Navigations Systems R & D Program

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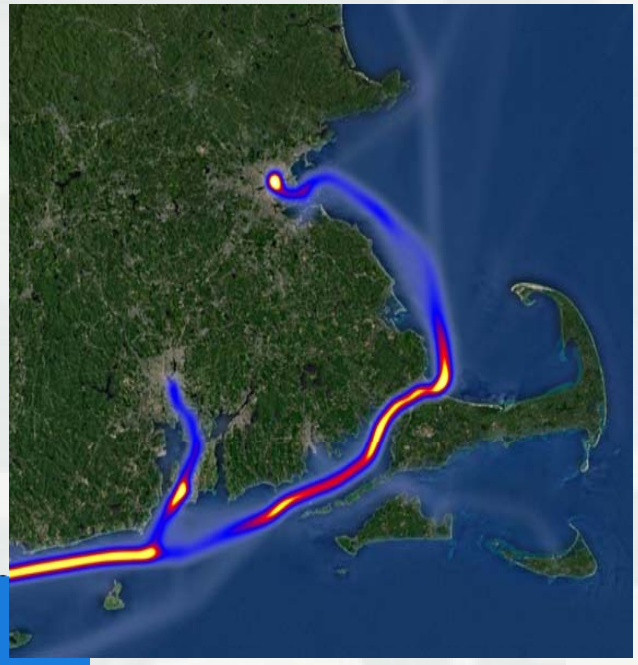
ERDC, CHL

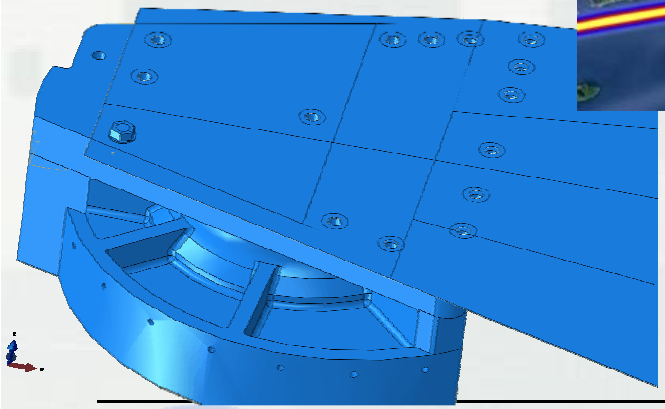
8 Apr 2015

US Army Corps of Engineers
BUILDING STRONG®

Overview of Presentation

- Program Overview
- Work Activities





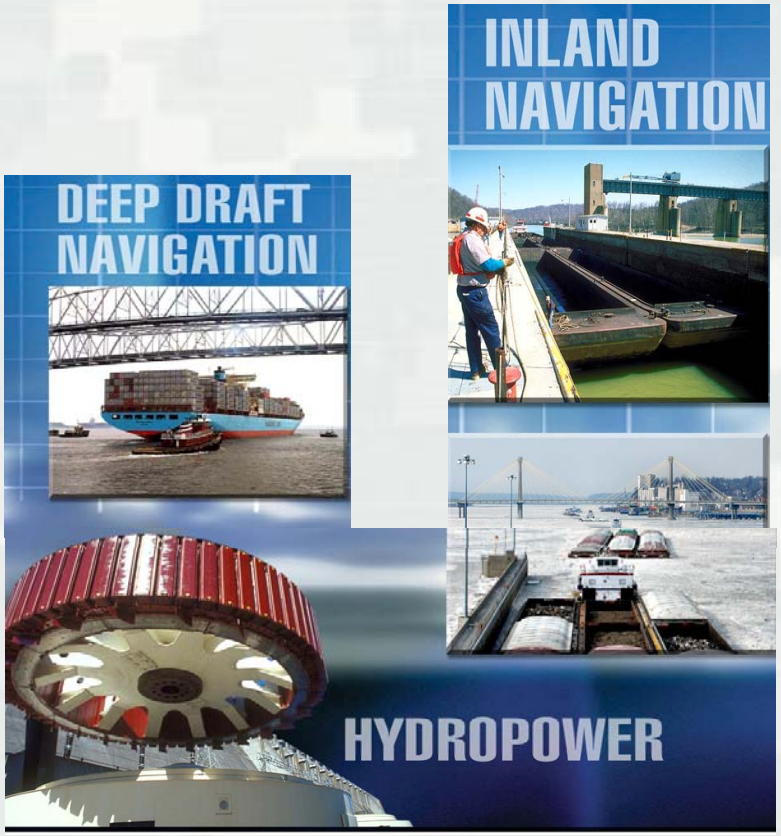
John Day Anchor Heads

New Corroded

Navigation Systems Research Program

USACE Navigation Mission: To provide safe, reliable, efficient, effective and environmentally sustainable waterborne transportation systems for movement of commerce, national security needs, and recreation.

Mission: Meet marine transportation, hydropower and infrastructure challenges through research that incorporates engineering, economic, and environmental solutions.



Focus Areas:

- Inland Navigation
- Deep Draft Navigation
- Marine Transportation Technologies
- Hydropower

Trunnion Rod Efforts

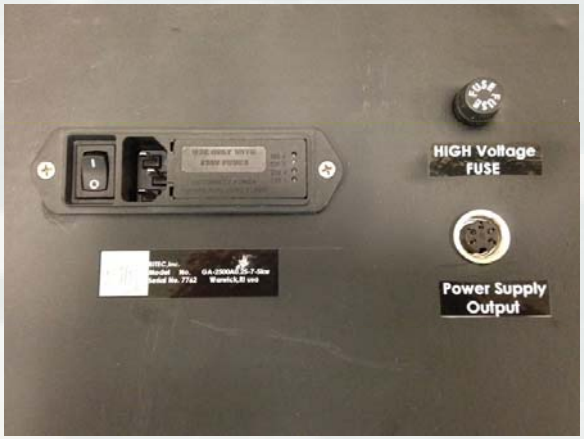
- Tension Measurement (2008-N-9)
- Micro-crack Detection (2011-N-16)
- Removal and replacement of rods (2009-N-18)

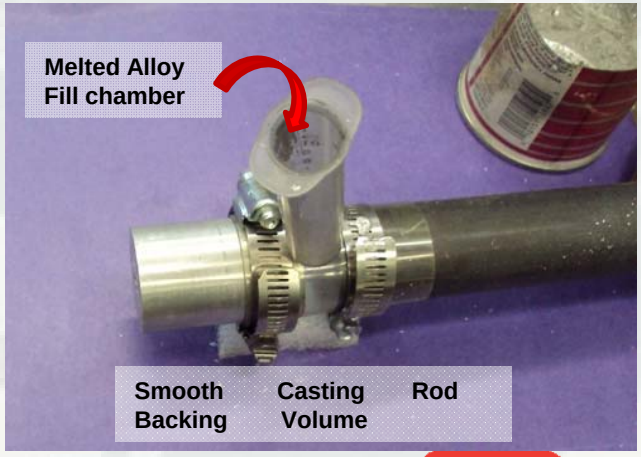
Micro-crack Detection
Jim Evans

Portable Guided Wave Trunion Rod Test System

System Specifications:
1) 5KW at 1500 volts @ 1Mhz
2) Laptop computer controlled
3) Output protected against both temperature and open/short circuit
4) Variable power output

