TRB ANNUAL MEETING 2020

99TH Annual Meeting
Washington, D.C.
January 12–16, 2020

DIVISION OF ENVIRONMENTAL RESOURCES

BUREAU OF ENVIRONMENTAL PROGRAM RESOURCES

Caroline Birsner, Environmental Specialist 2
John J. Riggi, Environmental Specialist 2

NEW JERSEY EXECUTIVE ORDERS AND ENERGY MASTER PLAN

- Executive Order No. 89
- Executive Order No. 100
- Energy Master Plan

The New York Times

With 130-Mile Coast, New Jersey Marks a First in Climate Change Fight

Builders will be forced to take climate change, including rising sea levels, into account to win government approval for projects.

Gov. Philip D. Murphy, a Democrat, giving the State of the State address in Trenton, N.J., this month. Seth Wenig/Associated Press

https://www.nytimes.com/2020/01/27/nyregion/climate-change-nj-environmental-rules.html

DECARBONIZATION

- Aggressive global, national, and regional targets for emissions reductions: **"Carbon-neutral by 2050"**
- Strategies:
  - Cap-and-trade / cap-and-invest
    - California State Transportation Agency
    - Transportation and Climate Initiative (TCI)
  - Electric vehicles / fuel efficiency standards
    - Norway, China
  - Leveraging pollution / air quality targets to co-benefit with emissions reduction targets
    - China, United Kingdom

https://www.discovermagazine.com/technology/new-battery-could-charge-an-electric-car-in-10-minutes

DECARBONIZATION (CONT.)

- Indicators of Federal support
  - America's Transportation Infrastructure Act (ATIA) – **federal funding bill**
    - $10 Billion "climate title"
      - Formula grants
      - Discretionary grants
    - Increase in funding for non-motorized transportation
  - **FHWA guidebook** for state DOTs on emissions reductions (by end of CY 2020)

Key Takeaways from FHWA:

- Most emissions reductions will come from **clean vehicle** and **fuel technologies**
- **Demand reduction** and **systems efficiency** strategies can reduce emissions another 5-20%
- Additional 2-3% reduction potential from DOT **construction materials**, **fuels/fleets**, and **buildings**
- GHG reduction targets of 75-80% by 2050 are challenging and will require widespread electrification and clean grid
- Most strategies require implementation at multiple levels (state, regional, local)

DECARBONIZATION (CONT.)

What are other state DOTs doing?

- Minnesota:
  - Reducing facilities emissions (building thermostats)
  - Prioritizing electric vehicles
- Washington State:
  - Reducing VMTs, reducing congestion
  - Promoting vehicle efficiency, electric vehicles, biofuels
- Texas
  - Drive Clean Texas campaign, toll credits for EV drivers
  - Teleworking, shortened work weeks for TXDOT employees
  - Clean operations: solar sign boards instead of diesel
  - Sustainable pavements: "warm mix" instead of hot mix asphalt, pavements with recycled products
  - Alternative fuel vehicles, electrifying corridors

So, what can NJDOT do?

- Support **EV/AFV infrastructure**, **clean transit** and **fleets**
- Implement ITS/efficient **traffic operations**
- Support **alternative modes** of transport to reduce VMTs, **reduce employee VMTs** wherever possible (i.e., encourage teleworking)
- Adjust office building **thermostats**
- Use low-carbon, recycled/reused **construction materials** where feasible
- **Collaborate** with other state, regional, and local agencies to do everything within collective power

RESILIENCE

- Risk and resilience assessment / modeling
  - Risk Analysis and Management for Critical Asset Protection (RAMCAP) model
    - Asset characterization
    - Threat characterization
    - Consequence analysis
    - Vulnerability analysis
    - Threat assessment
    - Risk/resilience assessment
    - Risk/resilience management
  - **Need quantitative data** in order to run models
- Design guidelines / manuals
  - City of New York Climate Resiliency Design Guidelines

Table 3 - Determine the sea level rise-adjusted design flood elevation (DFE)[55]

End of Useful Life	Base Flood Elevation (BFE)[56] in NAVD 88	+ Freeboard[57]	+ Sea Level Rise Adjustment[58]	= Design Flood Elevation (DFE) in NAVD 88
Critical* Facilities				
2020s (through to 2039)	FEMA 1% (PFIRM)	24"	6"	= FEMA 1% + 30"
2050s (2040-2069)	FEMA 1% (PFIRM)	24"	16"	= FEMA 1% + 40"
2080s (2070-2099)	FEMA 1% (PFIRM)	24"	28"	= FEMA 1% + 52"
2100+	FEMA 1% (PFIRM)	24"	36"	= FEMA 1% + 60"
Non-critical Facilities				
2020s (through to 2039)	FEMA 1% (PFIRM)	12"	6"	= FEMA 1% + 18"
2050s (2040-2069)	FEMA 1% (PFIRM)	12"	16"	= FEMA 1% + 28"
2080s (2070-2099)	FEMA 1% (PFIRM)	12"	28"	= FEMA 1% + 40"
2100+	FEMA 1% (PFIRM)	12"	36"	= FEMA 1% + 48"

https://www1.nyc.gov/assets/orr/pdf/NYC_Climate_Resiliency_Design_Guidelines_v3-0.pdf

RESILIENCE (CONT.)

