Environmental Resources

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2018 TRB ROUNDTABLE: BUREAU OF ENVIRONMENTAL PROGRAM RESOURCES

Monday, February 26, 2018

I. GLOBAL CHANGE RESEARCH PROGRAM (USGCRP) AND NCA4 VOLUME II (CLIMATE CHANGE IMPACTS, RISKS, AND ADAPTATION IN THE UNITED STATES)

II. IMPACTS TO URBAN AND RURAL TRANSPORTATION

III. TRANSPORTATION AT RISK

IV. ENVIRONMENTAL JUSTICE

Presented by: Chirag Patel, Environmental Specialist I
NJDOT Bureau of Environmental Program Resources

I. USGCRP and NCA4 Vol. II, What is it?

U.S. Global Change Research Program

Speaker: Dr. Jennifer Jacobs (University of New Hampshire & Director of ICNet)

U.S. Global Change Research Program (USGCRP):

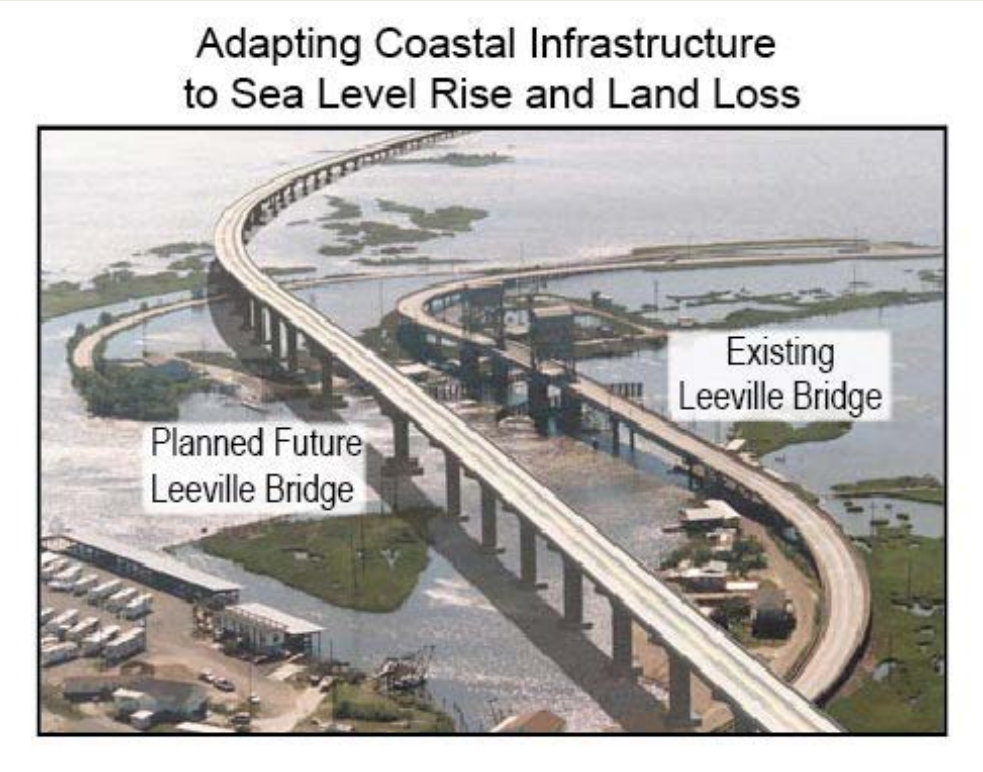
- Develop and coordinate "a comprehensive and integrated United States research program.
- Assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change.

- NCA4 Volume II contains technical scientific assessments. Does not make policy recommendations or evaluate existing or proposed policies.
- Volume II reflects on advances in the science of climate change impacts and adaptation with the inclusion of new national-level chapters on Air Quality; Climate Effects on U.S. International Interests; and a chapter on Sectoral Interdependencies, Multiple Stressors and Complex Systems
- Useful to NJDOT as it assesses a range of potential impacts, helping decision makers better identify risks that could be avoided or reduced.

II. Impacts to Urban and Rural Transportation

- **Speaker:** Susanne Des Roches (NY City Mayors Office of Recovery and Resilience)
- Extreme events that increasingly impact the transportation network are inducing societal and economic consequences, some disproportionately affect vulnerable populations.
- Rural and Urban transportation networks have distinct levels of redundancy and ability to recover.