Fields Metal used for coupling to torch cut trunion anchor rods



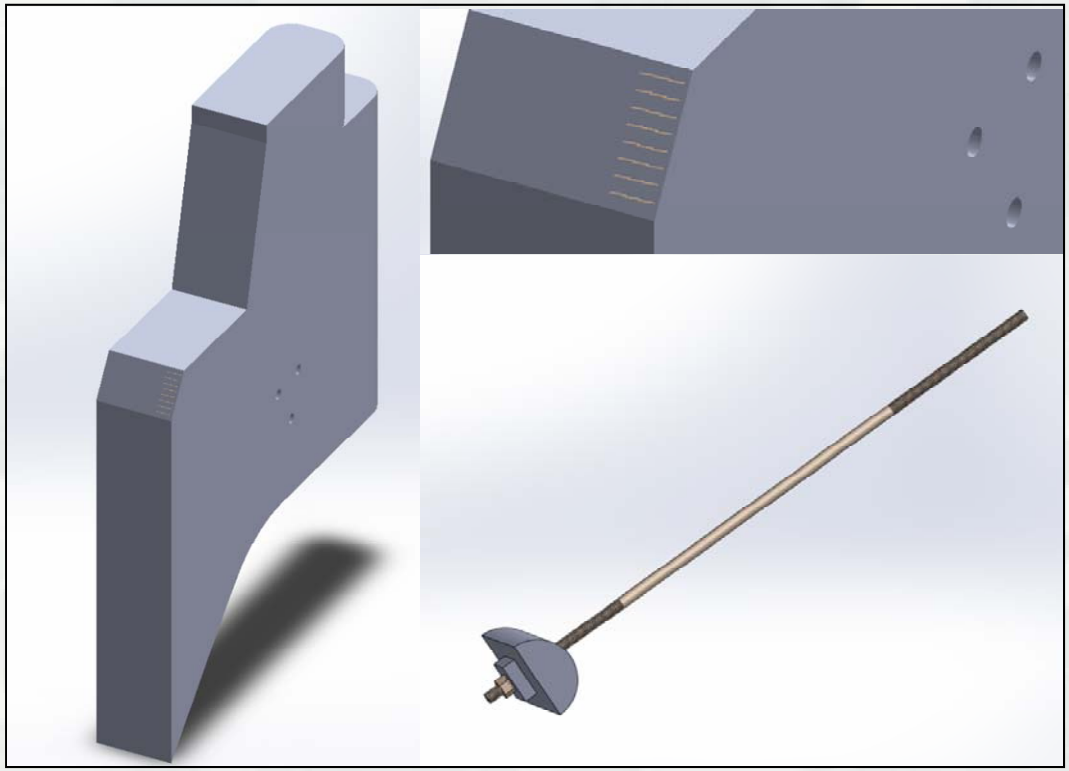


Replacement of Broken / Damaged Rods

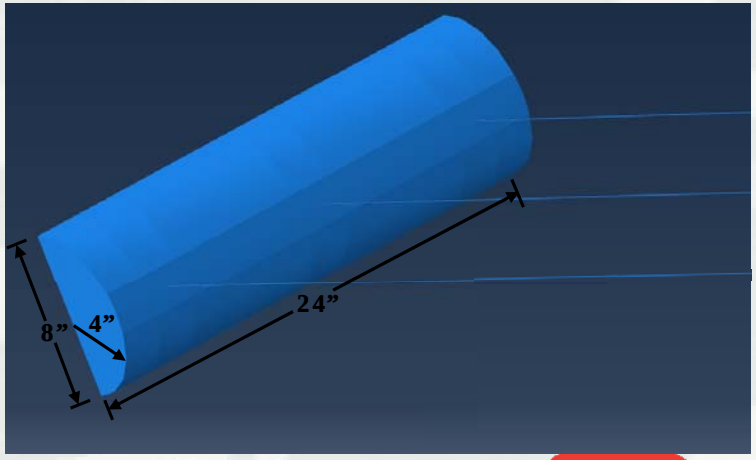
Joe Padula

Extensive finite element model analysis of stresses in the pier and components.

The proposed alternative retrofit consists of circular cores for removing anchor ends of rods and installation of semi-cylindrical adjustable steel bearing anchorage.



This retrofit allows for multiple, yet smaller less intrusive areas where concrete and rebar is removed from the pier.

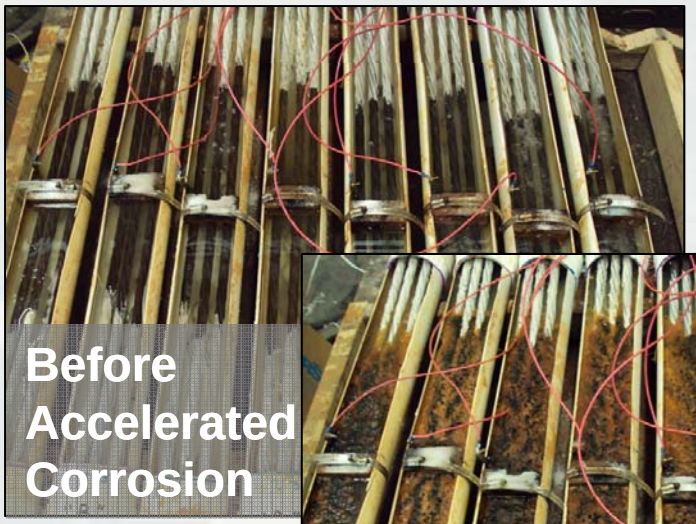


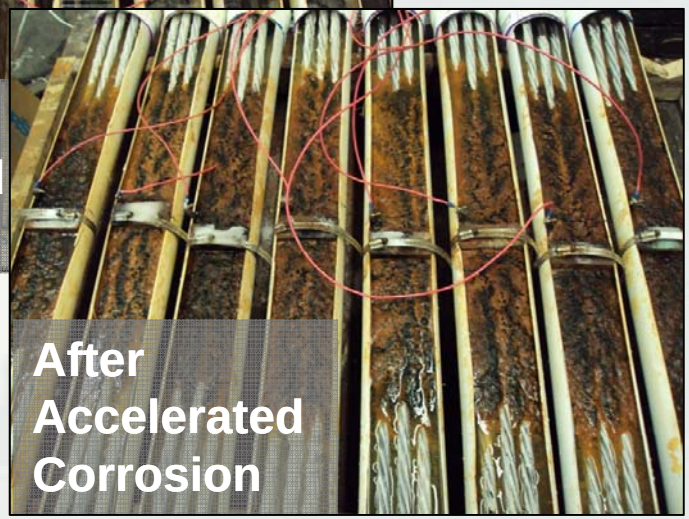
Multi-strand Anchor Tendons (2009-N-1)

Bob Ebeling

- Unknown state or capacity of numerous multi-strand ground anchors
  - Believe that most damage / breaks are near the top of the anchors
  - Laboratory testing measured capacity of 7-strand cables in various stages of corrosion loss

- NDT methods needed to determine:
  - Presence of broken strands
  - Quantify remaining diameter of strands