- Resilience and finance
  - Infrastructure financing and credit ratings
- Benefit-cost analyses, and the "business case"
  - Consider "the cost of doing nothing"
  - Attempt to quantify benefits from "avoided losses"
  - Focus on **smaller, cheaper improvements** rather than fortifying assets to the most extreme circumstances
- Funding: America's Transportation Infrastructure Act

https://www.econlib.org/library/Enc/BenefitCostAnalysis.html

FROM "LEVEL OF SERVICE" TO "QUALITY OF LIFE"

- Los Angeles DOT: "Green New Deal"
  - Goal of **zero-carbon** on-road transportation
  - Bike lanes: good
  - Roadway capacity projects: bad
- Utah DOT: "Community of Our Dreams"
  - **Mobility-focused** transformational shift
  - Moving cars → **moving people**
  - How will this affect environmental processes?
    - Importance of purpose & need statement
    - Modifying existing standards/protocols for NEPA, 4(f), 404

https://www.burlingtonvt.gov/DPW/ProtectedBicycleLanes

TRB Special Task Force on Climate Change

- TRB is reorganizing. This task force will sunset & be incorporated into a committees and subcommittees under the Transportation and Sustainability section (AMS00)
  - One subcommittee will be focused on the hazards of climate change the other on energy related issues
  - New opportunities for engagement of committee
- NHI course on resilience forthcoming next year from FHWA

Lectern 1241 – Current Trends in Landscape and Environmental Design

- Managing Urban Freeway Roadsides, Beverly Storey Texas A&M Transportation Institute
  - Urban Freeway Roadside (UFR) – high visibility urban freeways with limited pedestrian access, wider medians, interchanges, and overpasses
  - NCHRP Synthesis 20-05 Topic 49-06 for reference

Planning, Design & Management Issues

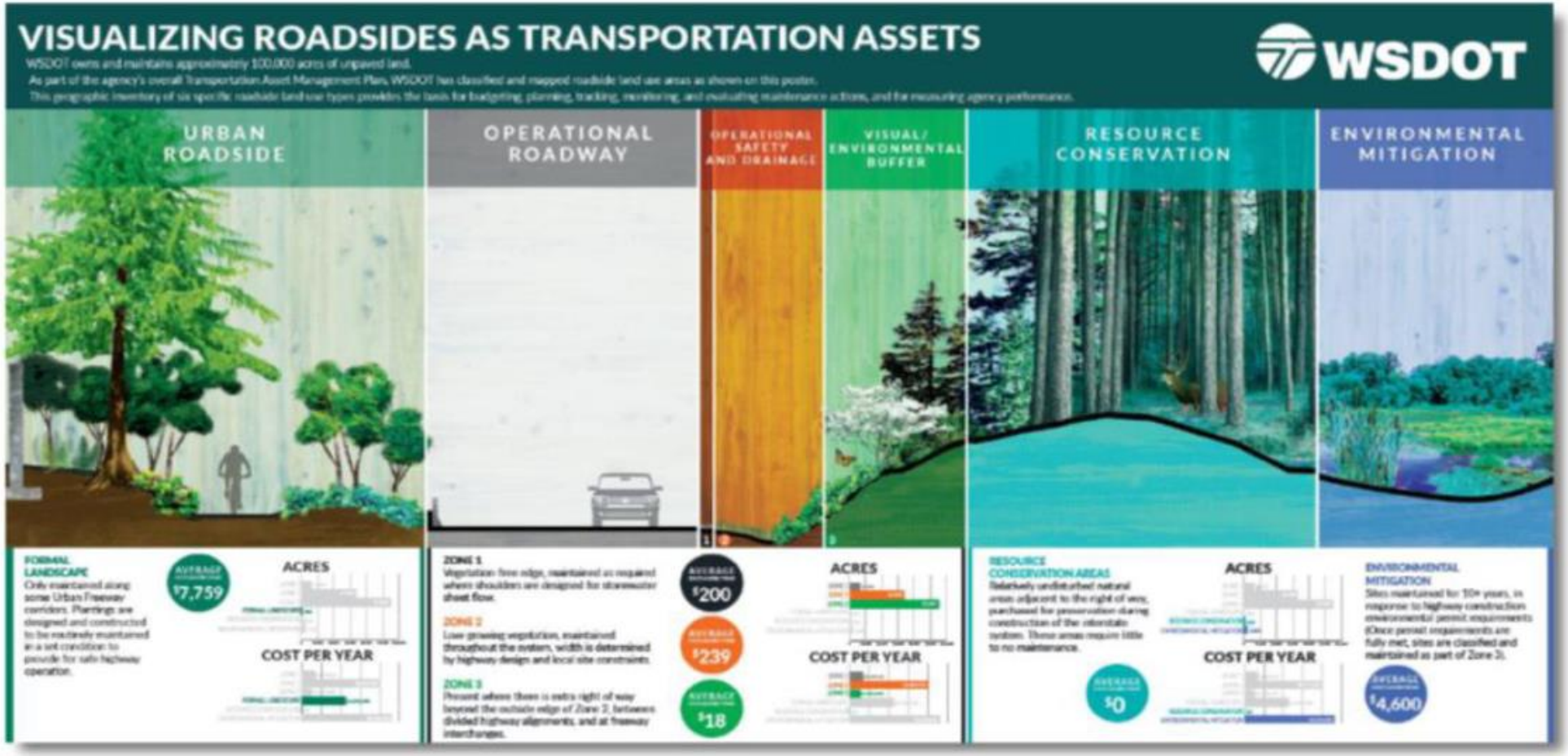
- **Access for maintenance personnel and equipment**
- Adjacent land uses
- Air pollution and particulate deposition
- Carbon sequestration
- Cooperative development/maintenance agreements
- Cost-effectiveness
- Disturbances caused by roadway repair, renovation and expansion
- Effects of de-icing agents, snow storage and ice
- Effects of structure shadowing
- Erosion control
- Fire risk/hazard
- Fixed object issues
- Graffiti opportunities on roadside art, retaining walls, noise barriers and other structures
- Headlight glare reduction
- Heat island effects of pavements, structures and buildings
- Highway alignment and design speed
- **Illegal encampments**
- Integration of historic, cultural, and scenic themes
- **Intelligent Transportation System technology placement, usage and maintenance**
- Lighting
- Multi-modal accommodations
- Noise and vibration
- Noxious and invasive weed management
- Outdoor advertising and other signage
- Plant species selection—native and adaptable
- Roadside appurtenances
- Safety clear zone
- Sight distance
- Soil requirements for pavement, subbase drainage and other infrastructure
- Soil requirements for sustainable landscape development
- Stakeholder expectations
- Stormwater management for quality and quantity
- Traffic volumes
- Utilities
- Views and screening
- Visual complexity
- Water and resource conservation
- Windbreak protection