III. Transportation at Risk

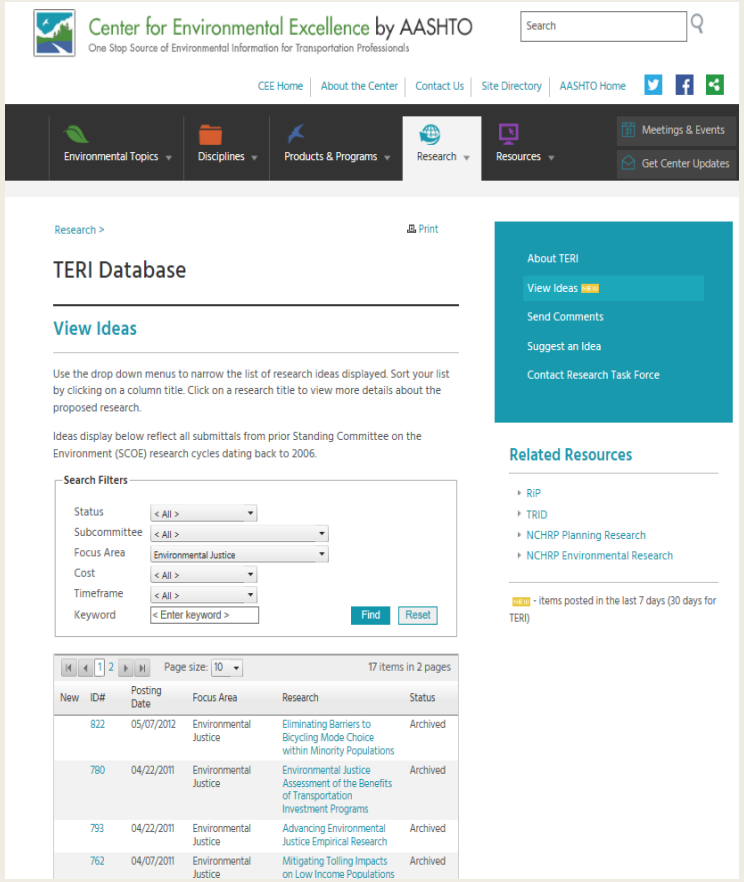


Speaker: Scott Douglas (South Coast Engineers)

- Climate change will continue to pose a risk to U.S. transportation performances and in the absence of intervention, projected changes may lead to increasing transportation challenges.
- Sea-level rise is making coastal roads and bridges more vulnerable and less functional.
- Physical stressors include: precipitation, coastal flooding and heat.
- Don't just build, build smarter or current improvements will become obsolete.

IV. Environmental Justice AASHTO Community of Practice, TERI Database, EJ Courses

- EJ Community of Practice: increase technical assistance and coordination b/w state DOT and MPOs (specific to EJ Analysis and consistency of data and information exchange).
- TERI Database - central storehouse for tracking and sharing new transportation and environmental research ideas including EJ research.
- National Highway Institute provides EJ Courses and technical assistance: www.nhi.fhwa.dot.gov



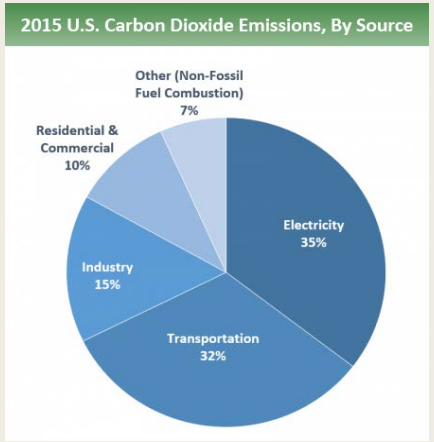
V. DECARBONIZATION & GREENHOUSE GAS REDUCTION: PROGRESS, PRIORITIES, AND RESEARCH NEEDS

