U.S. Army Engineer Research and Development Efforts on Sustainability and Life Cycle Assessment

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Bottom Line Up Front

- U.S. Army Engineer Research and Development Center-Construction Engineering Research Laboratory (ERDC-CERL) and the University of Illinois at Urbana-Champaign are key partners.

- Sustainability is a core value of how USACE does business. Incorporating resilience and leveraging smart systems within sustainability helps define the path forward.
Agenda

- Brief overview of ERDC-CERL
- ERDC Sustainability and LCA Efforts
- Sustainable vs Resilient vs Smart Infrastructure?
- Opportunities
- Contact and Questions
ERDC-CERL’s Mission: to develop and infuse innovative technologies to provide excellent facilities and realistic training lands for the Department of Defense, the U.S. Army and many other customers.
Engineer Research and Development Center (ERDC)

ERDC’s diverse laboratories are empowered to solve complex problems together
ERDC-CERL History

1966
USACE identified need for CERL

1967
University of Illinois selected to host CERL

1969
Dedication of CERL Facility

1972
Environmental Quality Mission Added

1974
Energy Conservation Mission Added

1999
Integration into ERDC
Military Programs Mission

Provide premier engineering, construction, real estate, stability operations, and environmental management products and services.

- Military Construction
- Environment
- Real Estate
- Contingency Support
- Interagency and International Services
- Installation Support

http://www.usace.army.mil/Missions/MilitaryMissions.aspx
Civil Works Program Vision and Mission

Dedicated to providing quality, responsive service to the nation in peace and war.

- Navigation
- Flood Risk Management
- Infrastructure
- Recreation
- Environmental Stewardship
- Emergency Response

ERDC Sustainability Efforts

- Sustainable Installations – Net Zero Planning
- Sustainable Energy Solutions
- Sustainable Water and Waste
- Sustainable Facilities and Infrastructure
- Sustainable Natural Infrastructure
- Green Remediation and Reuse
Center for the Advancement of Sustainability Innovations (CASI)

- Established in 2006 at CERL
- Focus ERDC expertise, technologies and partnerships towards achieving more sustainable missions, facilities, and operations
- CASI teams strive to measure sustainability innovations against the triple bottom line of mission, environment, and community
Reducing Construction and Demolition Waste – Residential Communities Initiative

Concrete recycling with on-site crusher.
Historic Preservation at Ft. Leonard Wood

Mural painted by Samuel Countee, placed above the German POW fireplace on the main floor of Bldg. 2101
McMurdo Station Antartica Run Off Characteristics

Extreme incident showing raging water from snowmelt (12 December 2007)
Airfield Redesign for Wheeled and Ski-fitted Aircraft

Isometric view of the apron, taxiway, and town site area of the proposed consolidated airfield
McMurdo Station Antarctica Snow Paver Test and Vehicle Impact Testing on Snow Roads
Airfield Redesign for Vertical Take Off Aircraft
FWD Structural Assessment of Geogrid Reinforced Base Course: Allows reduction of 33-42% of aggregate course
Bioswales and Wetland Treatment Systems Adjacent to Transportation Infrastructure
Pavement Life Cycle

Pavements need to be managed— not simply maintained.
PAVER Sustainment Management System (SMS) Methodology

**STRUCTURED METHODOLOGY**
- Inventory
  - Real Property Inventory
  - Airfield, Roads, Parking Lots Inventory

**STANDARDIZED ANALYSIS**
- Assessment
  - Condition Index
  - ASTM D5340 / D6433
- Analysis
  - Critical Pavement Condition Index
  - Remaining Service Life

**ASSET PLANNING**
- Work Planning
  - Work Generation
  - Work Prioritization
- Forecasting
  - “What If?” Scenarios
  - Budgets
  - Course of Action Analysis
<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
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<tr>
<td><strong>BUILDER</strong></td>
<td>for Building Components Program Management</td>
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<tr>
<td><strong>FUELER</strong></td>
<td>NEW! for Fuels Systems</td>
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<td><strong>PAVER</strong></td>
<td>for Airfields and Roads</td>
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<td><strong>RAILER</strong></td>
<td>for Track</td>
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<td><strong>ROOFER</strong></td>
<td>for Roofing Project Management</td>
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<td><strong>Utilities</strong></td>
<td>NEW! for Water, Sewer, Storm Sewer, Electrical, Gas, and Mech. Systems</td>
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Military Planner Perspective

- Planning intervention must have a national security nexus
- DoD Directive 4715.21 Climate Change Adaptation and Resilience, January 2016
- Resilience is the “end” which achieves the objective of climate change adaptation
- “Can we plan systems that are resilient, sustainable, and smart?”
Resilience is the ability of a system to prepare for, absorb, recover from, and adapt to disturbances.
Shocks to the system or community may be recurring or compounding.
Sustainable versus Resilient

- Security
- Prosperity
- Sustainable Transportation
- Resilience
- Social Values
- Economic Development
- Environmental Health

Long Term Vision is the sheath that binds
Smart and Resilient Infrastructure?

- **Objectives**
  - Maintenance
  - Safety
  - Environmental

- **Functions**
  - Cost Per Year
  - Data Calls
  - Warranty Management
  - Injuries
  - Intruder Detection
  - Fire Prevention
  - Indoor Air Quality Index
  - Waste Management
  - Energy Use

- **Resilience**
  - Absorb
  - Recover
  - Adapt

Graph shows the relationship between disturbance and time with absorptive, recoverive, and adaptive phases.
Resilience Elements Framework

- Fault tolerant systems
- Adaptive solutions
- Critical redundancy
- Mitigation

- These can be applied across various system types such as infrastructure, government, health services, and ecology
Conclusion

- Sustainability continues to be a strong element in the ERDC portfolio

- Opportunity: sustainable and holistic life-cycle assessment research that leverages smart systems and data analytics and builds resilient systems
Contact Info / Questions?

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