2005 Tri-Service Infrastructure Systems Conference & Exhibition

St. Louis, MO
"Re-Energizing Engineering Excellence"

2-4 August 2005

Agenda

***Panel**: The Future of Engineering and Construction*

- LTG Carl A. Strock, Commander, USACE
- Dr. James Wright, Chief Engineer, NAVFAC

***Panel**: USACE Engineering and Construction*

- Dr. Michael J. O'Connor, Director, R&D

***Panel**: Navy General Session*

- Mr. Steve Geusic, Engineering Criteria & Programs NAVFAC Atlantic

Introduction to Multi-Disciplinary Tracks, by Mr. Gregory W. Hughes
Engineering Circular: Engineering Reliability Guidance for Existing USACE Civil Works Infrastructure, by Mr. David M. Schaaf, PE, LRD Regional Technical Specialist, Navigation Engineering Louisville District
MILCON S&A Account Study, by Mr. J. Joseph Tyler, PE, Chief, Programs Integration Division, Directorate of Military Programs HQUSACE
Financial Justification on Bentley Enterprise License Agreement (ELA)

Track 1

- The Chicago Shoreline Storm Damage Reduction Project, by Andrew Benziger
- Protecting the NJ Coast Using Large Stone Seawalls, by Cameron Chasten
- Cascade: An Integrated Coastal Regional Model for Decision Support and Engineering Design, by Nicholas C. Kraus and Kenneth J. Connell
- Modeling Sediment Transport Along the Upper Texas Coast, by David B. King Jr., Jeffery P. Waters and William R. Curtis
- Sediment Compatibility for Beach Nourishment in North Carolina, by Gregory L. Williams
- Evaluating Beachfill Project Performance in the USACE Philadelphia District, by Monica Chasten and Harry Friebel
- US Army Corps of Engineers' National Coastal Mapping Program, by Jennifer Wozencraft
- Flood Damage Reduction Project Using Structural and Non-Structural Measures, by Stacey Underwood
- Shore Protection Project Performance Improvement Initiative (S3P2I), by Susan Durden
- Hurricane Isabel Post-Storm Assessment, by Jane Jablonski
- US Army Corps of Engineers Response to the Hurricanes of 2004, by Rick McMillen and Daniel R. Haubner
- Increased Bed Erosion Due to Increased Bed Erosion Due to Ice, by Decker B. Hains, John I. Remus, and Leonard J. Zabilansky
- Mississippi Valley Division, by James D. Gutshall
- Impacts to Ice Regime Resulting from Removal of Milltown Dam, Clark Fork River, Montana, by Andrew M. Tuthill and Kathleen D. White, and Lynn A. Daniels
- Carroll Island Micromodel Study: River Miles 273.0-263.0, by Jasen Brown
- Monitoring the Effects of Sedimentation from Mount St. Helens, by Alan Donner, Patrick O'Brien and David Biedenharn
  Watershed Approach to Stream Stability and Benefits Related to the Reduction of Nutrients, by John B. Smith
- A Lake Tap for Water Temperature Control Tower Construction at Cougar Dam, Oregon, by Stephen Schlenker, Nathan Higa and Brad Bird
- San Francisco Bay Mercury TMDL – Implications for Constructed Wetlands, by Herbert Fredrickson, Elly Best and Dave Soballe
- Abandoned Mine Lands: Eastern and Western Perspectives, by Kate White and Kim Mulhern
  Translating the Hydrologic Tower of Babel, byDan Crawford
- Demonstrating Innovative River Restoration Technologies: Truckee River, Nevada, by Chris Dunn
- System-Wide Water Resource Management – Tools of the Trade

Track 2

- Ecological and Engineering Considerations for Dam Decommissioning, Retrofits, and Reoperations, by Jock Conyngham
- Hydraulic Design of tidegates and other Water Control structures for Ecosystem Restoration projects on the Columbia River estuary, by Patrick S. O’Brien
- Surface Bypass & Removable Spillway Weirs, by Lynn Reese
- Impacts of using a spillway for juvenile fish passage on typical design criteria, by Bob Buchholz
- Howard Hanson Dam: Hydraulic Design of Juvenile Fish Passage Facility in Reservoir with Wide Pool Fluctuation, by Dennis Mekkers and Daniel M. Katz
- Current Research in Fate Current Research in Fate & Transport of Chemical and Biological Contaminants in Water Distribution Systems, by Vincent F. Hock
- Regional Modeling Requirements, by Maged Hussein
- Tools for Wetlands Permit Evaluation: Modeling Groundwater and Surface Water Interaction, by Cary Talbot
- Ecosystem Restoration for Fish and Wildlife Habitat on the UMRS, by Jon Hendrickson
- Missouri River Shallow Water Habitat Creation, by Dan Pridal
- Aquatic Habitat Restoration in the Lower Missouri River, by Chance Bitner
- Transition to an Oracle Based Data System (Corps Water Management System, CWMS), by Joel Asunskis
- RiverGages.com: The Mississippi Valley Division Water Control Website, by Rich Engstrom
- HEC-ResSim 3.0: Enhancements and New Capabilities, by Fauwaz Hanbali
- Hurricane Season 2004 – Not to Be Forgotten, by Jacob Davis
- Re-Evaluation of a Flood Control Project, by Ferris W. Chamberlin
- Helmand Valley Water Management Plan, by Jason Needham
- A New Approach to Water Management Decision Making, by James D. Barton
- Developing Reservoir Operational Plans to Manage Erosion and Sedimentation during Construction – Willamette Temperature
- Control, Cougar Reservoir 2002-2005, by Patrick S. O’Brien
- Improved Water Supply Forecasts for the Kootenay Basin, by Randal T. Wortman
- ResSIM Model Development for Columbia River System, by Arun Mylvahanan
- Prescriptive Reservoir Modeling and the ROPE, by Jason Needham
- Missouri River Basin Water Management, by Larry Murphy

Track 3

- Corps Involvement in FEMA’s Map Modernization Program, by Kate White, John Hunter and Mark Flick
- Innovative Approximate Study Method for FEMA Map Moderniation Program , by John Hunter
- Flood Fighting Structures Demonstration and Evaluation Program (FFSD), by Fred Pinkard
- Integrating Climate Dynamics Into Water Resources Planning and Management, by Kate White
- Hydrologic and Hydraulic Contributions to Risk and Uncertainty Propagation Studies, by Robert Moyer
- Uncertainty Analysis: Parameter Estimation, by Jackie P. Hallberg
- Geomorphology Study of the Middle Mississippi River, by Eddie Brauer
- Bank Erosion and Morphology of the Kaskaskia River, by Michael T. Rodgers
- Degradation of the Kansas City Reach of the Missouri River, by Alan Tool
- Sediment Impact Assessment Model (SIAM), by David S. Biedenharn and Meg Jonas
- Mississippi River Sedimentation Study, by Basil Arthur
- Sediment Model of Rivers, by Charlie Berger
- East Grand Forks, MN and Grand Forks, ND Local Flood Damage Reduction Project, by Michael Lesher
- Hydrologic and Hydraulic Analyses, by Thomas R. Brown
- Hydrologic and Hydraulic Modeling of the Mccook and Thornton Tunnel and Reservoir Plans, by David Kiel
- Ala Wai Canal Project, by Lynnette F. Schaper
- Missouri River Geospatial Decision Support Framework, by Bryan Baker and Martha Bullock
- Systemic Analysis of the Mississippi & Illinois Rivers Upper Mississippi River Comprehensive Plan, by Dennis L. Stephens

Section 227: National Shoreline Erosion Control Demonstration and Development Program Annual Workshop

- Workshop Objectives
- Section 227: Oil Piers, Ventura County, CA, by Heather Schlosser
- An Evaluation of Performance Measures for Prefabricated Submerged Concrete Breakwaters: Section 227 Cape May Point, New Jersey Demonstration Project, by Donald K Stauble, J.B. Smith and Randall A. Wise
- Bluff Stabilization along Lake Michigan, using Active and Passive Dewatering Techniques, by Rennie Kaunda, Eileen Glynn, Ron Chase, Alan Kehew, Amanda Brotz and Jim Selegean
- Storm Damage at Cape Lookout
- Branchbox Breakwater Design at Pickleweed Trail, Martinez, CA
- Section 227: Miami, FL
- Section 227: Sheldon Marsh Nature Preserve
- Section 227: Seabrook, New Hampshire
- Jefferson County, TX – Low Volume Beach Fill
- Sacred Falls, Oahsacred Falls, Oahu Section 227 Demonstration Project

Track 4

- Fern Ridge LakFern Ridge Lake Hydrologic Aspects of Operation during Failure, by Bruce J Duffe
- A Dam Safety Study Involving Cascading Dam Failures, by Gordon Lance
- Spillway Adequacy Analysis of Rough River Lake Louisville District, by Richard Pruitt
- Water Management in Iraq: Capability and Marsh Restoration, by Fauwaz Hanbali
- Iraq Ministry of Water Resources Capacity Building, by Michael J. Bishop, John W. Hunter, Jeffrey D. Jorgeson, Matthew M. McPherson, Edwin A. Theriot, Jerry W. Webb, Kathleen D. White, and Steven C. Wilhelms

- HEC Support of the CMEP Program, by Mark Jensen
- Geospatial Integration of Hydrology & Hydraulics Tools for Multi-Purpose, Multi-Agency Decision Support, by Timothy Pangburn, Joel Schlagel, Martha Bullock, Michael Smith, and Bryan Baker
- GIS & Surveying to Support FEMA Map Modernization and Example Bridge Report, by Mark Flick
- High Resolution Bathymetry and Fly-Through Visualization, by Paul Clouse
- Using GIS and HEC-RAS for Flood Emergency Plans, by Stephen Stello
- High Resolution Visualizations of Multibeam Data of the Lower Mississippi River, by Tom Tobin and Heath Jones
- System Wide Water Resources Program Unifying Technologies Geospatial Applications, by Andrew J. Bruzewicz
- Raystown Plate Locations
- Hydrologic Engineering Center: HEC–HMS Version 3.0 New Features, by Jeff Harris
- SEEP2D & GMS: Simple Tools for Solving a Variety of Seepage Problems, by Clarissa Hansen, Fred Tracy, Eileen Glynn, Cary Talbot and Earl Edris
- Sediment and Water Quality in HEC-RAS, by Mark Jensen
- Advances to the GSSHA Model, by Aaron Byrd and Cary Talbot
- Watershed Analysis Tool: HEC-WAT Program, by Chris Dunn
- Little Calumet River UnsteadLittle Calumet River Unsteady Flow Model Conversion UNET to HEC-RAS, by Rick D. Ackerson
  Kansas River Basin Model, by Edward Parker
- Design Guidance for Breakup Ice Control Structures, by Andrew M. Tuthill
- Computational Hydraulic Model of the Lower Monumental Dam Forebay, by Richard Stockstill, Charlie Berger, John Hite, Alex Carrillo, and Jane Vaughan
- Use of Regularization as a Method for Watershed Model Calibration, by Brian Skahill
- Demonstration Program Urban Flooding and Channel Restoration in Arid and Semi-Arid Regions (UFDP), by Joan Pope, Jack Davis, Ed Sing, John Warwick, Meg Jonas

Track 5

- Walla Walla District Northwestern Division, by Robert Berger
- Best Practices for Conduits through Embankment Dams, by Chuck R. Cooper
- Design, Construction Design, Construction and Seepage at Prado Dam, by Douglas E. Chitwood
- 2-D Liquefaction Evaluation with Q4Mesh, by David C. Serafini
- Unlined Spillway Erosion Risk Assessment, by Johannes Wibowo, Don Yule, Evelyn Villanueva and Darrel Temple
- Seismic Remediation of the Clemson Upper and Lower Diversion Dams; Evaluation, Conceptual Design and Design, by Lee Wooten and Ben Foreman
- Seismic Remediation of the Clemson Upper and Lower Diversion Dams; Deep Soil Mix Construction, by Lee Wooten and Ben Foreman
- Historical Changes in the State of the Art of Seismic Engineering and Effects of those changes on the Seismic Response Studies of Large Embankment Dams, by Sam Stacy
- Iwakuni Runway Relocation Project, by Vincent R. Donnally
- Internal Erosion & Piping at Fern Ridge Dam, by Jeremy Britton
- Rough River Dam Safety Assurance Project, by Timothy M. O'Leary
- Seepage Collection & Control Systems: The Devil is in the Details , by John W. France
- Dewey Dam Seismic Assessment, by Greg Yankey
- Seismic Stability Evaluation for Ute Dam, New Mexico, by John W. France
- An Overview of Criteria Used by Various Organizations for Assessment and Seismic Remediation of Earth Dams, by Jeffrey S. Dingrando
- A Review of Corps of Engineers Levee Seepage Practices and Proposed Future Changes, by George Sills
- Ground-Penetrating Radar Applications for the Assessment of Pavements, by Lulu Edwards and Don R. Alexander
- Peru Road Upgrade Project, by Michael P. Wielputz
- Slope Stability Evaluation of the Baldhill Dam Right Abutment, by Neil T. Schwanz
- Design and Construction of Anchored Bulkheads with Synthetic Sheet Piles Seabrook, New Hampshire, by Siamac Vaghar and Francis Fung
- Characterization of Soft Claya Case Study at Craney Island, by Aaron L. Zdinak
- Dispersive ClayDispersive Clays – Experience andHistory of the NRCS (Formerly SCS), by Danny McCook
- Post-Tensioning Institute, by Michael McCray
- Demonstration Program Urban Flooding and Channel Restoration in Arid and Semi-Arid Regions (UFDP), by Joan Pope, Jack Davis, Ed Sing, John Warwick, Meg Jonas

Track 6

- State of the Art in Grouting: Dams on Solution Susceptible or Fractured Rock Foundations, by Arthur H. Walz
- Specialty Drilling, Testing, and Grouting Techniques for Remediation of Embankment Dams, by Douglas M. Heenan
- Composite Cut-Offs for Dams, by Dr. Donald A. Bruce and Trent L. Dreese
- State of the Art in Grout Mixes, by James A. Davies
- State of the Art in Computer Monitoring and Analysis of Grouting, by Trent L. Dreese and David B. Wilson
- Quantitatively Engineered Grout Curtains, by David B. Wilson and Trent L. Dreese
- Grout Curtains at Arkabutla Dam: Outlet Monolith Joints and Cracks using Chemical Grout, Arkabutla Lake, MS, by Dale A. Goss
- Chicago Underflow Plan – CUP: McCook Reservoir Test Grout Program, by Joseph A. Kissane
- Clearwater Dam: Sinkhole Repair Foundation Investigation and Grouting Project, by Mark Harris
- Update on the Investigation of the Effects of Boring Sample Size (3" vs 5") on Measured Cohesion in Soft Clays, by Richard Pinner and Chad M. Rachel
- Soil-Bentonite Cutoff Wall Through Free-Product at Indiana Harbor CDF, by Joe Schulenberg and John Breslin
- Soil-Bentonite Cutoff Wall Through Dense Alluvium with Boulders into Bedrock, McCook Reservoir, by William A. Rochford
- Small Project, Big Stability Problem the Block Church Road Experience, by Jonathan E. Kolber
- Determination of Foundation Rock Properties Beneath Folsom Dam, by Michael K. Sharp, José L. Llopis and Enrique E. Matheu
  Waterbury Dam Mitigation, by Bethany Bearmore
- Armor Stone Durability in the Great Lakes Environment, by Joseph A. Kissane
- Mill Creek - An Urban Flood Control Challenge, by Monica B. Greenwell
- Next Stop, The Twilight Zone, by Troy S. O'Neal
- Limitations in the Back Analysis of Shear Strength from Failures, by Rick Deschamps and Greg Yankey
- Reconstruction of Deteriorated Concrete Lock Walls After Blasting and Other Demolition Removal Techniques, by Stephen G. O'Connor

- Flood Fighting Structures Demonstration and Evaluation Program (FFSD), by George Sills
- Innovative Design Concepts Incorporated into a Landfill Closure and Reuse Design Portsmouth Naval Shipyard, Kittery, Maine, by Dave Ray and Kevin Pavlik
- Laboratory Testing of Flood Fighting Structures, by Johannes L. Wibowo, Donald L. Ward and Perry A. Taylor
- Bluff Stabilization Along Lake Michigan, Using Active and Passive Dewatering Techniques, Allegan Co. Michigan, by Rennie Kaunda, Eileen Glynn, Ron Chase, Alan Kehew and Jim Selegean

Track 7

- Case History: Multiple Axial Statnamic Tests on a Drilled Shaft Embedded in Shale, by Paul J. Axtell, J. Erik Loehr, Daniel L. Jones
- The Sliding Failure of Austin Dam Pennsylvania - Revisited, by Brian H. Greene
- M3 –Modeling, Monitoring and Managing: A Comprehensive Approach to Controlling Ground Movements for Protection of Existing Structures and Facilities, by Francis D. Leathers and Michael P. Walker
- Time-Dependent Reliability Modeling for Use in Major Rehabilitation of Embankment Dams and Foundation, by Robert C. Patev
- Lateral Pile Load Test Results Within a Soft Cohesive Foundation, by Richard J. Varuso
- Engineering Geology Challenge Engineering Geology Challenges During Design and Construction of the Marmet Lock Project, by Ron Adams and Mike Nield
- Mill Creek Deep Tunnel Geologic Conditions and Potential Impacts on Design/Construction, by Kenneth E. Henn III
- McAlpine Lock Replacement Instrumentation: Design, Construction, Monitoring, and Interpretation, by Troy S. O'Neal
- Geosynthetics and Construction of the Second Powerhouse Corner Collector Surface Flow Bypass Project, Bonneville Lock and Dam Project, Oregon and Washington, by Art Fong
- McAlpine Lock Replacement Project Foundation Characteristics and Excavation, by Kenneth E. Henn III
- Structural and Geotechnical Issues Impacting The Dalles Spillwall Construction and Bay 1 Erosion Repair, by Jeffrey M. Ament
  Rock Anchor Design and Construction: The Dalles Dam Spillwalls, by Kristie M. Hartfeil
- The Future of the Discrete Element Method in Infrastructure Analysis, by Raju Kala, Johannes L. Wibowo and John F. Peters
- Sensitive Infrastructure Sites - Sonic Drilling Offers Quality Control and Non-Destructive Advantages to Geotechnical Construction Drilling, by John P. Davis

Track 8

- Evaluation of The Use of LithiuEvaluation of The Use of Lithium Compounds in Controlling ASR in Concrete Pavement, by Mike Kelly
- Roller Compacted Concrete for McAlpine Lock Replacement, by David E. Kiefer
- Soil-Cement for Stream Bank Stabilization, by Wayne Adaska
- Using Cement to Reclaim Asphalt Pavements, by David R. Luhr
- Valley Park 100-Yr Flood Protection Project: Use of 'Engineered Fill' in the Item IV-B Levee Core, by Patrick J. Conroy
- Bluestone Dam: AAR –A Case Study, by Greg Yankey
- USDA Forest Service: Unpaved Road Stabilization with Chlorides, by Michael R. Mitchell
- Use of Ultra-Fine Amorphous Colloidal Silica to Produce a High-Density, High-Strength Grout, by Brian H. Green
- Modular Gabion Systems, by George Ragazzo
- Addressing Cold Regions Issues in Pavement Engineering, by Edel R. Cortez and Lynette Barna
- Geology of New York Harbor: Geological and Geophysical Methods of Characterizing the Stratigraphy for Dredging Contracts, by Ben Baker, Kristen Van Horn and Marty Goff
- Rubblization of Airfield Concrete Pavements, by Eileen M. Vélez-Vega
- US Army Airfield Pavement Assessment Program, by Haley Parsons, Lulu Edwards, Eileen Velez-Vega and Chad Gartrell
- Critical State for Probabilistic Analysis of Levee Underseepage, by Douglas Crum,
- Curing Practices for Modern Concrete Production, by Toy Poole
- AAR at Carters Dam: Different Approaches, by James Sanders
- Concrete Damage at Carters Dam, by Toy Poole
  Damaging Interactions Among Concrete Materials, by Toy Poole
- Economic Effects on Construction of Uncertainty in Test Methods, by Toy Poole
- Trends in Concrete Materials Specifications, by Toy Poole
- Spall and Intermediate-Sized Repairs for PCC Pavements, by Reed Freeman and Travis Mann
- Acceptance Criteria Acceptance Criteria for Unbonded Aggregate Road Surfacing Materials, by Reed Freeman, Toy Poole, Joe Tom and Dale Goss
- Effective Partnering to Overcome an Interruption In the Supply of Portland Cement During Construction at Marmet Lock and Dam, by Billy D. Neeley, Toy S. Poole and Anthony A. Bombich

Track 10

- Marmet Lock &Dam: Automated Instrumentation Assessment, Summer/Fall 2004, by Jeff Rakes and Ron Adams
  Success Dam Seismic Remediation

Track 9

- Fern Ridge Dam, Oregon: Seepage and Piping Concerns (Internal Erosion)

Track 11

- Canton Dam Spillway Stability: Is a Test Anchor Program Necessary?, by Randy Mead
- Dynamic Testing and Numerical Correlation Studies for Folsom Dam, by Ziyad Duron, Enrique E. Matheu, Vincent P. Chiarito, Michael K. Sharp and Rick L. Poeppelman

Status of Portfolio Risk Assessment, by Eric Halpin
- Mississinewa Dam Foundation Rehabilitation, by Jeff Schaefer
- Wolf Creek Dam Seepage Major Rehabilitation Evaluation, by Michael F. Zoccola
- Bluestone Dam DSA Anchor Challenges, by Michael McCray
- Clearwater Dam Major Rehab Project, by Bobby Van Cleave
- Design, Construction and Seepage at Prado Dam, by Douglas E. Chitwood
- Seven Oaks Dam: Outlet Tunnel Invert Damage, by Robert Kwan
- An Overview of An Overview of the Dam Safety ProgramManagement Tools (DSPMT), by Tommy Schmidt

Track 12

- Greenup L&D Miter Gate Repair and Instrumentation, by Joseph Padula, Bruce Barker and Doug Kish
- Marmet Locks and Dam Lock Replacement Project, by Jeffrey S. Maynard,
- Status of HSS Inspections in The Portland District, by Travis Adams
- Kansas City District: Perry Lake Project Gate Repair, by Marvin Parks
- Mel Price – Auxiliary Lock Downstream Miter Gate Repair, by Thomas J. Quigley, Brian K. Kleber and Thomas R. Ruf
- J.T. Myers Lock Improvements Project Infrastructure Conference, by David Schaaf and Greg Werncke
- J.T. Myers Dam Major Rehab, by David Schaaf, Greg Werncke and Randy James
- Greenup L&D, by Rodney Cremeans
- McAlpine Lock Replacement Project, by Kathy Feger
- Roller Compacted Concrete Placement at McAlpine Lock, by Larry Dalton
- Kentucky Lock Addition Downstream Middle Wall Monolith Design, by Scott A. Wheeler
- London Locks and Dam Major Rehabilitation Project, by David P. Sullivan
- Replacing Existing Lock 4: Innovative Designs for Charleroi Lock, by Lisa R. Pierce, Dave A. Stensby and Steve R. Stoltz
- Olmsted L&D, Dam In-the-wet Construction, by Byron McClellan, Dale Berner and Kenneth Burg
- Olmsted Floating Approach Walls, by Terry Sullivan
- John Day Navigation Lock Monolith Repair, by Matthew D. Hanson
- Inner Harbor Navigation Canal (IHNC) Lock Replacement, by Mark Gonski
- Comite River Diversion Project, by Christopher Dunn
- Waterline Support Failure: A Case Study, by Angela DeSoto Duncan
- Public Appeal of Major Civil Projects: The Good, the Bad and the Ugly, by Kevin Holden and Kirk Sunderman
- Chickamauga Lock and Dam Lock Addition Cofferdam Height Optimization Study, by Leon A. Schieber
- Des Moines Riverwalk, by Thomas D. Heinold

Track 13

- Folsom Dam Evaluation of Stilling Basin Performance for Uplift Loading for Historic Flows and Modification of Folsom Dam
- Stilling Basin for Hydrodynamic Loading, by Rick L. Poeppelman, Yunjing (Vicky) Zhang, and Peter J. Hradilek
- Seismic Stress Analysis of Folsom Dam, by Enrique E. Matheu
- Barge Impact Analysis for Rigid Lock Walls ETL 1110-2-563, by John D. Clarkson and Robert C. Patev
- Belleville Locks & Dam Barge Accident on 6 Jan 05, by John Clarkson
- Portugues Dam Project Update, by Alberto Gonzalez, Jim Mangold and Dave Dollar
- Portugues Dam: RCC Materials Investigation, by Jim Hinds
- Nonlinear Incremental Thermal Stress Strain Analysis Portugues Dam, by David Dollar, Ahmed Nisar, Paul Jacob and Charles Logie
- Seismic Isolation of Mission-Critical Infrastructure to Resist Earthquake Ground Shaking or Explosion Effects, by Harold O. Sprague, Andrew Whitaker and Michael Constantino
- Obermeyer Gated Spillway S381, by Michael Rannie
- Design of High Pressure Vertical Steel Gates Chicago Land Underflow Plan McCook Reservoir, by Henry W. Stewart, Hassan Tondravi, Lue Tekola,
- Development of Design Criteria for the Rio Puerto Nuevo Contract 2D/2E Channel Walls, by Janna Tanner, David Shiver, and Daniel Russell
- Indianapolis NortIndianapolis North Phase 3A Warfleigh Section
- Design of Concrete Lined Tunnels in Rock CUP McCook Reservoir Distribution Tunnels Contract, by David Force

Track 14

- GSA Progressive Collapse Design Guidelines Applied to Concrete Moment-Resisting Frame Buildings, by David N. Bilow and Mahmoud E. Kamara,
- UFC 4-023-02 Retrofit of Existing Buildings to Resist Explosive Effects, by Jim Caulder
- Summit Bridge Fatigue Study, by Jim Chu
- Quality Assurance for Seismic Resisting Systems, by John Connor
- Seismic Requirements for Arch, Mech, and Elec. Components, by John Connor
- SBEDS - (Single degree of freedom Blast Effects Design Spreadsheets), by Dale Nebuda,
- Design of Buildings to Resist Progressive Collapse UFC 4-023-03, by Bernie Deneke,
- Fatigue and Fracture Assessment, by Jesse Stuart
- Unified Facilities Criteria: Seismic Design for Buildings, by Jack Hayes
- Evaluation and Repair Of Blast Damaged Reinforced Concrete Beams, by MAJ John L. Hudson
- Building an In-house Bridge Inspection Program
- United Facilities CriteriUnited Facilities Criteria Masonry Design for Buildings, by Tom Wright
- USACE Homeland Security Portal, by Michael Pace
- Databse Tools for Civil Works Projects

- Standard Procedure for Fatigue Evaluation of Bridges, by Phil Sauser
- Consolidation of Structural Criteria for Military Construction, by Steven Sweeney
- Cathodic Protectionfor the South Power Plant Reinforcing Steel, Diego Garcia, BIOT, by Thomas Tehada and Miki Funahashi

Track 15

- Engineering Analysis of Airfield Lighting System Lightning Protection, by Dr. Vladimir A. Rakov and Dr. Martin A. Uman
- Dr. Martin A. Uman
- Charleston AFB Airfield Lighting Vault
- UNIFIED FACILITIES CRITERIA (UFC) UFC 3-530-01 Design: Interior, Exterior Lighting and Controls, by Nancy Clanton and Richard Cofer
- Electronic Keycard Access Locks, by Fred A Crum
- Unified Facilities Criteria (UFC) 3-560-02, Electrical Safety, by John Peltz and Eddie Davis
- Electronic Security SystemElectronic Security Systems Process Overview
- Lightning Protection Standards
- Electrical Military Workshop
- Information Technology Systems Criteria, by Fred Skroban and John Peltz
- Electrical Military Workshop
- Electrical Infrastructure in Iraq- Restore Iraqi Electricity, by Joseph Swiniarski

Track 16

- BACnet® Technology Update, by Dave Schwenk
- The Infrastructur Conference 2005, by Steven M. Carter Sr. and Mitch Duke
- Design Consideration for the Prvention of Mold, by K. Quinn Hart
- COMMISSIONING, by Jim Snyder
- New Building Commissioning , by Gary Bauer
- Ventilation and IAQ TheNew ASHRAE Std 62.1, by Davor Novosel
- Basic Design Considerations for Geothermal Heat Pump Systems, by Gary Phetteplace
- Packaged Central Plants
- Effective Use Of Evaporative Cooling For Industrial And Institutional/Office Facilities, by Leon E. Shapiro
- Seismic Protection For Mechanical Equipment
- Non Hazardous Chemical Treatments for Heating and Cooling Systems, by Vincent F. Hock and Susan A. Drozdz
- Trane Government Systems & Services
- LONWORKS Technology Update, by Dave Schwenk
- Implementation of Lon-Based Specifications by Will White and Chris Newman

Track 17

- Utility System Security and Fort Future, by Vicki Van Blaricum, Tom Bozada, Tim Perkins, and Vince Hock
- Festus/Crystal City Levee and Pump Station
- Chicago Underflow Plan McCook Reservoir (CUP) Construction of Distribution Tunnel and Pumps Installation
- Technological Advances in Lock Control Systems, by Andy Schimpf and Mike Maher
- Corps of Engineers in Iraq Rebuilding Electrical Infrastructure, by Hugh Lowe
- Red River of the North at East Grand Forks, MN & Grand Forks, ND: Flood Control Project – Armada of Pump Stations Protect Both Cities, by Timothy Paulus
- Lessons Learned for Axial/Mixed Flow Propeller Pumps, by Mark A. Robertson
- Creek Automated Gate Considerations, by Mark A. Robertson
- HydroAMP: Hydropower Asset Management, by Lori Rux
- Acoustic Leak Detection for Water Distribution Systems, by Sean Morefield, Vincent F. Hock and John Carlyle
- Remote Operation System, Kaskaskia Dam Design, Certification, & Accreditation, by Shane M. Nieukirk
- Lock Gate Replacement System, by Shaun A. Sipe and Will Smith

Track 20

- “Re-Energizing Medical Facility Excellence”, by COL Rick Bond
- Rebuilding and Renovating The Pentagon , by Brian T. Dziekonski,
- Resident Management System
- Design-Build and Army Military Construction, by Mark Grammer
- Defense Acquisition Workforce Improvements Act - Update, by Mark Grammer
- Construction Management @ Risk: Incentive Price Revision – Successive Targets, by Christine Hendzlik
- Construction Reserve Matrix, by Christine Hendzlik
- Award contingent on several factors..., by Christine Hendzlik
- 52.216-17 Incentive Price Revision--Successive Targets (Oct 1997) - Alt I (Apr 1984), by Christine Hendzlik
- Preconstruction Services, by Christine Hendzlik
- Proposal Evaluation Factors, by Christine Hendzlik
- MILCON Transformation in Support of Army Transformation, by Claude Matsui
- Construction Practices in Russia, by Lance T. Lawton

- Partnering as a Best Practice, by Ray Dupont
- USACE Tsunami Reconstruction for USAID, by Andy Constantaras

Track 21

- Dredging Worldwide, by Don Carmen
- SpecsIntact Editor, by Steven Freitas
- SpecsIntact Explorer, by Steven Freitas
- American River Watershed Project, by Steven Freitas
- Unified Facilities Guide Specifications (UFGS) Conversion To MasterFormat 2004, by Carl Kersten
- Unified Facilities Guide Specifications (UFGS) Status and Direction , by Jim Quinn

Workshops

- Design of Buildings to Resist Progressive Collapse UFC 4-023-03, by Bernie Deneke
- Security Engineering and at Unified Facility Criteria (UFC), by Bernie Deneke, Richard Cofer, John Lynch and Rudy Perkey
- Packaged Central Plants, by Trey Austin

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION

STRENGTH THROUGH INDUSTRY & TECHNOLOGY

2005 Tri-Service Infrastructure Systems Conference & Exhibition

"Re-Energizing Engineering Excellence"

ON-SITE AGENDA

The America's Center
St. Louis Convention Center
St. Louis, MO
August 2-4, 2005
Event # 5150

Tri-Service Infrastructure Systems Conference & Exposition 2005

AGENDA

Monday, August 1, 2005

8:00 AM-9:00 PM	Exhibit Move-In
12 Noon-5:00 PM	Registration

Tuesday, August 2, 2005

7:00 AM-8:00 AM	Registration and Continental Breakfast
8:00 AM-8:15 AM Ferrara Theatre	Welcome and Introduction
8:15 AM-9:00 AM Ferrara Theatre	The Future of Engineering and Construction Panel Moderator: *Mr. Don Basham, Chief, Engineering & Construction, USACE* Panelists: *LTG Carl A. Strock, Commander, USACE* *Dr. James Wright, Chief Engineer NAVFAC*
9:00 AM-9:45 AM Ferrara Theater	Keynote Address The Lord of the Things: The Future of Infrastructure Technologies *Mr. Paul Doherty, AIA, Managing Director,* *General Land Corporation*
9:45 AM-10:15 AM	Break
10:15 AM-11:15 AM Ferrara Theatre	USACE Engineering and Construction Panel Moderator: *Mr. Don Basham, Chief, Engineering & Construction, USACE* Panelists: *MG Donald T. Riley, Director, Civil Works, USACE* *BG Bo M. Temple, Director, Military Programs, USACE* *Dr. Michael J. O'Connor, Director, R&D*
10:15 AM-11:15 AM Room 225	Navy General Session
11:00 AM - 7:00 PM	Exhibits Open
11:15 AM-1:00 PM	Lunch in Exhibit Hall (on your own)
11:15 AM-1:00 PM Washington G	Women's Career Lunch Session (Bring your lunch from Exhibit Hall) Moderator: *Ms. Demi Syriopoulou, HQ USACE* Opening Remarks: *LTG Carl A. Strock, Commander, USACE* Presentations & Discussion: *Dwight Beranek, Kristine Allaman, Donald Basham, HQ USACE*
1:00 PM-1:55 PM Ferrara Theatre	Introduction to Multi-Disciplinary Tracks

Tuesday, August 2, 2005

2:00 PM-2:50 PM — 1st Round of Multi-Disciplinary Concurrent Sessions (Continued)

Track 1:	Room 230	Acquisition Strategies for Civil Works *Walt Norko*
Track 2:	Room 231	Risk and Reliability Engineering *Anjana Chudgar* *David Schaaf*
Track 3:	Room 232	Portfolio Risk Assessment *Eric Halpin*
Track 4:	Room 240	Hydrology, Hydraulics and Coastal Engineering Support for USACE *Jerry Webb* *Darryl Davis*
Track 5:	Room 241	Civil Works R&D Forum *Joan Pope*
Track 6:	Room 242	Civil Works Security Engineering *Joe Hartman* *Bryan Cisar*
Track 7:	Room 226	Building Information Model Applications *Brian Huston* *Daniel Hawk*
Track 8:	Room 220	Design Build for Military Projects *Mark Grammer*
Track 9:	Room 221	Army Transformation/Global Posture Initiative/ Force Modernization *Al Young* *Claude Matsui*
Track 10:	Room 222	Force Protection - Army Access Control Points *John Trout*
Track 11:	Room 227	Cost Engineering Forum on Government Estimates vs. Actual Costs *Ray Lynn* *Jack Shelton* *Kim Callan* *Miguel Jumilla* *Ami Ghosh* *Joe Bonaparte*
Track 12:	Room 228	Engineering & Construction Information Technology *MK Miles*
Track 13:	Room 223	Sustainable Design *Harry Goradia*
Track 14:	Room 224	ACASS/CCASS/CPARS *Ed Marceau* *Marilyn Nedell*
Track 15:	Room 229	Whole Building Design Guide *Earle Kennett*

Tuesday, August 2, 2005

2:50 PM-3:30 PM	Break in Exhibit Hall
3:30 PM-4:20 PM	2nd Round of Multi-Disciplinary Sessions
4:30 PM-5:20 PM	3rd Round of Multi-Disciplinary Sessions
5:30 PM-7:00 PM	Ice Breaker Reception in Exhibit Hall

Wednesday, August 3, 2005

7:00 AM-8:00 AM	Registration and Continental Breakfast
8:00 AM-9:30 AM	Concurrent Sessions (Please Refer to Concurrent Session Schedule on the Following Pages)
9:00 AM	Exhibit Hall Opens
9:30 AM-10:30 AM	Break in Exhibit Hall
10:30 AM-12:00 Noon	Concurrent Sessions (Please Refer to Concurrent Session Schedule on the Following Pages)
12:00 Noon-1:30 PM	Lunch in Exhibit Hall
1:30 PM-3:00 PM	Concurrent Sessions (Please Refer to Concurrent Session Schedule on the Following Pages)
3:00 PM-4:00 PM	Break in Exhibit Hall
4:00 PM-5:30 PM	Concurrent Sessions
5:00 PM	Exhibit Hall Closes

Thursday, August 4, 2005

7:00 AM-8:00 AM	Registration and Continental Breakfast
8:00 AM-9:30 AM	Concurrent Sessions (Please Refer to Concurrent Session Schedule on Following Pages)
9:30 AM-10:30 AM	Break in Exhibit Hall (Last Chance to view Exhibits)
10:30 AM-12:00 Noon	Concurrent Sessions (Please Refer to Concurrent Session Schedule on Following Pages)
12:00 Noon-1:30 PM	Lunch (On your own)
12:00 Noon-6:00 PM	Exhibits Move-Out
1:30 PM-3:00 PM	Concurrent Sessions (Please Refer to Concurrent Session Schedule on Following Pages)
3:00 PM-3:30 PM	Break
3:30 PM-5:00 PM	Concurrent Sessions (Please Refer to Concurrent Session Schedule on following pages)