- Report surveyed state DOT's for UFR policy, plans, etc.
  - Some states unable to provide or did not respond
- One new discovery ITS conflict w/proposed plantings and landscape design
- Illegal encampments/trespassing a huge future issue to explore
  - Several intersections of policy, law, society, environmental issues
- Develop a future UFR best management practice guide

A Multifaceted Approach to Improve Conditions for Pollinators Along Washington State Highways, Raymond Willard, Washington State Department of Transportation

- WSDOT has an Integrated Vegetation Management plan for region offices
  - Pollinator habit modeling
  - Ecological design (life-cycle based management system)

Integrated Roadside Design and Management



An ongoing quest to find the most sustainable site-specific solutions

Washington State Department of Transportation

Green Infrastructure and Living Shorelines: Adaption of Transportation Systems
Wendy Meguro, University of Hawaii

- Researched three sites on the island of Oahu and evaluated different methods to address climate change, sea level rise & flooding
  - Sunset Beach north coastal highway
  - Waipahu TOD and rail station project
  - Waikiki beach

- Sunset Beach – discussion of realignment of roadway, relocation of houses and restoration of historic dune structure
- Waipahu TOD – green infrastructure (permeable pavement w/ underground drains, tree plantings, stream dechannelization)
- Waikiki Beach – deal with king tide impacts (areas of safe to fail transportation), enhancing off shore breakwaters, coral reef enhancement and restoration.

Virtual Reality for Evaluating Active Transportation Improvements for Roadways

Muhammad Habib, Dalhousie University

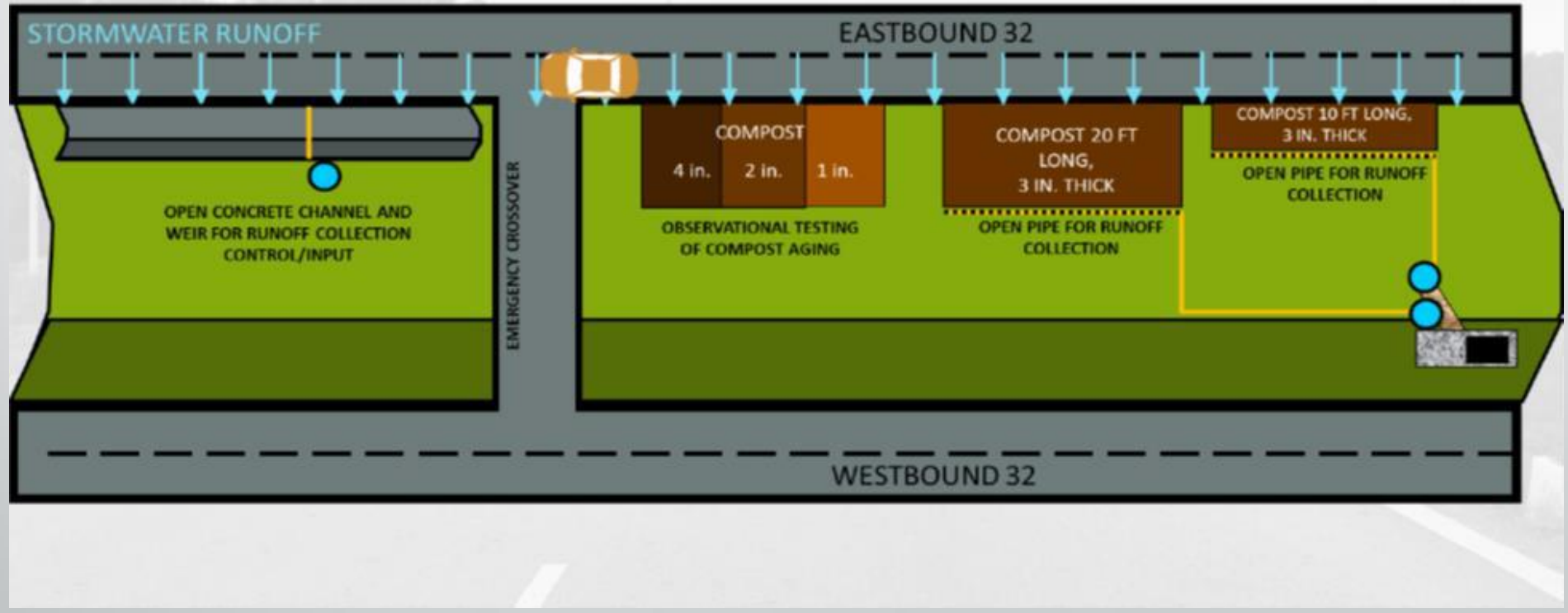
- Using VR interface (Oculus Rift VR headset) and VR software (Lumion) to have subject “interact” with a proposed streetscape
- Software is readily available and needs some coding (height of buildings, etc)
- Future needs in transportation jobs for compute science (coding)