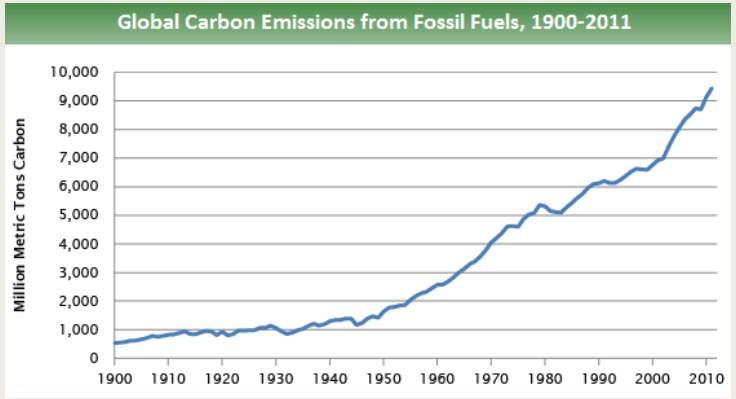
VI. TECHNOLOGICAL ADVANCES IN ROAD ECOLOGY SCIENCE

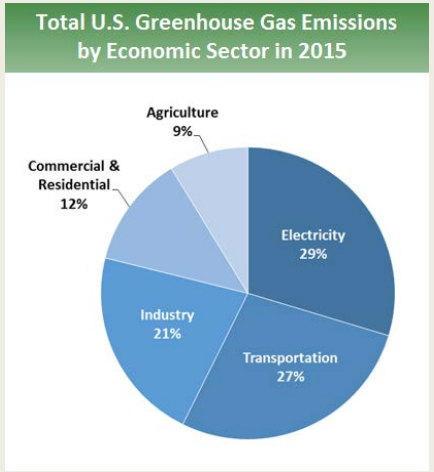
Presented by: Caroline Birsner, Environmental Specialist I
NJDOT Bureau of Environmental Program Resources

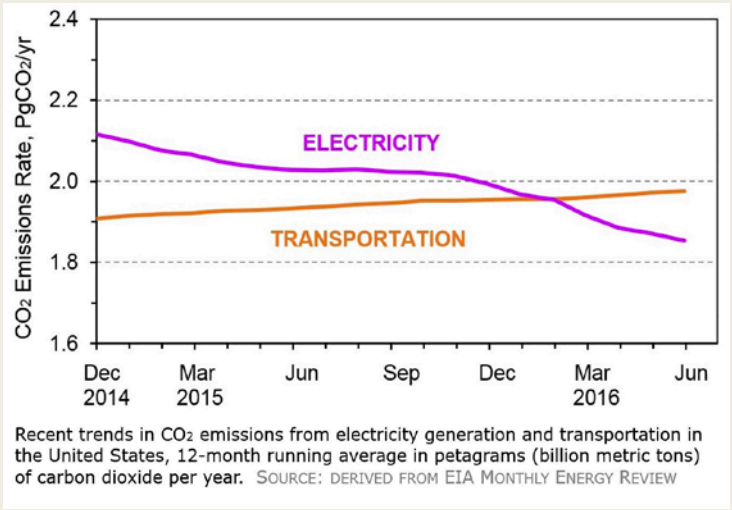
V. Decarbonization & Greenhouse Gas Reduction: Progress, Priorities, and Research Needs: *Introduction*

- **Why should we care?**
- Climate change & associated costs
- Transportation: 1/3 of all CO_2 emissions in US (*EPA*), surpassed electricity generation in 2016 to become #1 source of CO_2 (*EIA*)
- Decarbonization: eliminating or reducing carbon intensity of a system
- We have the technology we need to address climate change, we just need to prioritize it









Recent trends in CO_2 emissions from electricity generation and transportation in the United States, 12-month running average in petagrams (billion metric tons) of carbon dioxide per year. SOURCE: DERIVED FROM EIA MONTHLY ENERGY REVIEW