Wednesday, August 3, 2005 Concurrent Sessions

HH&C Track

Room	Track / Session	8:00 AM	8:30 AM	9:00 AM	9:30 AM	10:30 AM	11:00 AM	11:30 AM
Room 220	**TRACK 1** Coastal Structures, Session 1A / **TRACK 1** Coastal Regional Manangement, Session 1B	Protecting the NJ Coast using large stone seawalls *Cameron Chasten*	Chicago shoreline storm damage reduction project *Andrew Bezinger*	Risk and reliability in coastal structure design *Jeffrey Melby*	Break in Exhibit Hall	Cascade: An integrated regional model for decision support *Nicholas Kraus*	Upper Texas coast sediment transport modeling & sediment budgets *David King*	Sediment compatibility for beach nourishment in North Carolina *Gregory Williams*
Room 221	**TRACK 2** Ecological Engineering & Design, Session 2A / Session 2B	Ecological and engineering considerations for dam decommissioning, retrofits and operations *Jock Conyngham*	Hydraulic design of tidegates and other water control structures for ecosystem restoration on the Columbia Estuary *Patrick O'Brien*	Innovative Integration of engineering and biological tools aids hydraulic structure design for restoring T&E fish *Andrew Goodwin*	Break in Exhibit Hall	Innovative hydraulic structure design at Lower Granite Dam: design that saves water and salmon *Lynn Reese*	Impacts of using a spillway for juvenile fish passage on typical design criteria *Robert Buchholz*	Hydraulic design of juvenile fish passage facility for reservoir with wide range of pool elevation - Hanson Dam *Dennis Mekkers*
Room 222	**TRACK 3** Modeling, Session 3A / Session 3B	Corps involvement in the FEMA map modernization program *Kete White*	Innovative approximate study method for FEMA map modernization program *John Hunter*	Flood fight structures demonstration evaluation program *Fred Pinkard*	Break in Exhibit Hall	Integrating climate dynamics into water resources planning and management *Kate White*	Risk and uncertainty in flood damage reduction studies *Rob Moyer*	Uncertainty analysis and stochastic simulation *Jacke Hallberg*
Room 223	**TRACK 4** H&H Aspects of Dam Safety, Session4A / **TRACK 4** International/ Military H&H, Session 4B	Hydrologic aspects of operating in failure mode: Fern Lake *Bruce Duffe*	Dam safety study with cascading failures *Gordon Lance*	Rough river spillway capacity *Richard Pruitt*	Break in Exhibit Hall	Capability restoration and historic marsh restoration *Fauwaz Hanbali*	USACE capacity building effort for Iraq MoWR *Steven Wilhelms*	USACE support of CMEP in 2004 *Mark Jensen*

12 Noon — **Lunch in Exhibit Hall**

Room	Track / Session	1:30 PM	2:00 PM	2:30 PM	3:00 PM	4:00 PM	4:30 PM	5:00 PM
Room 220	**TRACK 1** Coastal Sediments, Session 1C / **TRACK 1** Shore Protection Projects, Session 1D	Evaluating beachfill project performance in the NAP *Monica Chasten*	USACE's regional coastal mapping program *Jennifer Wozencraft*	US Naval Academy flood damage reduction project using structural and non-structural measures *Stacey Underwood*	Break in Exhibit Hall	Hurricane Isabel effects on communities *Jane Jablonski*	Repair of the shore protection projects adversly affected by the hurricanes of 2004 *Rick McMillen*	Shore protection project performance assessmet *Sharon Haggett*
Room 221	**TRACK 2** Modeling Ecological Restoration/Systems Assessment, Session 2C / **TRACK 2** Ecosystem Habitat Restoration, Session 2D	Regional modeling requirements for ecosystem restoration *Maged Hussein*	Tools for wetlands permit evaluation: Modeling groundwater and surface water distribution systems *Cary Talbot*	Current research in fate and transport of chemical and biological contaminants in water distribution systems *Mark Ginsberg*	Break in Exhibit Hall	Aquatic habitat restoration in the lower Missouri River *Chance Bittner*	Missouri River restoration: shallow water habitat creation *Daniel Pridal*	Ecosystem restoration for fish and wildlife habitat on the upper Mississippi River *Jon Hendrickson*
Room 222	**TRACK 3** River Morphology, Session 3C / **TRACK 3** Modeling River Sedimentation, Session 3D	Geomorphology study of the Mississippi river *Edward Braurer*	Bank erosion and morphology of the Kaskaskia river *Michael Rodgers*	Sediment movement at Kansas City from water years 1920 to 2004 *Alan Tool*	Break in Exhibit Hall	Sediment impact assessment model (SIAM) *David Biedenharn*	Sediment modeling of MS River, Cairo to Gulf *Basil Arthur*	Sediment modeling of rivers *Charlie Berger*
Room 223	**TRACK 4** GIS and Surveying, Session 4C / **TRACK 4** GIS and Surveying, Session 4D	GIS tools available now to support HHC *Timothy Pangburn*	High resolution bathymetry and fly-through visualization *Paul Clouse*	GIS & surveying to support national FEMA *Mark Flick*	Break in Exhibit Hall	Update flood emergency plans with GIS and HEC-RAS *Stephen Stello*	High resolution visualizations of multibeam data: lower Mississippi River *Thomas Tobin*	GIS in SWWRP *Andrew Bruzewicz*

Wednesday, August 3, 2005 Concurrent Sessions

Geotechnical Track

Room	Track / Session	8:00 AM	8:30 AM	9:00 AM	9:30 AM	10:30 AM	11:00 AM	11:30 AM
Room 226	TRACK 5 Session 5A / 5B	Levee lowering for the Lewis & Clark bi-centennial celebration *Robert Berger*	Conduits through embankment dams - best practices for design, construction, problem id and evaluation, inspection, maintenance, renovation & repair *Dave Pezza*	Design, construction and seepage at Prado Dam, CA *Douglas Chitwood*	Break in Exhibit Hall	2-D liquefaction evaluation with q4MESH *David Serafini*	Unlined spillway erosion risk assessment *Johannes Wibowo*	Seismic remediation of the Clemson upper and lower diversion dams: evaluation, conceptal design and design (P1) *Ben Foreman*
Room 227	TRACK 6 Session 6A / 6B	USACE dams on solution susceptible or highly fractured rock foundations *Art Walz*	Special drilling and grouting techniques for remedial work in embankment dams *Doug Heenan*	Composite grouting & cutoff wall solutions *Donald Bruce*	Break in Exhibit Hall	State of the art in grout mixes *James Davies*	State of the art in computer monitoring, control, and analysis of grouting *Trent Dreese*	Quantitatively engineered grout courtains *David Wilson*
Room 228	TRACK 7 Session 7A / 7B	Case history: multiple axial statnamic test on a drilled shaft embedded in shale *Paul Axtell*	Austin Dam, Pennsylvania: the sliding failure of a concrete gravity dam revisited *Brian Greene*	M^3 (Modeling, Monitoring and Manufacturing) - a comprehensive approach to controlling ground movements for protecting existing structures and facilities *Michael Walker*	Break in Exhibit Hall	Controlled modulus columns: A ground improvement technique *Martin Taube*	Time-dependent reliability models for use in major rehabilitation of embankment dams and foundations *Robert Patev*	Engineering geology design challenges at the Soo Lock replacement project *Mike Nield*
Room 229	TRACK 8 Session 8A / 8B	Evaluation of the use of lithium nitrate in controlling alkali-silica reactivity in an existing concrete pavement *Mike Kelly*	Use of self-consolidating concrete in the installation of bulhead slots - Lessons learned in the use of this innovative concrete material *Darrell Morey*	Roller compacted concrete for McAlpine lock walls *David Kiefer*	Break in Exhibit Hall	Soil-cement for stream bank stabilization *Wayne Adaska*	Using cement to reclaim asphalt pavements *David Luhr*	Valley park 100-year flood protection project: use of "engineered fill" in item 4b levee core *Patrick Conroy*

12 Noon

Lunch in Exhibit Hall

Room	Track / Session	1:30 PM	2:00 PM	2:30 PM	3:00 PM	4:00 PM	4:30 PM	5:00 PM
Room 226	TRACK 5 Session 5C / 5D	Seismic remediation of the Clemson upper and lower diversion dams: deep soil mix construction *Ben Foreman*	Historical changes in the state-of-the-art of seismic engineering & effects of those changes on the seismic response studies of large embankement dams *Samuel Stacy*	New Iwakuni runway *Vincent Donnally*	Break in Exhibit Hall	Internal erosion and piping at Fern Ridge dam: Problems and solutions *Jeremy Britton, Ph.D.*	Rough river dam safety assurance project *Timothy O'Leary*	Seepage collection and control systems: The devil is in the details *John France*
Room 227	TRACK 6 Session 6C / 6D	Grout courtains at Arkabutla Dam outlet monolith joints using chemical grout to seal joints, Arkabutla, MS *Dale Goss*	Results from a large-scale grout test program, Chicago underflow plan (CUP) McCook Reservoir *Joseph Kissane*	Clearwater Dam - foundation drilling and grouting for repair of sinkholes *Mark Harris*	Break in Exhibit Hall	Update on the investigation of the effects of boring sample size (3' vs 5") on measured cohesion in soft clays *Richard Pinner*	Soil-bentonite cutoff wall through free-product at Indiana Harbor CDF *Joseph Schulenberg*	Soil-bentonite cutoff wall through dense alluvium with boulders into bedrock, McCook Reservoir *William Rochford*
Room 228	TRACK 7 Session 7C / 7D	Engineering geology during design and construction of the Marmet lock project *Michael Nield*	Mill Creek deep tunnel - Geological affects on proposed structures and construction techniques *Tres Henn*	Earth pressure loads behind the new McAlpine Lock replacement project *Troy O'Neal*	Break in Exhibit Hall	Geosynthetics and construction of the Bonneville lock and dam second powerhouse corner collector surface flow bypass project *Art Fong*	McAlpine lock replacement - foundation characteristics and excavation *Kenneth Henn*	
Room 229	TRACK 8 Session 8C / 8D	What to do if your dam is expanding: a case study *Greg Yankey*	Unpaved road stabilization with chlorides *Michael Mitchell*	Use of ultra-fine amorphous colloidal silica to produce a high-density, high-strength rock-matching grout for instrumentation grouting *Brian Green*	Break in Exhibit Hall	Innovative techniques in the Gabion system *George Ragazzo*	Addressing cold regions issues in pavement engineering *Lynette Barna*	Geology of New York Harbor - geological and geophysical methods of characterizing the stratigraphy for dredging contracts *Ben Baker*

Wednesday, August 3, 2005 Concurrent Sessions

Structural Engineering Track

Room	Track / Session	8:00 AM	8:30 AM	9:00 AM	9:30 AM	Track / Session	10:30 AM	11:00 AM	11:30 AM
Room 240	**TRACK 12** Civil Works Structural — Session 12A	Recent changes to Corps guidance on steel hydraulic structures — *Joe Padula*	Crack repairs and instrumentation of Greenup L&D miter gate — *Doug Kish*	Recent hydraulic steel structures findings in the Portland district — *Travis Adams*	Break in Exhibit Hall	**TRACK 12** Civil Works Structural — Session 12B	Perry Lake gate repair — *Marvin Parks*	Mel Price auxiliary lock gate repair — *Andrew Schimpf*	Mel Price auxiliary lock gate repair (Continued) — *Andrew Schimpf*
Room 241	**TRACK 13** Civil Works Structural — Session 13A	Folsom Dam evaluation of stilling basin performance for uplift loading for historic flows — *Rick Poeppelman*	Rehabilitation of Folsom Dam stilling basin — *Rick Poeppelman*	Seismic stability evaluation of Folson Dam — *Enrique Matheu*	Break in Exhibit Hall	**TRACK 13** Civil Works Structural — Session 13B	Seismic stress analysis of Folsom Dam — *Enrique Matheu*	Barge impact guidance for rigid lock walls, ETL 110-2-563 and probalistic barge impact analysis — *John Clarkson*	Belleville barge accident — *John Clarkson*
Room 242	**TRACK 14** Bridges/ Buildings — Session 14A	The USACE bridge management system — *Phil Sauser*	Standard procedures for fatigue evaluation of bridges — *Phil Sauser*	Fatigue and fracture assessment of Jesse Stuart Highway Bridge — *John Jaeger*	Break in Exhibit Hall	**TRACK 14** Bridges/ Buildings — Session 14B	Building an in-house bridge inspection program — *Jennifer Laning*	Fatigue analysis of Summit bridge — *Jim Chu*	Consolidation of Structural criteria for military construction — *Steve Sweeney*

12 Noon — **Lunch in Exhibit Hall**

Room	Track / Session	1:30 PM	2:00 PM	2:30 PM	3:00 PM	Track / Session	4:00 PM	4:30 PM	5:00 PM
Room 240	**TRACK 12** Civil Works Structural — Session 12C	Overview of John T. Myers locks improvements project — *Greg Werncke*	John T. Myers rehabilitation study — *Greg Werncke*	Ohio River Greenup Lock extension — *Rodney Cremeans*	Break in Exhibit Hall	**TRACK 12** Civil Works Structural — Session 12D	McAlpine lock replacement project, project summary and status of construction — *Kathleen Feger*	Results of Roller Compacted concrete placement at the McAlpine lock replacement project — *Larry Dalton*	Tennessee Valley authority Kentucky lock addition downstream middle wall monoliths — *Scott Wheeler*
Room 241	**TRACK 13** Civil Works Structural — Session 13C	Portugues Dam, Ponce, Puerto Rico project update — *Jim Mangold*	Portugues Dam, Ponce, Puerto Rico, RCC design and testing program — *Jim Hinds*	Portugues Dam, Ponce, Puerto Rico, Thermal analysis of hydration and subsequent cooling of RCC — *Ahmed Nisar*	Break in Exhibit Hall	**TRACK 13** Civil Works Structural — Session 13D	Miter gate anchorage design — *Andy Harkness*	Obermeyer gated spillway project - S381 — *Michael Rannie*	McCook Reservoir design of high pressure steel gates — *Luelseged Tekola*
Room 242	**TRACK 14** Brigdes/ Buildings — Session 14C	Unified facilities criteria seismic design for buildings — *Jack Hayes*	Seismic requirements for architectural, mechanical and electrical components — *John Connor*	Quality assurance for seismic resisting systems — *John Connor*	Break in Exhibit Hall	**TRACK 14** Bridges/ Buildings — Session 14D	Unified facilities criteria masonry structural design for buildings — *Tom Wright*	Cathodic protection of building reinforcing steel (in Diego Garcia) — *Thomas Tehada*	USACE Homeland security web portal — *Mike Pace*

Wednesday, August 3, 2005 Concurrent Sessions

Dam Safety Track & Construction Track

Room	Track	8:00 AM	8:30 AM	9:00 AM	9:30 AM	Track	10:30 AM	11:00 AM	11:30 AM
Room 224	**TRACK 10** Dam Safety Session 10A	Tuttle Creek warning and alert systems *Bill Empson*	Lessons from the dam failure warning system exercise - Tuttle Creek *Bill Empson*	Tuttle Creek ground modification treatability program *Bill Empson*	Break in Exhibit Hall	**TRACK 10** Dam Safety Session 10B	Dam safety analysis of Cannelton Dam *Terry Sullivan*	John Martin Dam, CO - Dam safety structural upgrades *George Diewald*	Vesuvius Lake Dam rehabilitation *Susan Peterson*
Room 225	**TRACK 11** Dam Safety Session 11A	Canton lake spillway stabilization project: IS a test anchor program NECESSARY? *Randy Mead*	Dynamic testing and numerical correlation studies for Folsom dam *Ziyad Duron*	Status of portfolio risk assessment *Eric Halpin*	Break in Exhibit Hall	**TRACK 11** Dam Safety Session 11B	Mississinewa Dam remediation *Jeff Schaefer*	Wolf creek seepage history *Michael Zoccola*	Blue dam major rehabilitation *Michael McCray*
Room 230	**TRACK 19** Construction Session 19A	RMS Update *Haskell Barker*	RMS Update (Continued) *Haskell Barker*	Updated CQM for Contractors Course *Walt Norko*	Break in Exhibit Hall	**TRACK 19** Construction Session 19B	Lessons learned on major construction projects *Jim Cox*	Update on safety issues - Safety manual 385-1-1 *Charles Ray Waits*	Update on safety issues - safety manual 385-1-1 (continued) *Charles Ray Waits*
Room 231	**TRACK 20** Construction Session 20A	Construction methods in Russia *Lance Lawton*	Construction methods in Russia (Continued) *Lance Lawton*	Renovating the Pentagon using Design/Build delivery *Brian Dziekonski*	Break in Exhibit Hall	**TRACK 20** Construction Session 20B	Completion of the Olmsted approach walls *Dale Miller*	Completion of the Olmsted approach walls (Continued) *Dale Miller*	Construction management at risk *Christopher Prinslow*

12 Noon — **Lunch in Exhibit Hall**

Room	Track	1:30 PM	2:00 PM	2:30 PM	3:00 PM	Track	4:00 PM	4:30 PM	5:00 PM
Room 224	**TRACK 10** Dam Safety Session 10C	Project specific risk analysis - Success Dam *Ronn Ross*	Dam safety lessons learned, Winter storm 2005, Muskingum & Scioto Basins *Charles Barry*	Dam security and Dams Government Coordinating Council *Roy Braden*	Break in Exhibit Hall	**TRACK 10** Dam Safety Session 10D	Prompton Dam hydrologic deficiency and spillway modification *Troy Cosgrove*	"Well, that's water over the dam" - Rough River spillway adequacy design *Richard Pruitt*	Roller-compacted concrete for dam spillways and overtopping protection *Fares Abdo*
Room 225	**TRACK 11** Dam Safety Session 11C	Clearwater Dam major rehabilitation *Bobby Van Cleave*	Success dam seismic dam safety modification *Norbert Suter*	Problems on the Santa Ana River - Prado Dam *Douglas Chitwood*	Break in Exhibit Hall	**TRACK 11** Dam Safety Session 11D	Problems on the Santa Ana River - Seven Oaks Dam *Robert Kwan*	Dam safety program management tools *Tommy Schmidt*	
Room 230	**TRACK 19** Construction Session 19C	3D Modeling and impact on constructability *Gary Cough*	3D Modeling and impact on constructability (Continued) *Gary Cough*	Construction in Iraq & Afganistan *Walt Norko*	Break in Exhibit Hall	**TRACK 19** Construction Session 19D	Air Force streamlining Design/Build *Joel Hoffman*	Air Force streamlining Design/Build (Continued) *Joel Hoffman*	Sustainable design requirements & construction implementation *Harry Goradia*
Room 231	**TRACK 20** Construction Session 20C	Tsunami reconstruction *Andy Constantaras*	Tsunami reconstruction (Continued) *Andy Constantaras*	Military construction transformation in support of Army transformation *Sally Parsons*	Break in Exhibit Hall	**TRACK 20** Construction Session 20D	MEDCOM Construction Issues *Rick Bond*	MEDCOM Construction Issues (Continued) *Rick Bond*	*TBA*

Wednesday, August 3, 2005 Concurrent Sessions

Electrical & Mechanical Engineering Track

Room	Track / Session	8:00 AM	8:30 AM	9:00 AM	9:30 AM	Track / Session	10:30 AM	11:00 AM	11:30 AM
Room A	**TRACK 15** Military Electrical — **Session 15A**	Tri-Service Electrical Criteria Overview - *Tri-Service Panel*	Tri-Service Electrical Criteria Overview - (Continued) *Tri-Service Panel*	Tri-Service Electrical Criteria Overview -(Continued) *Tri-Service Panel*	Break in Exhibit Hall	**TRACK 15** Military Electrical — **Session 15B**	Interior/Exterior and security lighting criteria *Tri-Service Panel*	Information technology systems criteria *Tri-Service Panel*	Information technology systems criteria (Continued) *Tri-Service Panel*
Room B	**TRACK 16** Military Mechanical — **Session 16A**	Building Commissioning *Dale Herron*	HVAC Commissioning *Dale Herron*	Ventilation and indoor air quality *Davor Novosel*	Break in Exhibit Hall	**TRACK 16** Military Mechanical — **Session 16B**	Ventilation and indoor air quality (Continued) *Davor Novosel*	Refrigerant implications for HVAC specifications, selection, and o&m - now and future *Mike Thompson*	Refrigerant implications for HVAC specifications, selection, and o&m - now and future (Continued) *Mike Thompson*
Room D	**TRACK 17** Military Mechanical / Electrical — **Session 17A**	Sustainable design update *Harry Goradia*			Break in Exhibit Hall	**TRACK 17** Military Mechanical / Electrical — **Session 17B**	Utility systems security and fort future *Vicki L. Van Blaricum*	Acoustic leak detection for utilities distribution systems *Sean Morefield*	Acoustic leak detection for utilities distribution systems (Continued) *Sean Morefield*
Room E	**TRACK 18** Civil Mechanical — **Session 18A**	Emsworth Dam vertical lift gate hoist replacement *John Nites*	Hydraulic drive for Braddock Dam *Janine Krempa*	John Day navigation lock upstream lift gate wire rope failure *Ronald Wridge*	Break in Exhibit Hall	**TRACK 18** Civil Mechanical — **Session 18B**	Overhead bulkhead at Olmstead Lock *Rick Schultz*	Replacement of gate # 5 intermediate gear and pinion at RC Byrd Lock and Dam *Brenden McKinley*	Mechanical design issues during construction of McAlpine Lock *Richard Nichols*

12 Noon — Lunch in Exhibit Hall

Room	Track / Session	2:00 PM	2:30 PM	3:00 PM	3:30 PM	Track / Session	4:00 PM	4:30 PM	5:00 PM
Room A	**TRACK 15** Military Electrical — **Session 15C**	Mass notification system *Tri-Service Panel*	Mass notification system (Continued) *Tri-Service Panel*	Electronic card access locks *Fred Crum*	Break in Exhibit Hall	**TRACK 15** Military Electrical — **Session 15D**	Lightning protection standards *Richard Bouchard*	Lightning and surge protection *Tri-Service Panel*	Lightning and surge protection (Continued) *Tri-Service Panel*
Room B	**TRACK 16** Military Mechanical — **Session 16C**	Basic design considerations for geothermal heat pump systems *Gary Phetteplace*	Basic design considerations for geothermal heat pump systems (Continued) *Gary Phetteplace*	Pentagon renovation *Mitch Duke*	Break in Exhibit Hall	**TRACK 16** Military Electrical — **Session 16D**	Effective use of evaporative cooling for industrial and institutional/office facilities *Leon Shapiro*	Efective use of evaporative cooling for industrial and institutional/office facilities (Continued) *Leon Shapiro*	Non-hazardous chemical treatments for heating and cooling systems *Vincent Hock*
Room D	**TRACK 17** Civil Mechanical / Electrical — **Session 17C**	Hydropower asset management partnership (hydroAMP) *Lori Rux*	New gas fueled/diesel fueled turbine powered electrical generating station in Iraq *Lester Lowe*	The construction of distribution tunnels and pump installation for the metropolitan Chicago sewer systems *Ernesto Go*	Break in Exhibit Hall	**TRACK 17** Civil Mechanical / Electrical — **Session 17D**	The Festus/Crystal City levee and pump station project *Stephen Farkas*	Remote operations for Kaskaskia Dam *Shane Nieukirk*	Technological advances in lock control systems *Andy Schimpf*
Room E	**TRACK 18** Civil Mechanical — **Session 18C**	New coating products for civil works structures *Al Beitelman*	New guide specification for procurement of turbine oils *John Micetic*	Synchronous condensing with large Kaplan turbine - A case study *Brian Moentenich*	Break in Exhibit Hall	**TRACK 18** Civil Mechanical — **Session 18D**	Acquifer storage and recovery (ASR) system *Gerald Deloach*	Wastewater infrastructure improvements in Appalachia *James Sadler*	Storm water pumps *Thomas Jamieson*

Thursday, August 4, 2005 Concurrent Sessions

HH&C Track

Room	Track	8:00 AM	8:30 AM	9:00 AM	9:30 AM	Track	10:30 AM	11:00 AM	11:30 AM
Room 220	**TRACK 1 Sedimentation & New Concepts Session 1E**	Ice jams, contaminated sediment and structures Clark Fork River, MT *Andrew Tuthill*	Increased bed erosion due to ice *John Hains*	Monitoring the Mississippi River using GPS coordinated video *James Gutshall*	**Break in Exhibit Hall**	**TRACK 1 Sedimentation, Case Examples Session 1F**	Watershed approach to stream stability the reduction of nutrients *John B. Smith*	Monitoring the effects of sedimentation from Mount St. Helen *Alan Donner*	Navigation and environmental interests in alleviating repetitive dredging *Jason Brown*
Room 221	**TRACK 2 Water Management Session 2E**	Enhancements and new capabilities of HEC-ResSim 3.0 *Fauwaz Hanbali*	Transition to Oracle based data system *Joel Asunskis*	Accessing real time Mississippi Valley water level data *Rich Engstrom*		**TRACK 2 Water Management Session 2F**	Hurricane Season 2004 *Susan Sylvester*	Reevaluation of a project's flood control benefits *Ferris Chamberlin*	Helmand Valley water management plan *Jason Needham*
Room 222	**TRACK 3 Case Studies Session 2E**	Red River of the north flood protection project *Michael Lesher*	Southeast Arkansas flood control & water supply feasibility study *Thomas Brown*	McCook and Thorton tunnel and reservoir modeling *David Kiel*		**TRACK 3 Case Studies Session 3F**	Ala Wai Canal Project, Honolulu, Oahu, Hawaii *Lynnette Schapers*	Missouri River geospatial decision support framework *Brian Baker*	Systemic analysis of the Mississippi & Illinois Rivers *Dennis Stephens*
Room 223	**TRACK 4 Modeling Session 4E**	Hydrologic models supported by ERDC *Robert Wallace*	HEC-HMS Version 3.0 new features *Jeff Harris*	SEEP2D & GMS: Simple tools for solving a variety of seepage problems *Clarissa Hansen*		**TRACK 4 Modeling Session 4F**	Water quality and sediment transport in HEC-RAS *Mark Jensen*	Advances to the GSSHA program *Aaron Byrd*	Software integration for watershed studies HEC-WAT *Chris Dunn*

12 Noon

Lunch

Room	Track	1:30 PM	2:00 PM	2:30 PM	3:00 PM	Track	3:30 PM	4:00 PM	4:30 PM
Room 220	**TRACK 1 Water Quality Management Session 1G**	San Francisco Bay Mercury TMDL-Implications for constructed wetlands *Herb Fredrickson*	Abandoned mine land: Eastern and Western perspectives *Kate White*	A lake tap for temperature control tower construction at Cougar Dam *Steve Schlenker*	**Break**	**TRACK 1 Watershed Management Session 1H**	Demonstrating innovative river restoration technologies: Truckee River, NV *Chris Dunn*	Comprehensive watershed restoration in the Buffalo district *Anthony Friona*	Translating the hydrologic tower of Babel *Dan Crawford*
Room 221	**TRACK 2 Water Management Session 2G**	Developing reservoir operation plans to manage erosion *Patrick O'Brien*	New approaches to water management decision making *James Barton*	Improved water supply forecasts for Kooteny basin using principal components regression *Randal Wortman*		**TRACK 2 Water Management Session 2H**	Prescriptive reservoir modeling and ROPE study *Jason Needham*	Missouri River mainstem operations *Larry Murphy*	Res-Sim model for the Columbia River *Arun Mylvahanan*
Room 222	**TRACK 3 Section 227 Session 3G**	Section 227 Workshop/ Program Review *William Curtis*	Section 227 Workshop/ Program Review (Continued) *William Curtis*	Section 227 Workshop/ Program Review (Continued) *William Curtis*		**TRACK 3 Section 227 Session 3H**	Section 227 Workshop/ Program Review *William Curtis*	Section 227 Workshop/ Program Review (Continued) *William Curtis*	Section 227 Workshop/ Program Review (Continued) *William Curtis*
Room 223	**TRACK 4 Modeling Session 4G**	Little Calumet River unsteady flow model conversion *Rick Ackerson*	Kansas City River basin model *Edward Parker*	Design guidance for breakup ice control *Andrew Tuthill*		**TRACK 4 Modeling Session 4H**	Forebay flow simulations using Navier-Stokes code *Charlie Berger*	Use of regularizatino as a method for watershed model calibration *Brian Skahill*	Demonstration program in the arid southwest *Margaret Jonas*

Thursday, August 4, 2005 Concurrent Sessions

Geotechnical Track

Room	Track / Session	8:00 AM	8:30 AM	9:00 AM	9:30 AM	10:30 AM	11:00 AM	11:30 AM
Room 226	TRACK 5 Session 5E / 5F	Dynamic deformation analyses Dewey Dam Huntintong District Corps of Engineers *Greg Yankey*	Seismic stability evaluation for Ute Dam, NM *John France*	An overview of criteria used by various organizations for assessments and seismic remediation of earth dams *Sean Carter*	Break in Exhibit Hall	USACE seepage berm design criteria and district practices *George Sills*	Ground penetrating radar applications for the assessment of airfield pavements *Lulu Edwards*	Challenges of the Fernando Belaunde Terry road upgrade Campanillia to Pizana - Peru road project *Michael Wielputz*
Room 227	TRACK 6 Session 6E / 6F	Small geotechnical project, big stability problem - The Block Church Road experience *Jonathan Kolber*	Geophysical investigation of foundation conditions beneath Folsom Dam *Jose Llopis*	Bioengineering slope stabilization techniques coupled with traditional engineering applications - The result a stable slope *Bethany Bearmore*	Break in Exhibit Hall	Shoreline armor stone quality issues *Joseph Kissane*	Mill Creek - An urban flood control challenge *Monica Greenwell*	Next stop, The Twilight Zone *Troy O'Neal*
Room 228	TRACK 7 Session 7E / 7F	The geotechnical and structural issues impacting the Dalles spillway construction *Kristie Hartfeil*	The Dalles spillway engineering and design *Kristie Hartfeil*	The future of the discrete element method in infrastructure analysis *Raju Kala*	Break in Exhibit Hall	Evaluating the portable falling weight deflectometer as a low-cost technique for posting seasonal load restrictions on low volume payments *Maureen Kestler*	Soil structure interaction effects in the seismic evaluation of success dam control tower *Michael Sharp*	Olmsted locks and Dam project geotechnical/construction issues *Jeff Schaefer*
Room 229	TRACK 8 Session 8E / 8F	Rubblization of airfield concrete pavement *Eileen Velez-Vega*	US Army airfield pavement assessment program *Haley Parsons*	Critical state for probabilistic analysis of levee underseepage *Douglas Crum*	Break in Exhibit Hall	Curing practices for modern concrete construction *Toy Poole*	AAR at Carters Dam, a different approach *James Sanders*	Concrete damage at Carters Dam, GA *Toy Poole*

12 Noon — **Lunch**

Room	Track / Session	1:30 PM	2:00 PM	2:30 PM	3:00 PM	3:30 PM	4:00 PM	4:30 PM
Room 226	TRACK 5 Session 5G / 5H	Slope stability evaluation of the Baldhill Dam right abutment *Neil Schwanz*	Lateral pile load test results within a soft cohesive foundation *Richard Varuso*	Design and construction of anchored bulheads for river diversion, Seabrook, NH *Siamac Vaghar*	Break	Characterization of soft marine clays - A case study at Craney Island *Aaron Zdinak*	50 years of NRSC experience with engineering problems caused by dispersive clays *Danny McCook*	Changes in the post-tensioning institutes new (4th Ed. 2004) "Recommendations for prestressed rock and soil anchors" *Michael McCray*
Room 227	TRACK 6 Session 6G / 6H	Perils in back analysis failures *Greg Yankey*	Reconstruction of deteriorated lock walls concrete after blasting and other demolition removal techniques *Steve O'Connor*	Flood fighting structures demonstrations and evaluation program *George Sills*	Break	Innovative design concepts incorporated into a landfill closure and reuse design *Dave Ray*	Laboratory testing of flood fighting structures *Johannes Wibowo*	Bluff stabilization along Lake Michigan using active and passive dewatering techniques *Eileen Glynn*
Room 228	TRACK 7 Session 7G / 7H	Geotechnical instrumentation and foundation re-evaluation of John Day lock and Dam, Columbia River, Oregon-Washington *David Scofield*	A study of the long term performance of seepage cutoff barriers in dams *John Rice*	Design, construction, and performance of seepage barriers for Guanella Dam, near Empire, CO *John France*	Break	Sensitive infrastructure sites and structures - Sonic drilling offers quality control and non-destructive advantages to geotechnical construction drilling *John Davis*	Subgrade failure criteria according to soil type and moisture condition *Edel Cortez*	The automated stability monitoring of the Mississippi River levees using the range scan system *Robert Jolissian*
Room 229	TRACK 8 Session 8G / 8H	Damaging interactions among concrete materials *Toy Poole*	Economic effects on construction of uncertainty in test methods *Toy Poole*	Major issues in materials specifications *Toy Poole*	Break	Spall and intermediate-sized repairs for PCC pavements *Reed Freeman*	Acceptance criteria for unbonded aggregate road surfacing materials *Reed Freeman*	Effective partnering to overcome an interruption in the supply of Portland cement during construction of Marmet lock and Dam *Billy Neeley*

Thursday, August 4, 2005 Concurrent Sessions

Geotechnical, Specifications, Electrical & Mechanical Engineering & Construction Tracks

Room	Track / Session	8:00 AM	8:30 AM	9:00 AM	9:30 AM	Track / Session	10:30 AM	11:00 AM	11:30 AM
Room 225	**TRACK 9** Geotechnical, Session 9E	Seepage Committee Meeting *GROUP DISCUSSION*	Seepage Committee Meeting (Continued) *GROUP DISCUSSION*	Seepage Committee Meeting (Continued) *GROUP DISCUSSION*	Break in Exhibit Hall	**TRACK 9** Geotechnical, Session 9F	GMCoP Forum *GROUP DISCUSSION*	GMCoP Forum (Continued) *GROUP DISCUSSION*	GMCoP Forum (Continued) *GROUP DISCUSSION*
Room 232	**TRACK 21** Specifications, Session 21E	SpecsIntact-Demonstration of the SI explorer, publishing to PDF and Word *Patricia Robinson*	SpecsIntact - Demonstration of the SI editor, UMRL and reference wizard *Patricia Robinson*	UFGS status and direction *Jim Quinn*	Break in Exhibit Hall	**TRACK 21** Specifica-tions, Session 21F	UFGS transitin to Master-Format 2004 *Carl Kersten*	Project specifications for the upper tier Folsom outlet works modifications *Steve Freitas*	UFGS dredging *Don Carmen*
Room A	**TRACK 15** Military Electrical, Session 15E	Electronic Security *Tri-Service Panel*	Electronic Security (Continued) *Tri-Service Panel*	AIRFIELD lightning protection & grounding and lighting *Tri-Service Panel*	Break in Exhibit Hall	**TRACK 15** Military Electrical, Session 15F	Electrical safety and arc flash UFC *Tri-Service Panel*	Electrical safety and arc flash UFC (Continued) *Tri-Service Panel*	Electrical infrastructure in Iraq - Restore Iraqi electricity *Joseph Swiniarski*
Room B	**TRACK 16** Military Mechanical, Session 16E	Lon works technology update *David Schwenk*	BACnet Technology Update *David Schwenk*	Implementation of Lon-based specifications *Will White*	Break in Exhibit Hall	**TRACK 16** Military Mechanical, Session 16F	Prefabricated Chiller Plants *Trey Austin*	Seismic for ME systems *Greg Stutts*	Design considerations for the prevention of mold *Quinn Hart*
Room D	**TRACK 17** Civil Mechanical, Session 17E	Lessons learned on flood water pump stations *Mark Robertson*	Armada of pump stations, Grand Forks and East Grand Forks *Timothy Paulus*	Various screen equipment selection guide *Sara Benier*	Break in Exhibit Hall	**TRACK 17** Civil Mechanical, Session 17F	Lock gate replacement system *Will Smith*	Lock gate replacement system (Continued) *Will Smith*	Automated closure gate design for Duck creek flood control *Mark Robertson*
Room 230	**TRACK 19** Construction, Session 19E	NAVFAC Construction scheduling *Glenn Saito*	NAVFAC Construction scheduling (Continued) *Glenn Saito*	ACASS/CASS - CPARS *Ed Marceau*	Break in Exhibit Hall	**TRACK 19** Construction, Session 19F	Self-consolidating concrete *Beatrix Kerhoff*	Self-consolidating concrete (Continued) *Beatrix Kerhoff*	
Room 231	**TRACK 20** Construction, Session 20E	Update on DAWIA and Facilities Engineering *Mark Grammer*	Update on DAWIA and Facilities Engineering (Continued) *Mark Grammer*	Partnering as a best practice *Ray DuPont*	Break in Exhibit Hall	**TRACK 20** Construction, Session 20F	S&A Update *Harry Jones*	Construction Issues Open Forum (Q&A) *Don Basham*	Construction Issues Open Forum (Q&A) (Continued) *Don Basham*

12 Noon **Lunch**

Room	Track / Session	1:30 PM	2:00 PM	2:30 PM	3:00 PM	3:30 PM	4:00 PM	4:30 PM
Room 225	**TRACK 9** Geotechnical, Session 9G	Seismic Manual *GROUP DISCUSSION*	Seismic Manual (Continued) *GROUP DISCUSSION*	Seismic Manual (Continued) *GROUP DISCUSSION*				

Thursday, August 4, 2005 Concurrent Sessions

Dam Safety Track & Structural Engineering Track

Room	Track / Session	8:00 AM	8:30 AM	9:00 AM	9:30 AM	Track / Session	10:30 AM	11:00 AM	11:30 AM
Room 224	TRACK 10 Dam Safety Session 10E	Seepage and stability, final evaluation for reservoir pool raising project, Terminus Dam, Kaweah River, CA *Michael Ramsbotham*	Initial filling plan, Terminus dam spillway enlargement, Terminus Dam, Kaweah River, CA *Michael Ramsbotham*	Hydrologic aspects of operating in a "failure mode" - Fern Ridge Lake, OR *Bruce Duffe*	Break in Exhibit Hall	TRACK 10 Dam Safety Session 10F	A dam safety study involving cascading dam failures *Gordon Lance*		The relationship of seismic velocity to the erodibility index *Joseph Topi*
Room 240	TRACK 12 Civil Works Structural Session 12E	London lock and dam, West Virginia major rehabilitation project *David Sullivan*	Replacing existing lock 4-Innovative designs for Charleroi lock *Steveb Stoltz*	Use of non-linear incremental structural analysis in the design of the Charleroi lock *Randy James*	Break in Exhibit Hall	TRACK 12 Civil Works Structural Session 12F	Olmsted dam in-the-wet construction methods *Lynn Raque*	Completion of the Olmstead approach walls *Terry Sullivan*	John Day lock monolith repair *Mathew Hanson*
Room 241	TRACK 13 Civil Works Structural Session 13E	Chicago shoreline project *Jan Plachta*	Structural assessment of Bluestone Dam *Robert Reed*	Duck Creek, OH local flood protection projection phase III Culvert damage *Jeremy Nichols*	Break in Exhibit Hall	TRACK 13 Civil Works Structural Session 13F	Development of design criteria for the Rio Puerto Nuevo contract 2D/2E channel wall *Jana Tanner*	Design of concrete lined tunnels in rock *David Force*	Indianapolis north phase IIIA project *Gene Hoard*
Room 242	TRACK 14 Bridges/ Buildings Session 14E	Urban search & rescue program overview *Tom Niedernhofer*	Evaluation and repair of blast damaged reinforced concrete beams *John Hudson*	Single degree of freedom blast effects spreadsheets *Dale Nebuda*	Break in Exhibit Hall	TRACK 14 Bridges/ Buildings Session 14F	UFC 4-023-02 Structural design to resist explosive effects for existing buildings *Jim Caulder*	Progressive collapse UFC requirements *Brian Crowder*	U.S. general services admnistrative progressive collapse design guidelines applied to concrete moment-resisting frame buildings *David Billow*

12 Noon **Lunch**

Room	Track / Session	1:30 PM	2:00 PM	2:30 PM	3:00 PM	Track / Session	3:30 PM	4:00 PM	4:30 PM
Room 224	TRACK 10 Dam Safety Session 10G	Dam safety instrumentation data management utilizing WinIDP to aid data collection and evaluation *Travis Tutka*	Automated instrumentation assessments at Marmet lock & Dam *Ronald Rakes*	Potential failure mode analysis of Eau Galle Dam *David Rydeen*	Break	TRACK 10 Dam Safety Session 10H	Dam safety officers panel - The Good *Bruce Murray*	Dam safety officers panel - The Bad *Bruce Murray*	Dam safety officers panel - The Ugly *Bruce Murray*
Room 240	TRACK 12 Civil Works Structural Session 12G	Inner Harbor navigation canal and lock structure *Mark Gonski*	Design features and challenges of the Comite River diversion project *Christopher Dunn*	Waterline support failure on the Harvey canal: A case study *Angela DeSoto Duncan*	Break	TRACK 12 Civil Works Structural Session 12H	Public appeal of major civil projects- The good, the bad and the ugly *Kevin Holden*	Des Moines Riverwalk *Thomas Heinold*	Chickamauga lock and Dam height optimization study using Monte Carlo simulation *Leon Schieber*

Thursday, August 4, 2005 Concurrent Workshops

Room	Workshop	1:30 PM	2:00 PM	2:30 PM	3:00 PM	Workshop	3:30 PM	4:00 PM	4:30 PM
Room 241	**Workshop 1** DoD Security Engineering **Session 1A**	Security planning & minimum standards *Curt Betts*	Security planning & minimum standards (Continued) *Curt Betts*	Security planning & minimum standards (Continued) *Curt Betts*	**Break**	**Workshop 1** DoD Security Engineering **Session 1B**	Security design manuals *Bernie Deneke*	Security design manuals (Continued) *Bernie Deneke*	Security design manuals (Continued) *Bernie Deneke*
Room 231	**Workshop 2** Electrical Workshop **Session 2A**	National Electrical Code 2005 Changes *Mark McNamara*	National Electrical Code 2005 Changes (Continued) *Mark McNamara*	National Electrical Code 2005 Changes (Continued) *Mark McNamara*	**Break**	**Workshop 2** Electrical Workshop **Session 2B**	National Electrical Code 2005 Changes (Continued) *Mark McNamara*	National Electrical Code 2005 Changes (Continued) *Mark McNamara*	National Electrical Code 2005 Changes (Continued) *Mark McNamara*
Room 242	**Workshop 3** Mechanical Engineering **Session 3A**	Design and application of packaged central cooling plants *The Trane Company*	Design and application of packaged central cooling plants (Continued) *The Trane Company*	Design and application of packaged central cooling plants (Continued) *The Trane Company*	**Break**	**Workshop 3** Mechanical Engineering **Session 3B**	Improving dehumidification in HVAC systems *The Trane Company*	Improving dehumidification in HVAC systems (Continued) *The Trane Company*	Improving dehumidification in HVAC systems (Continued) *The Trane Company*
Room 230	**Workshop 4** Construction **Session 4A**	Construction Community of Practice Forum *Walt Norko*	Construction Community of Practice Forum (Continued) *Walt Norko*	Construction Community of Practice Forum (Continued) *Walt Norko*	**Break**				
Room 232	**Workshop 5** Specifications **Session 5A**	Open Meeting of Corps Specifications Steering Committee *Robert Iseli, et al.*	Open Meeting of Corps Specifications Steering Committee (Continued) *Robert Iseli, et al.*	Open Meeting of Corps Specifications Steering Committee (Continued) *Robert Iseli, et al.*	**Break**	**Workshop 5** Specifications **Session 5B**	Open Meeting of Corps Specifications Steering Committee (Continued) *Robert Iseli, et al.*	Open Meeting of Corps Specifications Steering Committee (Continued) *Robert Iseli, et al.*	Open Meeting of Corps Specifications Steering Committee (Continued) *Robert Iseli, et al.*

NOTES

NDIA

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION

STRENGTH THROUGH INDUSTRY & TECHNOLOGY

2005 Tri-Service Infrastructure Systems Conference & Exhibition

"Re-Energizing Engineering Excellence"

August 2-4, 2005

St. Louis, MO

US Army Corps of Engineers
Kansas City District

Critical State for Probabilistic Analysis of Levee Underseepage

Douglas Crum, P. E.