Methods - “Pocket Parks” Models

Lectern Session 1376 Treatment of Highway StormwaterRunoff

- Preliminary Data on Vegetated Compost Blankets as Highway Stormwater Control Measures Erica Forgione, University of Maryland, College Park
- Studied section of Maryland Route 32 along with lab study
- Use vegetated compost blankets for removal of roadway contaminants

FIELD SITE DESIGN



- Overall the field locations for vegetated blankets showed removal of heavy metals from runoff. However, increase in nitrogen and phosphorous due the compost blanket itself.

- Follow-up NCHRP 14-39 design guidance will be forthcoming from the study.

Enhancement of Stormwater Infiltration, Water Retention, Nutrient Removal, and Plant Growth in Bioretention Media Through Biochar Amendment Paul Imhoff, University

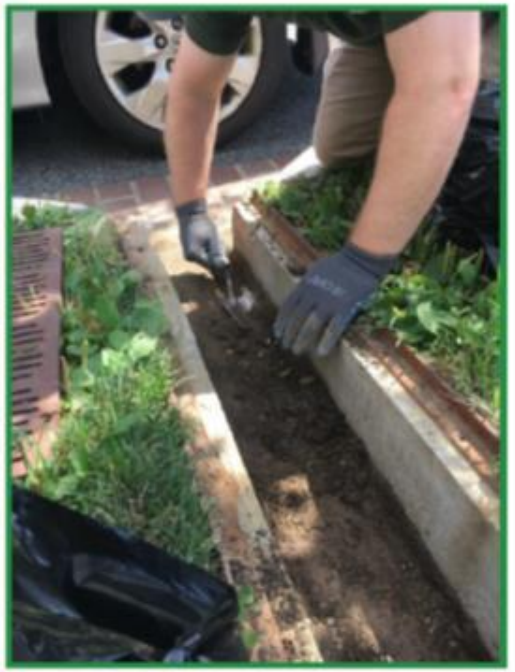
- Study used a mix of biochar (think Kingsford but pellets) and sawdust, and other media to test the ability of the biochar to remove nutrients
- Delaware mix, North Carolina mix and ratios of biochar in study
- Biochar increased phosphate leeching in bioretention mix overall, greater infiltration in NC biochar study
- Secondary study on plants and bioretention media after creating labd “drought” conditions
- NC mix plants better suited and survived “drought” study

Practical Lessons Learned on Design and Implementation of BMPs in the Right of Way

- Outreach with the public early and often
  - Why they are needed, the need for street sweeping (porous concrete), loss of parking
- Sign facilities (rain garden descriptions, do not mow)

2 DESIGN

- Keep maintenance in mind
- Involve the public
- Use underutilized space e.g., under the sidewalk



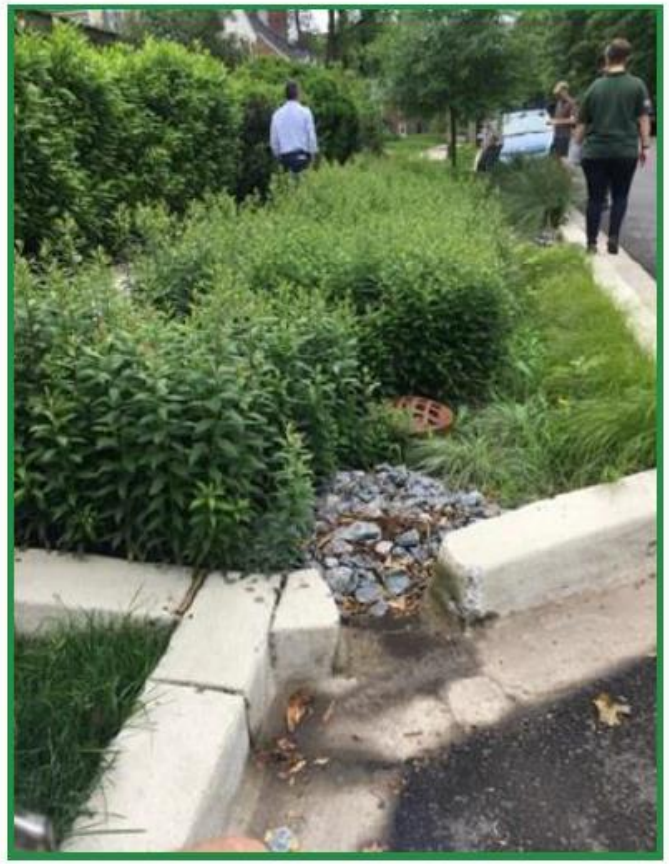
@DOEE_DC

2 DESIGN

- Remember to take into account the area outside the ROW
  - Stormwater volume
  - Tree impacts
  - Homes

3 CONSTRUCTION

- Make lots of notes on plan sets
- Have staff on hand or construction management (preferably the designers)
- Keep in mind timing of construction
  - Minimize disturbance
  - Time of year