V. Decarbonization & Greenhouse Gas Reduction: *Methods*

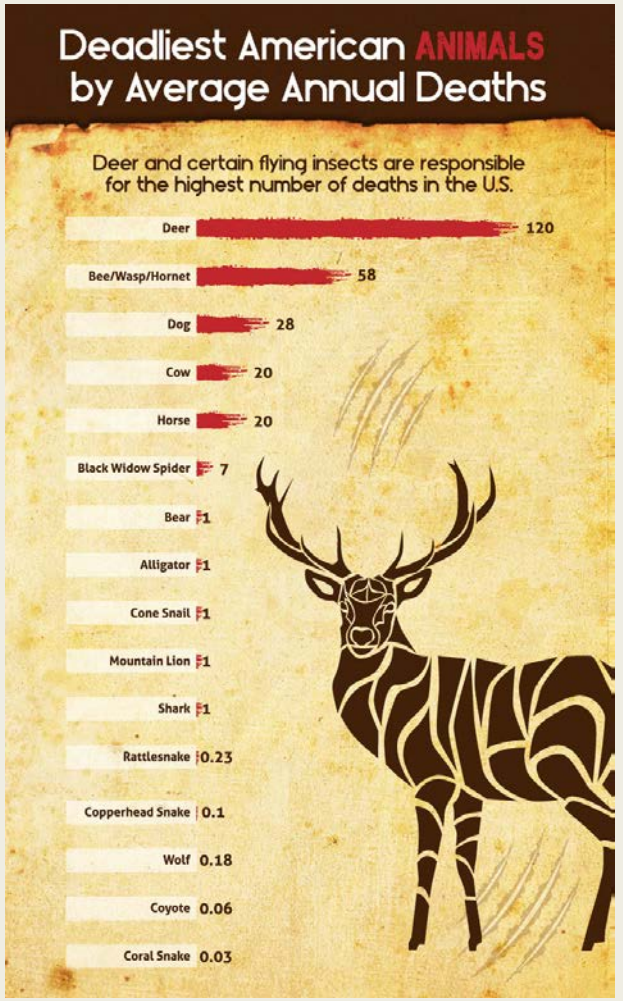
- Project Drawdown (nonprofit think tank in CA that maps and models solutions to climate change)
  - *"Drawdown": point in time where emissions begin to reduce and eventually can extract CO_2 out of atmosphere*
  - *Modeled transport solutions to achieving drawdown by 2050:*
  - *#1 solution to decarbonizing transportation sector is **electric vehicles** (EVs), followed by (in descending order) mass transit, truck fuel efficiency, car fuel efficiency, ship fuel efficiency, walkable cities, telepresence, bike infrastructure, airplane fuel efficiency, electric bikes, high speed rail, train fuel efficiency, and carpooling*
    - Electric vehicles have low operational cost and high operational savings when deployed en masse
- Mobility as a service (MaaS): car share, bike share, car rentals, demand-responsive shared ride vans
- Maximizing efficiency through improving vehicle design: 0.3% to 0.5% of energy content of fuel actually moves the driver
  - *Ultralighting: fuel savings from lighter mass*
    - **Carbon fiber:** very cost effective at scale due to reduced manufacturing/maintenance costs (but only if all vehicle components are carbon fiber!)
    - Carbon fiber vehicles aren't necessarily more expensive to purchase
    - Very relevant to DOT operations/maintenance because most road wear and tear is based on weight

V. Decarbonization & Greenhouse Gas Reduction: *Conclusion*

- Importance of incorporating sustainability and resilience in all stages of the transportation planning process
  - *The earlier, the better (and more cost-effective in the long run)*
- Be conscious of and resist the tendency to form “silos”
- Emphasis on intersectionality and increased coordination among all relevant parties
  - *Engineers, scientists, planners, environmental staff*

VI. Technological Advances in Road Ecology Science: *Introduction*

- **Why should we care?**
- Ecological impact: ~1 million vertebrates killed every day in US (*Forman and Alexander 1998*)
- Human impact: Significant motorist safety concern (*Bissonette et al 2008*), motorist trauma
- Economic loss:
  - Direct: $8.4 billion in damages annually in US (*Huijser et al 2008*), $150 million in damages annually in New Jersey (*NJDEP 2018*)
  - Ancillary: Incident management, carcass management/disposal, congestion
- State regulations



Technologies presented at TRB 2018:

1. Collecting and using big data for wildlife-vehicle conflict (WVC)
2. Roadside animal detection systems
3. Vehicle automation

VI. Technological Advances in Road Ecology Science: *1. Data*

- "There is a current, critical need for accurate and standardized WVC data because these are the foundation for mitigation projects that protect both motorists and wildlife" (*Olson et al 2014*)
- Challenges: different methods of record collecting
- Data collection methods presented at TRB:
  - *Pull data by querying an existing database (California-specific)*
    - Live and dead wildlife occurrence on roads: http://wildlifecrossing.net
    - Wildlife movement under/over roads: http://wildlifeobserver.net
    - Wildlife-vehicle conflict: http://roadecology.ucdavis.edu/chips (CHiPS is California Highway Patrol website updated in real-time)
    - Other systems from around the world: http://globalroadkill.net
  - *EXIF (Exchangeable image file): information associated with images*
  - *Large-scale volunteer data collection: crowdsourcing*
- NJDEP developing an app that the public can use to report roadkill as well as rare animal sightings