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1. Failure Prediction
2. Reliability
3. Levee Underseepage
4. Surcharge Factor
5. Evidence (Case Histories)
6. Recommendations

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Levee Consequences & Damages

- Impending Failure Mechanism
- Prediction of Limit (Collapse) State
- Not Design Criteria

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Reliability Criteria

- PGL No. 26 (1991)
  - Requires reliability approach for levees
  - Mentions PFP/PNP
- ETL 1110-2-328 (1993)
  - Template Method
- ER 1105-2-101 (1996)
  - Requires risk analysis for flood damage reduction studies
- EM 1110-2-1619 (1996)
  - Economics
- ETL 1110-2-556 (1999)
  - Geotechnical risk analysis for planning studies
  - Appendix B, "Evaluating the Reliability of Existing Levees"

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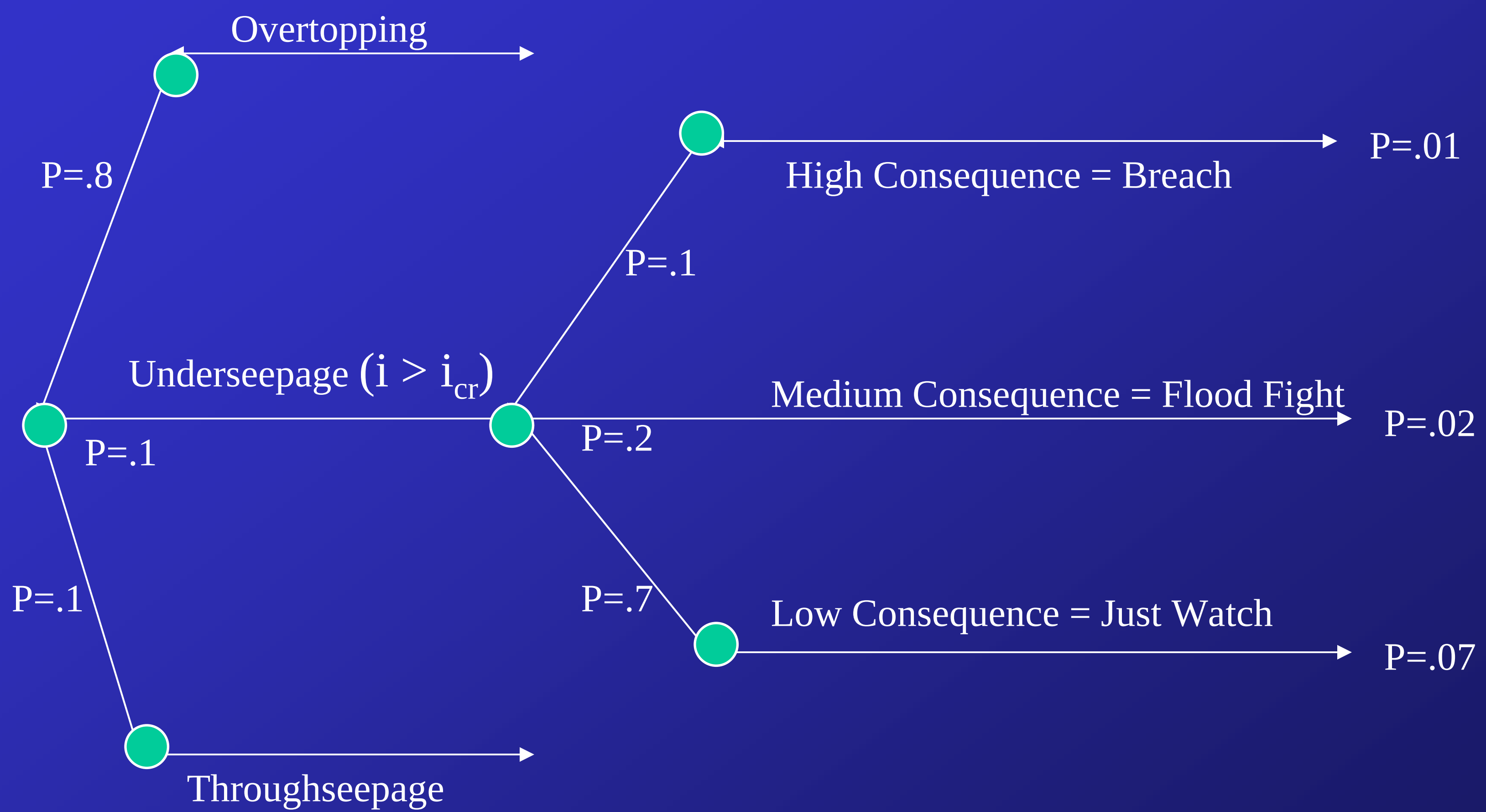
Reliability

Methods

- Taylor's Series (first order – second moment)
- Point Estimate
- Advanced Method (Hasofer & Lind)
- Monte Carlo

Reliability



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LEVEE FAILURE MODES

- Overtopping

•Other (Scour, Trees, etc.)

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LEVEE FAILURE MODES

Slides

- End of Construction
- Steady State Seepage
- Rapid Drawdown

- Seepage

Under-seepage

Through-seepage

Pipes/Structures

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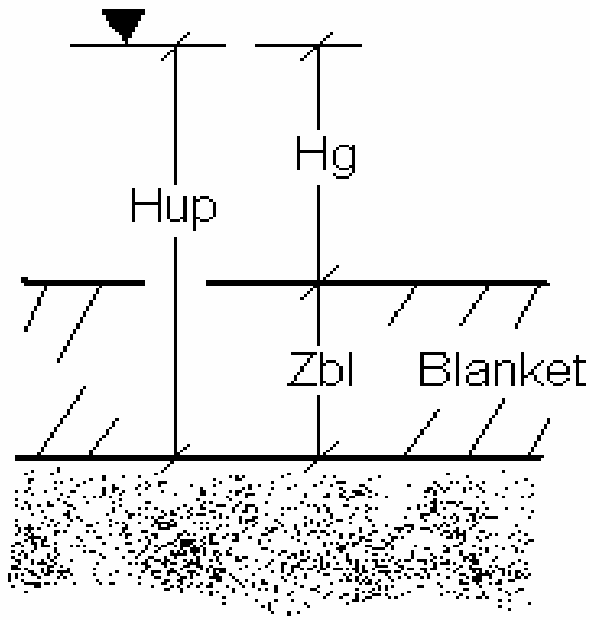
Levee Underseepage: Piping and Heave

$$FS_g = \frac{\gamma_{sat} \cdot Z_{bl} - \gamma_w \cdot Z_{bl}}{\gamma_w \cdot H_g}$$

$$FS_{up} = \frac{\gamma_{sat} \cdot Z_{bl}}{\gamma_w \cdot H_g + \gamma_w \cdot Z_{bl}}$$

At critical state:

$FS_{up} = FS_g = 1$



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Performance Function

$$FS_g = i_{cr}/i$$

Critical state at "quick conditions"is when effective stress throughout layer is reduced to zero.

$$i_{cr} = \gamma_b/\gamma_{h20} = (G_s - 1)/(1+e)$$

Unsatisfactory Performance at the Critical Gradient

$$FS_g = i_{cr}/i$$

Capacity (C) = i_{cr} = critical gradient

Demand (D) = i = calculated gradient

Normally distributed, uncorrelated:

$$\beta = \frac{E(C) - E(D)}{\sqrt{\sigma_C{}^2 + \sigma_D{}^2}}$$

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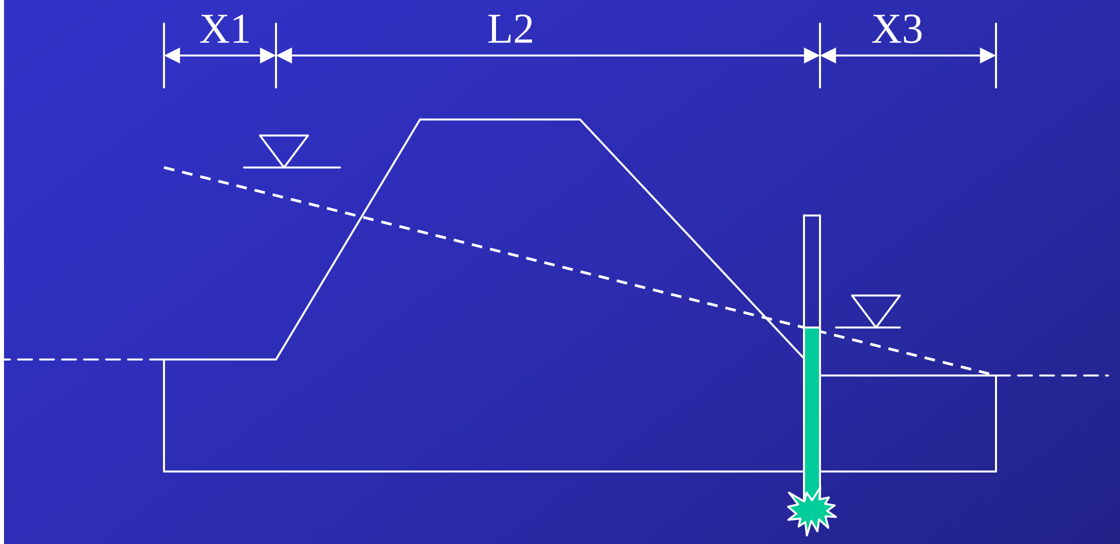
Levee Underseepage



$$m_{toe} = \frac{X3}{X1 + L2 + X3}$$

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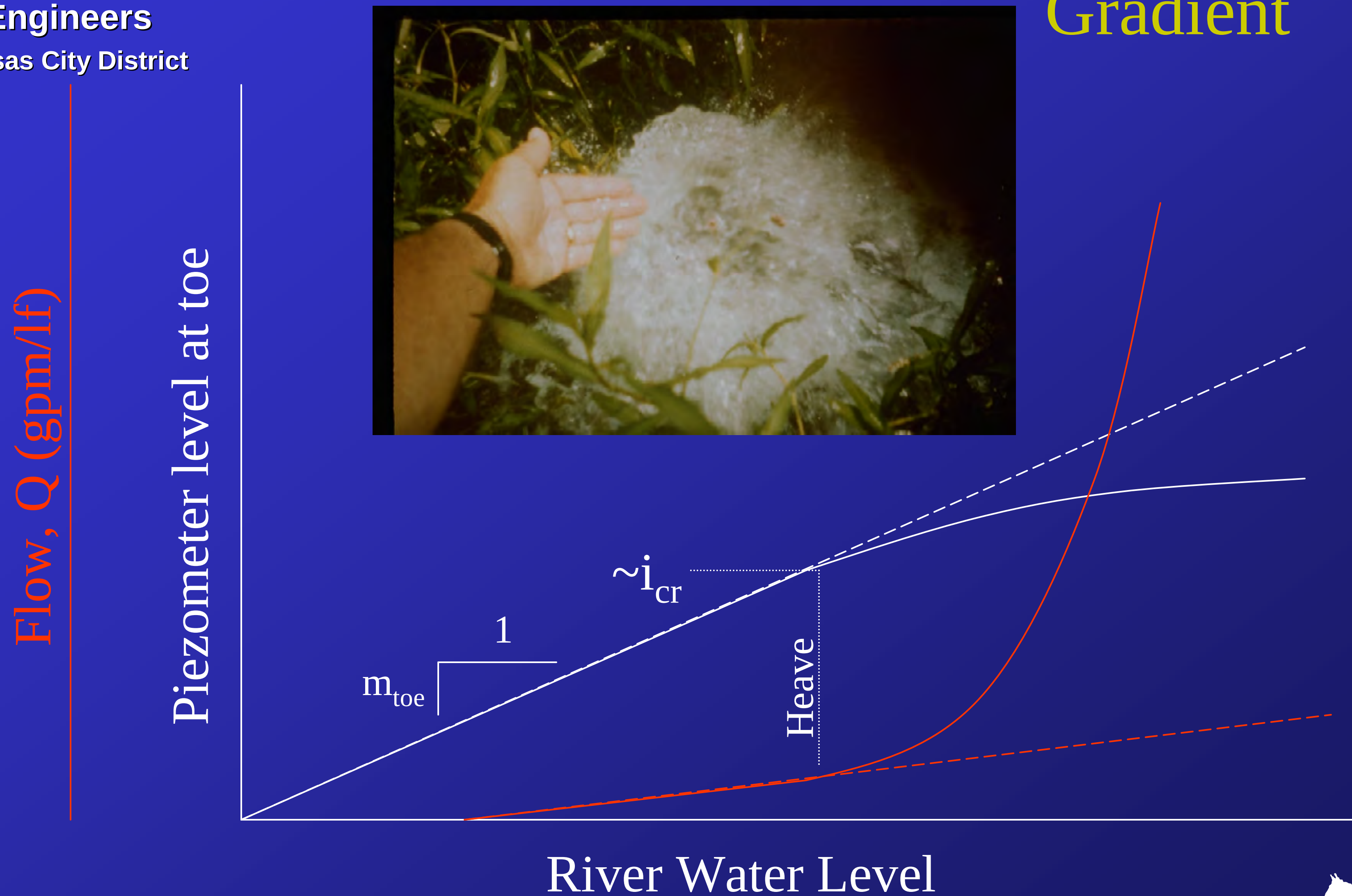
Levee Underseepage: Extrapolated Gradient



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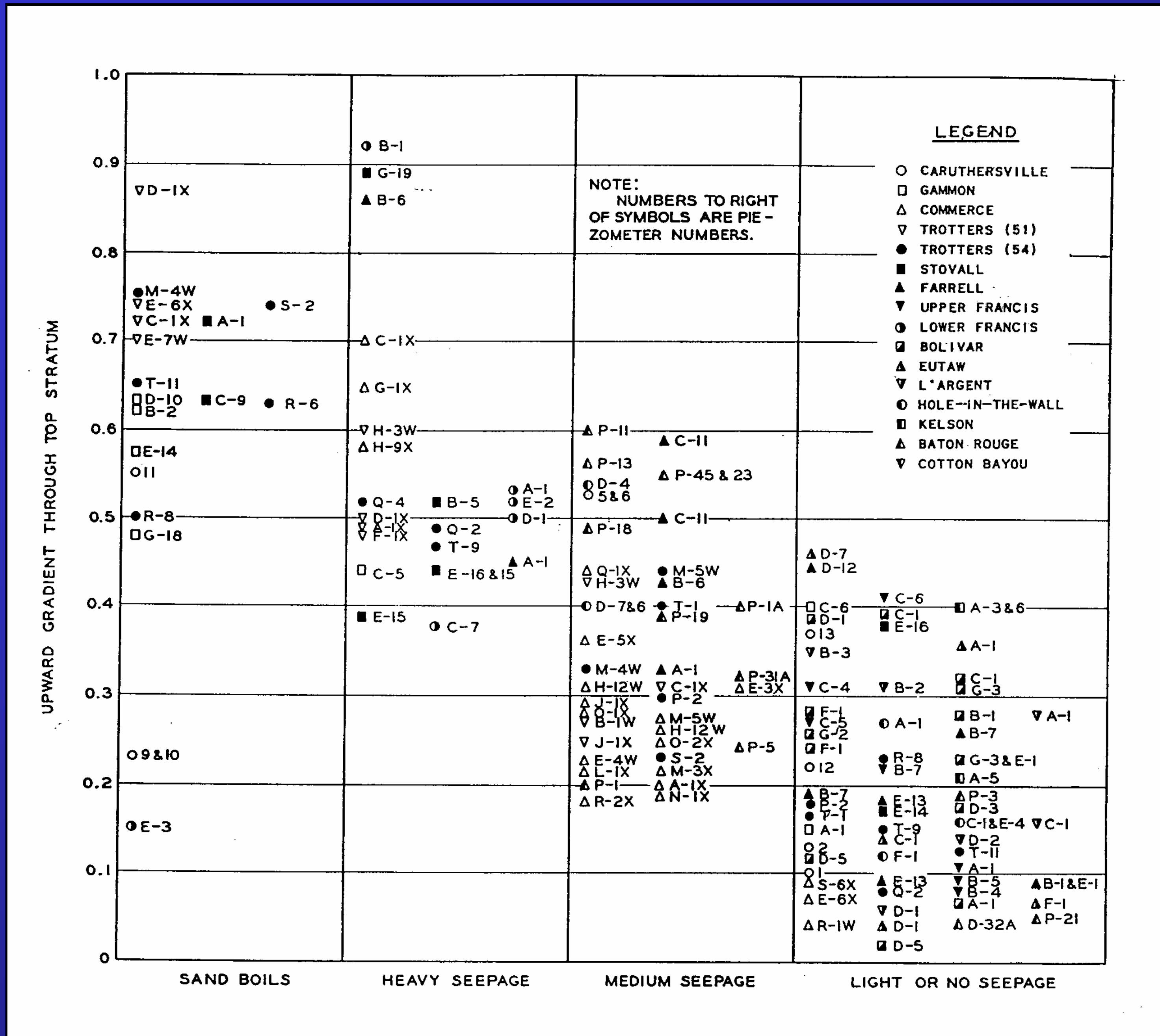
WES Technical Memorandum 3-424 Figure 47 (1956)



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CASE 1: Kansas City District, Historic Design Criteria for Agricultural Levees

- No past boil activity, $FS_g = 1$
- Minor boil or heavy seepage, $FS_g = 1.25$
- Major boil activity, $FS_g = 1.5$

The ratio 1:1.5 approximates
(Critical State : Failure State).
$\rightarrow (i_{cr}/i_f) = 1/1.5 = 0.67 \cong 0.7$

References:
Design memorandum no. 1 – underseepage control – levee unit 400-L, 20 Nov. 1953
Design memorandum no. 1 – underseepage control – levee unit 406-L, revised 24 mar 1953

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CASE 2: Rock Island District, Historic Design Criteria for Agricultural Levees

- "The Rock Island District has a philosophy….. to organize the necessary men and equipment to put up a flood fight. …they feel justified in allowing major boils to develop…"
- Design criteria at toe: $FS_g > 0.7$

  Assuming a necessary flood fight to prevent a breach is tantamount to failure, $i = i_f$

  $\rightarrow (i_{cr}/i_f) = FS_g = 0.7$

Reference:
Rock Island District Levee Practices, MRKED-F Memorandum for Branch File, 25 October 1962.

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CASE 3: Kansas City District, Back Calculation from 1952 Flood

Computed FS_g at flood crest	Seepage Conditions during flood crest
< 0.55	Objectionable seepage, major flood fight, boils requiring sandbagging
> 0.8	Tolerable Seepage, distributed seepage, pin boils

$$\rightarrow (i_{cr}/i_f) = (.55/.8) = 0.6875 \cong 0.7$$

Reference:

Meeting at MRD on Underseepage Control on Agricultural Levees, 27 November 1962.

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CASE 4: St. Louis District, Back Calculation from 1993 Flood

Bois Brule & Kaskaskia Island levee failures

- Both failures were due to underseepage and resulted in an actual breach of the levee.
- Back calculated gradient = 1.35
- Assume $i_{cr} \cong 0.85$

$$\rightarrow (i_{cr}/i_f) = (.85/1.35) = 0.63$$

Reference:
Communication with Mr. Edward Demsky, CEMVS, 19 July 2004

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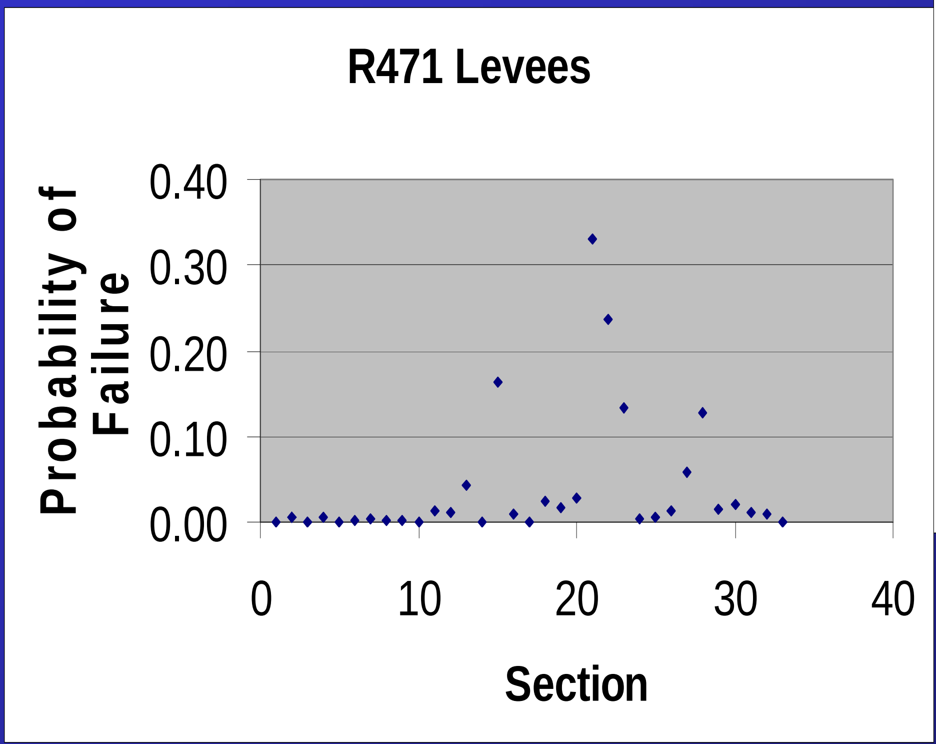
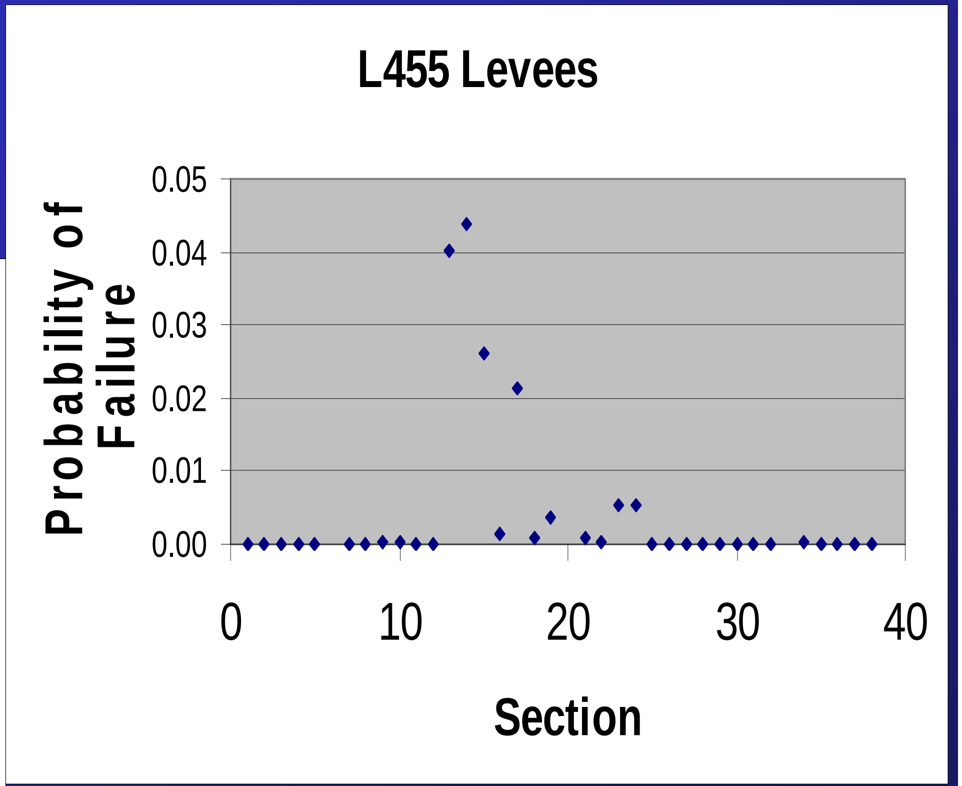
CASE 5: 1993 Flood Calibrations for Existing Projects





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Unsatisfactory Performance at the Critical Gradient

$$FS_g = i_{cr}/i$$

Capacity (C) = i_{cr} = critical gradient

Demand (D) = i = calculated gradient

Normally distributed, uncorrelated:

$$\beta = \frac{E(C) - E(D)}{\sqrt{\sigma_C^{\ 2} + \sigma_D^{\ 2}}}$$

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Unsatisfactory Performance at Impending Failure

$$FS = i_f / i$$

Surcharge Factor = $(i_{cr}/i_f) \cong 0.7$

Capacity (C) = $i_f = i_{cr}/(i_{cr}/i_f)$ = "failure" gradient

Demand (D) = i = calculated gradient (extrapolated)

Normally distributed, uncorrelated:

$$\beta = \frac{E(C) - E(D)}{\sqrt{\sigma_C^{\ 2} + \sigma_D^{\ 2}}}$$

Recommendations

- Rational methods are necessary for deriving the Limit State from design criteria
- A consistent methodology should be adopted
- Impending Levee Breaches Occur near a Surcharge Factor of $(i_{cr}/i_f) = 0.7$

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Design Criteria Concerns

- Deterioration of Levee from Past Seepage Distress
- Flood Fight Capability
- Managing Risk & Consequences (Urban/Rural/Agricultural)
- Affect on B/C ratio

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From executive summary, *"Risk Analysis and Uncertainty in Flood Damage Reduction Studies*", National Academy Press, (2000).

> "The committee recommends that the Corps undertake statistical ex post studies to compare predictions of geotechnical levee failure probabilities made by the reliability model against frequencies of actual levee failures during floods."

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~~Questions~~

Comments

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Spall and Intermediate-Sized Repairs for PCC Pavements

Reed Freeman and Travis Mann

US Army Engineer Research and Development Center

Joint Rapid Airfield Construction (JRAC) Program

- Site Selection
- Enhanced Construction Technology
- Rapid Stabilization

… develop materials and techniques for rapidly upgrading existing or constructing new contingency airfields in-theater with a low logistical footprint.

ERDC
Engineer Research and Development Center

JRAC
Joint Rapid Airfield Construction

Problem Statement

- Existing airfields are typically in poor shape. However, they are essential to operations
  - strategic locations
  - better than starting from scratch
- Military demands extremely fast “return to service” time
  - Rapid Repair – 24 hours
  - Very Rapid Repair – 3 hours

ERDC Engineer Research and Development Center

JRAC Joint Rapid Airfield Construction

Project Plan

- FY04: partial-depth spall repair
  - PCC-surfaced and AC-surfaced
- FY05: partial replacement of PCC slabs
  - 1 cu.ft. < size of repair < 1 cu.yd.
- FY06: secure cracked surfaces
  - reduce FOD potential
- FY07: repair structurally deteriorated AC surfaces
  - also, program-wide demonstration for C-17

FY04 – Spall Repair

- Specific Problem:
  - many materials on the market
  - wide range of performances
  - need to define when to use what

FY04 – Scope

- Spalls
  - Surficial, not structural
  - Size that can be handled by a portable mixer
- Asphalt and concrete surfaces
- Products
  - Recommendations for materials and procedures
  - Establish material approval process
    - physical and mechanical requirements

Repair Requirements

- Ready for C-17 in less than 1 day ("rapid repairs") or 3 hours ("very rapid repairs")
  - Consistent with ASTM C 928
- Simple procedures and little equipment
- Should last a couple of years and sustain several thousand aircraft operations

Materials

- Polymeric
  - Delcrete
- Asphaltic
  - Quality Pavement Repair
  - Instant Road Repair
- Cementitious
  - Set-45
  - PaveMend
- Aggregate
  - Pea gravel

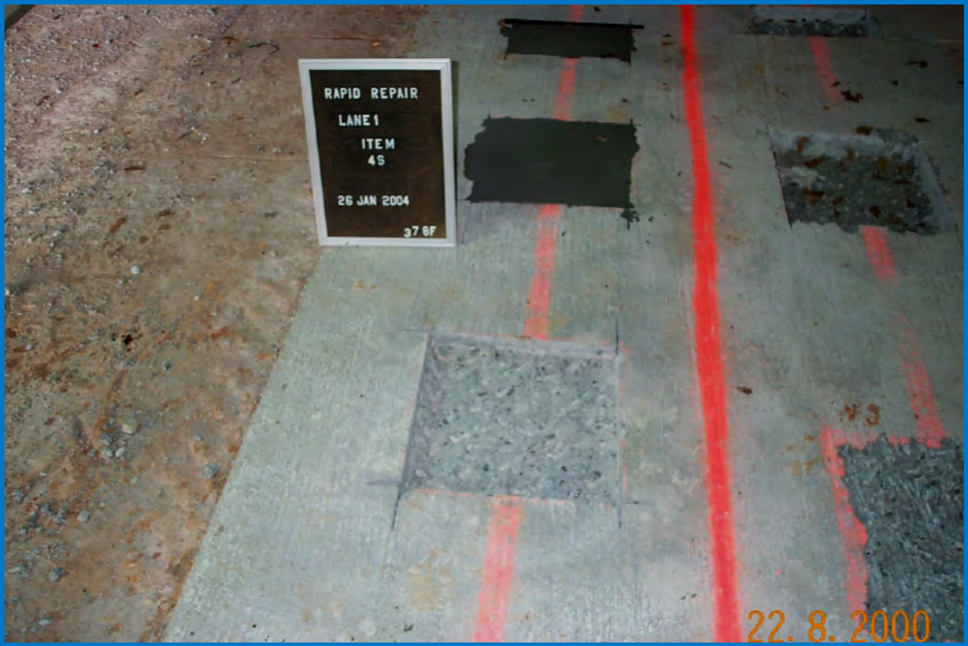
'Field' Placements

‘Field’ Placements

Load Cart

HVS

‘Field’ Placements

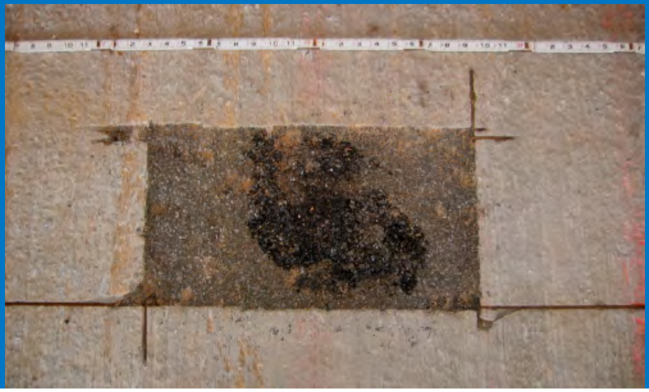


Field Placements – Findings

- Delcrete
  - Resists cracking
  - No rutting
  - Abraded by dozer blade
  - Not for use on asphalt concrete
  - Cumbersome
  - Expensive

Field Placements – Findings

- Asphaltic materials
  - Difficult to compact adequately
  - Couldn't conform to irregularities
  - Both QPR and IRR rutted
  - QPR remained soft
  - Cheap



Field Placements – Findings

- Set 45
  - Mortar mixer required
  - Vibration and floating required
    - – Particularly for “extended” mix
  - Good bond
  - Good color match for PCC
  - No cracking

Field Placements – Findings

- PaveMend
  - Drill and paddle mixer
  - Self-leveling
  - Excellent bond
  - Conformed to irregularities
  - No cracking
  - Technicians' favorite

Field Placements – Findings

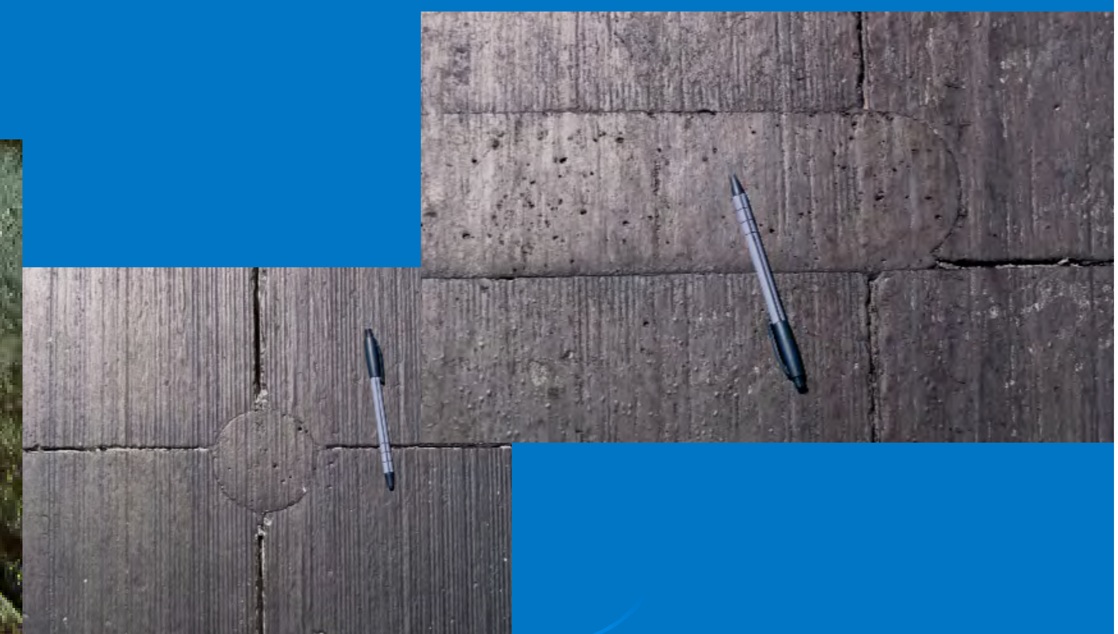
- PaveMend
  - Used successfully as a leveling material