4 MAINTENANCE

- Plan for reconstruction

Lectern Session 1452 Seasonal Climatic Effects on Transportation Infrastructure

- Network-Level Risk Evaluation of Unbound Pavement Foundation Layers to Extreme Weather Events Using Remote Sensing Joe Rosalez, California State University, Los Angeles
  - Used NASA Soil Moisture Active Passive (SMAP) satellite to analyze pavement stress from to Hurricane Harvey

- Characterizing Influence of Water Access Condition During Freezing on Resilient Behavior of Base Course Materials Lin Li, Nanjing Forestry University
  - Study looked at the frost freeze cycle on Alaskan base course soils when they are saturated and how frost-freeze cycles effect their strength
- Poroelastic Modeling of Pore Pressure Development in Unbound Pavement Bases Zhe Wan, University of Pittsburgh
  - Poroelastodynamic Finite Integration Technique (PEFIT) was used to show how increased pore pressure in saturated roads affects conditions
- Microstructure-Based Random FEM Model for the Freezing Effects in Soils and Cold Region Retaining Walls Shaoyang Dong, Case Western Reserve University
  - Conclusions showed that not only having drainage of water in backfill but also insulation helped mitigate lateral frost heaving

Lectern Session 1524 New Directions in Hydraulic Scour Design

- The FHWA Scour Program Joe Krolak, Federal Highway Administration
  - Current standard uses HEC-18, assumes a uniform layer of soil for the site
    - Newer 2D modeling improves flow calculations
  - NextScour balances the two variables (flow and soil) for calculations

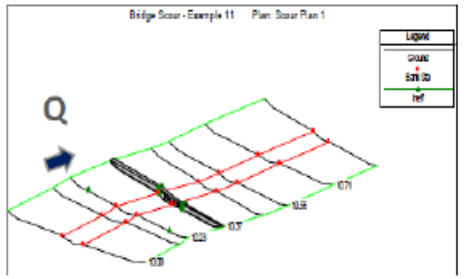
HEC-18

Hydraulics: What is Typical Hydraulic Design Practice?

1D Modeling & HEC-18

Flood Discharge

HEC-RAS Model



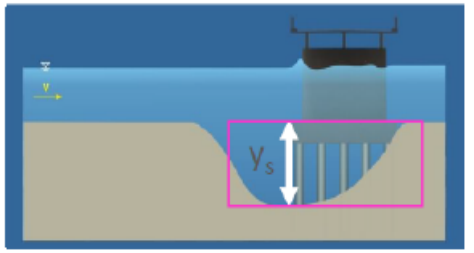
y_1, V_1, Fr_1, etc.

Flow Velocity/Depth

HEC-18 Equations / Hydraulic Toolbox

$$y_s = 2.0K_1K_2K_3\left(\frac{a}{y_1}\right)^{0.65} Fr_1^{0.43} * y_1$$

Maximum Scour Depth



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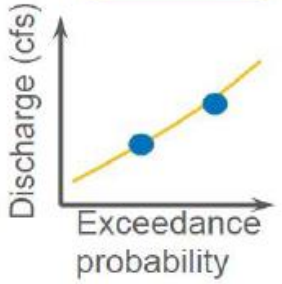
Federal Highway Administration

2D Modeling & HEC-18

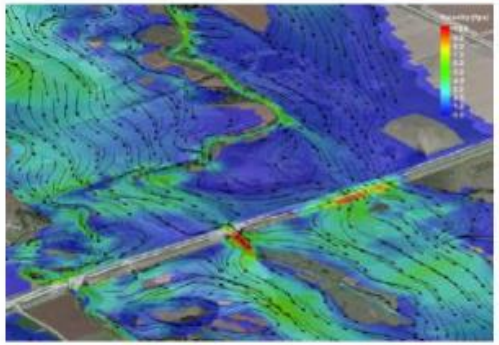
Hydraulics: What is Improved Hydraulics Design Practice?

2D Modeling & HEC-18

Flood Discharge



SRH-2D Model



y_1, V_1, Fr_1, etc.

Flow Velocity/Depth

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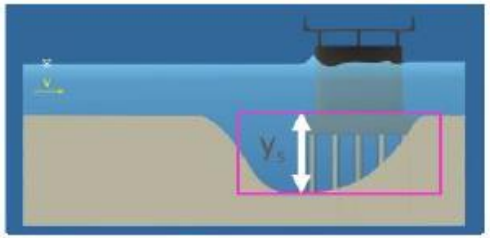
Maximum Scour Depth



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Automated CFD Scour Tool

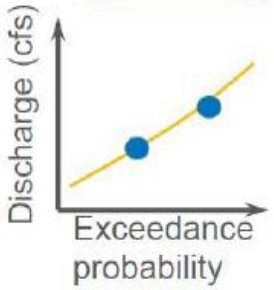
Hydraulics: What about a Future Design Practice???