VI. Technological Advances in Road Ecology Science: *2. Roadside Animal Detection Systems*

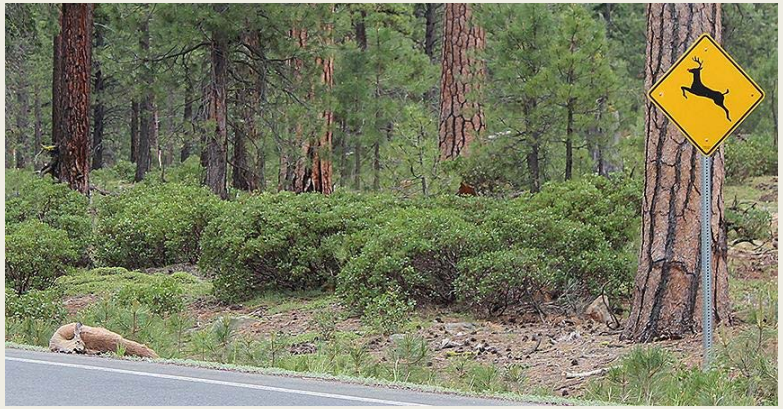
- Wildlife crossings are most effective way to mitigate WVC
- Technology: crossing structure, detection and warning system
  - *Crossing structure: over roadway (overpass), under roadway (culvert, underpass)*
  - *On roadway (roadside animal detection systems [RADS])*
    - Detection:
      - *Laser beam sensors (break beam detection): mixed results*
      - *Buried cable detection: mixed results*
      - *Radar detection: promising*
      - *Lidar detection: not currently used in roadside monitoring but potentially promising*
      - *Thermal/infrared (FLIR) "camera" detection: promising and cheaper than radar*
      - *Radio collaring of animals: mixed results*
    - Warning (signage):
      - *What type? Fixed v. variable*
      - *Where? 1 mile apart, ½ mile apart*
    - Most effective RADS technology: combination of **thermal camera** and **variable message warning signs** placed **½ mile** apart
- Arizona elk crossing case study with CrossTek: benefits ($1.86 million) of installing RADS far outweighed upfront costs ($750,000). Reduced annual elk collisions around Preacher Canyon elk crossing by 75%.

VI. Technological Advances in Road Ecology Science: *3. Vehicle Automation*

- Automated v. autonomous
- Cars heavily computerized already and increasingly ‘connected’
- Challenges: size detection thresholds
  - *Most technology thresholds are set for 20 lbs (small human child): how to detect smaller animals such as raccoons, skunks, possums, squirrels, turtles?*
  - *Driver complacency*
- Vehicle automation technology does not preclude the need for data collection and wildlife crossings!!!

VI. Technological Advances in Road Ecology Science: *Conclusion*

- WVC pose a serious hazard to the traveling public and cause significant material and economic damage
  - *$8.4 billion in annual damages nationwide*
  - *$150 million in annual damages in New Jersey*
- There are numerous technologies available to transportation agencies to reduce the risk of WVC
  - *Data provides foundation for mitigation: need to strengthen and standardize data collection and tracking*
  - *Most effective and cost-effective roadside animal detection technology to reduce WVC: combination of thermal 'camera' sensors and variable warning signs*
- Again, need for increased collaboration with other agencies and institutions researching and implementing WVC mitigation
- Opportunities for NJDOT to adapt this research to suit the needs of New Jersey
  - *Deer and other non-protected species*
  - *Threatened/Endangered Species (State & Federal)*



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VII. WHAT'S HOT IN STATE DOTS