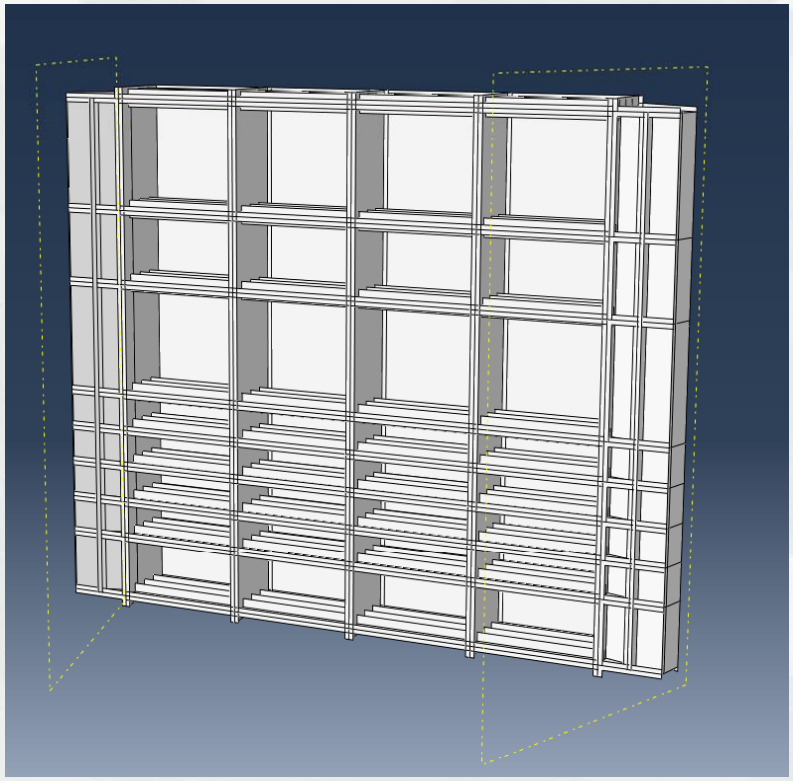




Pull-test data for:
22 Pristine
161 Corroded

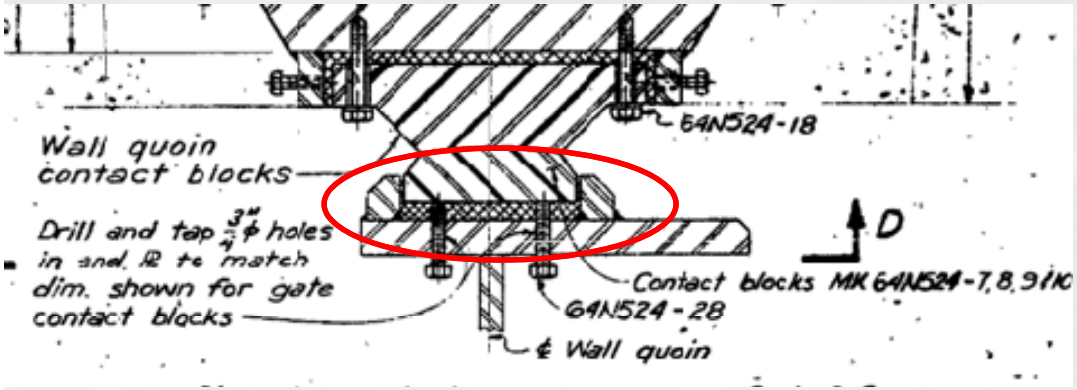
Miter Gate Efforts

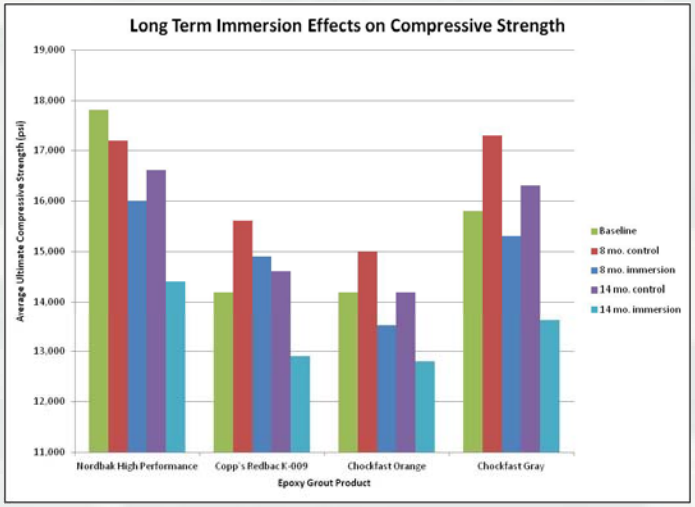
- Evaluation of Emerging Filler Materials (2009-N-13)
- Redesign of Pintle Sockets (2013-N-21)
- 3D Pro Miter (2012-N-07)



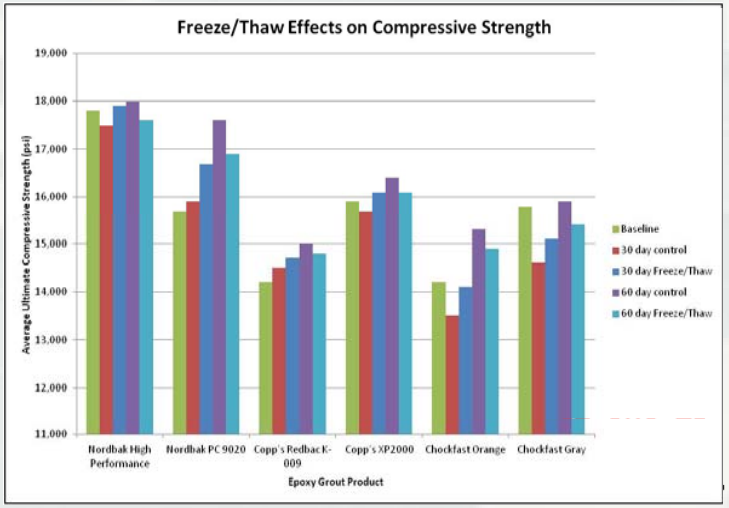
Evaluation of Emerging Filler Materials

Jonathan Trovillion





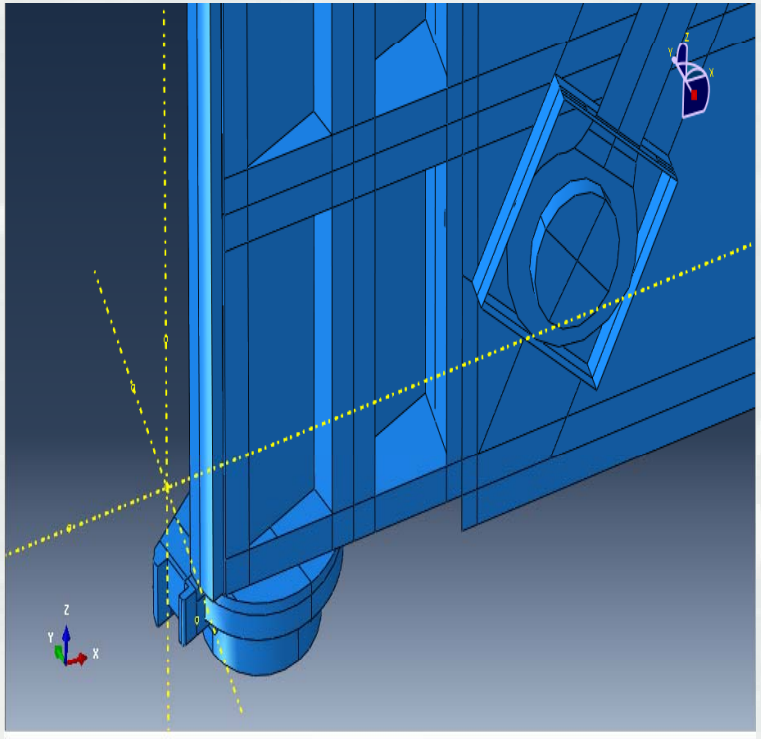
- Unified Facility Guide Specifications UFGS 35 20 16.33 "Miter Gates" Outdated.
- Continue Water Absorption & Freeze Thaw and Accelerated Aging Tests



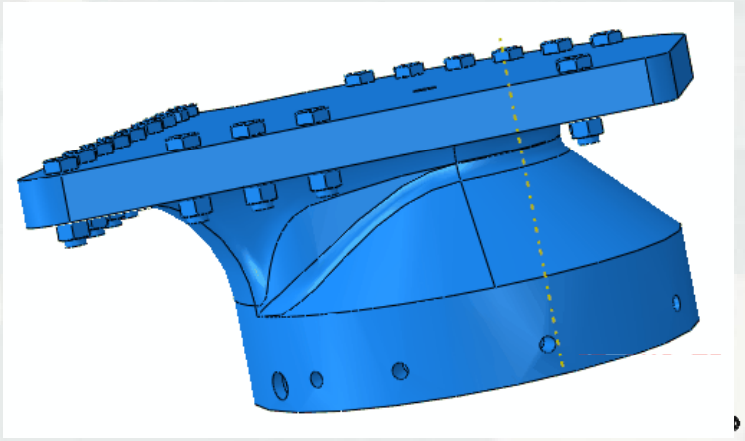
Redesign of Pintle Sockets

Don Wilson

- If gaps between the contact blocks are present, there will almost certainly be pintle damage or sheared pintle bolts discovered during dewatering of the locks.