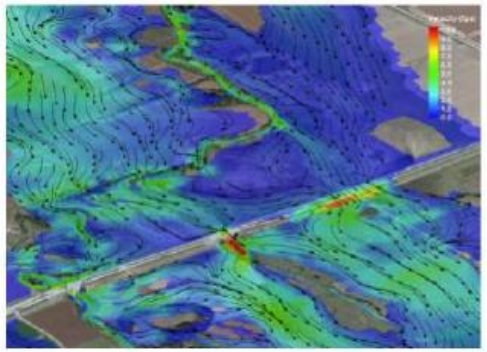
Automated CFD Scour Tool

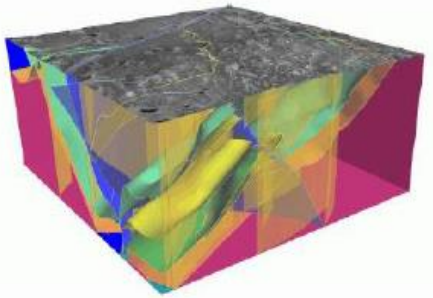
Flood Discharge

SRH-2D + Automated CFD Scour Tool + subsurface erosion maps/stratigraphy

3D Scour bathymetries







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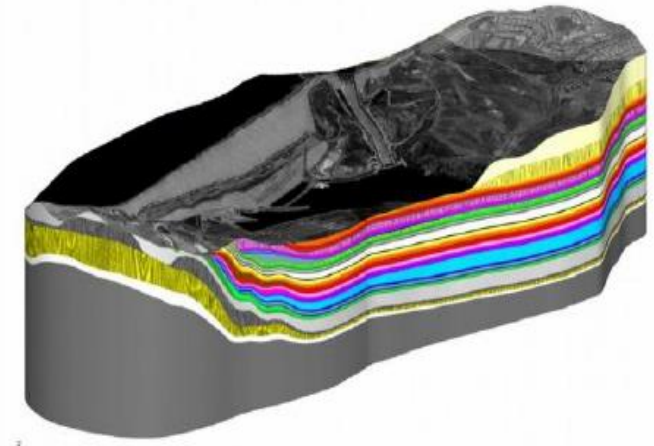
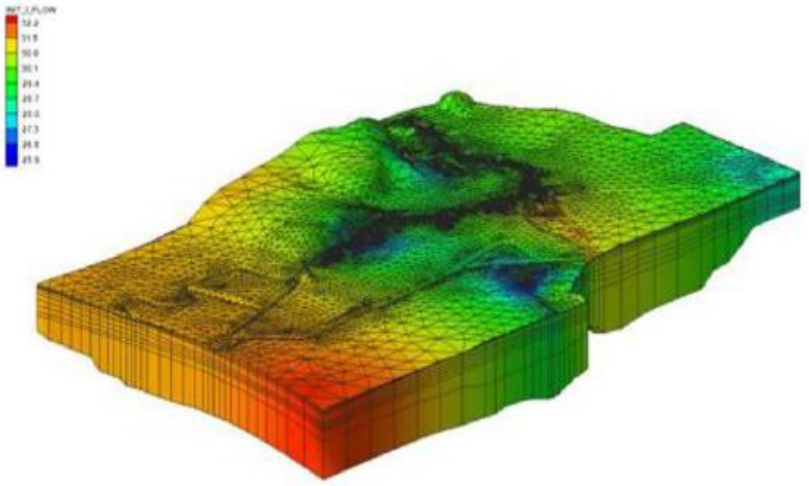
- NextScour uses testing of soils, erosion indexing and mapping to find out the strength of soils at each site location

Geotechnical: Erosion Mapping

Stratigraphy Development



Subsurface Erosion Maps



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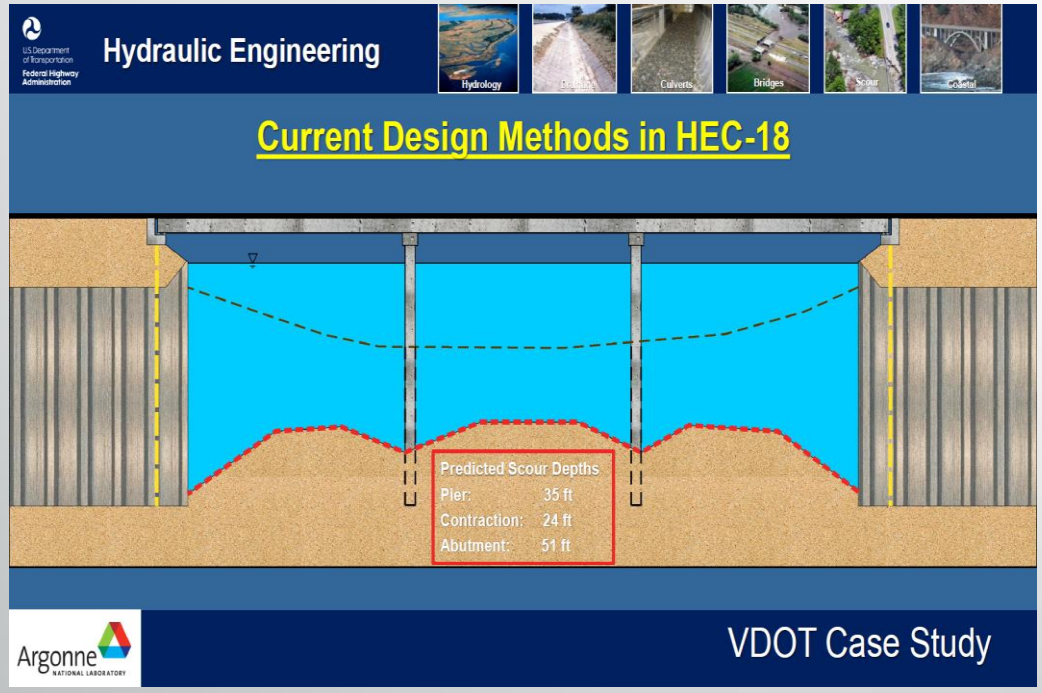
Federal Highway Administration

