically, socially and environmentally. INVEST was created specifically for transportation agencies to evaluate the sustainability of the full lifecycle of their highway and transportation projects and plans. A free, web-based, self-evaluation tool, INVEST provides a collection of criteria and practices that allow transportation agencies to gauge their level of sustainability and systematically integrate sustainable practices into their actions.

The Illinois Tollway is integrating INVEST into its \$12B, 15-year Move Illinois capital improvement program to evaluate projects as well as system planning and operations & maintenance programs. The purpose of this session will be to explain implementation of INVEST at the Tollway, share preliminary results and sustainable improvements resulting from implementation, and to discuss lessons learned in the implementation as well as in leveraging INVEST to improve the sustainability of the Tollway's projects and programs.

Winnie Okello, Pennsylvania Department of Transportation: Engineering in a Global Context: Recycled Materials Applicability in Developing Nations



In an era of resource scarcity it has become imperative to evaluate alternative renewable/reusable sources of materials that can be applicable in the transportation sector. The transportation industry has made great efforts in researching reusable materials for construction and maintenance activities. The journey to environmental stewardship within the context of transportation infrastructure design, construction and maintenance has not been without failed attempts, however, it is these lessons learned that developing nations can glean valuable data and avoid similar setbacks in the learning curve. These industry-tested recycled materials and processes can be modified and applied in developing nations to prevent further resource depletion, and encourage environmental stewardship, and resource management.

Fatih Yonar, Istanbul Technical University: Utilization of EAF Slag in Highway Construction and Possible Environmental Outcomes in Turkey



As has been in many developed countries, to reduce the environmental impact of production and consumption of natural resources in Turkey, alternatives should be taken in to consideration. Construction is a leading sector in Turkey and requires the highest amount of raw materials. In this respect, steel sector as the producer and highway construction sector as the consumer stand out, in scope of international researches and applications. Turkey is the 8th biggest steel producer in the world with the capacity of 49,6 million tones. Electric arc furnaces (EAF) produce 75,9% of this capacity. 4,8 million tones of slag may be obtained from EAFs in full production per year in Turkey. Even

though EAF slag is accepted as a by-product in international literature, no utilization procedures or processes defined in Turkey. In this context, utilization of EAF slag in highway construction has a great importance in aspects of environment, economy and sustainability. In this paper; 3 EAF slag samples are reviewed according to cooling, contamination and weathering conditions. Secondly physical properties are investigated according to ASTM standards by the limits in Turkish Highway Specifications 2013. Unbound granular layer and Marshall mixtures are designed. Lastly environmental and economical outcomes are considered according to test results.

Andrew Graettinger, University of Alabama: Recycled Material Web Map: Connecting Producers and Consumers



The Recycled Materials Resource Center at the University of Wisconsin initiated a Recycled Material Web Map project in conjunction with The University of Alabama, through a transportation pooled fund study, to produce an on-line tool that connects producers and consumers of nonhazardous recyclable material. The Recycled Material Web Map is comprised of three core layers: stockpiles, regulations, and case studies. The stockpile layer allows facility managers to login and enter or update information about recycled material stockpiles including type(s), application, and availability. The regulation layer includes both environmental regulations and Department of Transportation specifications pertaining to

the beneficial reuse of recycled material based on specific location, type, and application. The case study layer locates projects that successfully utilized recycled materials and includes information regarding the type, application, volume data, and the facility that supplied the recycled material. Consumers can pinpoint the location of a construction project, search for sources and quantities of recycled material that meet project specifications, and identify applicable regulations. The web map utilizes search capabilities to locate facility stockpiles and minimize transportation costs. The Recycled Material Web Map bridges the information gap between producers and consumers

Jennifer Gonzalez, Louis Berger: Transit as a Force Multiplier in Climate Change Resilience, Including Regional Economies as a Key Beneficiary



Increasingly whether on a global or regional scale, the economic competitiveness of cities and their regional economies is based both on access to human capital and upon vulnerability to climate change and extreme weather. Transit infrastructure is unique in that it represents a highly efficient asset to move urban region's most valuable and increasingly vulnerable resources: its people. As our cities and regions become increasingly under pressure to protect against the effects of climate change, their ability to maintain connectivity within the region for all members of the region becomes essential, including responding to long term land use changes that may occur as a result of climate change. This

presentation/discussion will look at different regions and the role of transit in regional resilience and new opportunities to leverage this critical role for transit system and associated resource development funding.