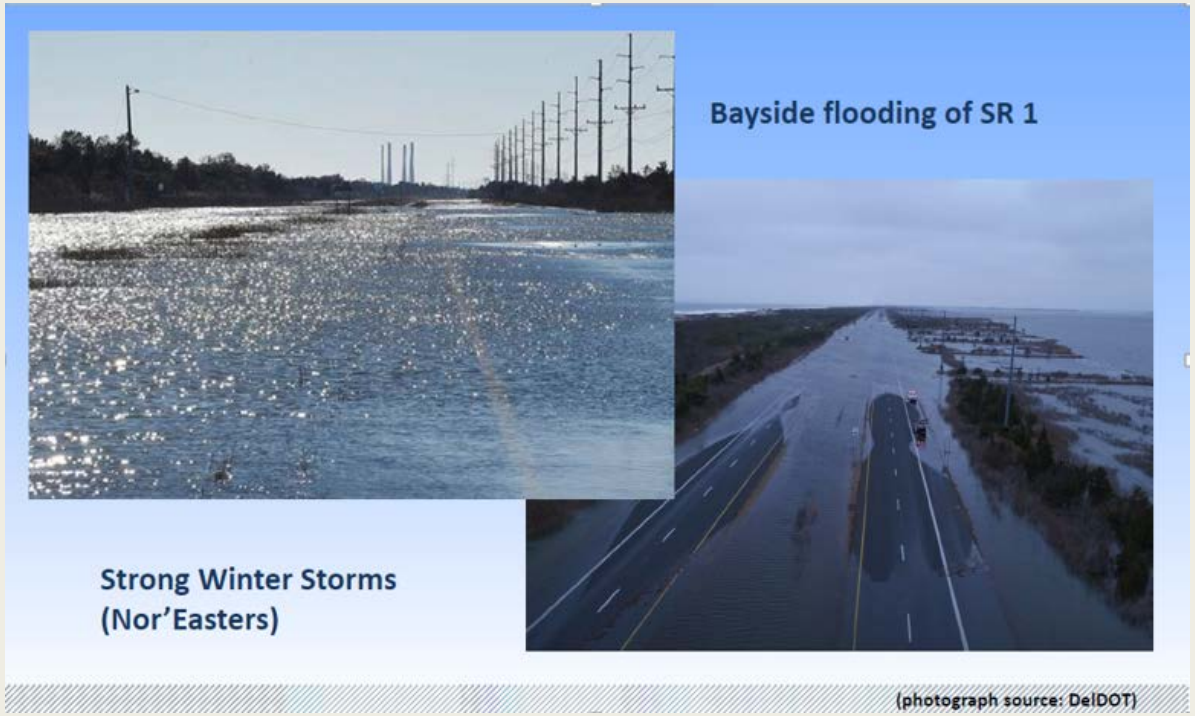
VIII. INCREASING INFRASTRUCTURE RESILIENCE THROUGH BIOENHANCEMENT

IX. VISUALLY CONNECTING WITH STAKEHOLDERS USING VIRTUAL REALITY

Presented by: Lauralee Rappleye, Project Manager
NJDOT Bureau of Environmental Program Resources

VII. What's Hot in State DOTs: *Delaware*

- Coastal Green Infrastructure Pilot
- Issues:
  - *381 miles of shoreline*
  - *Sea level change*
    - 20 communities experiencing impacts
    - Executive Order requiring state agencies to prepare for sea level rise, storm surge events
  - *Nuisance flooding*



VII. What's Hot in State DOTs: *Delaware (cont.)*

- **Guidance:** *Avoiding and Minimizing Risk of Flood Damage to State Assets: A Guide for Delaware State Agencies*
- **Solutions:**
  - *Mapping to identify/analyze vulnerable locations*
  - *Engineering*
    - Cleaning of stormwater outfalls
    - Addition of 6" HMA to raise roadway elevations
    - Installation of tide gates to prevent
  - *Green Infrastructure to Promote Resilience*
    - Living shorelines/levees
    - Oyster castles and oyster shell bags
    - Partnering with Coastal Communities to Master Plans

VII. What's Hot in State DOTs: *Minnesota*

- Roadsides as critical infrastructure
- Traditional View: Roadside Clear Zones = Safety or Refuge Areas
- Minnesota View: Roadsides = Opportunities with Critical Values
  - *Safety*
  - *Traffic Calming*
  - *Stormwater Management*
  - *Soil Stabilization*
  - *Habitat*
  - *Biodiversity*
  - *Aesthetics*
  - *Health*
  - *Socioeconomic*