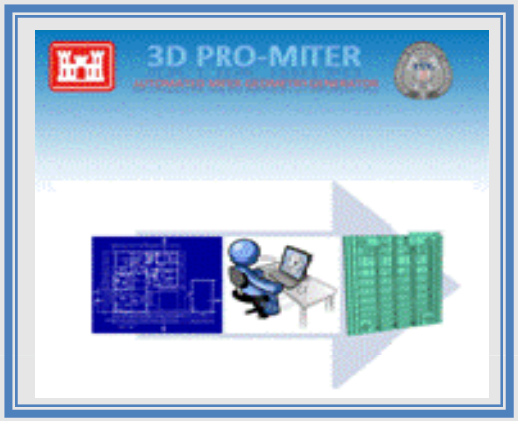


- The quoin block, the pintle, and the miter gate were assembled in the FEM so that the interaction of these elements could be fully evaluated when the quoin block deteriorates.
  - Modeled as-designed
  - Preliminary results obtained for various degrees of quoin block deterioration



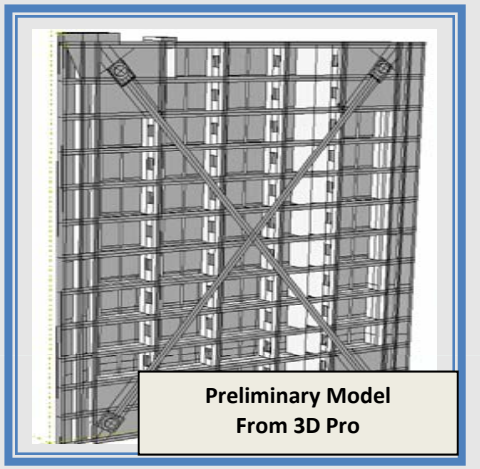
3D Pro Miter

Guillermo Riveros

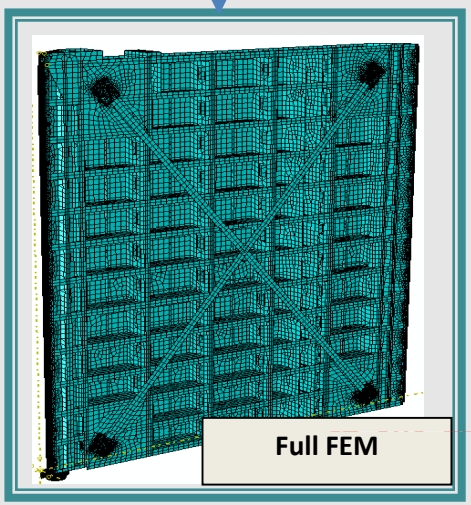


Debbuging

Corrections



- Assignment of material properties
- Load and displacement BC
- Mesh seeding
- Pintle Socket Geometry Builder
- Scripting to analyze results



NAVSYS

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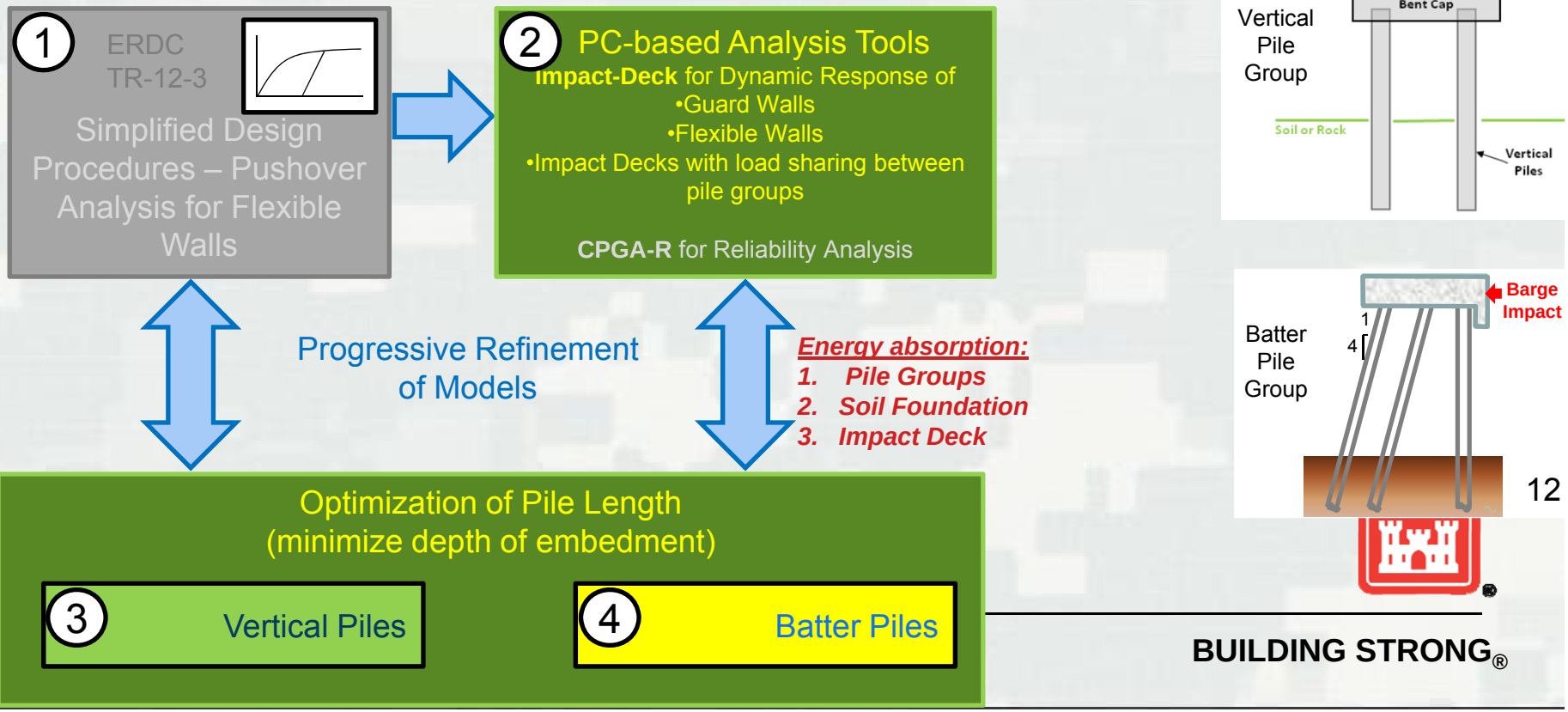
Flexible Designs (2009-N-11)
Dr. Bob Ebeling