Field Placements – Findings

- Feathering
  - Works for:
    - neat Set 45 and PaveMend
    - PCC pavement
  - No good for:
    - Delcrete
    - mixes extended with aggregate
    - AC pavement

Field Placements – Findings

- Repairs at Joints
  - Delcrete – can place through joint
  - Cementitious – place against joint filler



Field Placements – Findings

- Accounting for climate
  - PaveMend and Set45
    - > 85 °F
      - PM30 and Set45-HW
      - cool materials, water, and repair surface
      - extend with rounded gravel (max. particle size = ½ in.)
    - < 45 °F
      - PM5 or PM15 and Set45
      - warm materials, water, and repair surface
  - Delcrete NG > 95 °F
  - Asphaltic materials NG < °32

Material Approval Process

- Cementitious Materials Only
- Include physical and mechanical considerations
- Use standard test procedures
- Learn from REMR study by ERDC (mid-1990's)

Physical Property Requirements (1 of 2)

- Flow (for grouts)
  - Maximum = 80 sec
  - 'self-leveling'
- Coefficient of thermal expansion
  - Maximum = 7×10^{-6} / °F
- Freeze-thaw resistance
  - Maximum loss in dynamic modulus = 50% after 50 cycles

Physical Property Requirements (2 of 2)

- Restraining Ring Shrinkage Test
  - 14 days
  - 50 microstrain max.
  - No cracks

Mechanical Property Requirements

- Chord modulus
  - Max. = 3.5×10^6 psi
- Compressive strength
  - 3000 psi (3 hours) *or*
  - 3000 psi (1 day)
- Bond strength (1 day)
  - 500 psi (to opc mortar) *and*
  - 1000 psi (to self)

Material Approval Process

- Test Summary
  - Flow (for grouts) ……………………….(ASTM C 939)
  - Coefficient of thermal expansion …….(ASTM C 531)
  - Freeze-thaw resistance ……………….(ASTM C 666, Method A)
  - Restraining Ring Shrinkage …………..(AASHTO PP34)
  - Chord modulus ………………………….(ASTM C 469)
  - Compressive strength …………………(ASTM C 109, ASTM C 39)
  - Bond strength …………………………..(ASTM C 882)
- Additional Important Considerations
  - Shelf life
  - Simplicity
  - Safety / non-hazardous
  - Effects of using non-potable water

Project Plan

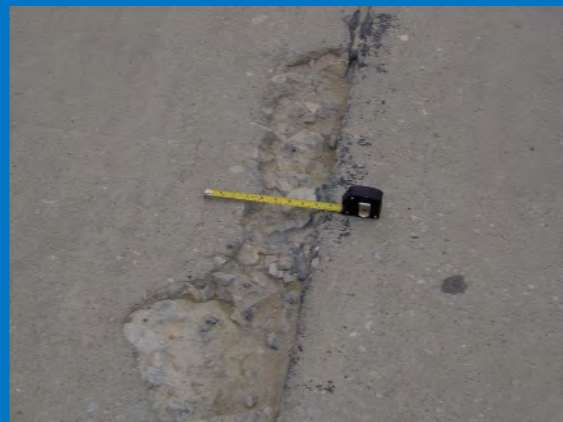
- FY04: partial-depth spall repair
  - PCC-surfaced and AC-surfaced
- FY05: partial replacement of PCC slabs
  - 1 cu.ft. < size of repair < 1 cu.yd.
- FY06: secure cracked surfaces
  - reduce FOD potential
- FY07: repair structurally deteriorated AC surfaces
  - also, program-wide demonstration for C-17

ERDC Engineer Research and Development Center

JRAC Joint Rapid AirField Construction

Categories of Repair

- Spalls
  - < 1 cu.ft.
  - partial depth



- Airfield Damage Repair (ADR)
  - ‘crater repair’
  - surface area > 50 sq.ft. (typ.)
  - damage well into subgrade

Categories of Repair

- Intermediate-Sized Repairs
  - up to partial slab replacement, < 1 cu.yd. (typ.)
  - full-depth concrete
  - minimal work on base course

Intermediate Repairs

- Requirements for Proposed Repair Method
  - minimize requirement for transported materials
  - meet ‘rapid’ and/or ‘very rapid’ repair requirements
  - use only equipment accessed easily by military construction units

Intermediate Repairs

- Description of Proposed Repair Method
  - remove unsound concrete
  - place debris back in the hole
  - pour in grout that can penetrate to the bottom of the hole
  - ensure level, smooth pavement surface

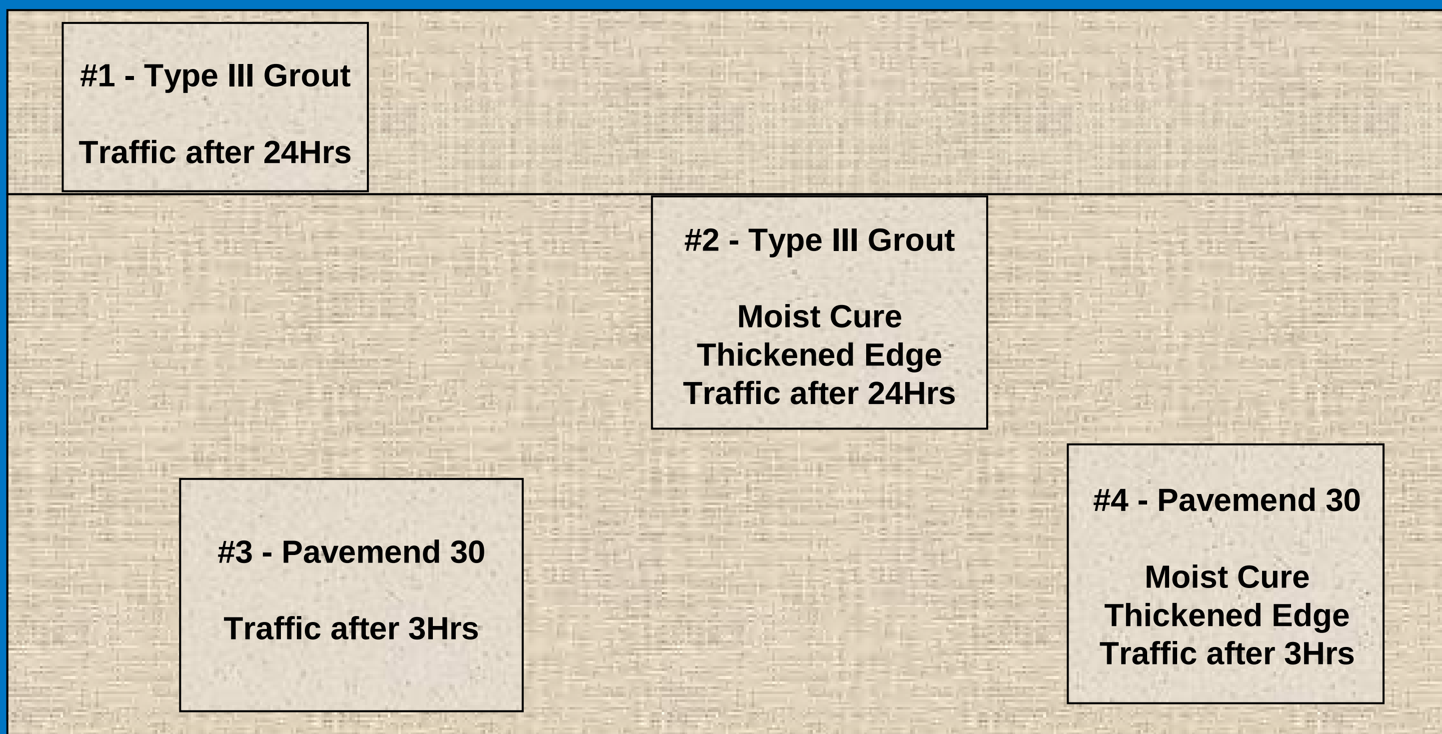
Processing?

Ensure Grout Penetration?

Removal?

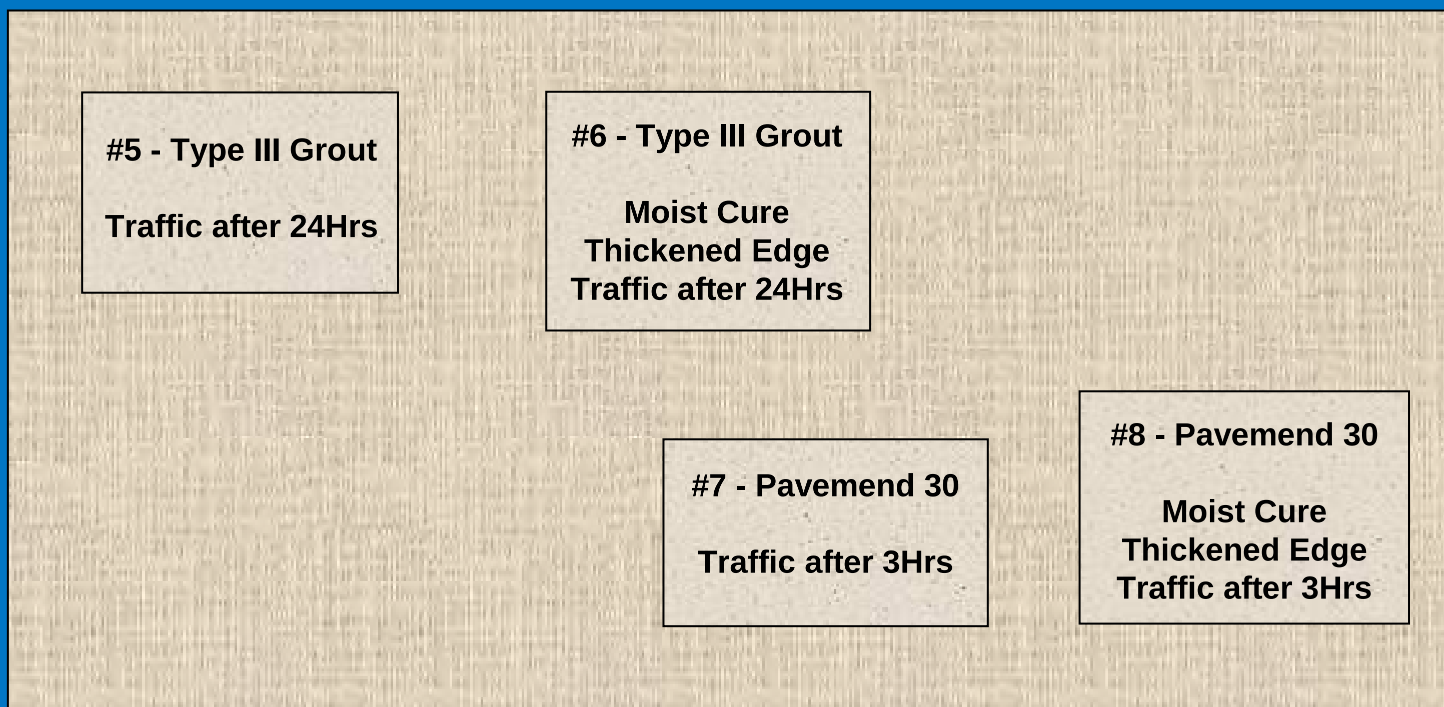
Field Placements

- Slab No. 1
  - Repairs 1 through 4
  - Slab = 18 in. thick



Field Placements

- Slab No. 2
  - Repairs 5 through 8
  - Slab = 9.5 in. thick



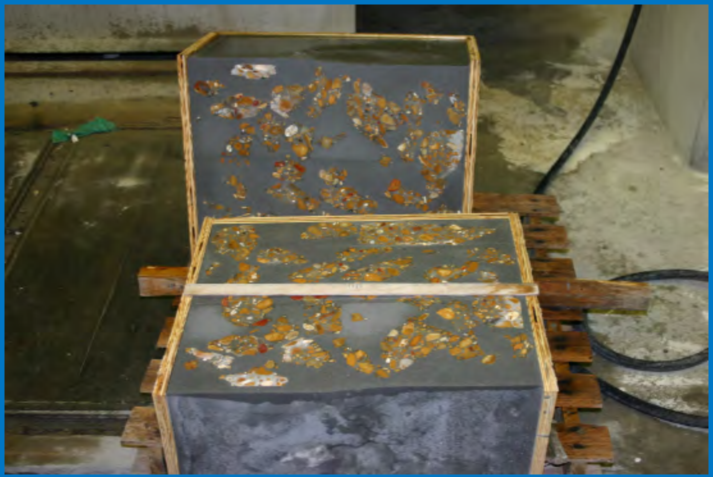
Develop Method of Removal

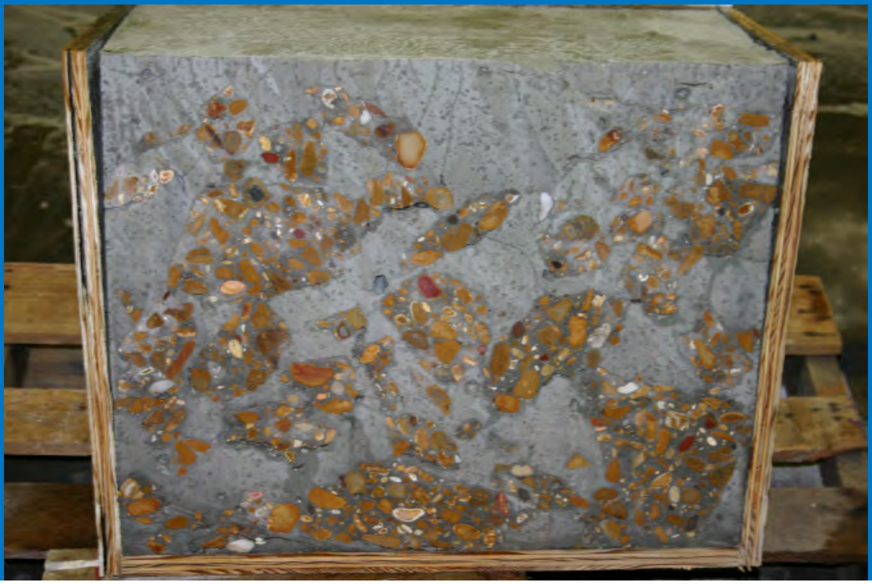
Characterize Debris

Ensure Grouts Could Penetrate

Ensure Grouts Could Penetrate

Ensure Grouts Could Penetrate





Field Placements

Field Placements

Field Placements

Field Placements

44,000 lb, 50 passes

Field Placements - Findings

- Wheel saw + hammer attachments make the technique viable
- Type of concrete affects debris gradation
- No load-related distresses
- No evidence of thermal distress
- Type III grout had shrinkage cracks if not moist-cured
- Type III repair - $200 / cu.yd.
- PaveMend repair - $2000 / cu.yd.

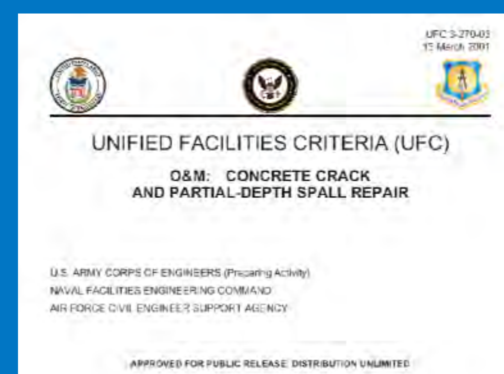
Conclusions

- Recommend military units purchase wheel saw and hammer attachments
- Sieve debris over 2 in. screen
- Thickened edge not needed for short-term, but is good practice
- Place larger debris near bottom, smaller near top of repair
- Curing advisable for Type III grout if possible
- Type III grout = rapid repair (24 hr),
- PaveMend = very rapid repair (3 hr)
- Type III grout – cheaper and consistent over time
- PaveMend requires special care
  - Reduced set time when placing layer on top of hot (setting) material
  - Should use PM-TR as a cap

Where to Publish?

- Airfield Damage Repair (craters)
  - UFC 3-270-07, “Airfield Damage Repair”
- Spall Repair
  - UFC 3-270-07 only provides expert contacts
  - Could incorporate modern (non-PCC) materials into
    - UFC 3-270-03, “Concrete Crack and Partial-Depth Spall Repair”
    - UFGS 02980, “Patching of Rigid Pavements”
  - Recommend posting material assessments on the Triservice Transportation website

http://www.triservicetransportation.com



Where to Publish?

- Intermediate-Sized Repairs
  - Could incorporate into:
    - UFC 3-270-07, “Airfield Damage Repair”
  - Could produce a flip-book manual similar to:
    - UFC 3-270-03, “Concrete Crack and Partial-Depth Spall Repair”
  - Could produce a new guide specification such as:
    - UFGS 02980, “Patching of Rigid Pavements” and
    - UFGS 03372, “Preplaced Aggregate Concrete”


UFC 3-270-07
12 August 2002

UNIFIED FACILITIES CRITERIA (UFC)

O&M:
AIRFIELD DAMAGE REPAIR

APPROVED FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED


UFC 3-270-03
15 March 2001

UNIFIED FACILITIES CRITERIA (UFC)

O&M: CONCRETE CRACK
AND PARTIAL-DEPTH SPALL REPAIR

U.S. ARMY CORPS OF ENGINEERS (Preparing Activity)
NAVAL FACILITIES ENGINEERING COMMAND
AIR FORCE CIVIL ENGINEER SUPPORT AGENCY

APPROVED FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

Thanks

Acceptance Criteria for Unbonded Aggregate Road Surfacing Materials

Reed Freeman
Toy Poole
Joe Tom

Dale Goss

Vicksburg District, Mississippi Valley Division

Engineer Research and Development Center

US Army Corps of Engineers

ERDC

Engineer Research and Development Center

Problem

- Good sand clay gravel sources nearly depleted
- Crushed aggregates provide various levels of performance
- Need to update/improve UFGS 02731A, “Aggregate Surface Course”

Objective

- Update UFGS 02731A to allow the use of various types of unbound materials
  - Well-defined limits used to accept or reject proposed material sources
  - Differentiate between construction and maintenance situations

Current UFGS 02731A

- 4 grading options
  - Natural or crushed

USACE Grading Requirements for Surface Aggregate				
Sieve Size	**No. 1**	**No. 2**	**No. 3**	**No. 4**
1 in.	100	100	100	100
3/8 in.	50 – 85	60 – 100	---	---
No. 4	35 – 65	50 – 85	55 – 100	70 – 100
No. 10	25 – 50	40 – 70	40 – 100	55 – 100
No. 40	15 – 30	24 – 45	20 – 50	30 – 70
No. 200	8 – 15	8 – 15	8 – 15	8 – 15

- Coarse fraction
  - LA abrasion <= 50%
  - Flat/elongated <= 20%
- Fine fraction
  - LL <= 35%
  - PI = 4 to 9

MVD Specifications

- 3 material options
  - 1 grading each
- Coarse fraction
  - LA abrasion <= 40%
  - MgSO4 soundness < 15%

MVK Grading Requirements for Surface Aggregate			
Sieve Size	Sand Clay Gravel	Crushed Stone	Crushed Stone with Binder
2 in.	100	No data	No data
1-1/2 in.	95 – 100	100	100
1 in.	75 – 100	No data	No data
3/4 in.	No data	50 – 95	50 – 100
1/2 in.	45 – 90	42 – 85	42 – 85
No. 4	30 – 65	25 – 65	25 – 65
No. 10	20 – 50	No data	20 – 50
No. 40	10 – 30	10 – 32	10 – 32
No. 200	5 – 15	3 – 12	3 – 12

- Fine fraction
  - LL <= 30%
  - PI = 5 to 15%

- Fine fraction
  - LL <= 30%
  - PI = 4 to 9%

Compaction Requirements

- UFGS 02731A
  - 100% modified Proctor
- MVD
  - "... compacted as evenly and densely as practicable by the controlled movement of the hauling equipment over the entire area."
  - Dress with a motor grader

Review of Other Agencies

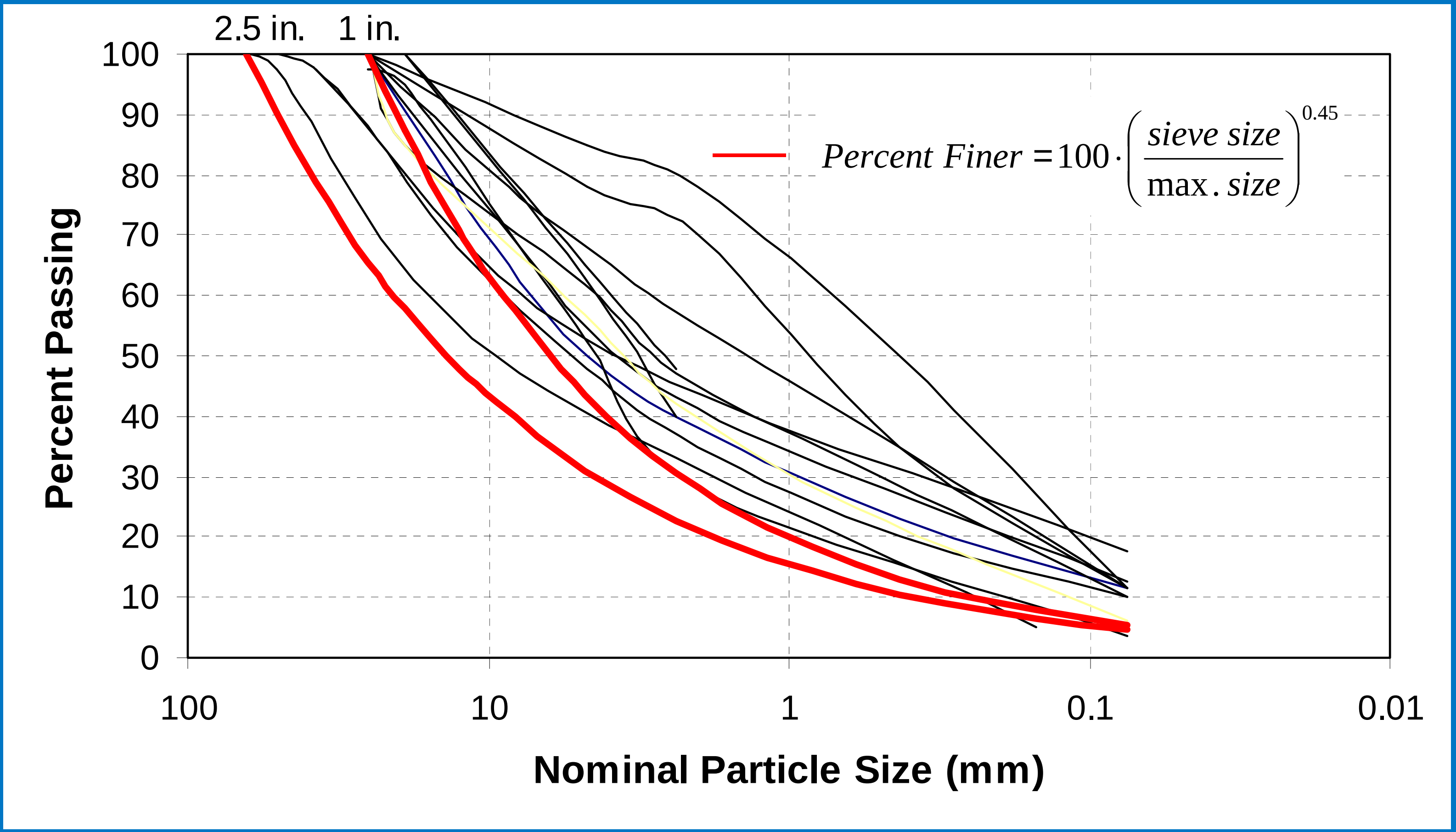
- 9 state DOTs
- US Forest Service
- FHWA
- South Africa, SRA and CSIR
- Popular specification tests:
  - gradation
  - LA abrasion
  - flat / elongated
  - fractured face counts
  - LL and/or PI
  - sulfate soundness
  - sand equivalent
  - % passing No. 200
  - No. 200 / No. 40

Popular Specification Tests

Test	Limit(s)	Note
Gradation	next slide	
LA Abrasion	35 to 50% max.	% loss
Flat / Elongated	10 to 20% max.	3 to 1 ratio
Fractured Face Counts	50 to 75% min.	at least one face
LL	25 to 40% max.	
PI	8 to 15% max. 0 to 5% min.	
Sulfate Soundness	12 to 15% max.	Na or Mg
Sand Equivalent	40 to 45% min.	
% Passing No. 200	10 to 20% max. 0 to 10% min.	
No. 200 / No. 40	67% max.	