Ileana Ivanciu, Dewberry:

Superstorm Sandy Recovery: A Case Study for Environmental Protection Success in Response to Extreme Weather Events



New Jersey's recovery after Superstorm Sandy hinged on the success of the waterway debris removal along New Jersey's 127-mile coast. Debris clogged recreational and commercial waters, as well as thousands of acres of floodplain wetlands, impacting the state's coastal livelihood and threatening the \$19 billion attributed to Jersey Shore tourism and the \$1.7 billion attributed to saltwater commercial and recreational fishing industries annually. Governor Chris Christie and his administration committed to rapid debris removal to reopen the waterways for recreation and commerce. The New Jersey Department of Environmental Protection (NJDEP), with Dewberry as its program manager, partnered to manage an unprecedented cleanup while protecting the sensitive ecology and history that make the Jersey Shore a national treasure. All reported wet debris was removed by the July 4th weekend and Governor Christie announced the program's completion on the storm's one-year anniversary—the Federal Emergency Management Agency (FEMA) reimbursement deadline. The program removed 194 vessels and vehicles; four homes; 6,019 submerged targets; over 100,000 cubic yards of debris; and over 360,000 cubic yards of sediment. This presentation will share successful program procedures that can be repeated in response to future disasters to manage debris waste streams generated by these events.

Peter Hall, Amec Foster Wheeler: Integrated City Resiliency Solutions to Manage Critical Assets



Amec Foster Wheeler will review case studies that demonstrate how predicting extreme weather, proactive communication of impacts, managing critical assets and the development of implementation plans have enabled cities to improve resiliency. Amec Foster Wheeler is a 100 Resiliency Cities (Pioneered by the Rockefeller Foundation) Platform Partner and will review how these integrated set of services can support city resiliency efforts within this global program framework. Los Angeles is one of the cities in the 100RC cities network and our role, along with other platform partners, is to help individual cities become more resilient and facilitate the creation of a global practice of resilience building which will also be discussed. An overview of scalable resiliency solutions that can be applied to any city to improve resiliency, better manage future risks and secure funding for projects will be reviewed and include: • Extreme weather forecasting/flood warning services which will allow cities to incorporate resiliency into their infrastructure and operations • Critical asset data management to management to help cities identify, prioritize and track key critical city assets that are most vulnerable to shocks and stresses • Tactical action plans for resilience implementation.

Mike Tumulty, STV Group:

Evaluating Risk in Setting Design Criteria for Protection of Transportation Infrastructure from Coastal Flooding



Climate change and natural disasters impact and influence the design of our transportation infrastructure and communities. This presentation will discuss the need to consider the probability of different flood levels in setting design criteria for transportation infrastructure. FEMA provides 10-, 50-, 100- and 500-year flood levels, and NOAA provides flood level predictions based on storm surge models. With a myriad of storm event information and analysis, what flood levels should we use for design of our transportation infrastructure systems? What amount of freeboard is appropriate and should sea level rise be included? Changing predictions for sea level rise make these questions even more difficult to answer. The presentation will also explore examples of how different transportation organizations are specifying flood design levels for their assets.

If you enjoyed this workshop and would like to be more involved in the Transportation Research Board Committee on Waste Management and Resource Efficiency's activities, check out our web site at: <http://www.trb-adc60.org/> or sign up as an official friend of the committee at <https://www.mytrb.org/> (requires you to set up a user profile).



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