VII. What's Hot in State DOTs: *Ohio*

- Practical design: using the flexibility in practical design for both NEPA and Design
- ***Practical Design*** = Performance based project development wherein the proposed improvements are **targeted** and **right-sized** based on the **project need**
  - *Identify what makes sense from broad perspective*
  - *Build many "good" projects rather than few perfect projects*
- Develop Purpose and Need
  - *Primary needs **must** be addressed*
  - *Secondary Needs addressed based on potential impacts and costs*
    - Decision made during feasibility study
- **Some fix/improvement is better than none, especially when funding or other obstacles limit project scope**

VII. What's Hot in State DOTs: *Washington State*

- Washington State DOT's Corridor Sketch Initiative
- Corridor Based Statewide Analysis
  - *identification*
  - *what works sufficiently*
  - *what needs to change*
  - *performance gaps*
  - *ways to close gaps*
- Data Collection comprises database
  - *public engagement*
  - *chronic environmental Issues*
  - *stormwater treatment*
  - *wetland mitigation*
  - *wildlife sanctuary*
  - *noise issues/noise wall locations*
  - *historic bridges*
- **Product**: Corridor by Corridor Summary for Planning Future Investments, supported by a database with specific, mapped information

VII. What's Hot in State DOTs: *Ohio (cont.)*

- Ohio's NEPA assignment experience
- NEPA Assignment =/ Total Delegation of FHWA Responsibilities
- FHWA Involvement Required
  - *Training*
  - *Program Issues*
  - *Air Quality Conformity*
  - *Projects Crossing State Lines*
  - *Consultation with Native Peoples*

- April 1, 2016 through March 31, 2017
  - *Processed > 2,000 Projects*
  - *Added Staff:*
    - 1 NEPA Assignment Manager
    - 1 Legal Reviewer
    - 1 Part time staff member
  - *Savings:*
    - Lower Level CEs (C List) 9-10 days/project
    - Higher Level CEs (D list) 52 days/project

Total Savings: 2,970 days, valued at $13.12 Million

VII. What's Hot in State DOTs: *Utah*

- NEPA assignment in Utah
- NEPA Assignment for Cat Exes (CEs) since 2008
- 2008 – Present Have Processed approx. 1400 Cat Ex
  - *None challenged; no longer audited*
- In 2017 – Processed 5 EAs and 4 EISs
- Reorganized staff for consistency, added 1 staff member
- Rewrote "manual of instruction"; subjected to legal sufficiency review

UDOT Keeping Utah Moving

- **Advantages:**
  - *Decisions made at local level; staff understands local issues & political climate*
  - *Utah DOT staff have to own answer to problems & outcomes*
  - *State decides where to take risk*
  - *Have ability to enhance the environmental and address transportation needs*
  - *Requires fiscal assurance; funding is programmed = commitment to build*

VIII. Increasing Infrastructure Resilience through Bioenhancement

- **Andrew Rella, Stevens Institute** – Increasing the Resilience of Coastal and Marine Infrastructure through Bioenhancement
- Fact: Hardening of shorelines has replaced > 70% of the natural shorelines worldwide
- Fact: 70% of our coastal infrastructure is concrete based
- Fact: Concrete & fiberglass encapsulation are poor substrates for balanced biocommunities
  - *Vertical relief*
  - *Smooth Surface*
  - *Surface chemistry – high alkalinity*

VIII. Increasing Infrastructure Resilience through Bioenhancement (*cont.*)

- **Goal:** Enhanced Biogenic build-up to promote bioprotection of infrastructure
  - *Increases strength of concrete*
  - *Reduces chloride infiltration/breakdown of concrete*
  - *Absorbs wave energy*
  - *Increases abundance of species and biodiversity of ecosystem*
  - *Increased populations of filter feeders improves local water quality*






IX. Visually Connecting with Stakeholders Using Virtual Reality

- **Stephen Paul, AECOM**
- Immersive Technologies
- Options:
  - *Virtual Reality*
  - *Augmented Reality*
  - *Mixed Reality*
- Equipment:
  - *Mobile 360 Aps –Software designed to run on mobile device*
  - *Google Cardboard – Phone mounted foldout cardboard viewer*
  - *Samsung Gear VR – Samsung Phone mounted to headset*
- Challenges: Need clarity of vision and need for information to be transmitted
  - *Initial costs for research and development*
  - *Constant pace of change of the technology*
  - *The potential of the technology makes choices overwhelming*