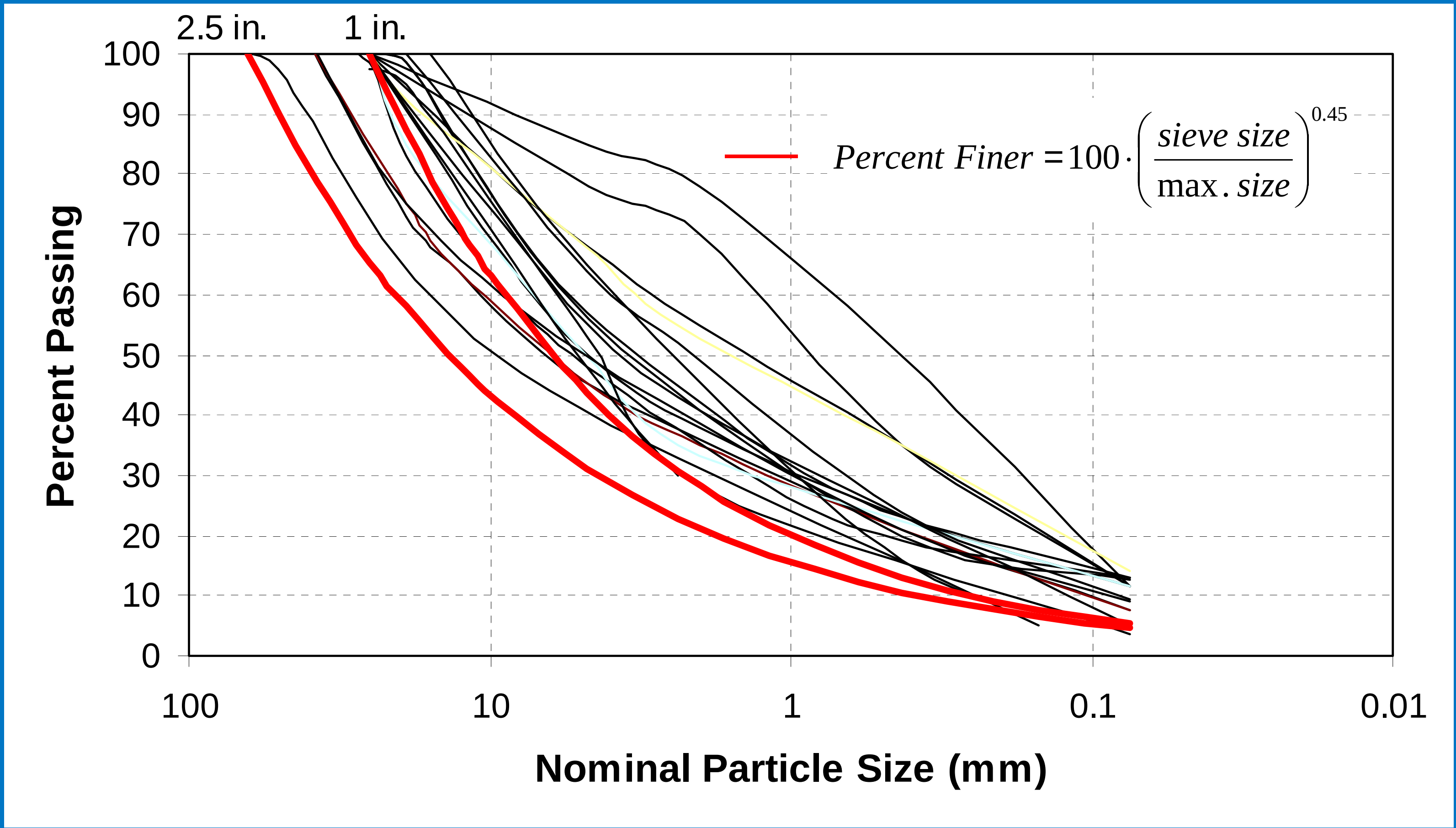
Target Gradations - Literature

Natural Aggregate



Target Gradations - Literature

Crushed Aggregate



This Study - 5 Aggregate Sources

1) Sand clay gravel, SCG

SC

Greenwood Hill Gravel in Greenwood, MS

5 Aggregate Sources

2) Crushed limestone, LS

GW-GM

Vulcan Materials Co., Reed Quarry, Gilbertsville, KY

5 Aggregate Sources

3) Sandstone, SS

GP-GM

Pine Bluff Sand and Gravel, River Mountain Quarry, Delaware, AR

5 Aggregate Sources

4) Igneous, IGN

GP

McGeorge Corp., Granite Mountain Quarries, Little Rock, AR

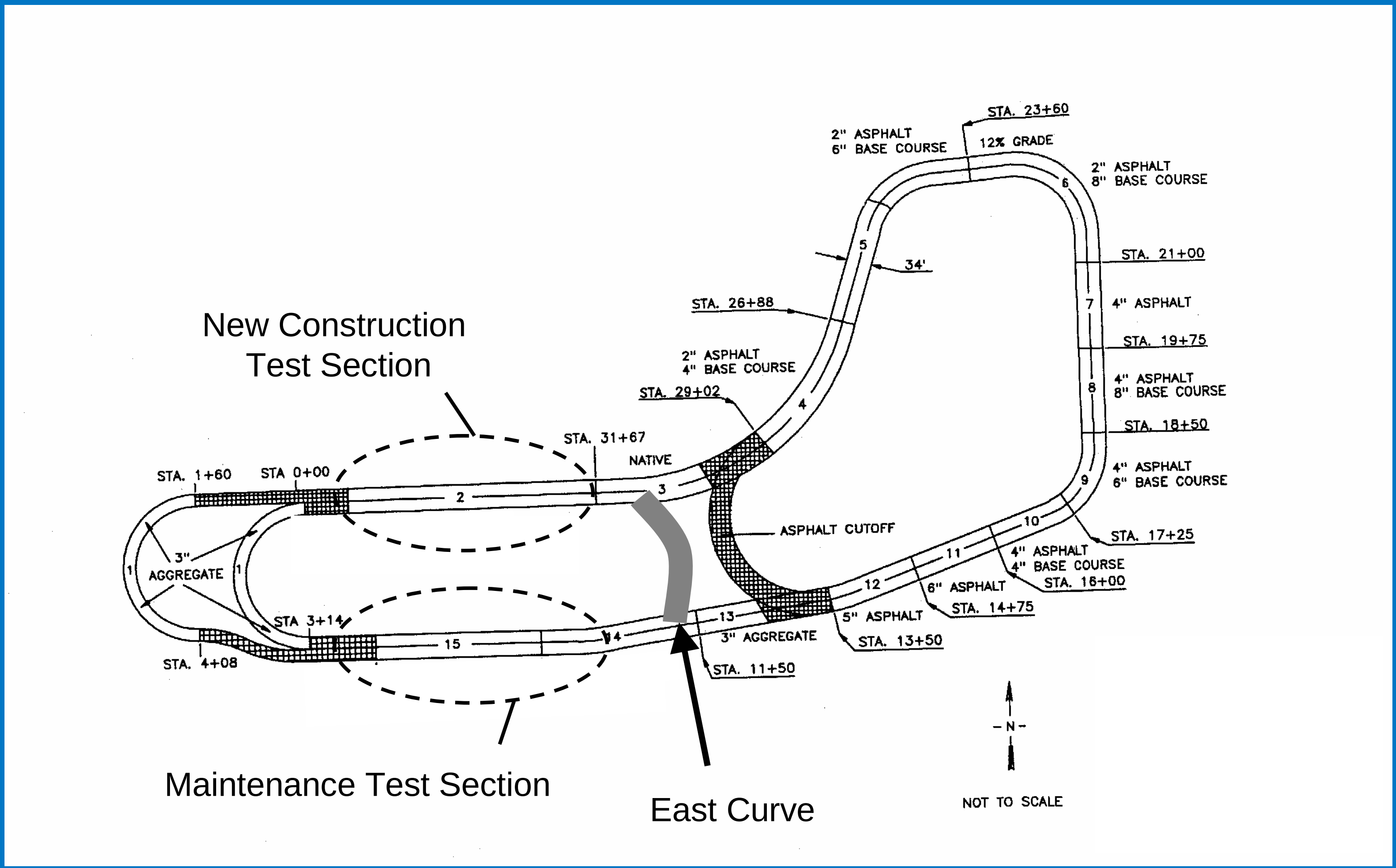
5 Aggregate Sources

5) Sandstone with binder, SSB

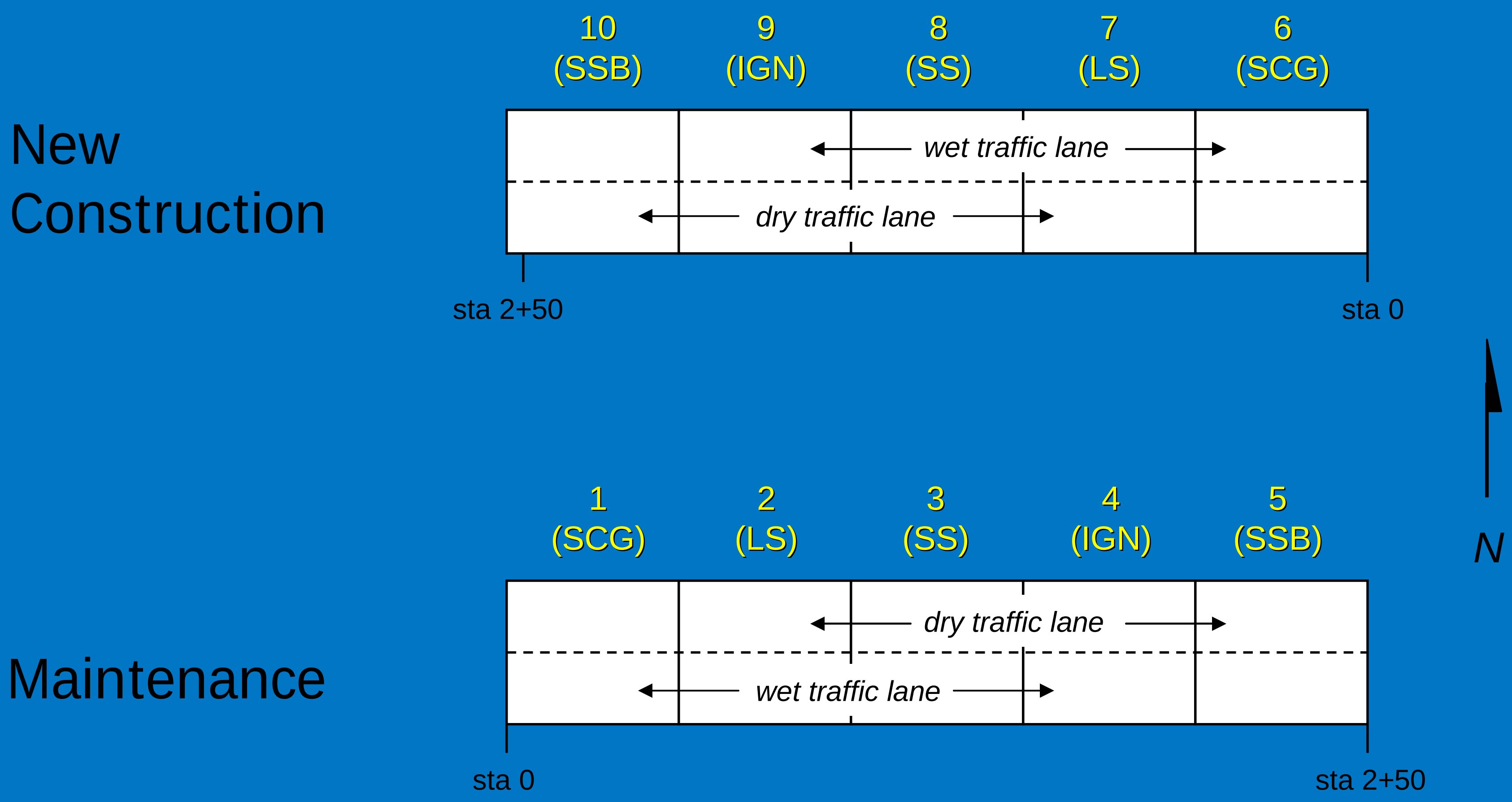
GC

Martin Marietta Aggregates, Sawyer Quarry, Sawyer, OK

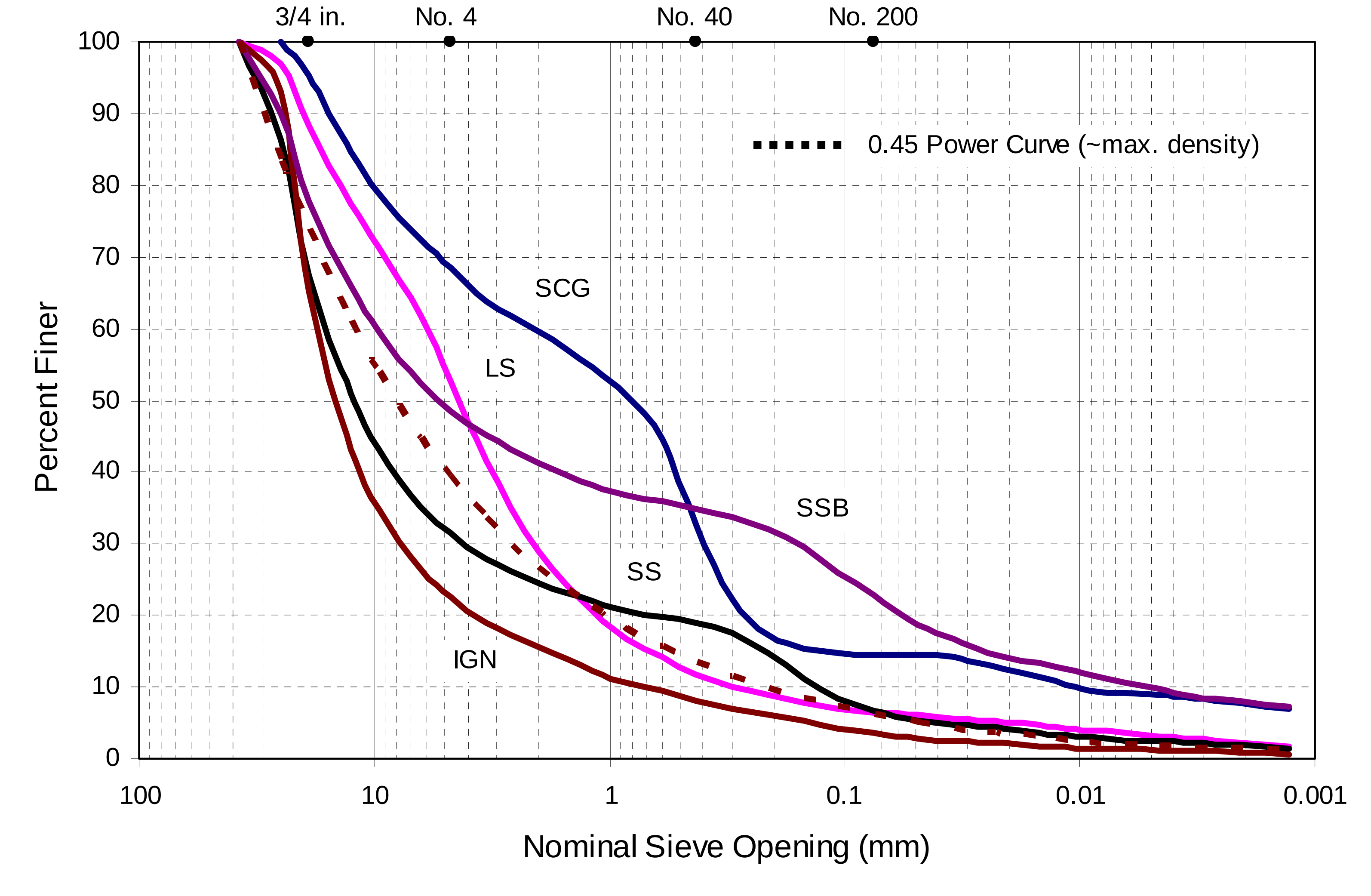
Experimental Approach



Experimental Approach

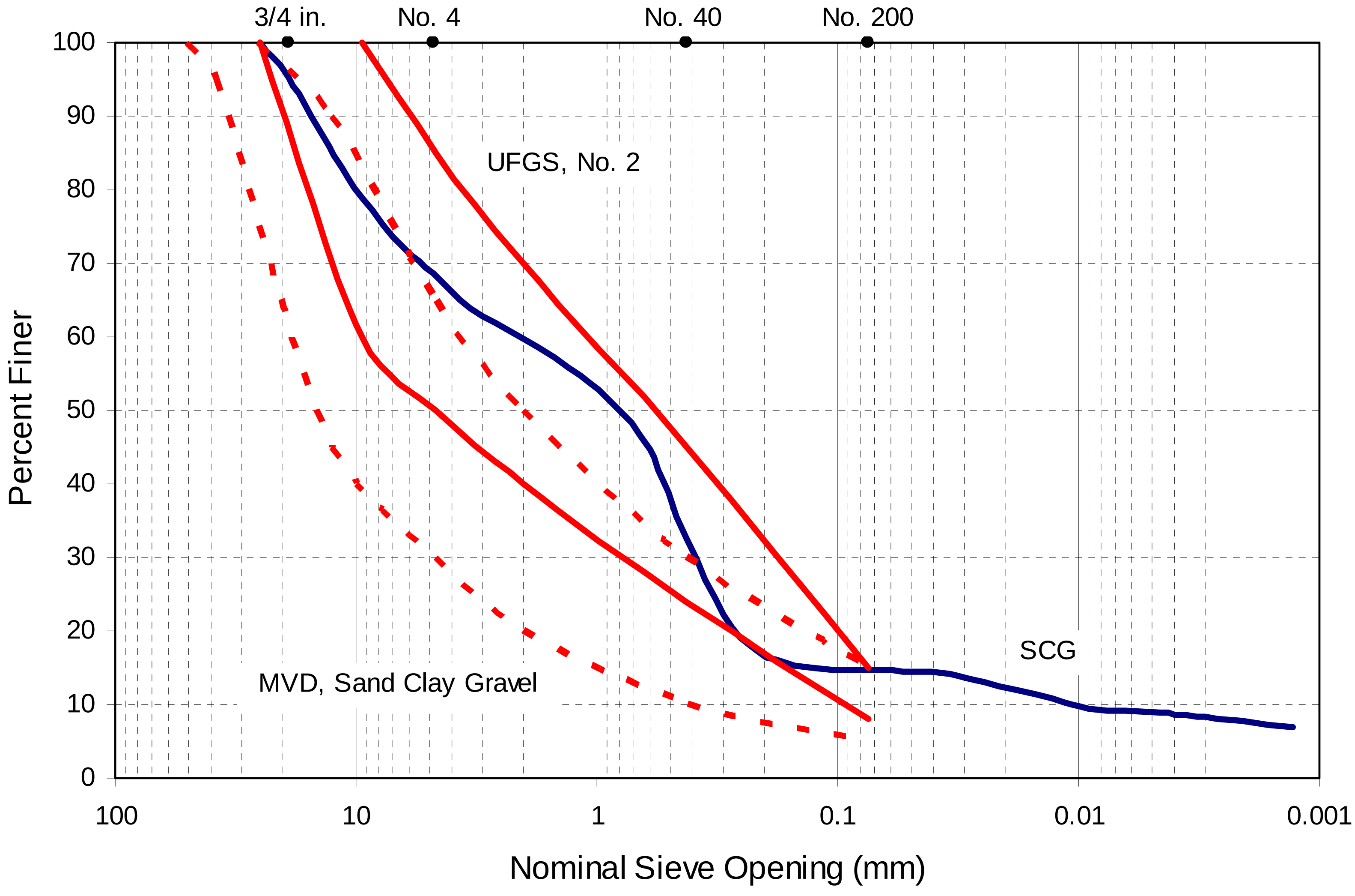


Particle Size Distribution



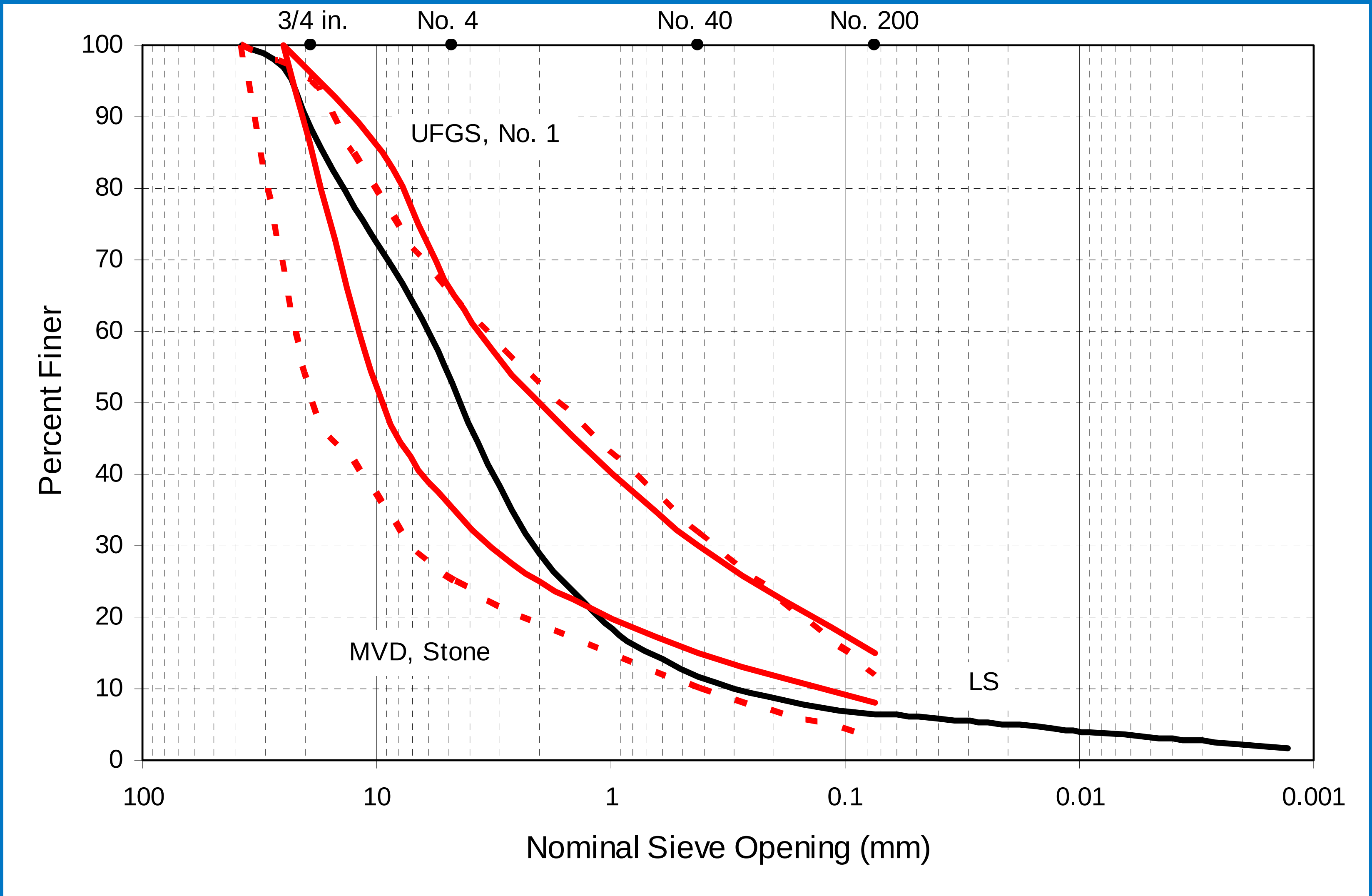
Particle Size Distribution

sand clay gravel



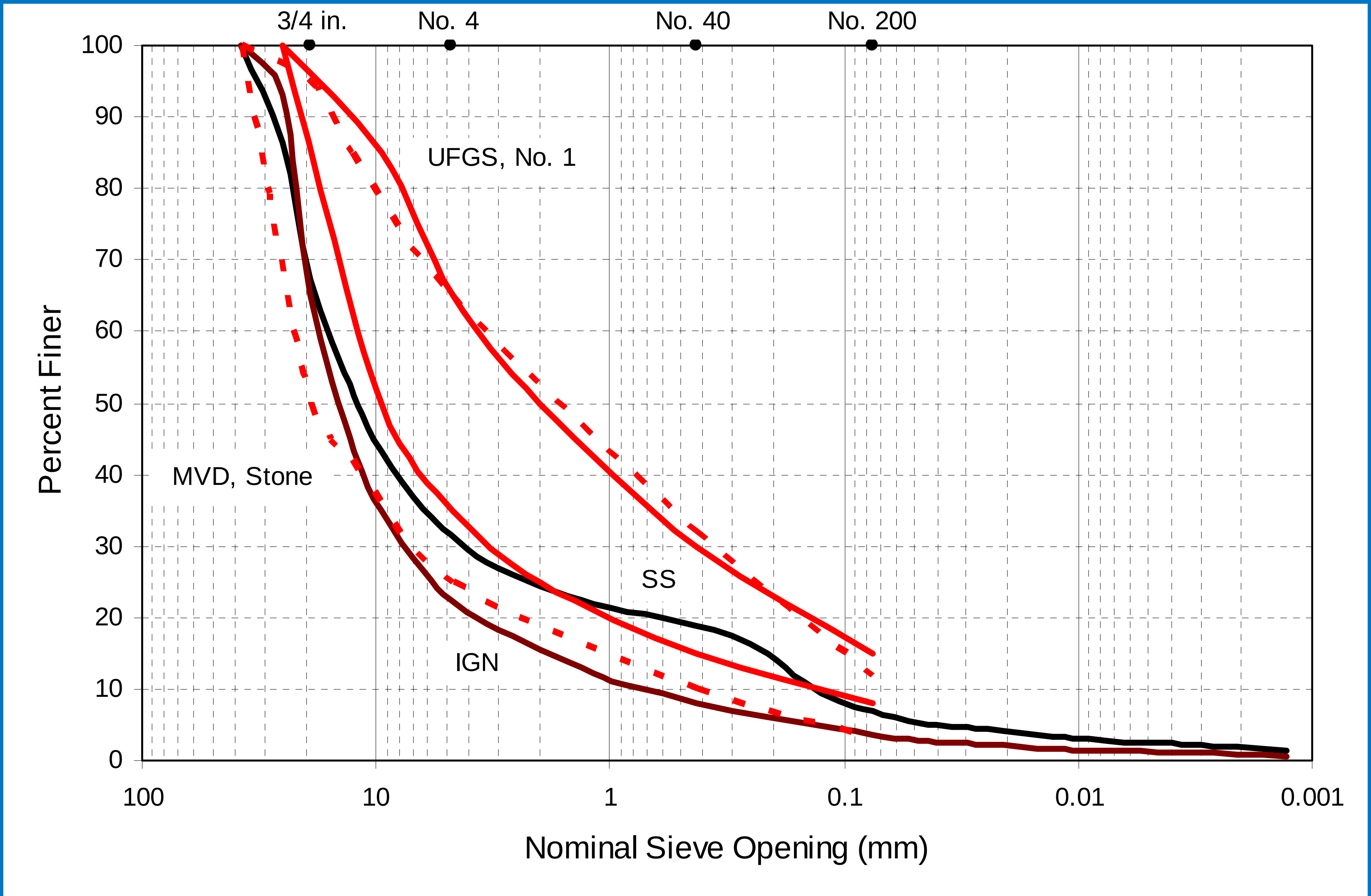
Particle Size Distribution

limestone



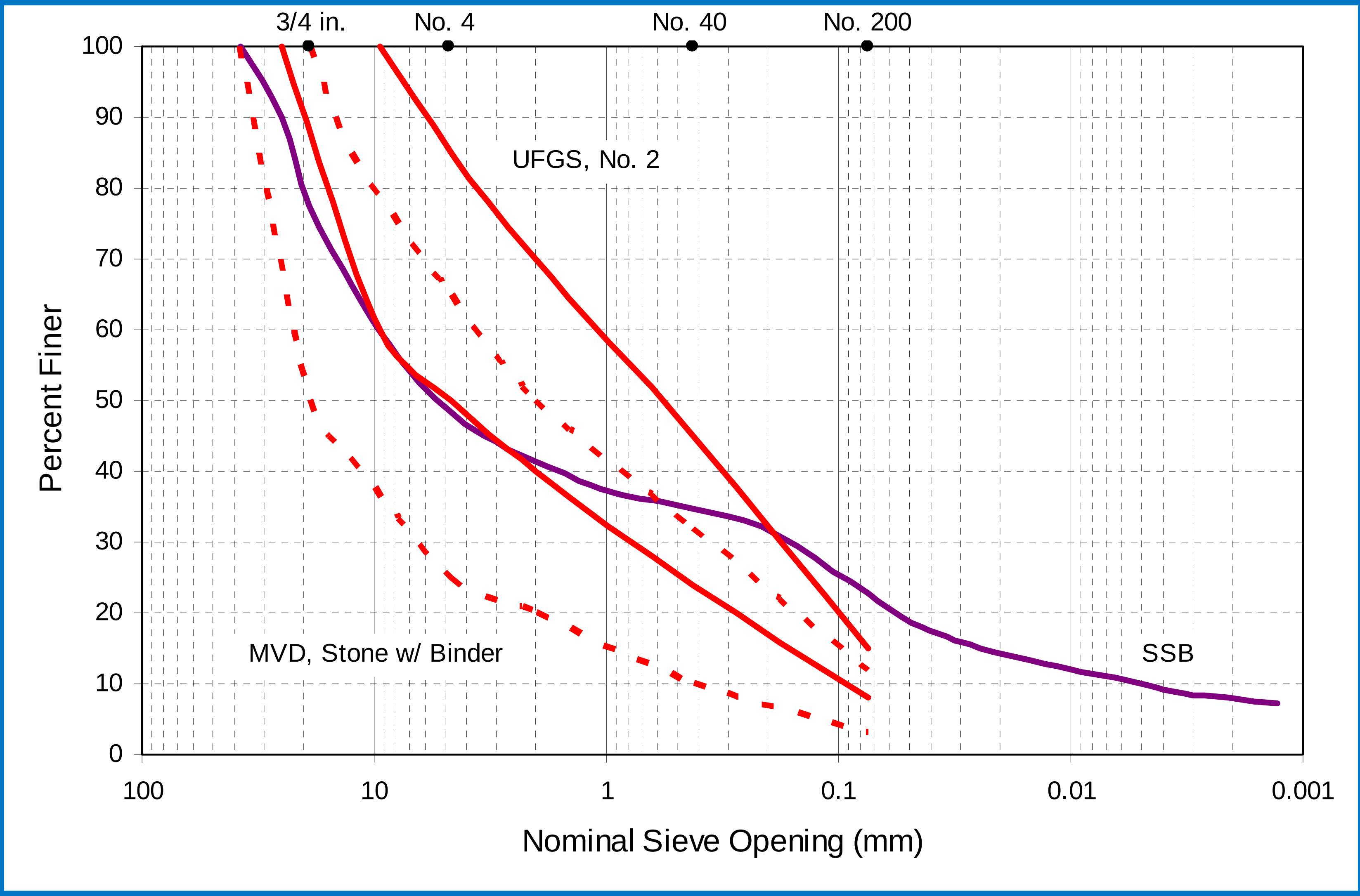
Particle Size Distribution

igneous and sandstone



Particle Size Distribution

sandstone with binder



Material Characteristics

Test		SCG	LS	SS	IGN	SSB
LA Abrasion	35 to 50% max.	18.2	18.8	33.5	27.3	27.8
Flat / Elongated	10 to 20% max.	4.2	5.8	5.5	5.8	10.8
LL	25 to 40% max.	31	NP	NP	NP	28
PI	8 to 15% max. 0 to 5% min.	18	NP	NP	NP	14
Sulfate Soundness	12 to 15% max.	1.0	0.3	4.2	0.4	6.4
Sand Equivalent	40 to 45% min.	20	73	23	61	10
Linear Shrinkage	So. Africa	6.1	1.1	0.2	0.5	6.4
% Passing No. 200	10 to 20% max. 0 to 10% min.	14.4	6.3	6.8	3.6	22.8
No. 200 / No. 40	67% max.	44	53	36	28	66

Construction

- Targets
  - Subgrade CBR = 5 to 10%
  - Surface to receive maintenance layer to have dry unit weight = 130 pcf
  - Compaction of surface layers to be similar to field

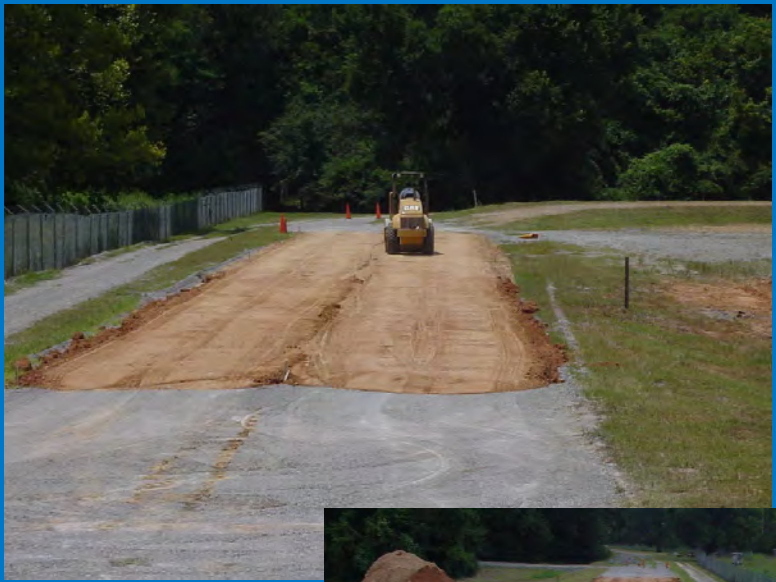
New Construction Test Section

Initial buildup
CBR = 4 to 25%

After reworking top 6 in.
Moisture = 13 to 19%
CBR = 5 to 15%

Maintenance Test Section

Placed 6 in. of SCG at
6 to 8% moisture
Dry unit wt. = 128 to 130 pcf



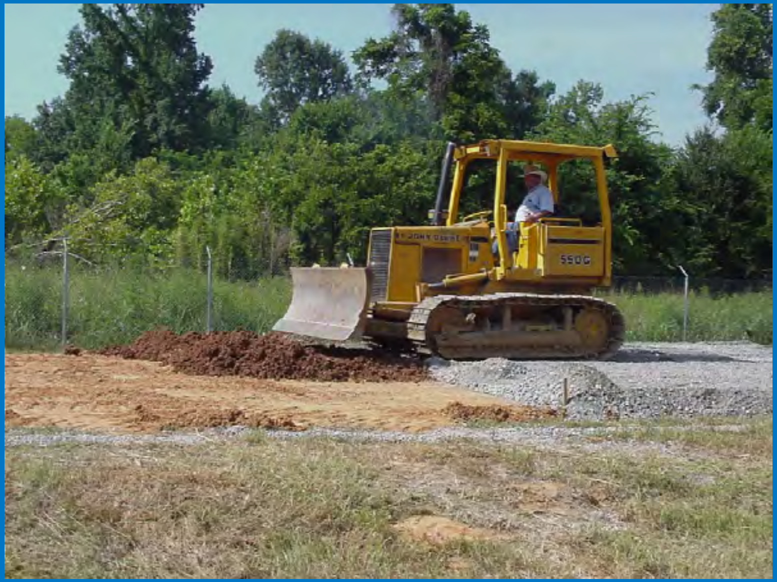
3 to 5 in. clay-limestone mix remains
CBR = 50 to 100% over
CBR ~ 10% at 10 in.

Placing Surface Materials

Spread with John Deere 550G track dozer

Add 16 coverages with dozer

Smooth with static steel drum



Placing Surface Materials

Maintenance Test Section

New Construction Test Section

Trafficking

15 to 20 mph

pickup w/ 500 lb

small empty dump truck

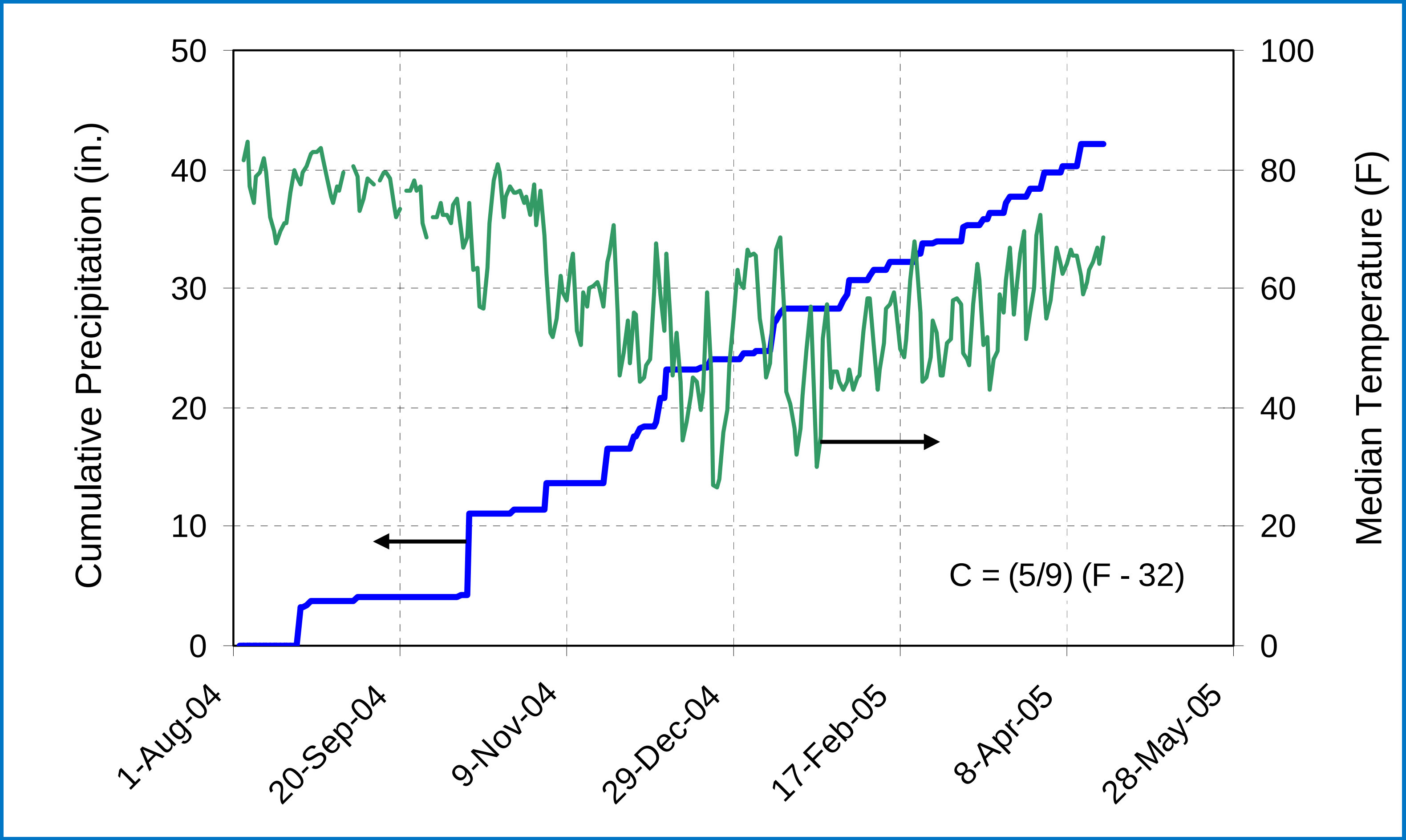
flatbed w/ 2000 lb

emulsion truck w/ 750 gal

Trafficking

Vehicle	Front Axle, lb	Rear Axle, lb	Inflation Pressure, psi
Pickup Truck	2600	2400	40
Dump Truck	6800	7500	110
Flatbed	5500	11000	80
Emulsion	5700	21800	80

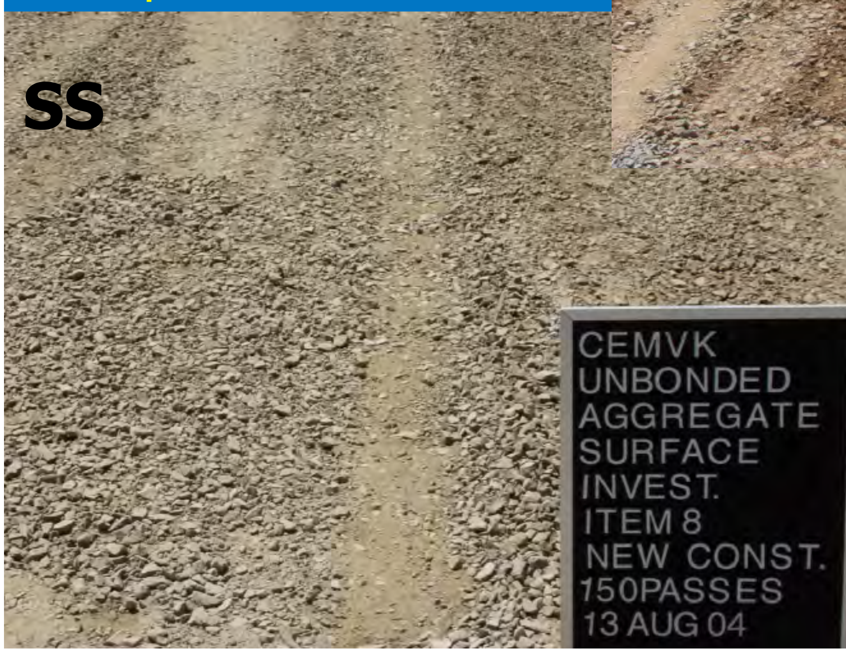
Climate



Cumulative Precipitation (in.)
Median Temperature (F)
50
40
30
20
10
0
100
80
60
40
20
0
C = (5/9) (F - 32)
1-Aug-04
20-Sep-04
9-Nov-04
29-Dec-04
17-Feb-05
8-Apr-05
28-May-05

August 2004
Pickup Truck
150 passes

dry conditions



October 2004
Pickup Truck
2500 passes

dry conditions

After Rainy Oct./Nov. (> 10 in.)

17 November 2004
Dump Truck, 10 passes
dry surface – wet subgrade

Only LS on New Construction Rutted:
- 4 to 6 in.
- both wheelpaths

All other items had no distress.

05 April 2005
Emulsion Truck
200 passes

relatively dry conditions
maintenance section

16 Feb 2005
Dump Truck
200 passes

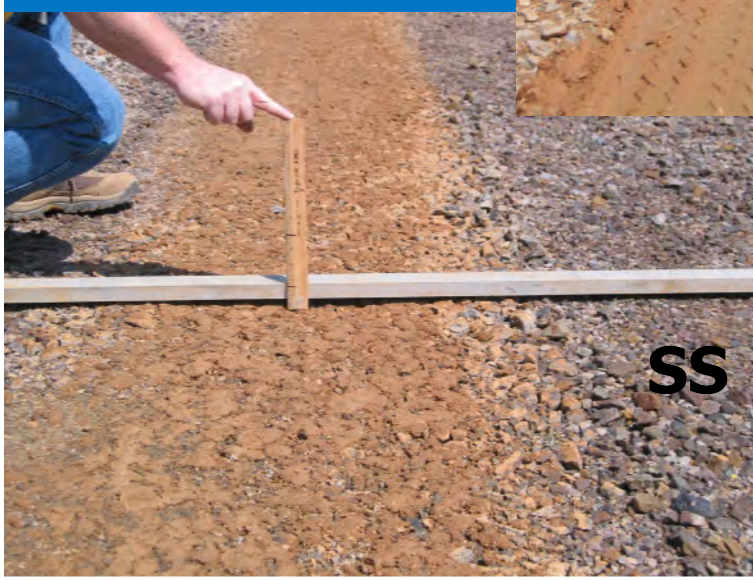
very wet conditions
maintenance section

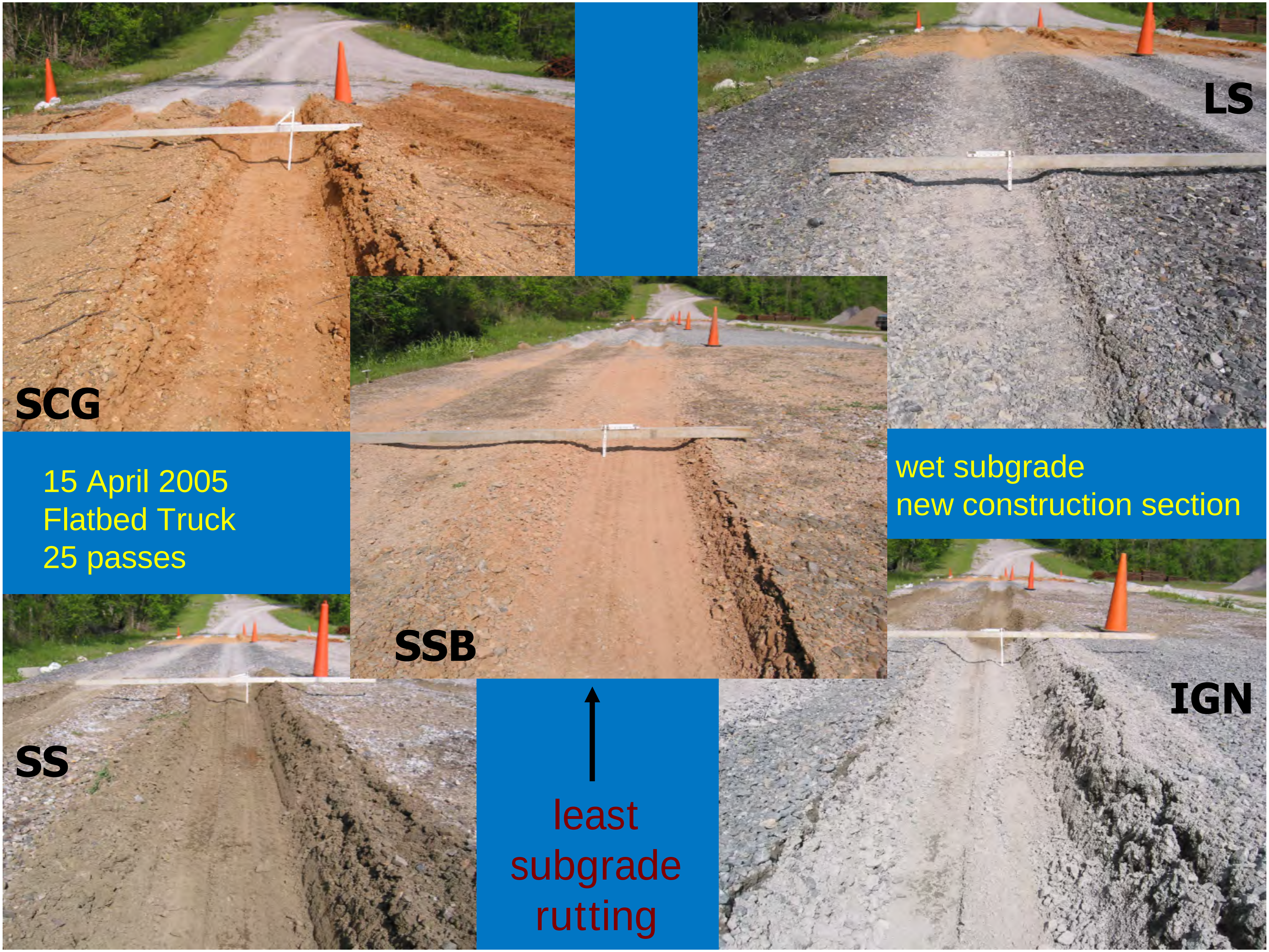
08 Mar 2005
Pickup Truck
150 passes

very wet surface
1.25 in. rain event
maintenance section

01 April 2005
Flatbed Truck
50 passes

wet conditions
maintenance section




SCG
LS
15 April 2005
Flatbed Truck
25 passes
SSB
wet subgrade
new construction section
SS
IGN
least
subgrade
rutting

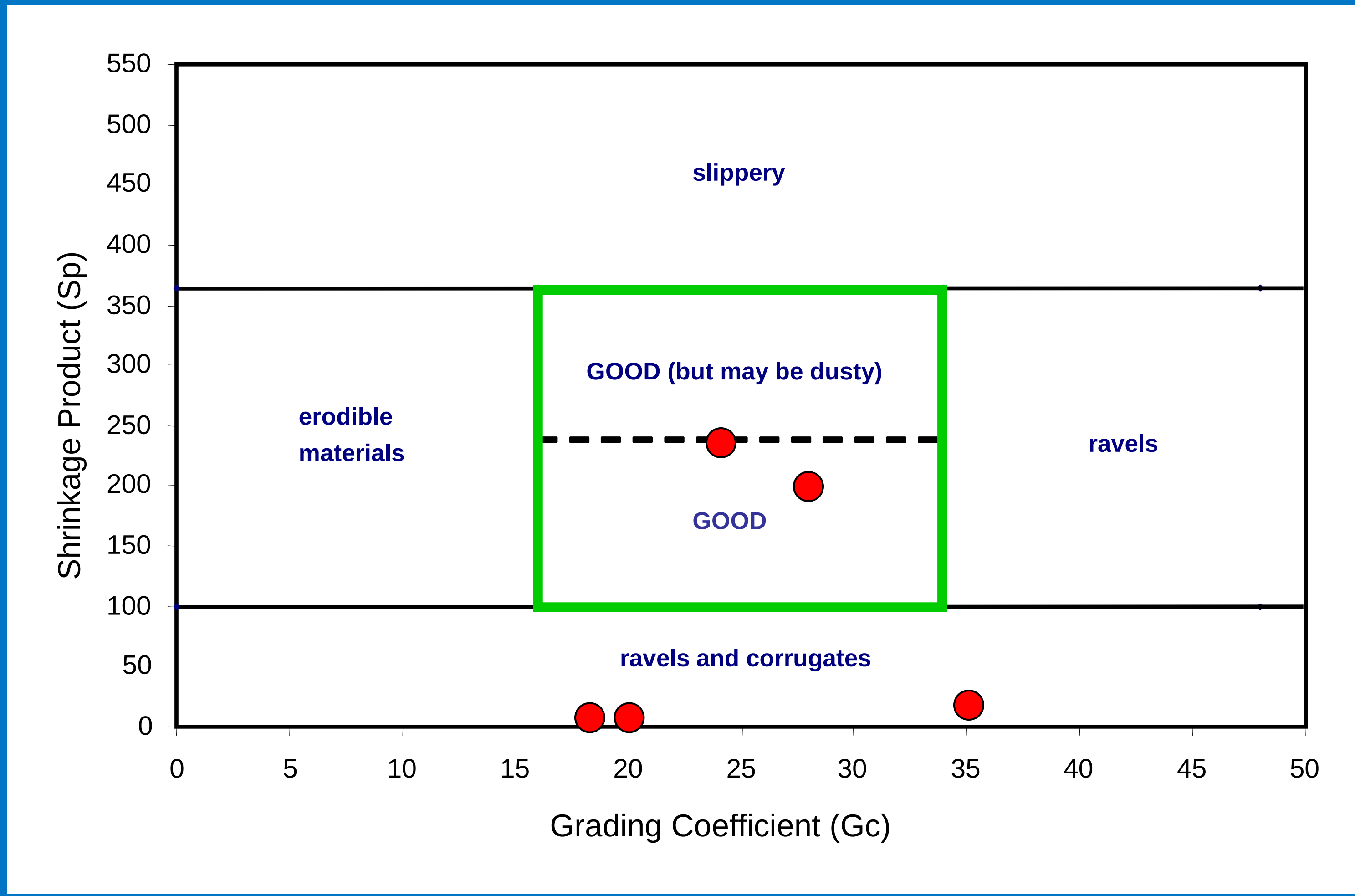
Summary

- New Construction (no subbase)
  - All materials could support light traffic adequately in dry conditions
  - SCG had surface rutting when wet, even under light traffic
  - Aggregates with high fines and plasticity partially protected subgrade from rain, thus prolonging life of road
  - SSB performed best under heavy traffic
  - If heavy traffic is possible, road should include a subbase

Summary

- Maintenance (SCG subbase)
  - o All materials, except SCG, could support light traffic adequately in dry or wet conditions
  - o SCG had surface rutting when wet, even under light traffic
  - o SS and IGN performed best under medium and heavy traffic in wet conditions

South African Approach



Sp = linear shrinkage (%) x No. 40

$$Gc = \frac{(1\,\text{in.} - \text{No.}\,10) \cdot \text{No.}\,4}{100}$$

Conclusions

- Subbase layer is recommended if heavy traffic is possible
  - o If no subbase, criteria for surface aggregate will be different than for the case of aggregate on top of subbase
- Key components of new specification:
  - o overall gradation
  - o minus No. 200
  - o No. 200 / No. 40
  - o plasticity of fines
  - o linear shrinkage?
- o Apply concept similar to South Africans' but adjust for higher precipitation

Thanks

Use of Ultra-Fine Amorphous Colloidal Silica to Produce a High-Density, High-Strength Grout

Brian H. Green, R.P.G.