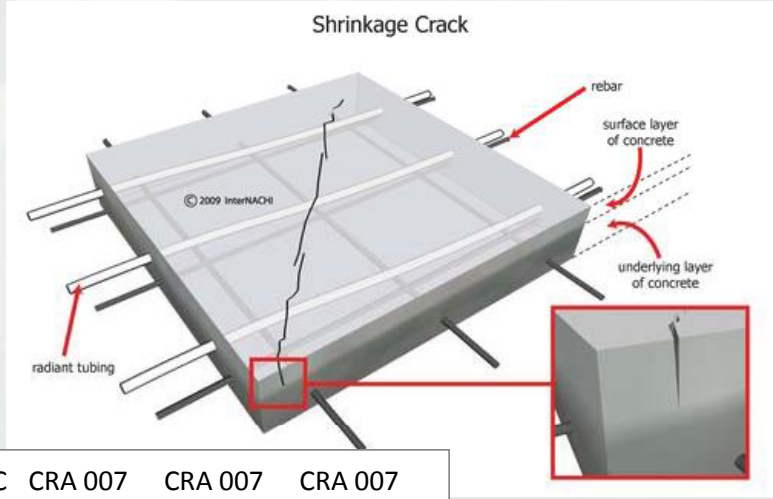
- Develop engineering dynamic analysis methodology and tools
  - Software: Impact Deck & CPGA-R
  - Applications: impact decks with load sharing between pile groups, guard walls, and flexible walls
- Optimize pile length for both vertical and batter piles (ERDC/ITL TR 12-3)

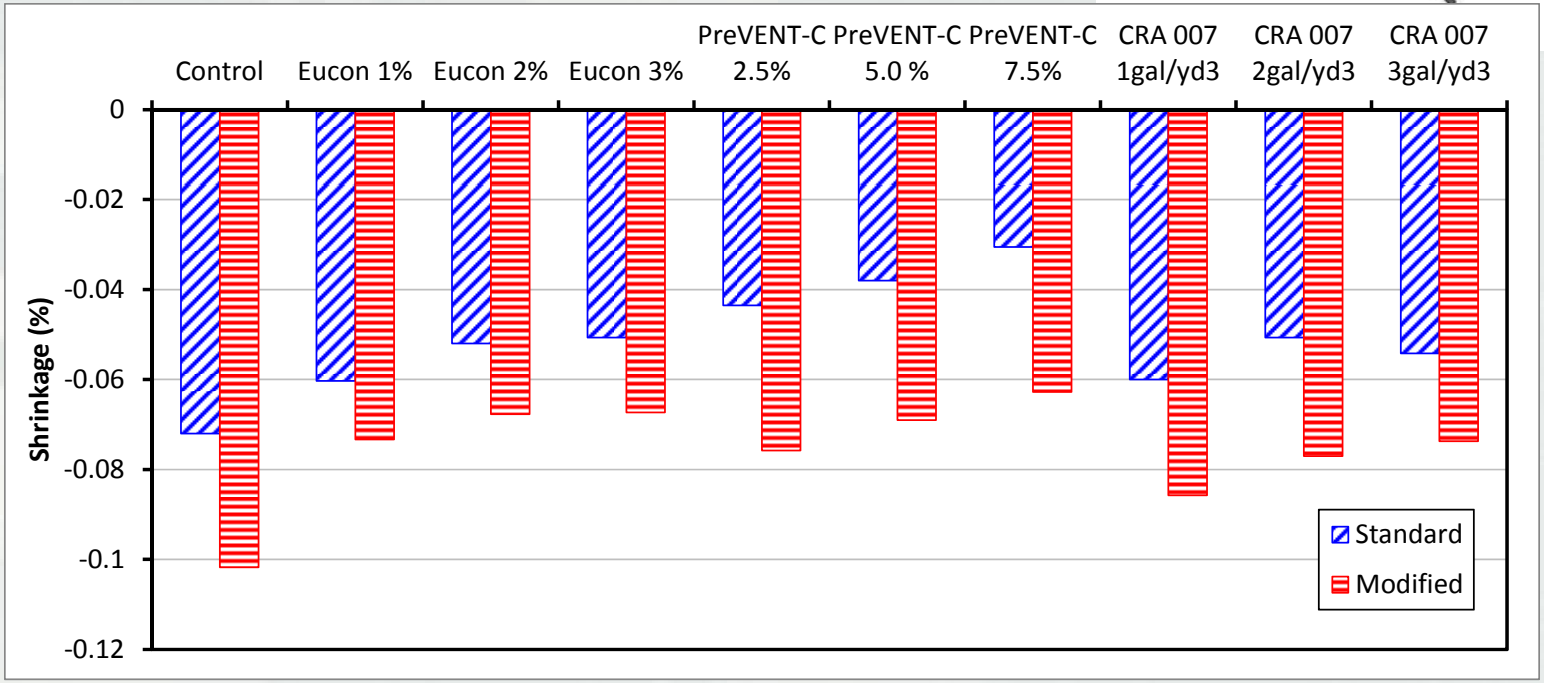


Horizontal Concrete Repair (2013-N-23)

Robert Moser

- Need durable material for repairing horizontal concrete surfaces.
- Admixture shrinkage studies – curing is critical
- Test slabs made for testing repair materials