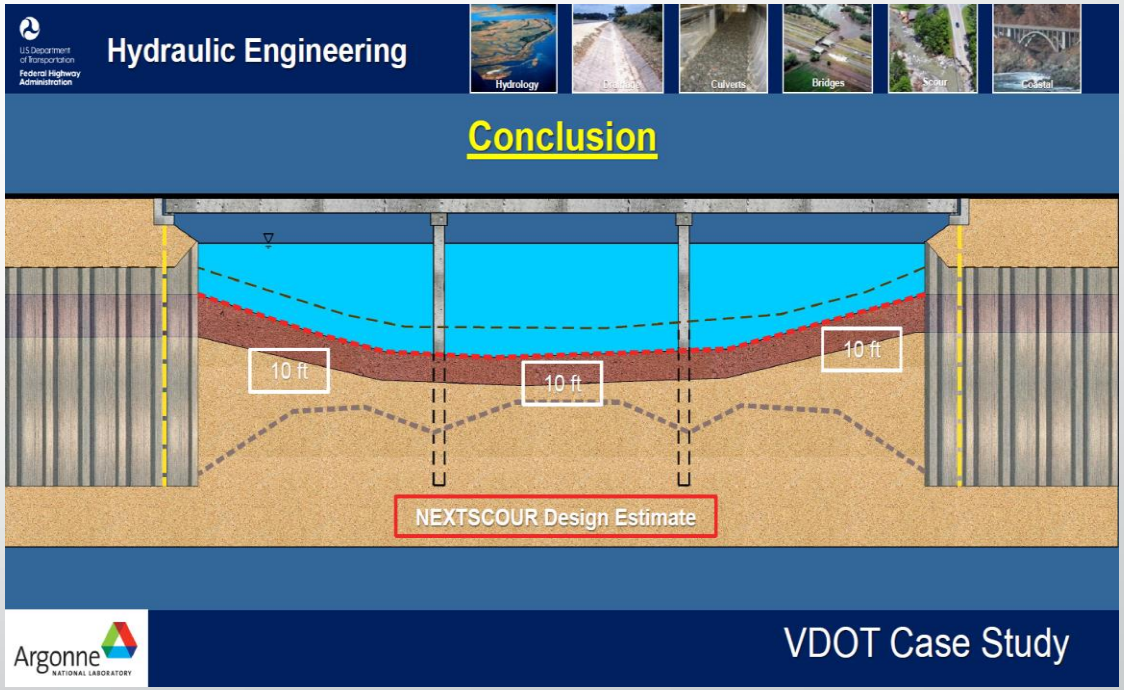
3D CFD Scour Calculations

KornelKerenyi, Federal Highway Administration (FHWA)
Marta Sitek, Argonne National Laboratory

- Study used a case study VA Route 671 Bridge Replacement over the Nottoway River in NextScour

Comparison


U.S. Department of Transportation
Federal Highway Administration
Hydraulic Engineering
Hydrology
Culverts
Bridges
Scour
Current Design Methods in HEC-18
Predicted Scour Depths
Pier: 35 ft
Contraction: 24 ft
Abutment: 51 ft
Argonne NATIONAL LABORATORY
VDOT Case Study


U.S. Department of Transportation
Federal Highway Administration
Hydraulic Engineering
Hydrology
Culverts
Bridges
Scour
Conclusion
10 ft
10 ft
10 ft
NEXTSCOUR Design Estimate
Argonne NATIONAL LABORATORY
VDOT Case Study

FHWA HEC-25:
Update to Highways in the Coastal Environment
Scott Douglass, South Coast Engineers

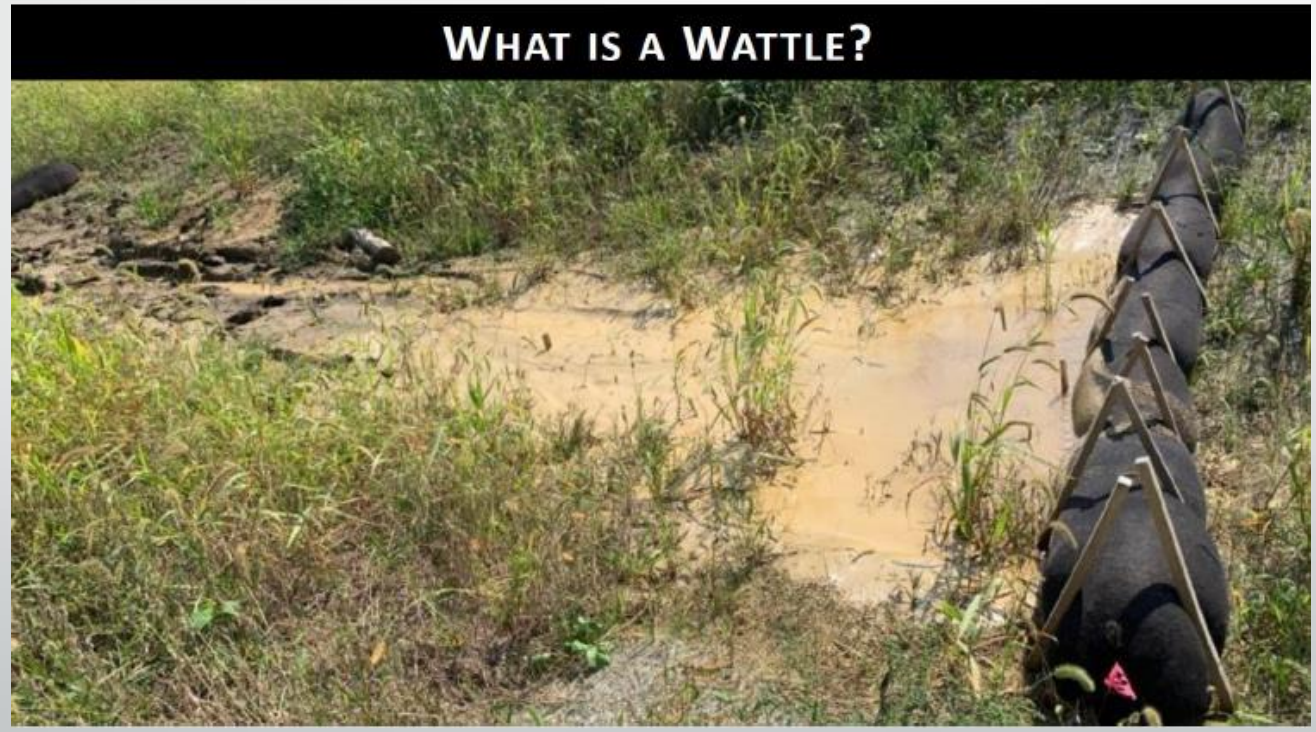
- HEC-25 Manual Highways in the Coastal Environment will combine the 1stedition (2008) and 2ndedition (2014) into a new document in weeks
  - Revised document will have 28-pg glossary and new sections
  - Coastal Highway Vulnerability Assessment
    - Engineering Risks at the Coast
    - Analysis Methods for Vulnerability to Extreme Coastal Storms
    - Adaptations Strategies for Coastal Highways
  - NHI Course 135082 Highways in Coastal Environment highly suggested