Research Geologist

Concrete and Materials Branch

Geotechnical and Structures Laboratory

Research

- **Performed by:**
- **Concrete and Materials Branch**
- **Geotechnical and Structures Laboratory**

- **Grout Requirements**
  - **High Density: > 2.6 Mg/m^3 (162.3 lb/cu ft)**
  - **High Strength: > 70 MPa (10,150 psi)**
  - **Ultra-Sonic Pulse Velocity: > 3.65 km/sec (11,975 ft/sec)**

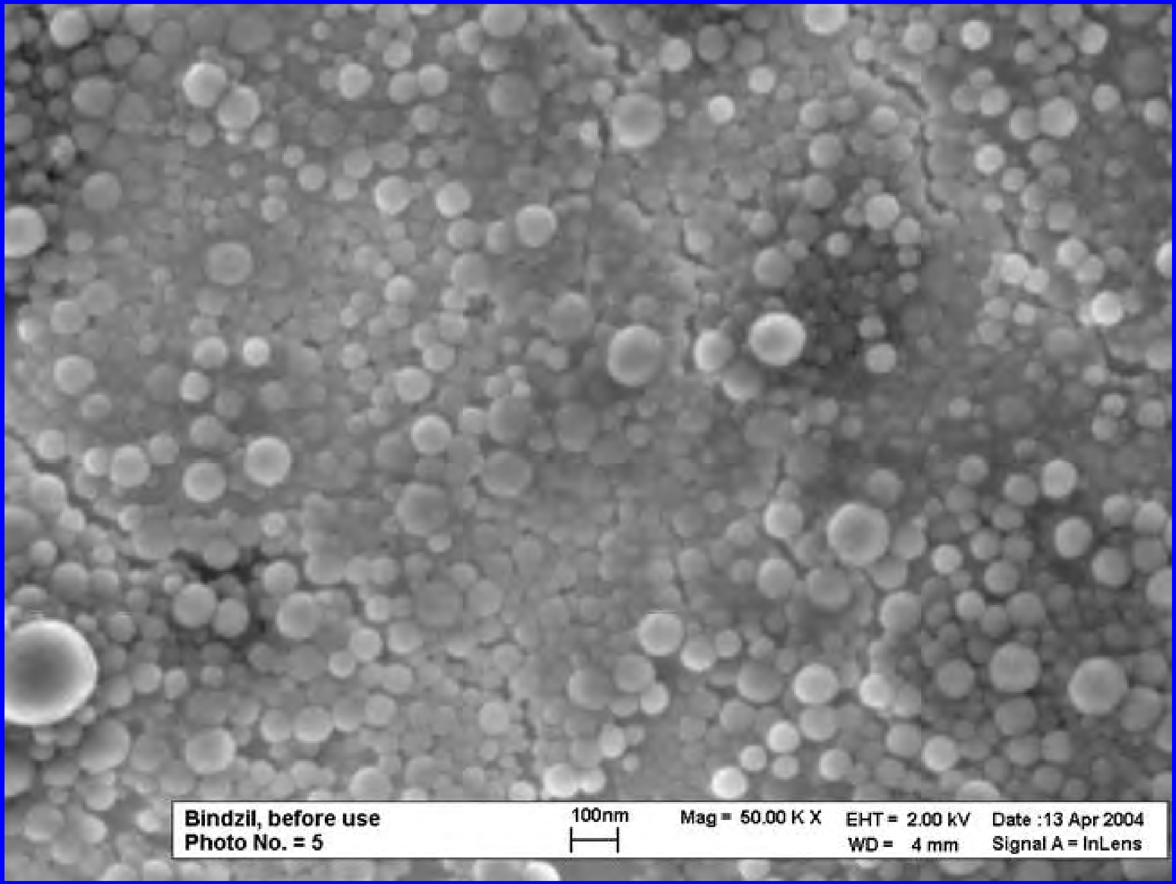
Materials for Grout Mixture

- **Portland Cement - ASTM C 150, Type I/II**
  - **Lehigh Portland Cement**
- **Hematite Fine Aggregate – ASTM C 637, Grading 1**
  - **Nuclear Shielding Supplies and Service**
- **Silica Fine Aggregate – # 20 to # 40 Sieve Size**
  - **Oglebay Norton**
- **Silica Fume – Low-Carbon, from Production of Zirconia**
  - **Elkem Materials**

Chemical Admixtures for Grout Mixture

- **High-Range Water Reducing Admixture**
  - **Glenium 3030 NS, Degussa Admixtures, Inc.**
- **Air *De*training Admixture**
  - **D7 Defoamer, Amber Chemical**
- **Ultra-fine Amorphous Colloidal Silica (UFACS)**
  - **Cembinder 8, Eka Chemical, Akzo Nobel**

Ultra-Fine Amorphous Colloidal Silica



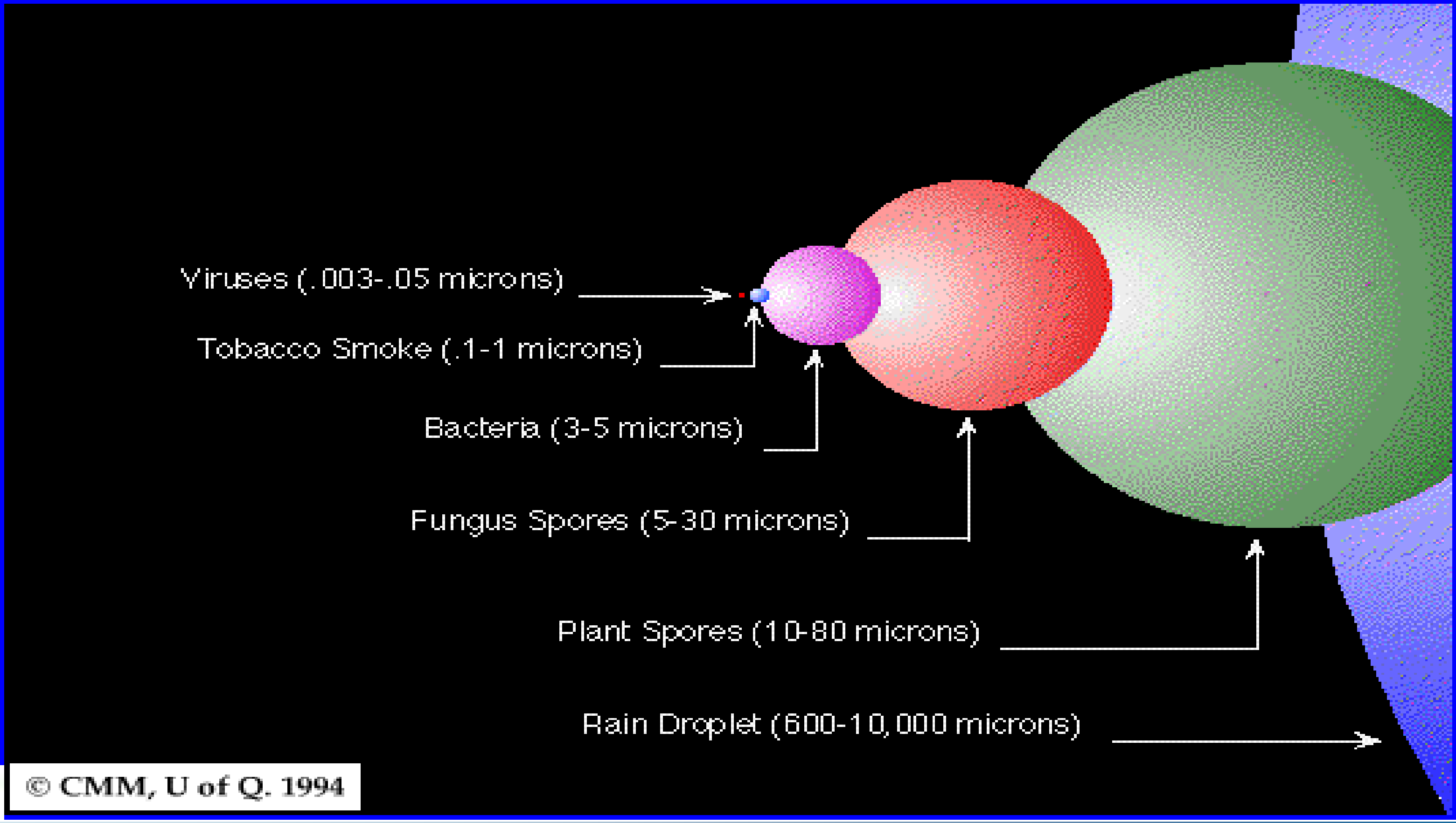
Ultra-Fine Amorphous Colloidal Silica (UFACS)

- **Nano-Silica**
- **Nano-SiO_2**

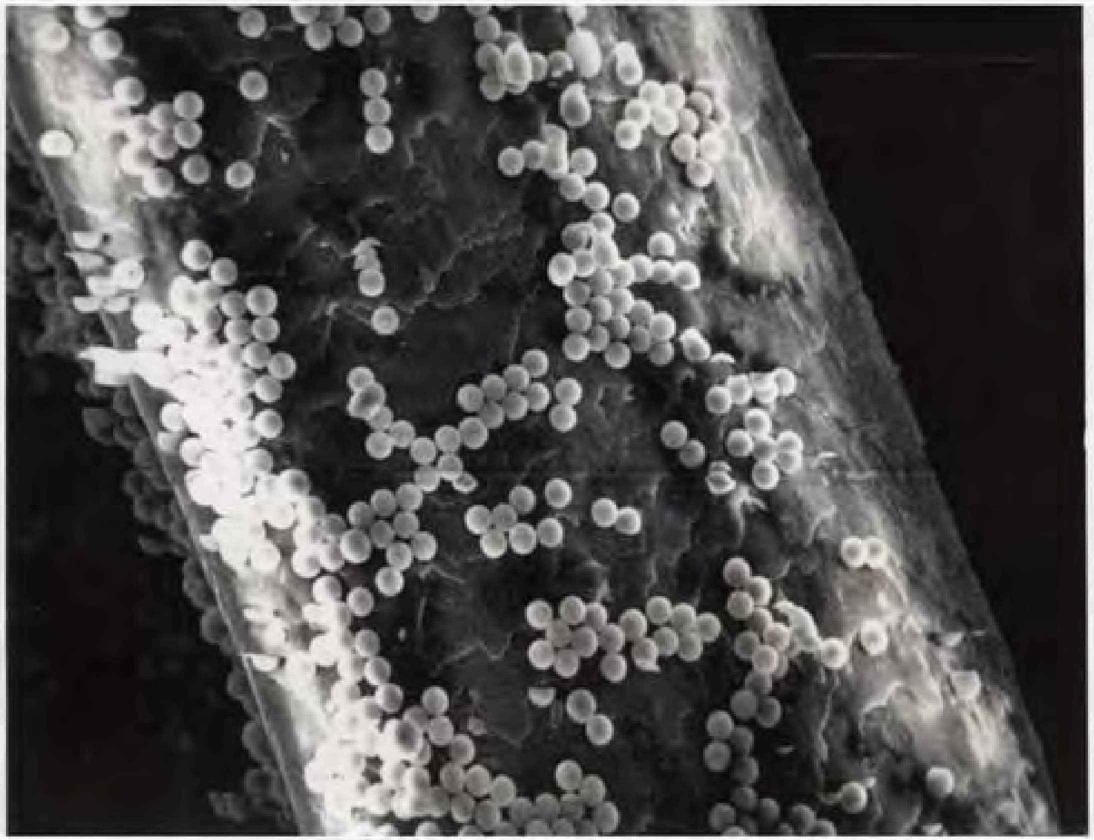
Viscosity Modifier

Definitions - Ultra-Fine Amorphous Colloidal Silica

- **Nano – From the Greek *Nanos* – Meaning "Dwarf"**
  - **10^{-9} Meter or One *Billionth* of a Meter**
  - **Nanoscience - 1 to 100 Nanometer Scale**

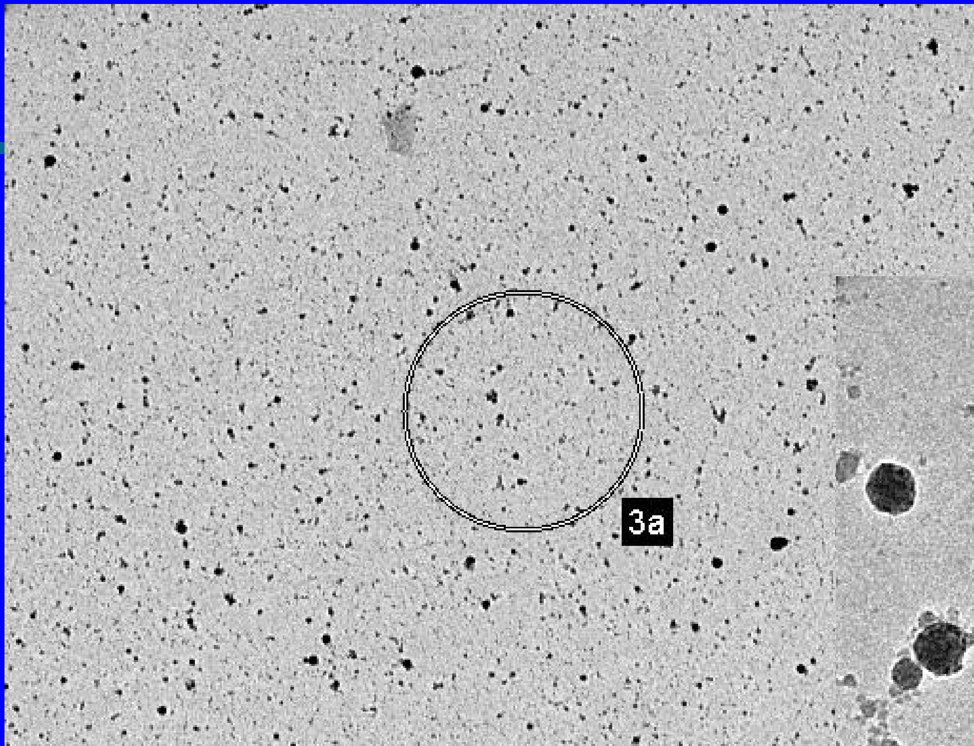


3.4 ☞m = 3,400 Nanometers!

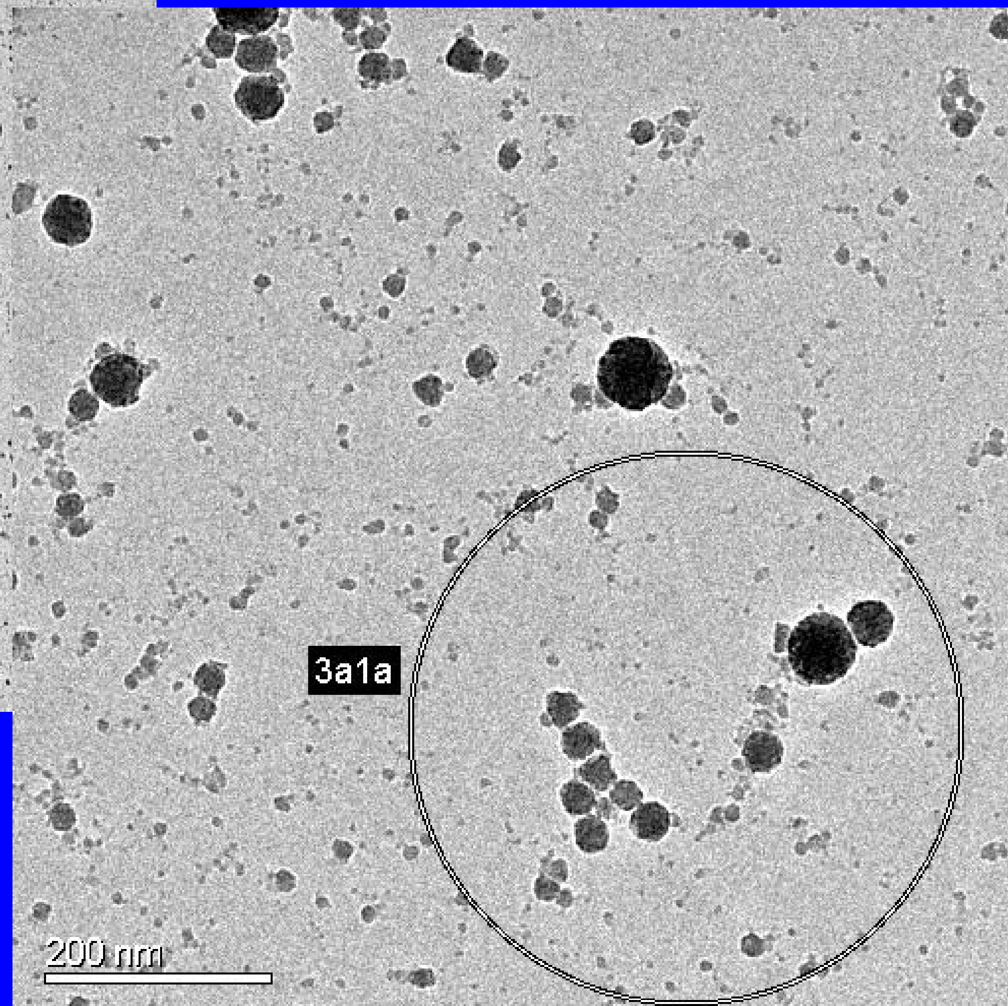


SEM PHOTO of 3.4 um PARTICLES ON HUMAN HAIR, 1000X

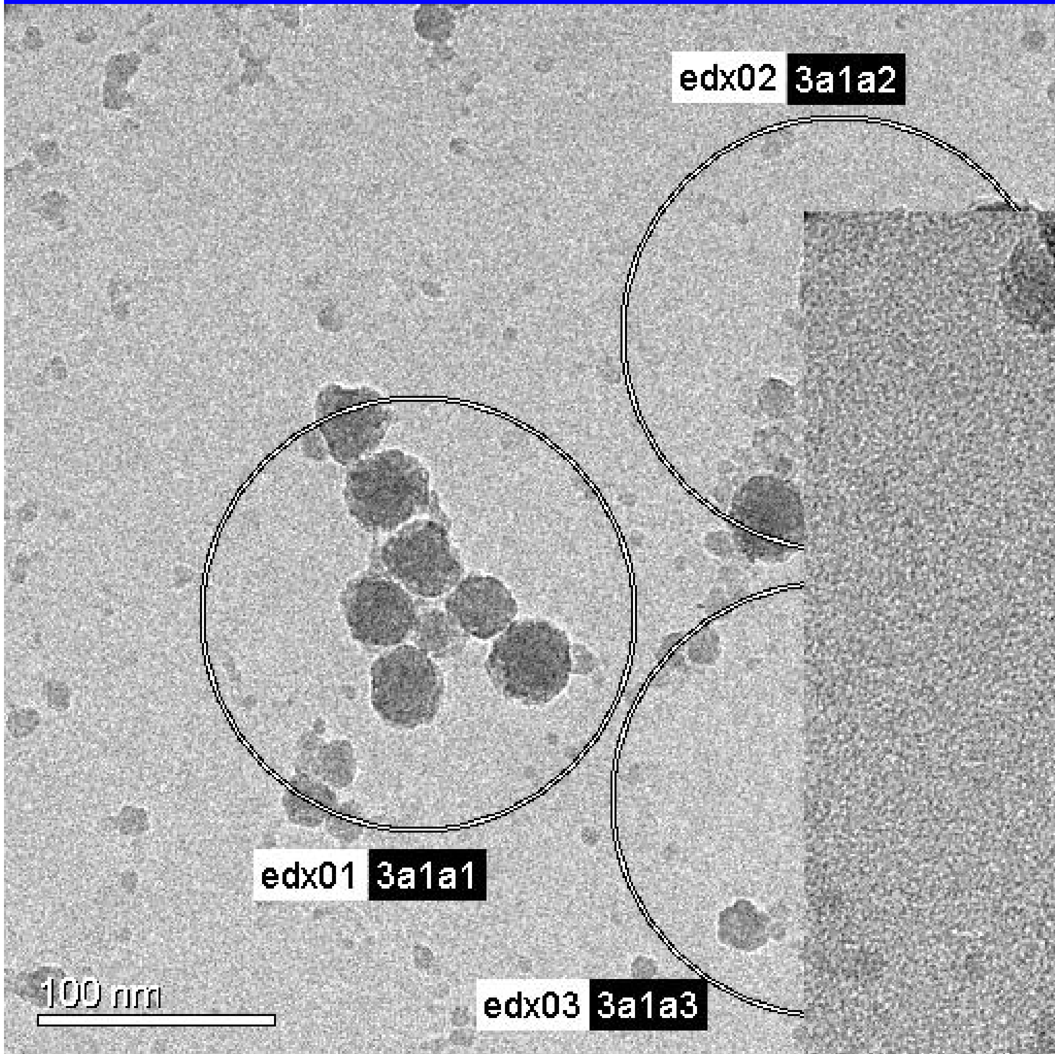
Cembinder Particles

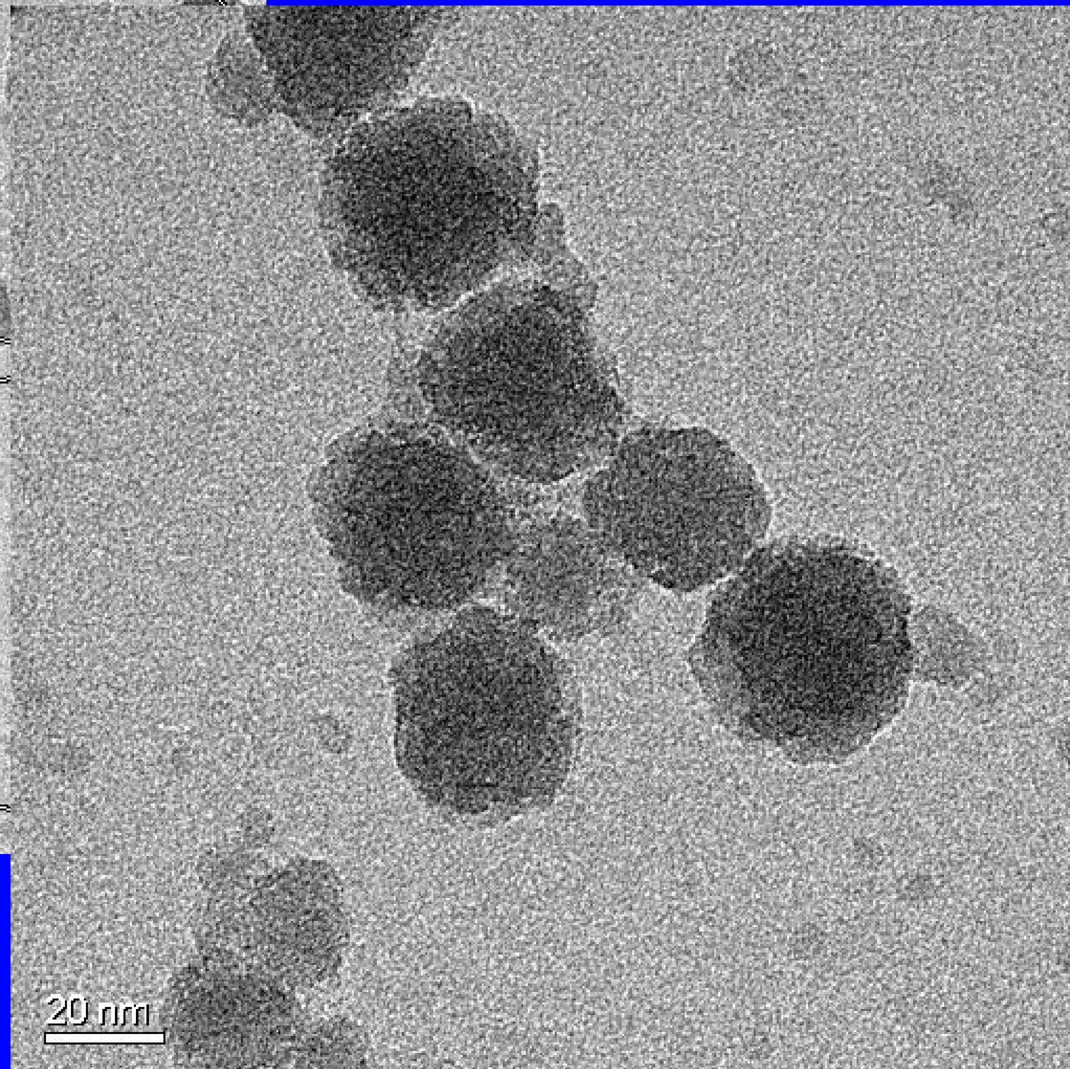


SEM PHOTO of 3.4 um PARTICLES ON HUMAN HAIR, 1000X



Cembinder Particles





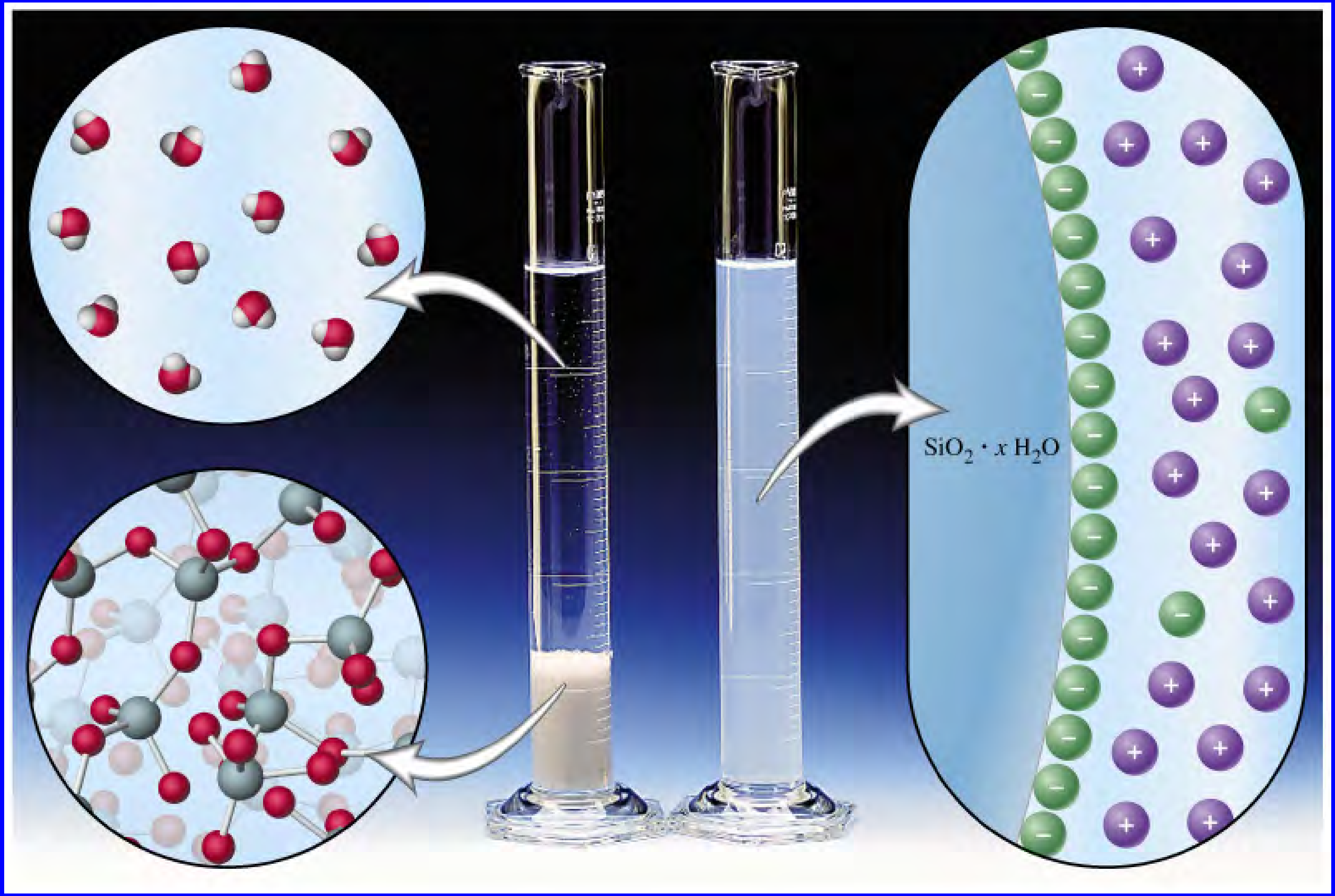
Definitions - Ultra-Fine Amorphous Colloidal Silica

- **Amorphous**
  - **Non-Crystalline Silica**
  - **Random Distribution of $[SiO_4]^{4-}$ tetrahedra**
  - **Glass is a Common Amorphous Material**

Definitions - Ultra-Fine Amorphous Colloidal Silica

- **Colloid**
  - **- <u>Stable</u> dispersion of particles in a medium**
    - **No settling out!**
  - **Small – Can't be seen with light optics**
    - **>1 nm to < 100 nm**
  - **Can't pass through a membrane**

Suspension of Silica Vs. Colloidal Silica



Definitions - Ultra-Fine Amorphous Colloidal Silica

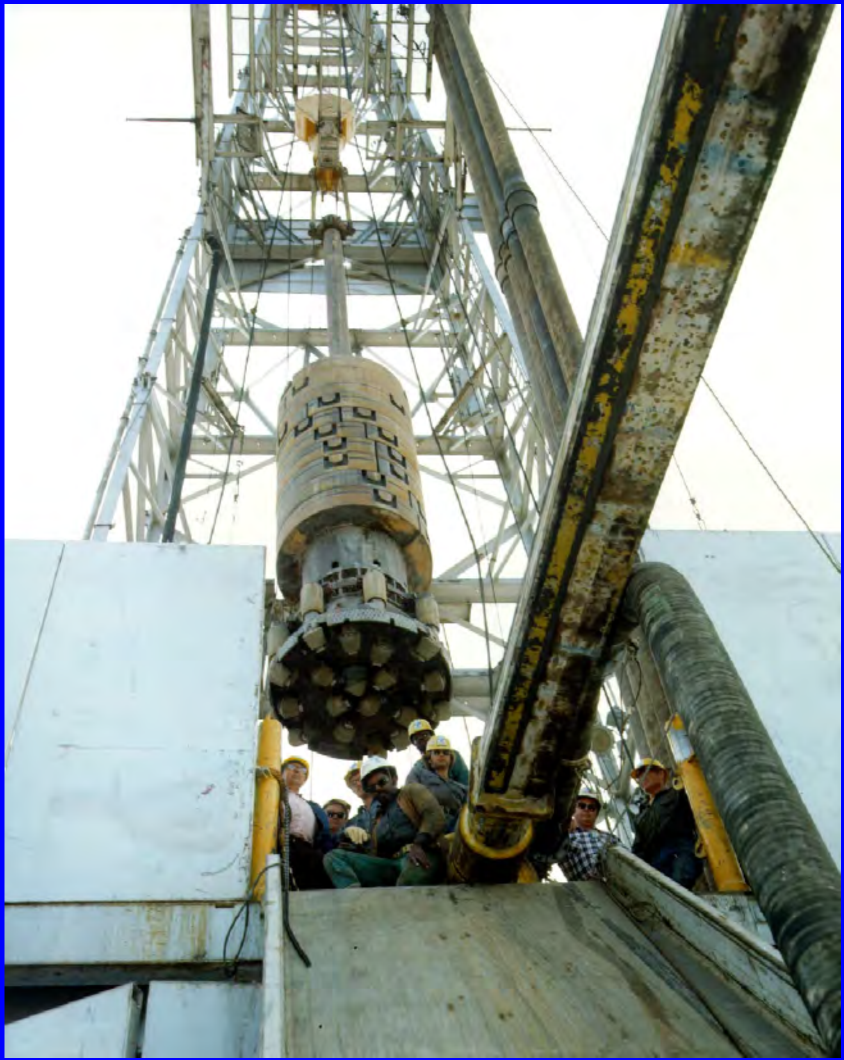
- **Ultra-Fine Amorphous Colloidal Silica (UFACS)**
  - **Industrially Manufactured**
  - **Liquid Form**
  - **Resembles Skim Milk**

Ultra-Fine Amorphous Colloidal Silica

Ultra-Fine Amorphous Colloidal Silica

- **Developed for Drilling Applications**

- **Keep Solid Particles in Grout Mixture from Segregating or "Falling Out"**



Grout Mixer and Pump

Grout Consistency

Grout - Fresh Properties

- **ASTM C 939 (Flow Cone Method)**
  - **20- 30 Second, Flow Time**
- **Wet Density:**
  - **ASTM C 938, Section 9.5.1 (Proportioning Grout Mixtures for Preplaced-Aggregate Concrete)**
  - **2.7-2.76 Mg/m^3 (168-172 lbs/ft$^{3)}$**

Grout –Hardened Results

- **Hardened Density: 2.68 Mg/m^3 (167.4 lb/cu ft)**
- **High Strength: 71.2 MPa (13,230 psi)**
- **Ultra-Sonic Pulse Velocity: 4.40 km/sec (14,435 ft/sec)**

- **New Chemical Admixture**
  - **Viscosity Modifying Admixture (VMA)**
  - **Keeps Solids in Suspension**
  - **Does not Decrease Strength**
  - **Reduces Bleed**

Questions?