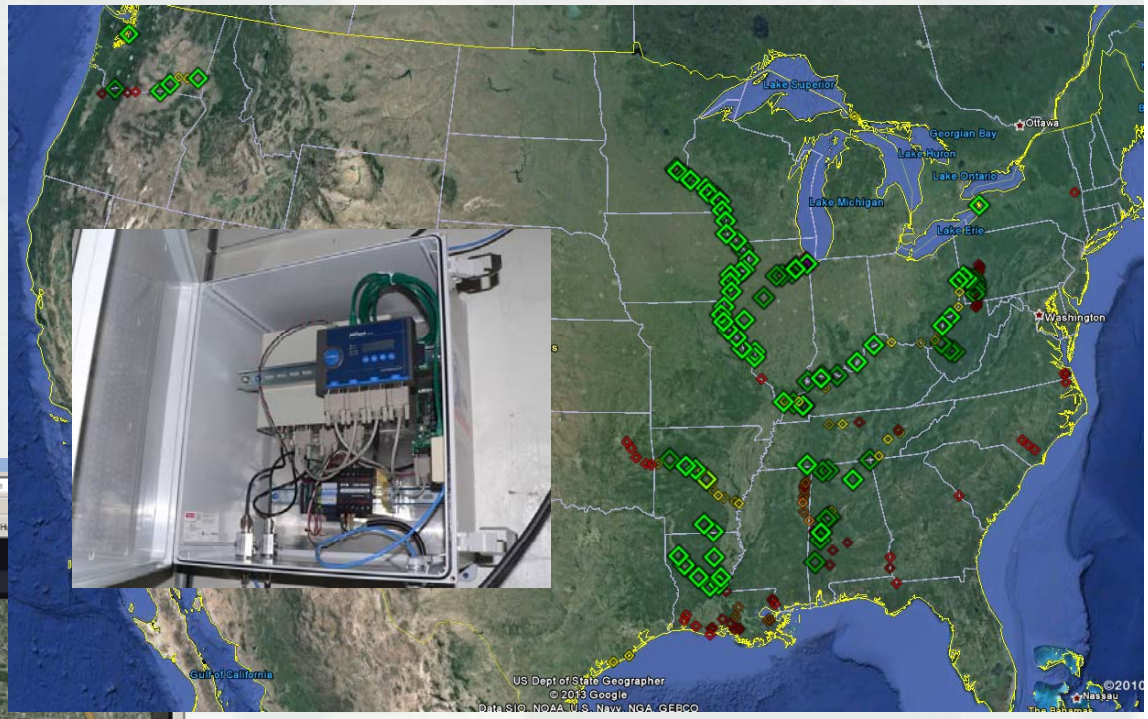


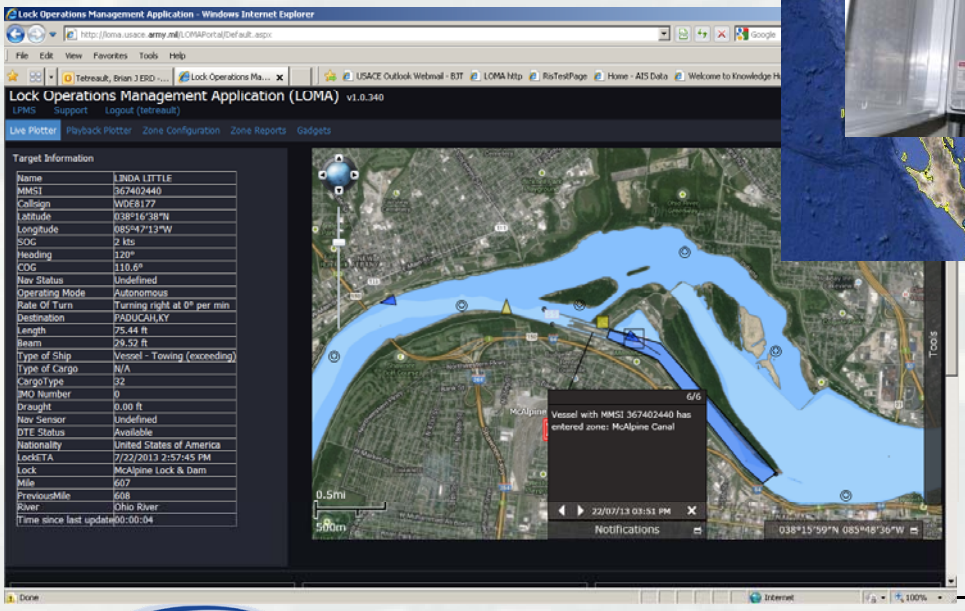


Lock Operations Management Application (LOMA) 3.0

Brian Tetreault

- Received Authority to Operate (Became operational)
- >94 units deployed
- Collaborating with:
  - Lock Approach Modeling
  - Condition Health Monitoring

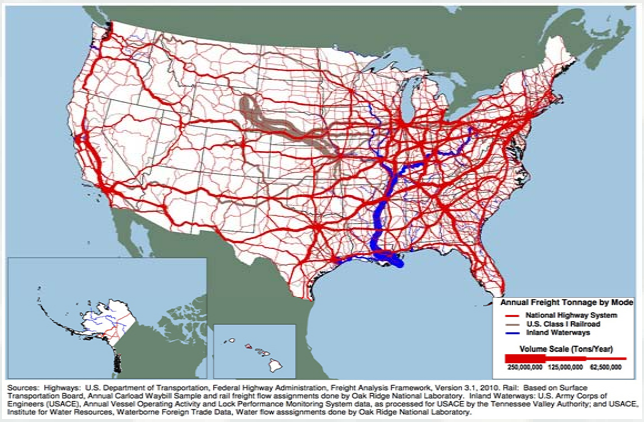


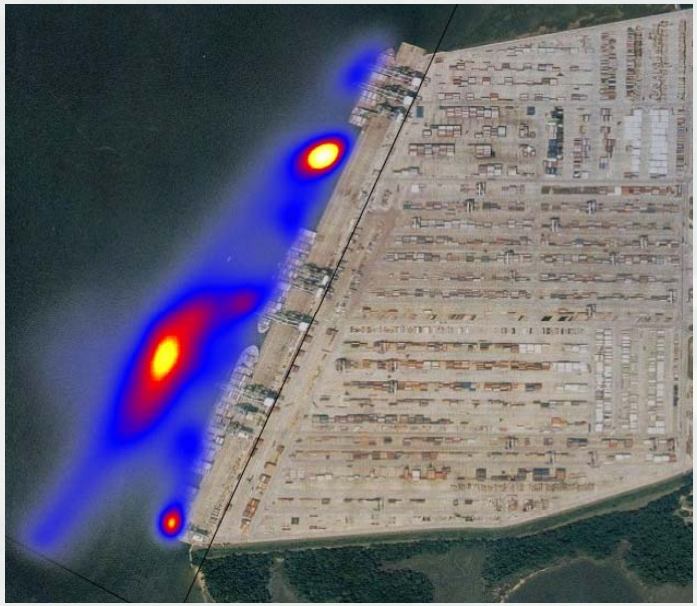


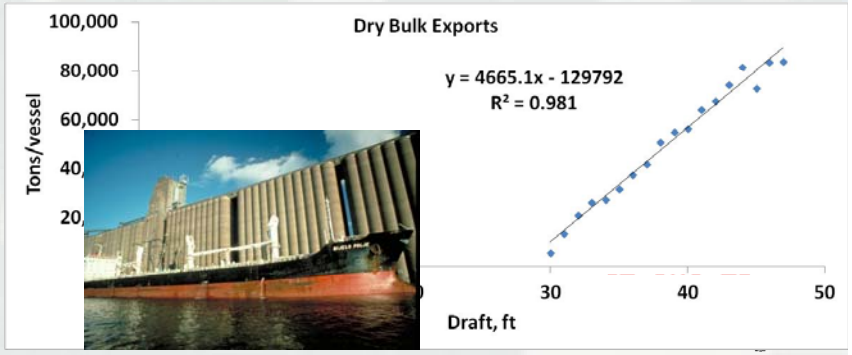
Navigation Transportation Systems Management

Kenneth “Ned” Mitchell

- Genetic algorithm (GA) approach to O&M dredging project selection
- Link-based MTS Travel Time methodology via AIS position reports
- CPT improvements
- IMTS Water levels vs. travel time analysis
- AIS Collision Risk Analysis