Lectern Session 1589 Current Practices in Highway Stormwater Management

- Evaluating Results from PennDOT's Statewide SCM Inspections Winnie Okello, PennDOT Jeffrey MacKay, NTM Engineering, Inc.
  - PennDOT owns over 2,700 Stormwater Control Measures (SCM), adding 5-10% per year
  - Has sites mapped by watershed and a set inspection, maintenance and training schedule
  - PennDot SCM Maintenance Manual (Publication 888)
  - Lack of construction QC and maintenance upkeep = SCM rehabilitation

Hydraulic Performance Evaluation of Wattles Used for Erosion and Sediment Control

J. Whitman, Middle Tennessee State University



- Tested impoundment ratio, subcritical length ratio for various materials
- Materials ranged from straw, wood chips, coir, synthetic, miscanthus fiber
  - The standard Iowa DOT wattle (Excelsior) did not test as well as synthetic or miscanthus
  - Miscanthus had superior moisture and sediment absorbtion

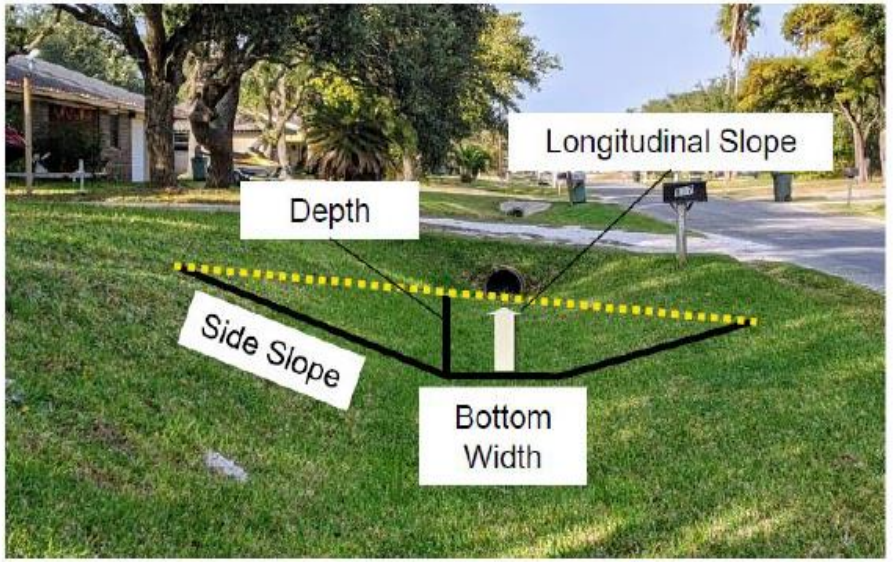
Forensic Evaluation of Roadside Ditches in Urban Settings Using Mobile LiDAR

Nasir Gharaibeh, Texas A&M University, College Station

- Surveyed roadside channels in Sunnyside neighborhood (suburb of Houston, Harris) county
  - Truck mounted LiDAR driving at posted speeds.
- Measured 6 different attributes

Attributes for Roadside Channels

1. Depth
2. Longitudinal slope
3. Bottom width
4. Side slope
5. Number of subsurface pipes/culverts
6. Length of subsurface pipes/culverts



Lectern Session 1718 Panel Discussion on Collecting and Managing Vegetation Assets on the Roadway

- Raymond Willard, Washington State Department of Transportation
  - WSDOT has included a chapter on vegetation management in their TAMP, integrated vegetation management plans
  - Future research and report from standing committee on Roadside Maintenance Ops on integrated vegetation management
- John LeFante, DBI Services, Inc.
  - Private consulting firm that tracks, analyzes and perform roadside vegetation maintenance
- John Krouse, Maryland Department of Transportation
  - Track location and quantity of pesticide treatment along roadway for budgetary and regulatory requirements