Contact Information

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Evaluation of The Use of Lithium Compounds in Controlling ASR in Concrete Pavement

Tri-Service Infrastructure Conference

3 August 2005

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Norfolk, Nebraska

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ASR Distress

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Site Layout

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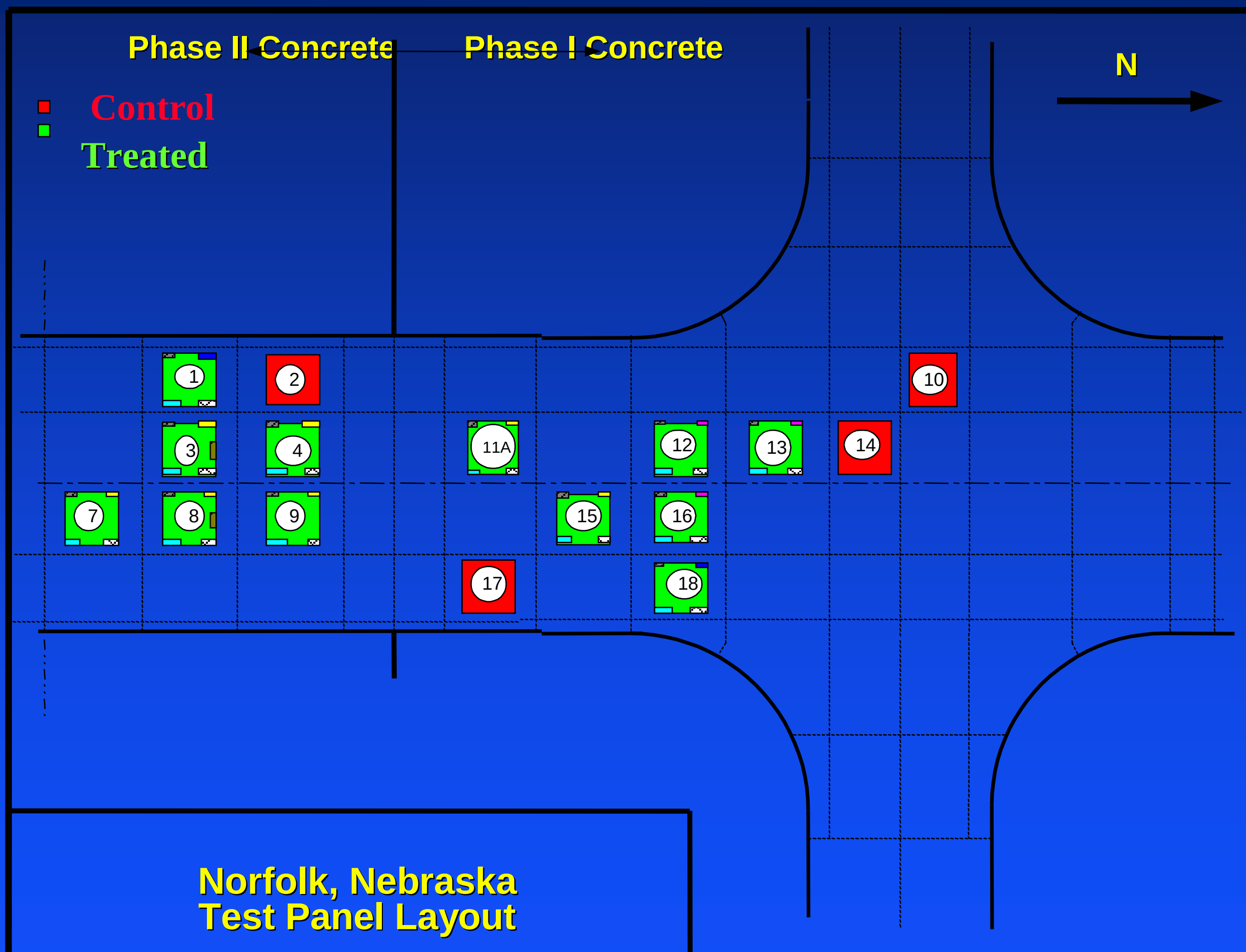

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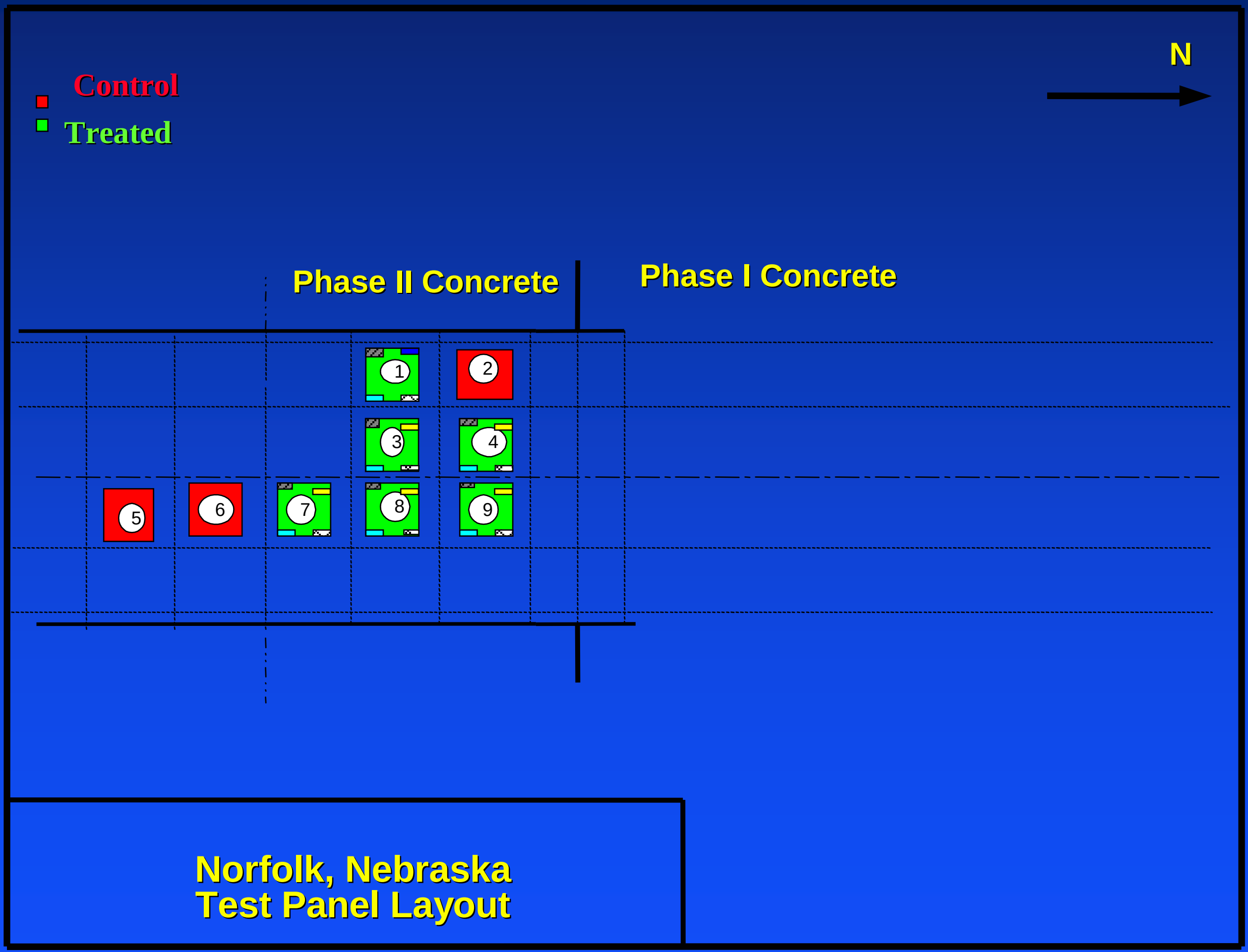
Site Layout



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Site Characterization

- Petrographic Examination
- Map Cracking
- “V” Meter
- Schmidt Hammer
- Impact Echo
- Expansion / Contraction Measurements

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Core Samples

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Core Samples

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Petrographic Examination

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Crack Mapping

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Crack Mapping

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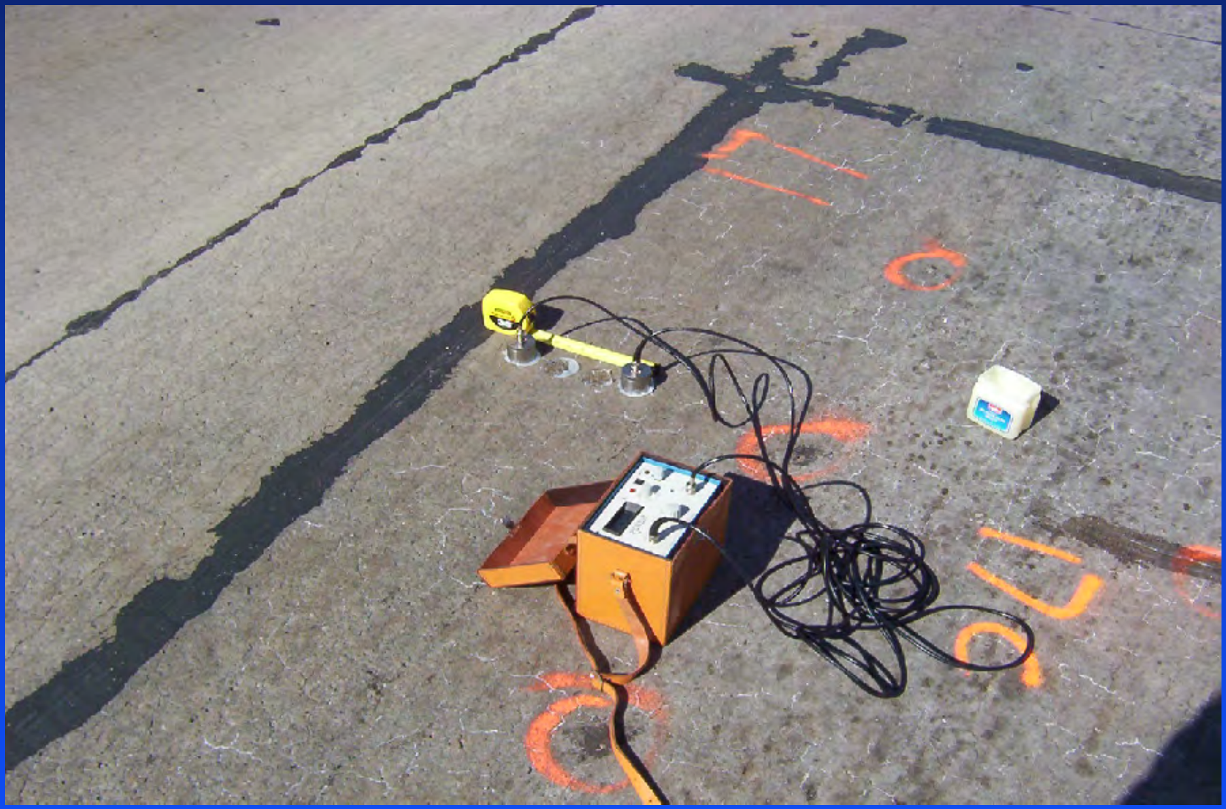
"V"-Meter



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Schmidt Hammer

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Impact Echo

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Expansion / Contraction Demac Points

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Demac Point

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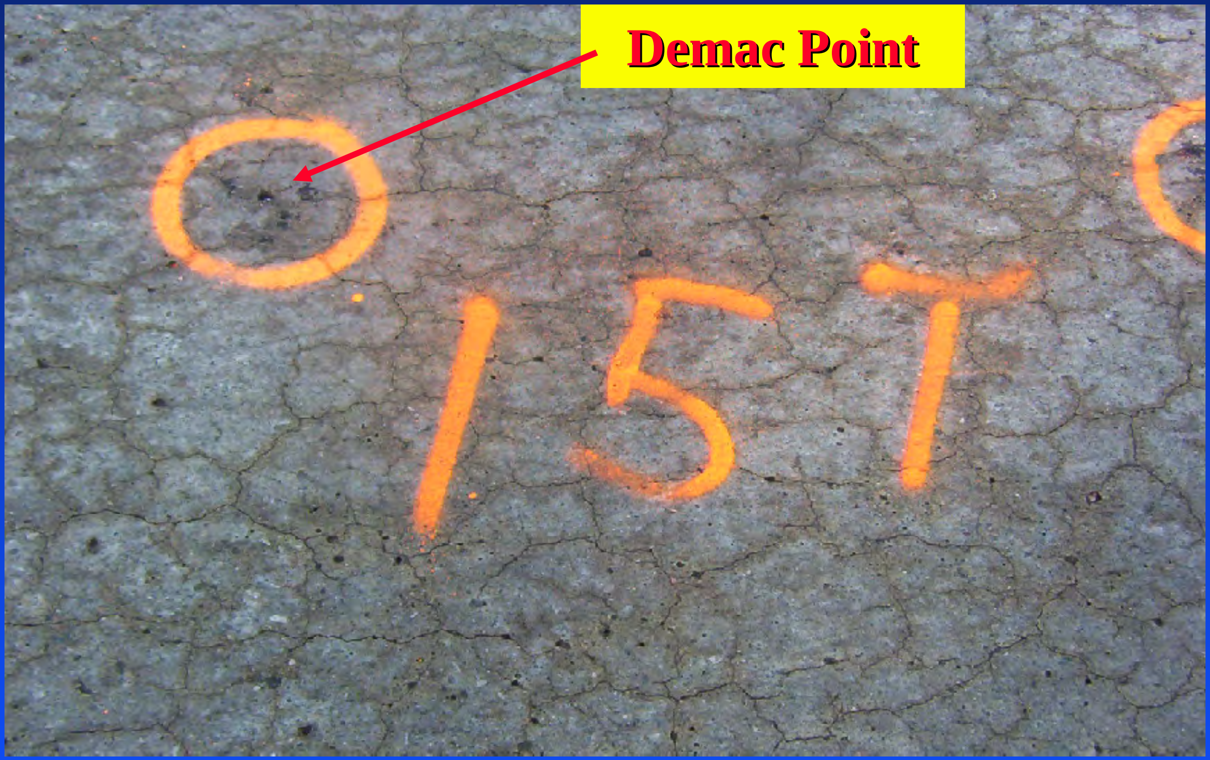
Demac Points



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Expansion / Contraction Measurements

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Expansion / Contraction Measurements

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Saw Cut Operation

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Full Depth Saw Cut

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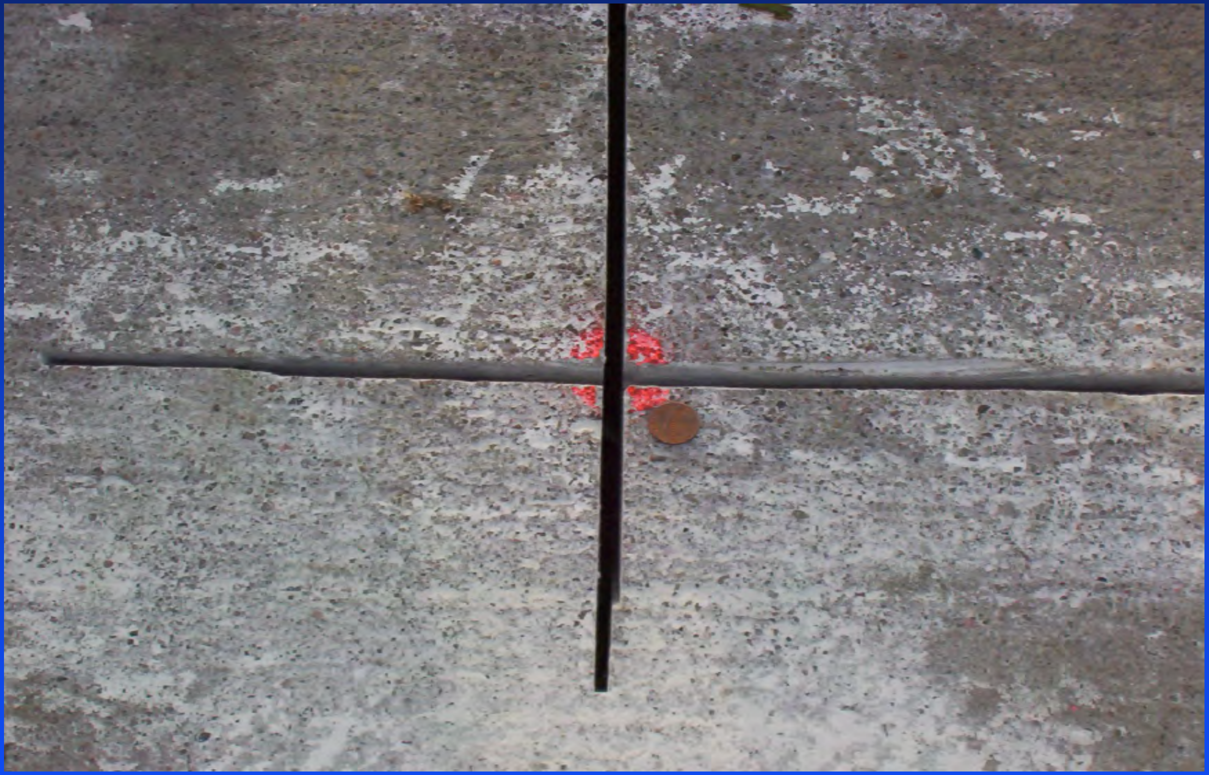
Saw Cut



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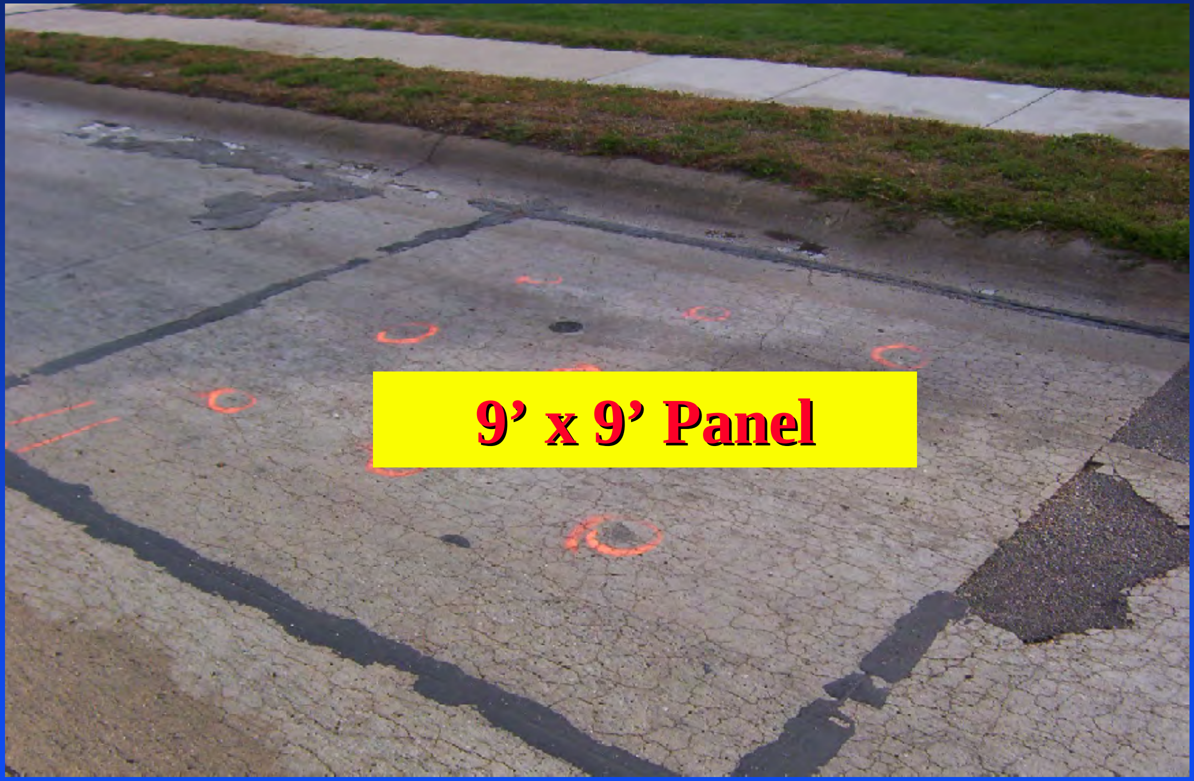
Treated / Control Panels



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Lithium Application

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Lithium Application

Dates & Application Rates:

- Nov 2002: 0.006 – 0.012 gal/s.f.
- Dec 2002: 0.012 gal/s.f.
- May 2003: 0.006 gal/s.f.
- Oct 2003: 0.006 gal/s.f.
- May 2004: 0.006 gal/s.f.
- Oct 2004: 0.012 gal/s.f.

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Lithium Material

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Salt Residue

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Addition of Water

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Powder Samples

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Powder Samples

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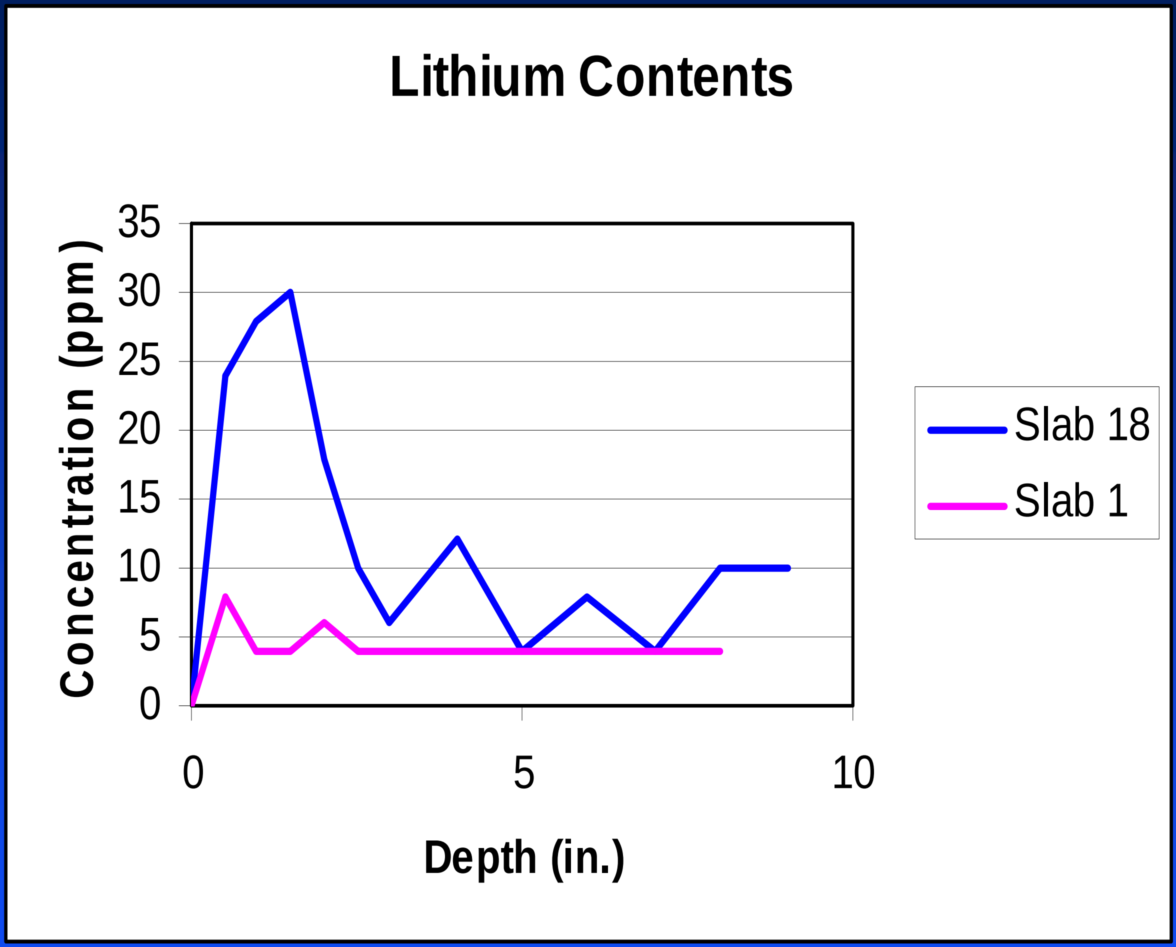

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Pressure Injection

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Pressure Cell

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Pressure Cell

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Pressure Cell

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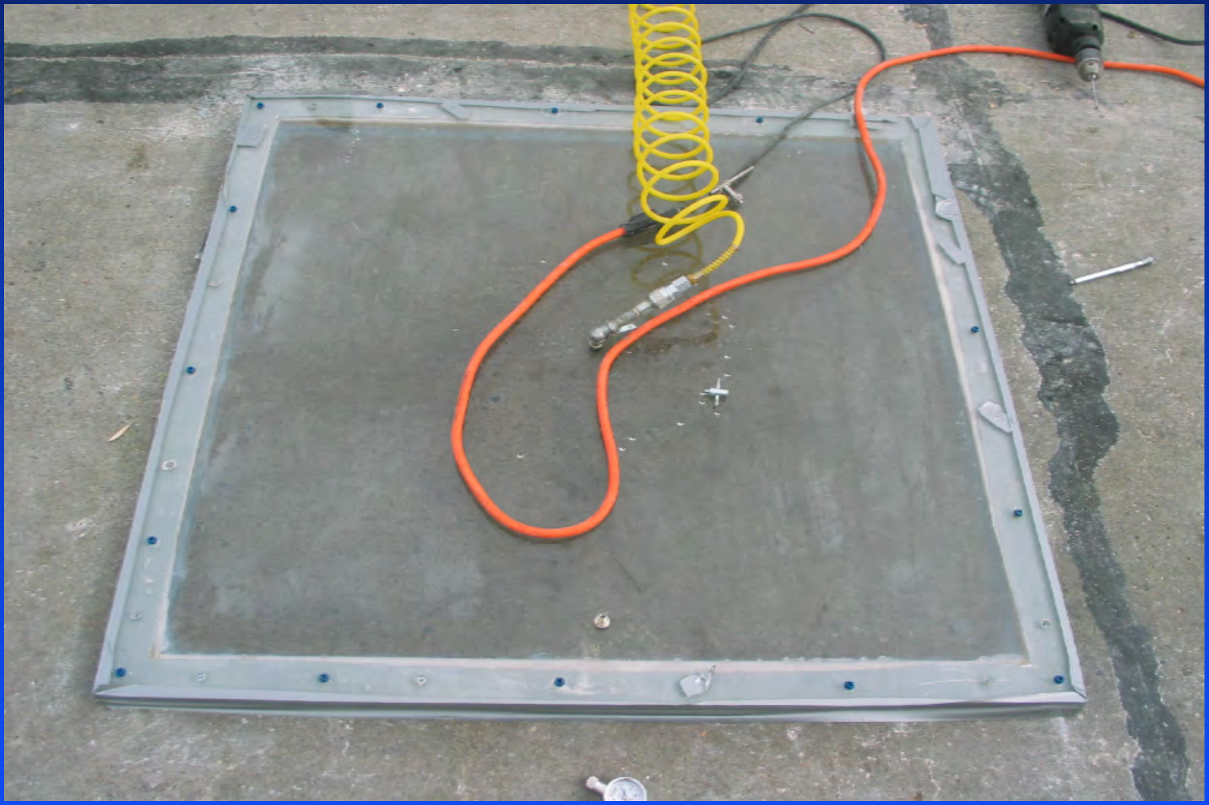
Pressure Injection



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Pressure Cell

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Pressure Application

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Vacuum Impregnation

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Vacuum Impregnation

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Powder Samples

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Data Analysis

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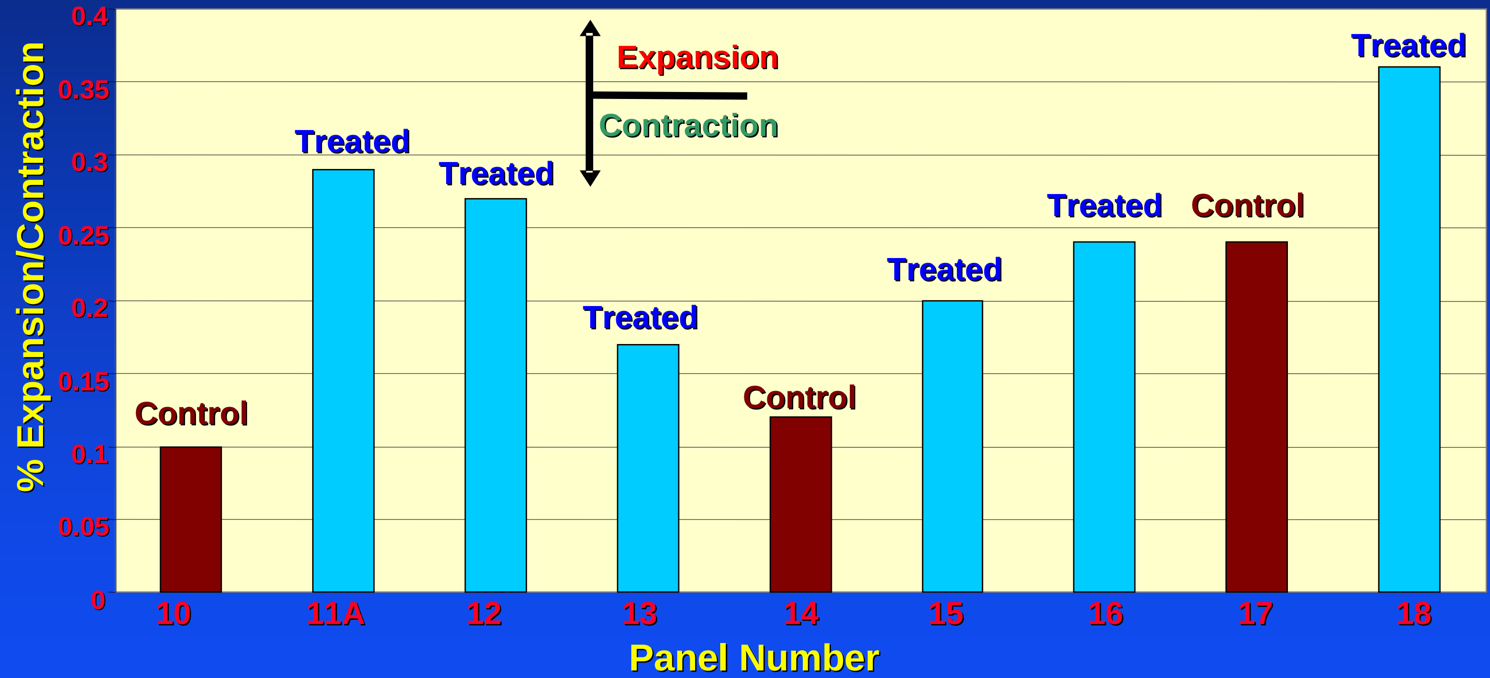
N-S Phase I Concrete



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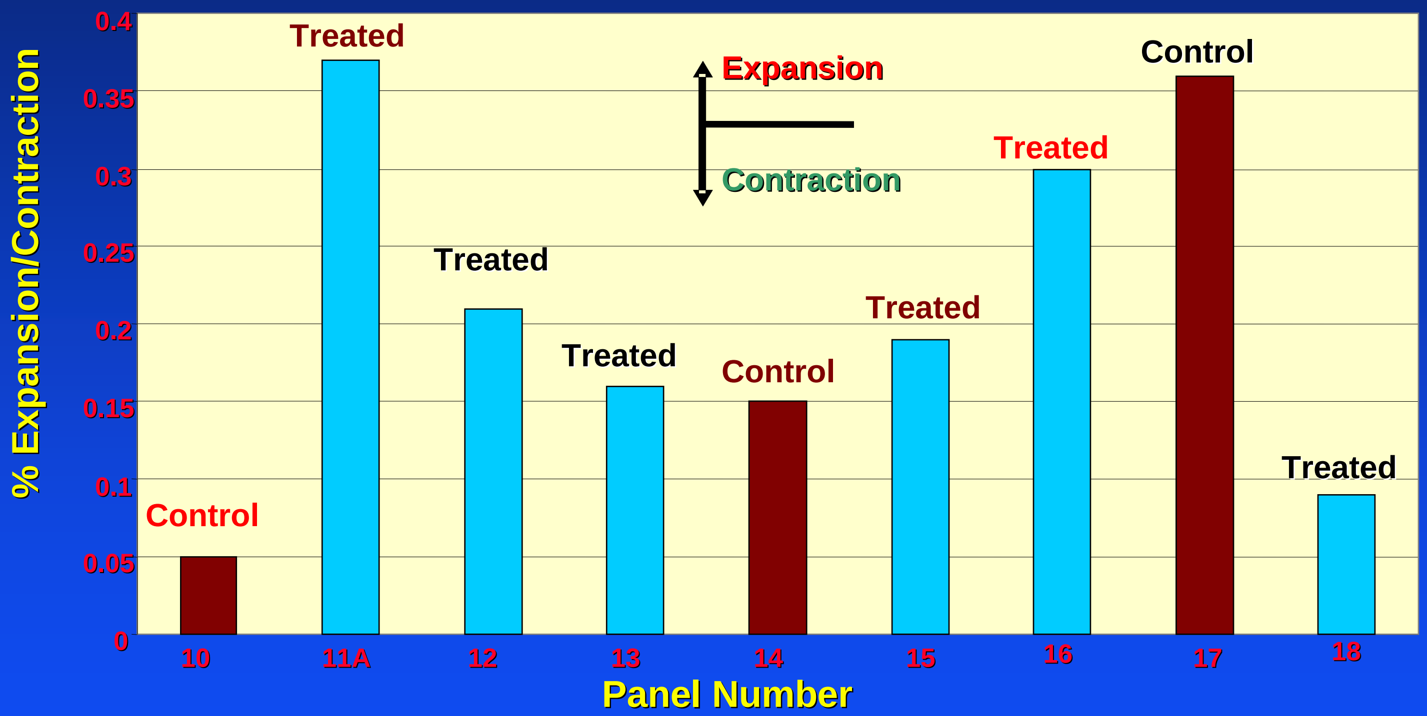
E-W Phase I Concrete



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N-S Phase II Concrete

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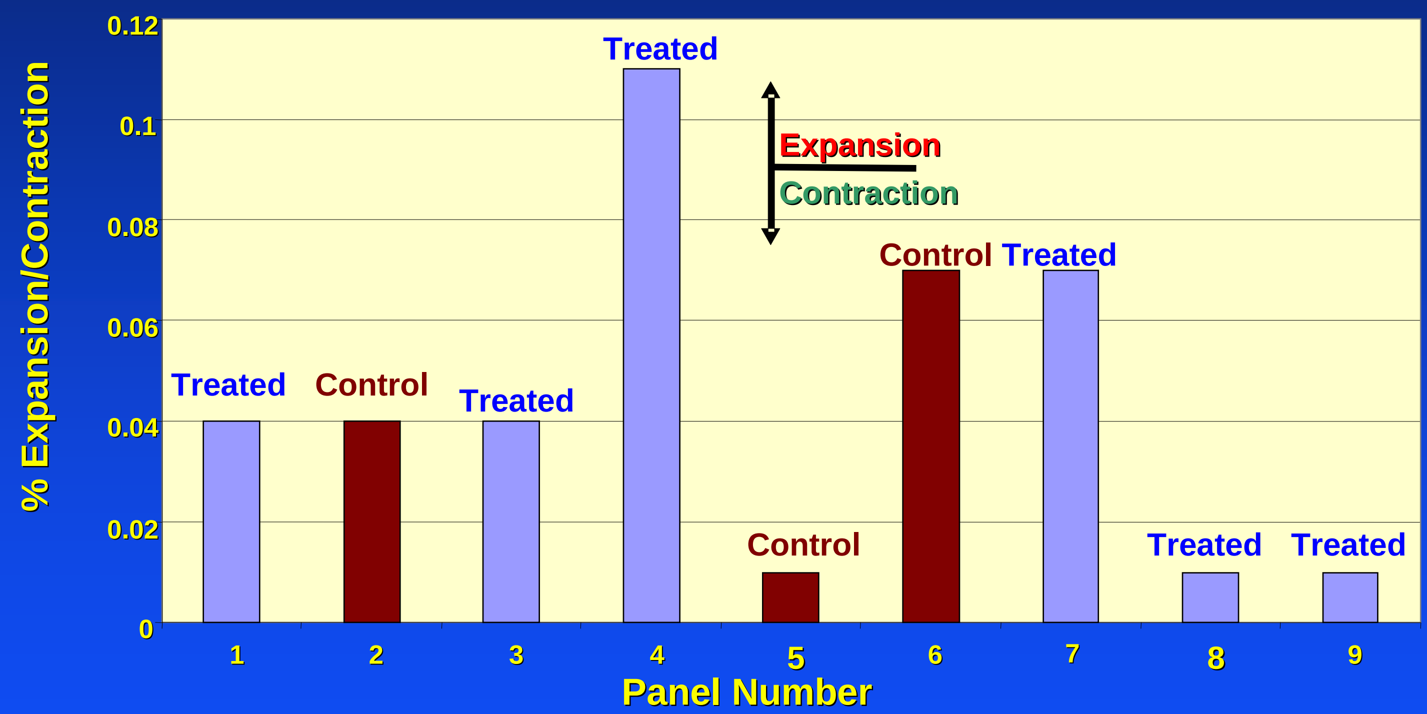

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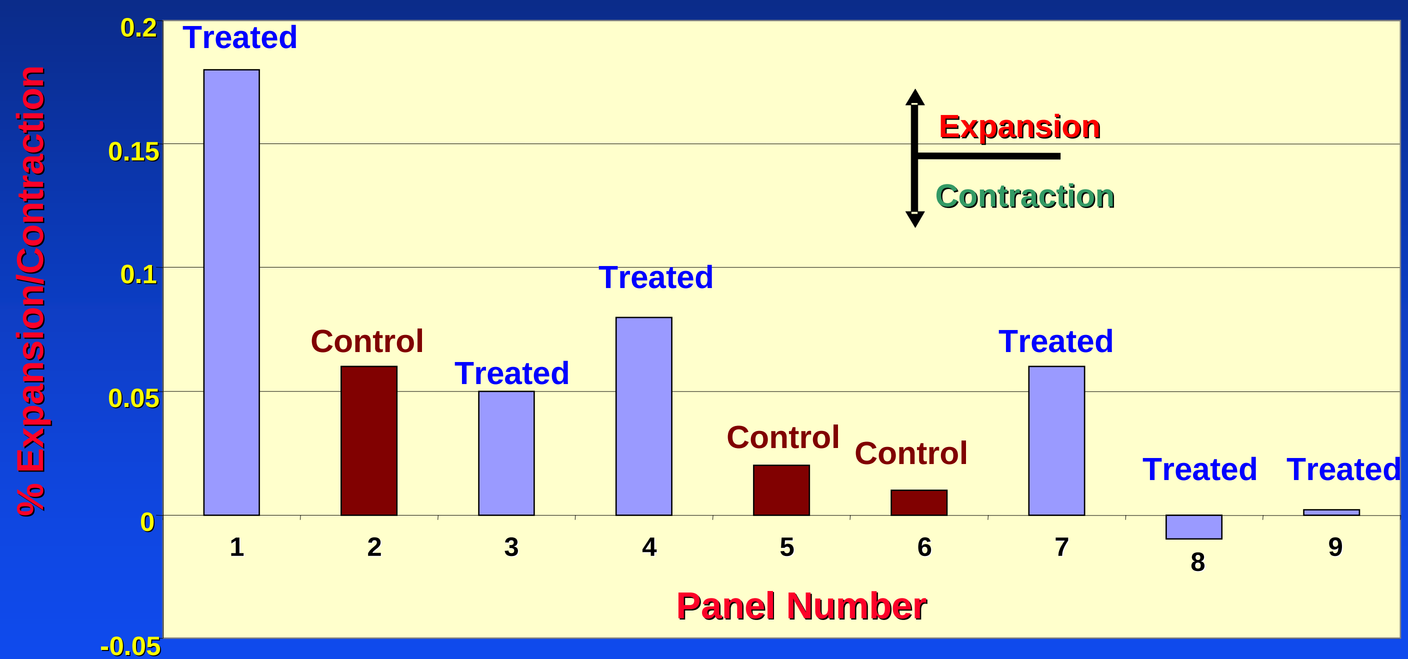
E-W Phase II Concrete



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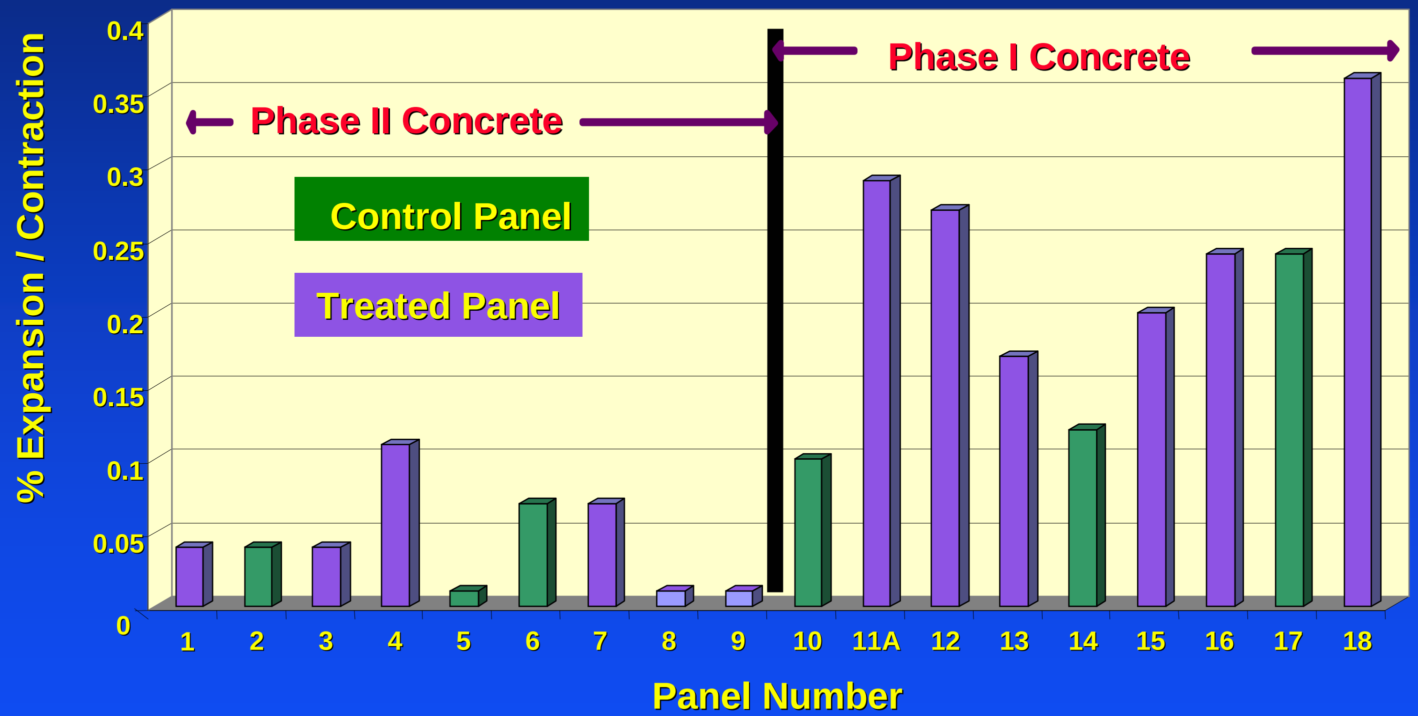
N-S Expansion / Contraction