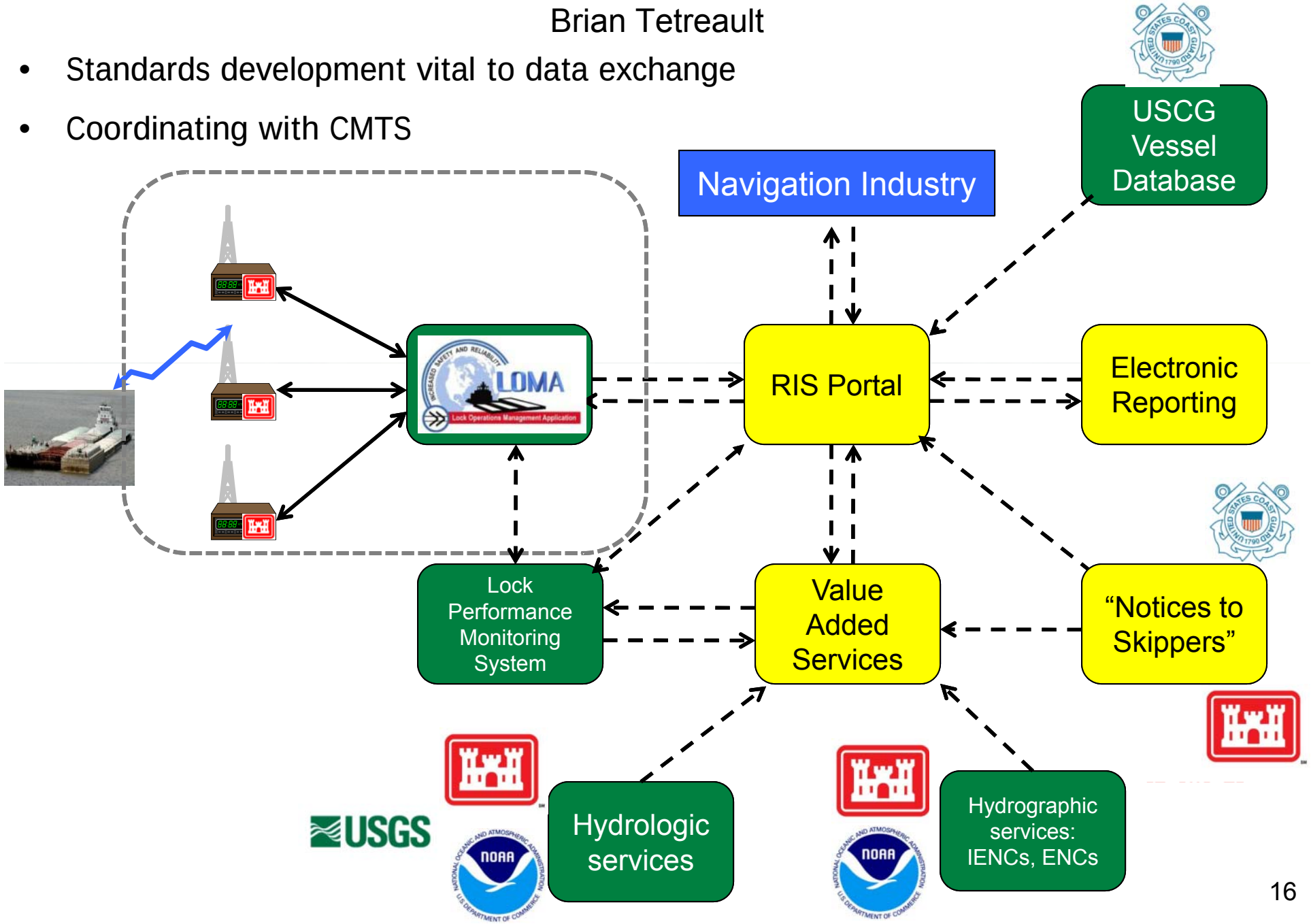




River Information Services

Brian Tetreault

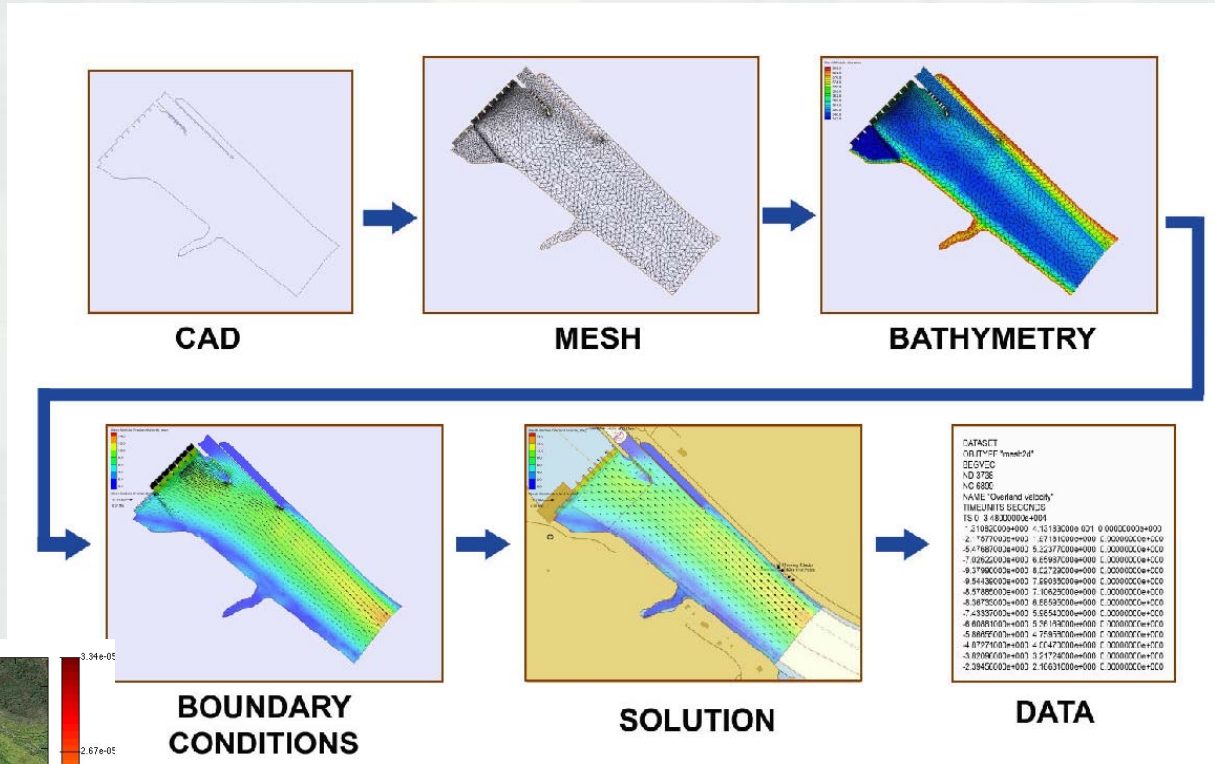
- Standards development vital to data exchange
- Coordinating with CMTS

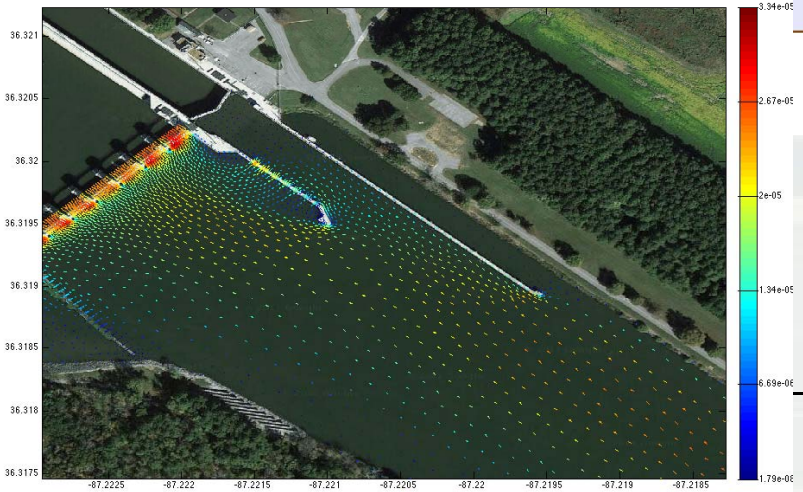


Modeling of Lock Approach Currents

Keith Martin

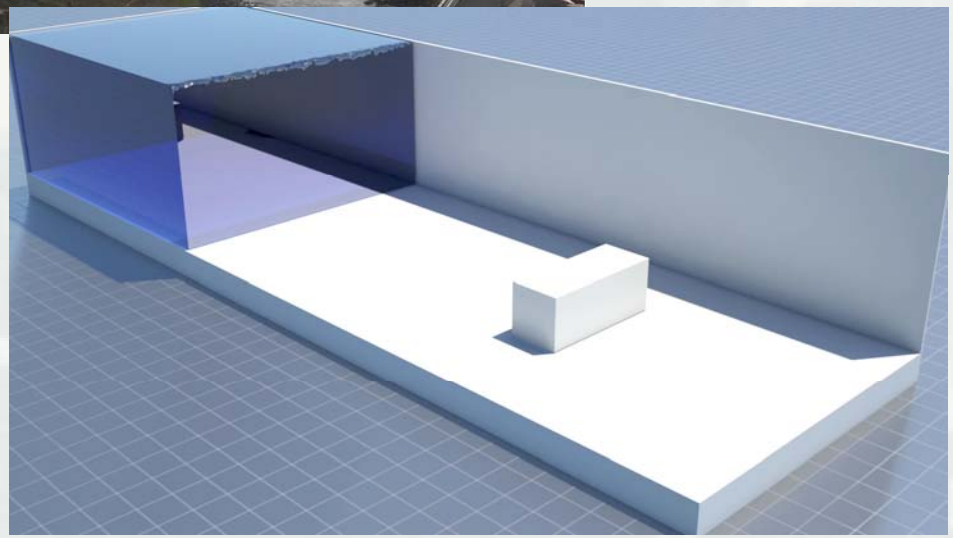
- Improve awareness of potentially hazardous approach currents





Coastal Navigation Structures and Wave Response (2011-N-8)

Chris Kees



- Air/Water V&V Test Set
  - Adding and documenting new test problems for navigation and coastal structures
- Computational Model Development
  - Wave generation/absorbtion
  - Moving structures
  - Parallel scalability

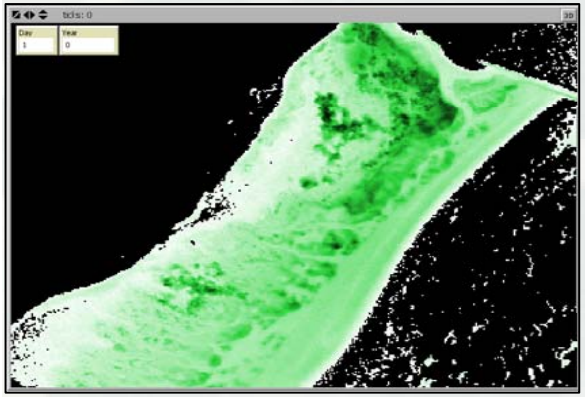
Developing computational wave flume capabilities that will provide:

- very high-fidelity hydrodynamic computational tools for R&D and project design
- cost effective and more versatile alternative to physical modeling

Process-Driven Ecological Modeling for Landscape Change Analysis (2013-N-17)

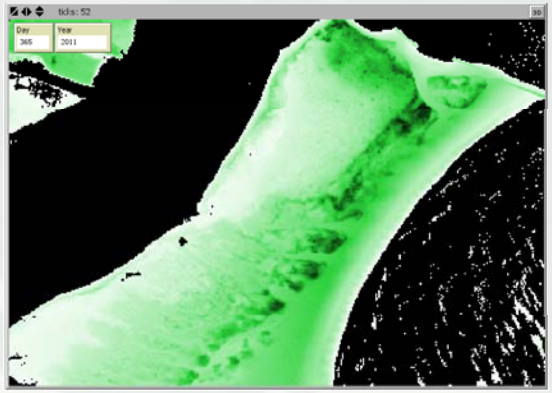
Molly Reif

- Standard methods to generate thematic land-cover / land-use products
  - These support a variety of engineering, planning and study needs
- Understand factors that influence landscape changes
- Predict changes to landscape structure as a result of Engineering With Nature projects



USACE Project

Model:
Landscape Evolution
Project potential habitat change in landscape



Quantify System Change

Metric	Process	Benefit
Clumpiness	Biodiversity	↑↓
Cohesion	Connectivity	↓↑

Change in Landscape Pattern

Change in Ecosystem Function

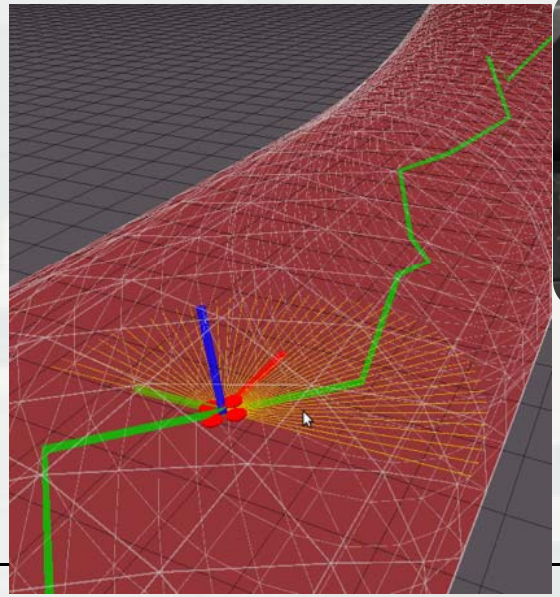
NAVSYS Navigation Systems Research Program

Microbotic Infrastructure Inspection

Jennifer Wozencraft

- Planned platform is a six rotor vehicle sensors to navigate and collect data in confined and hazardous-to-reach spaces

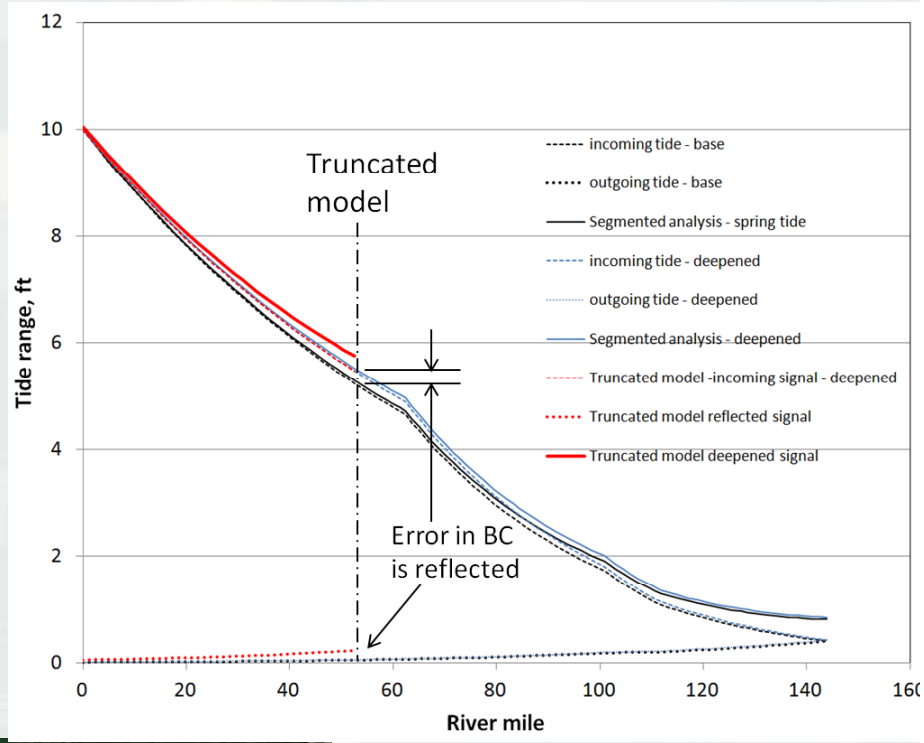
- Test planned at Carters Dam late April 2015



Development of Rational, Process Based Protocols for Subdividing Large Systems for Numerical Analysis (2011-N-9)

Gary Brown

- Standard methods and guidance for dividing large areas for numeric modeling
- Modeling in 'parts' generates same result as modeling the 'whole'



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New Work Activities

- 2014-N-17 Life expectancy of hydraulic structures/ Design Life (Concrete)
- 2013-N-25 Lock Miter Gate Contact Block Redesign
- 2014-N-06 Quantification of Ship Wake Effects on Adjacent Shorelines
- 2014-N-16 Streamlined Ship Simulation for Feasibility Studies

Thank you!

Questions?

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