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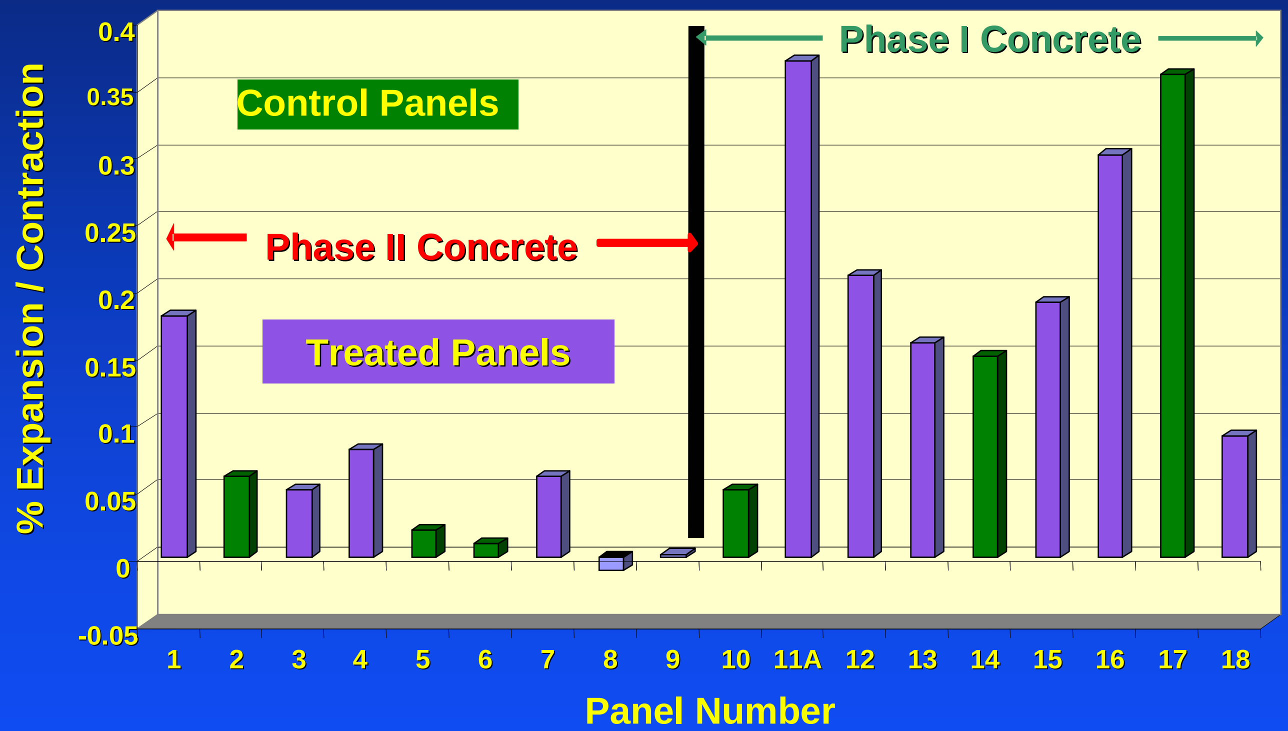
E-W Expansion / Contraction



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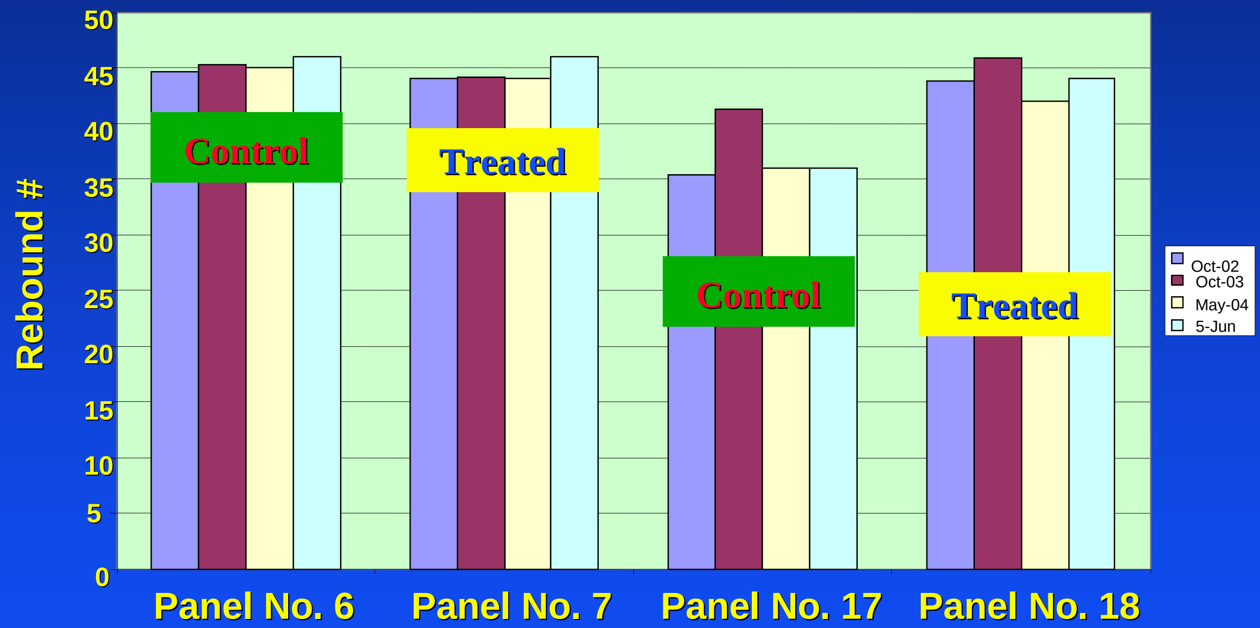
Schmidt Hammer Evaluation



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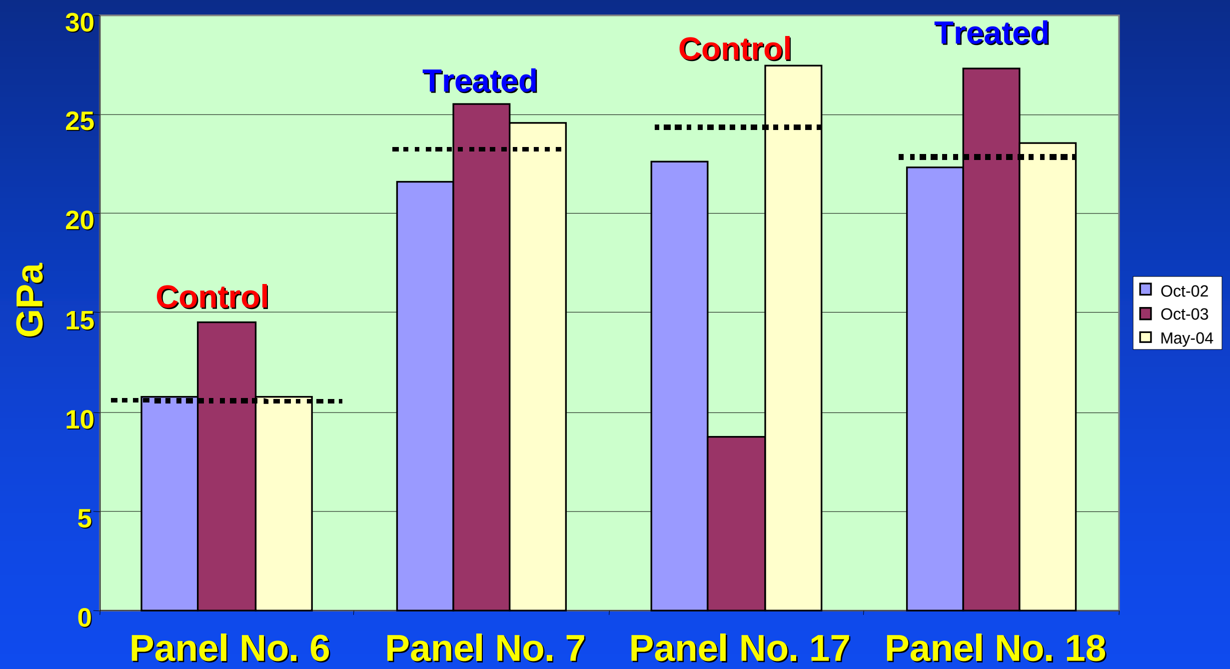
Impact Echo Evaluation



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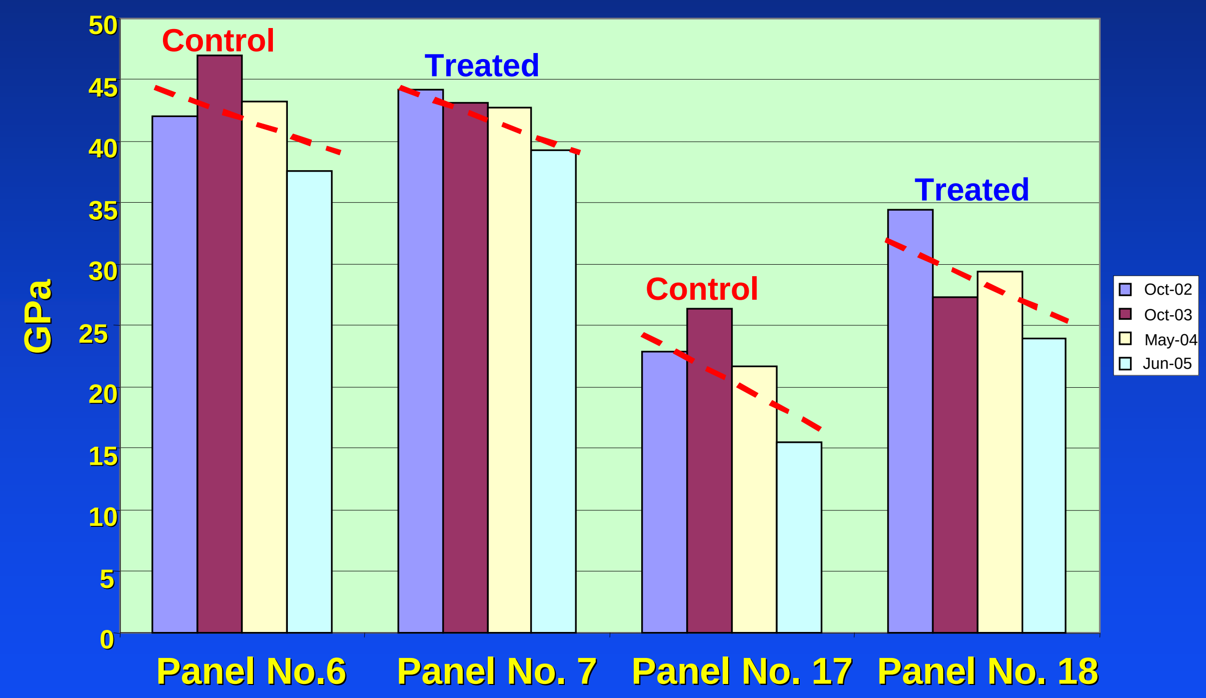
"V"- Meter Evaluation



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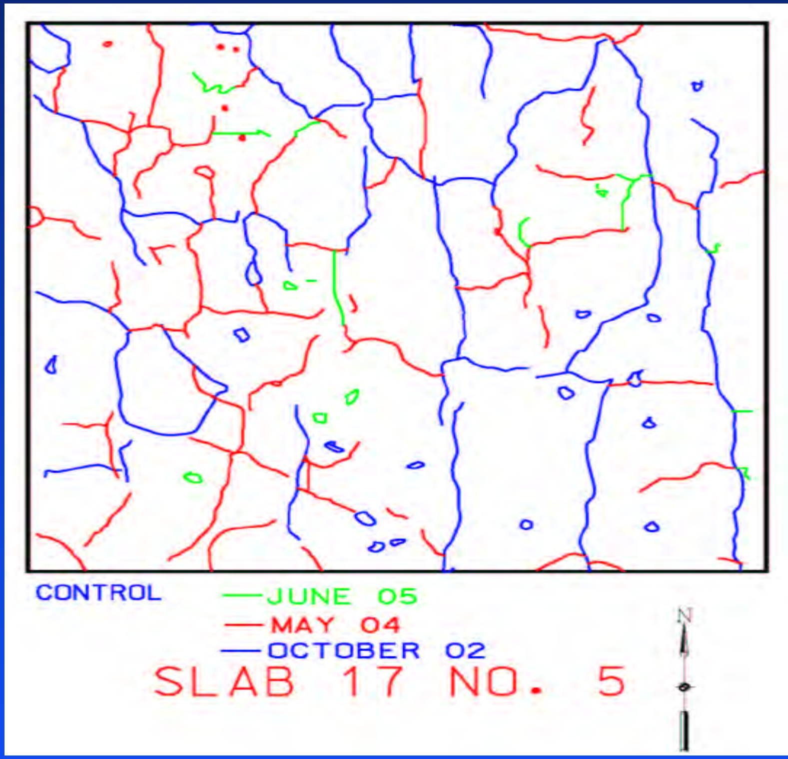
Map Cracking



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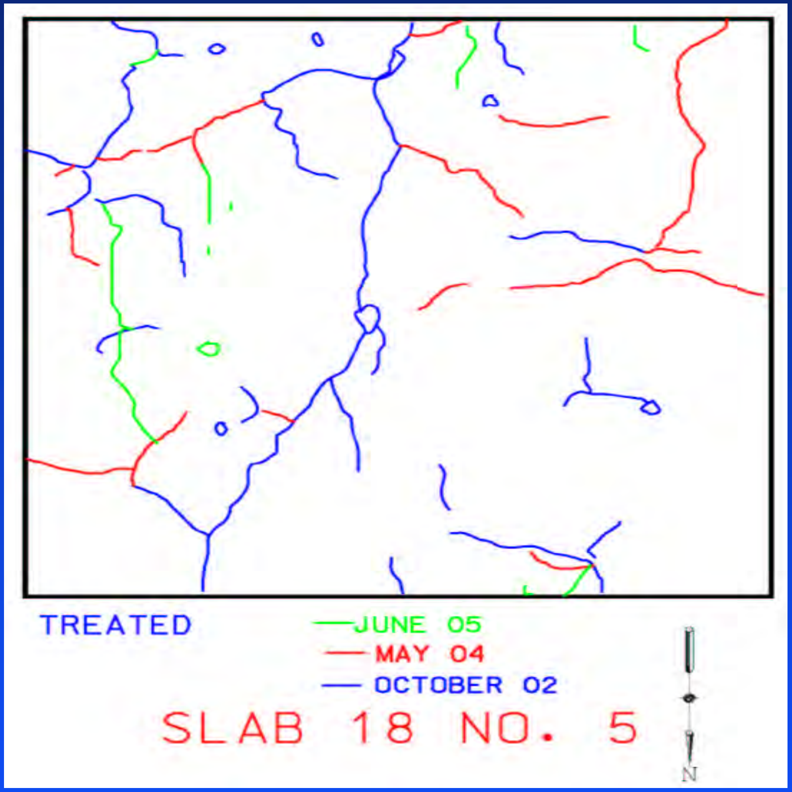
Map Cracking



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Questions ??

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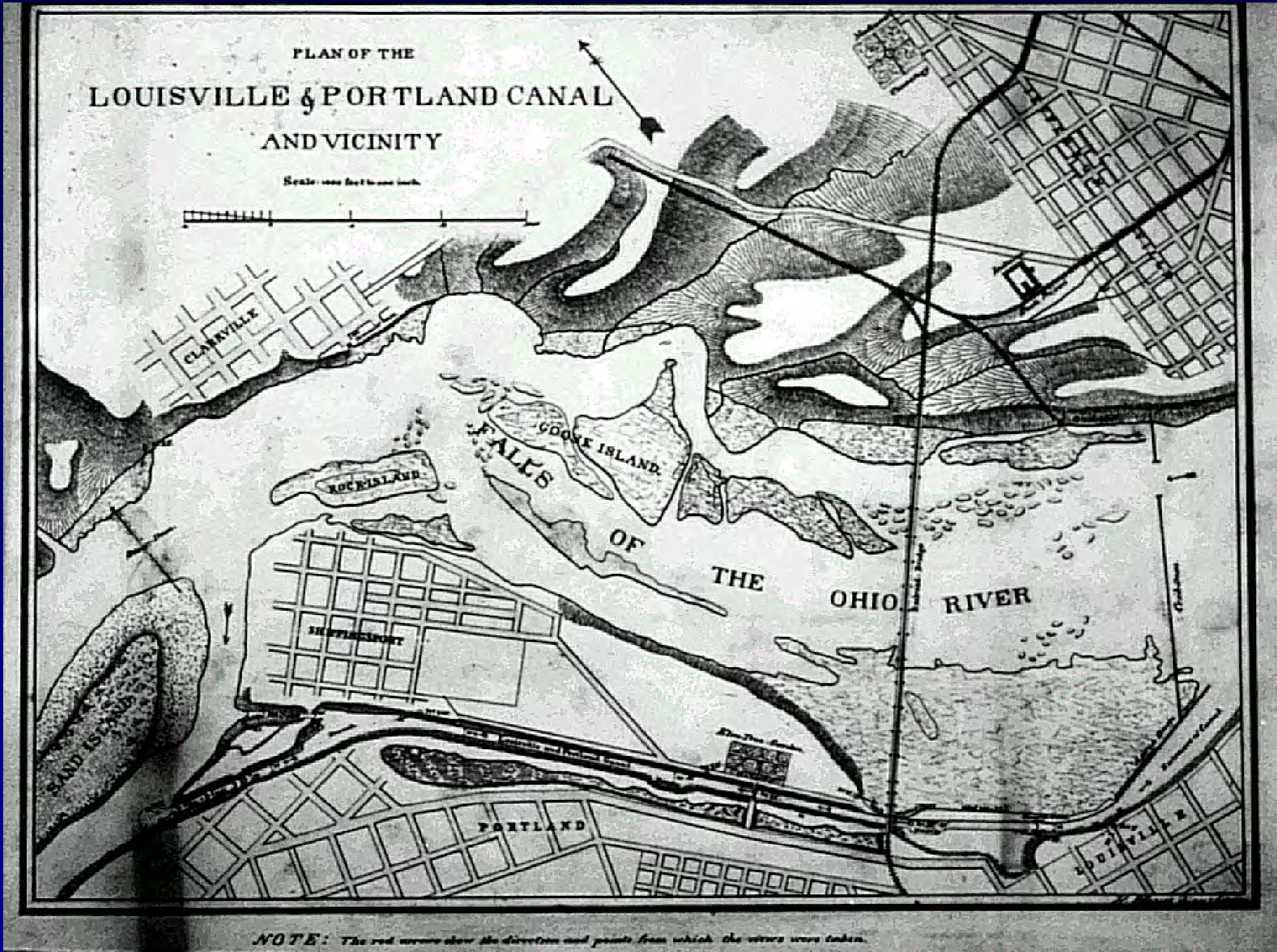
Louisville District

ROLLER COMPACTED CONCRETE FOR McALPINE LOCK REPLACEMENT:

BY

DAVID E. KIEFER P.E.


PLAN OF THE
LOUISVILLE & PORTLAND CANAL
AND VICINITY
CLARKVILLE
ROCK ISLAND
GOOSE ISLAND
FALLS
OF
THE
OHIO RIVER
SHIPPINGPORT
SAND ISLAND
PORTLAND
LOUISVILLE
NOTE: The red arrows show the direction and points from which the views were taken.

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CONSTRUCTION OF 360' 2-STAGE LOCK, 1870

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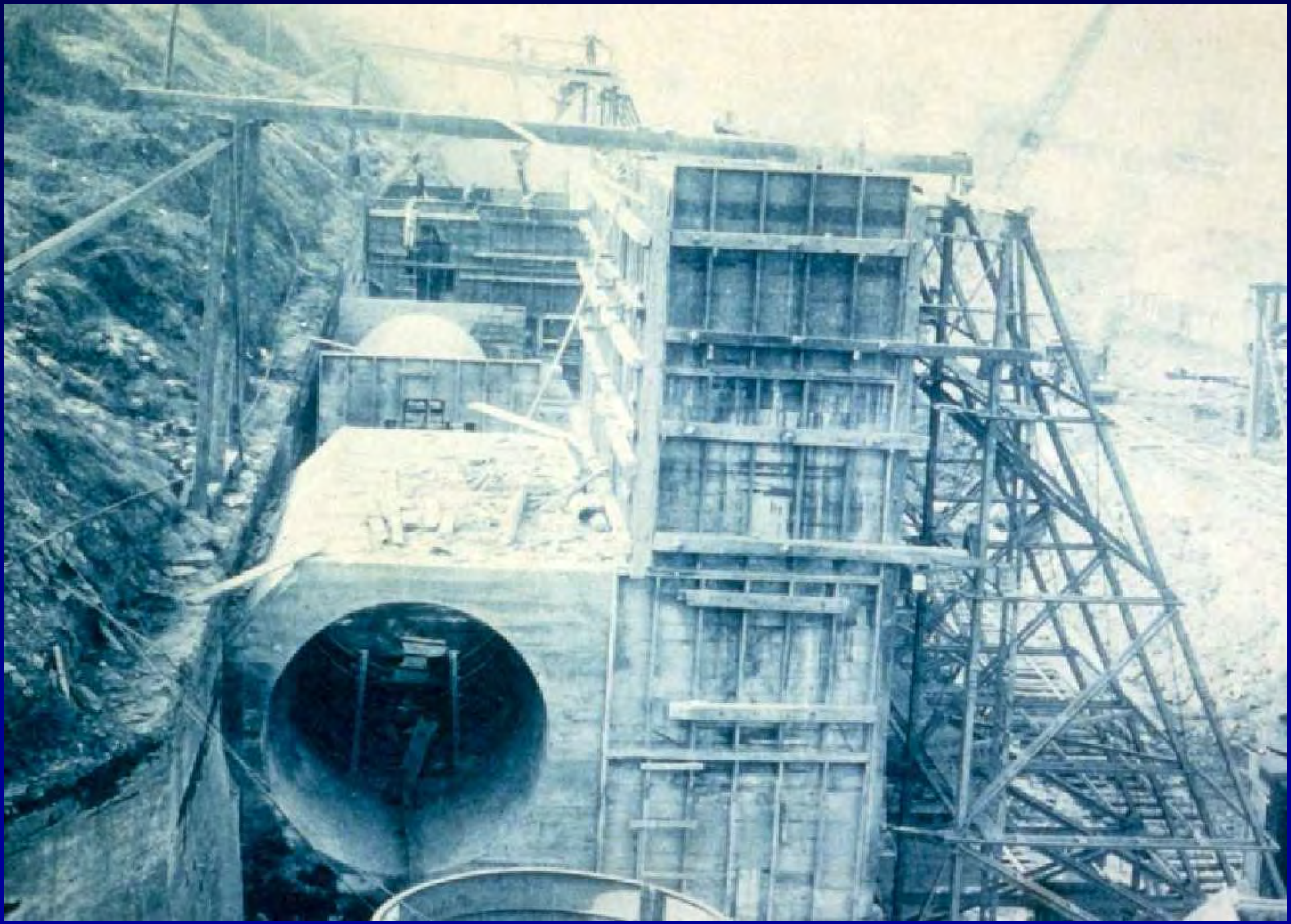
CONSTRUCTION OF 600' LOCK, 1900



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CONSTRUCTION OF EXISTING 1200' LOCK, 1960

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McALPINE LOCK REPLACEMENT PROJECT

*360’ lock deactivated due to miter gate failure

*600’ lock used only as back-up (slow and unreliable)

*New 1200’ lock will add capacity and reliability

*New lock will be located south of existing 1200’ lock

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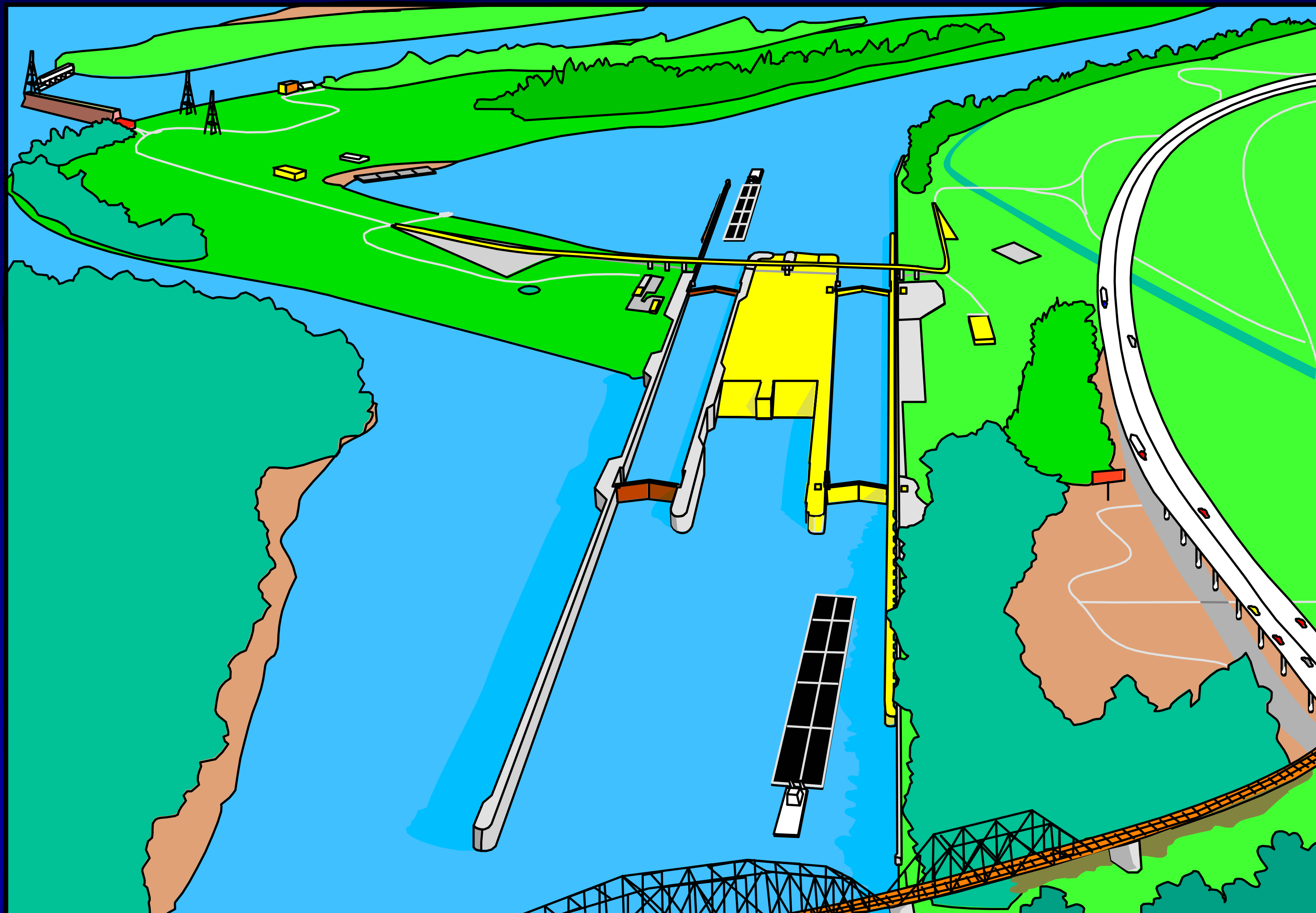
NEW 1200' LOCK



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Downstream Cell Construction

Downstream Cofferdam Cells

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Upstream Cofferdam Cells

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Demolition and Foundation Excavation

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ENGINEERING AND DESIGN OF NEW LOCK

*Evaluate Alternative/Innovative Emptying and Filling Systems

*Evaluate Alternative Lock Wall Designs

*Perform Hydraulic Model Studies

*Select Best Alternative for Hydraulic and Wall Construction Considerations.

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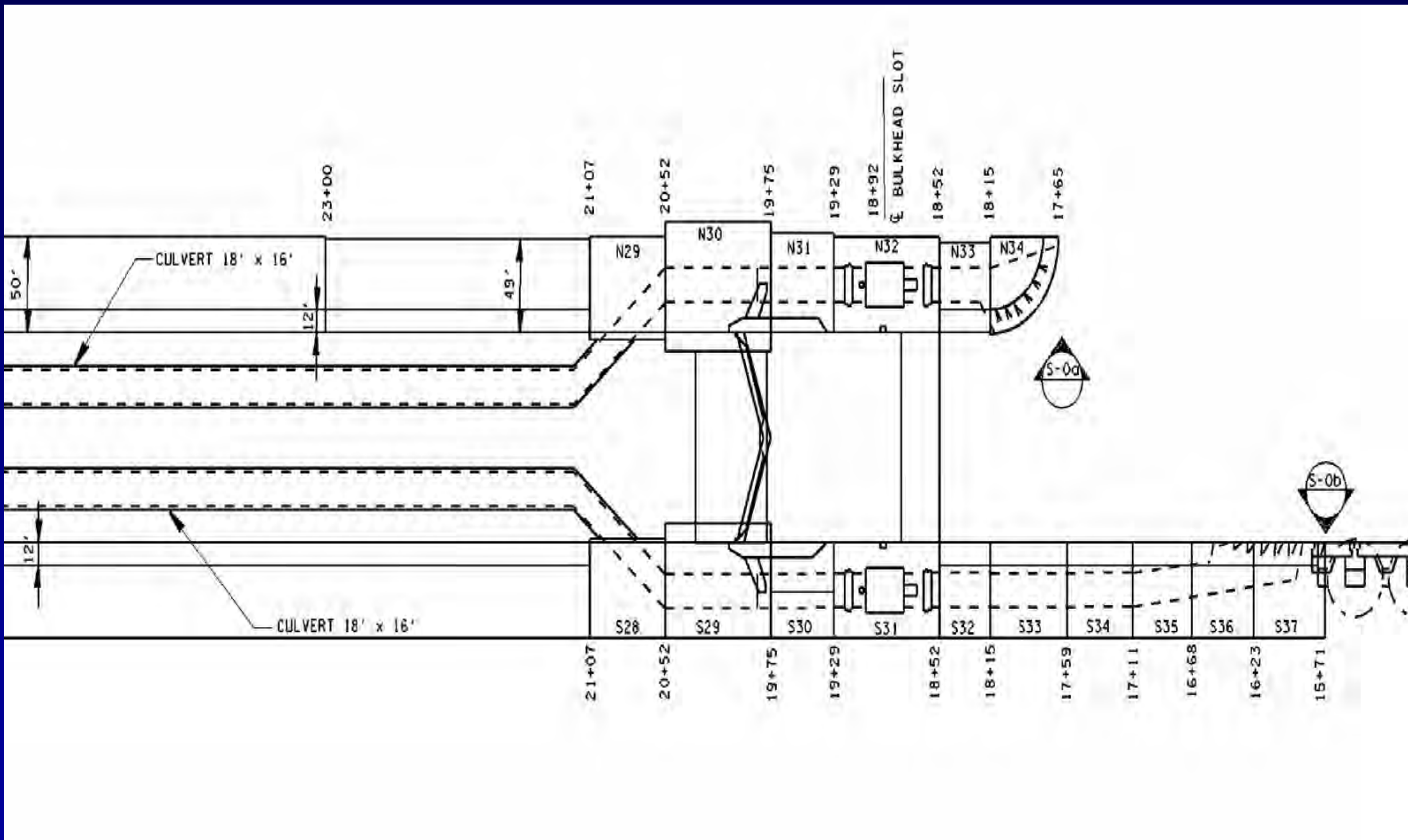
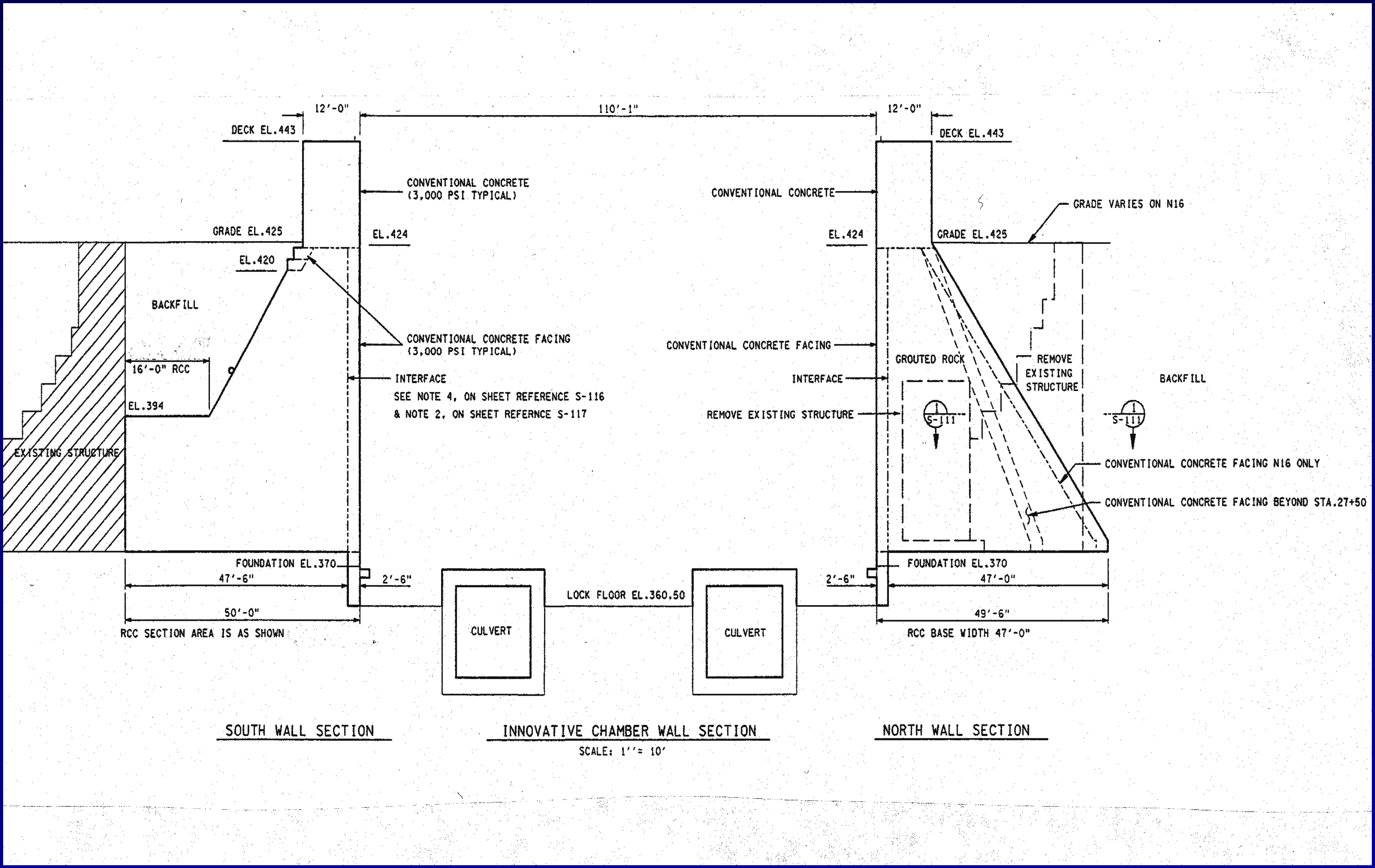
CONVENTIONAL INTAKE SYSTEM W/LOCK FLOOR CULVERTS



NEW 1200' LOCK CROSS SECTION



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LOCK WALL OPTIONS

* Thin-wall design with tie-back anchors

* Reinforced Earth type wall

* Thin-wall design with deadmen

* Grouted Stone Fill

* Roller Compacted Concrete (RCC) Selected as Preferred Option

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ROLLER COMPACTED CONCRETE

* ACI 207; Concrete of no-slump consistency in its unhardened state that is transported, placed, and compacted using earth and rockfill construction equipment.

* A well graded aggregate mixture with a little bit of cement, fly ash and water thrown in for good measure.

* Looks like a pile of wet rock.

* Work it like dirt/soil, core it like concrete.

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RCC CONSTRUCTION

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McALPINE
LOCK CONSTRUCTION

* 150,000 cubic yards rock excavation

* 400,000 cubic yards concrete

* Access Bridge: 42 drilled shafts,
6’ diameter, 45’ to 100’ long

* 165,000 cubic yards backfill

* Traylor Bros, Granite, Massman (TGM)

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CONCRETE MATERIALS FOR MASS AND RCC

* Crushed Limestone Coarse Aggregate, 2” NMSA

* Natural, River Dredged Fine Aggregate

* Class F Fly Ash

* Type II, max 80 cal/g cement

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BATCH PLANT

- Twin 6-yard Besser compulsory mixers
- ASTM #3 (2-inch) and #57 (1-inch) coarse aggregate.
- Coarse aggregate wet belt and liquid nitrogen for temperature control.
- 70 Degree (Mass) and 80 Degree (RCC) temperature requirements.

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BATCH PLANT

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BATCH PLANT

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WET-CHILL BELT

LIQUID NITROGEN

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TEST SECTION

- Constructed to demonstrate suitability of Contractor's equipment, methods and personnel.
- 50' long by 30' wide at top, (5) 1-foot lifts.
- Test section saw cut and inspected after placement for evaluation of RCC placement procedures.

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TEST SECTION

TEST SECTION

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TEST SECTION

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McALPINE
RCC CONSTRUCTION

RCC and conventional concrete transported from batch plant using Maxon Agitor trucks.

•Rotec creter-crane primarily used for concrete placement.

•Buckets and creter-crane used for RCC facing concrete

•Large and small rollers used for compaction

SOUTH LOCK WALL

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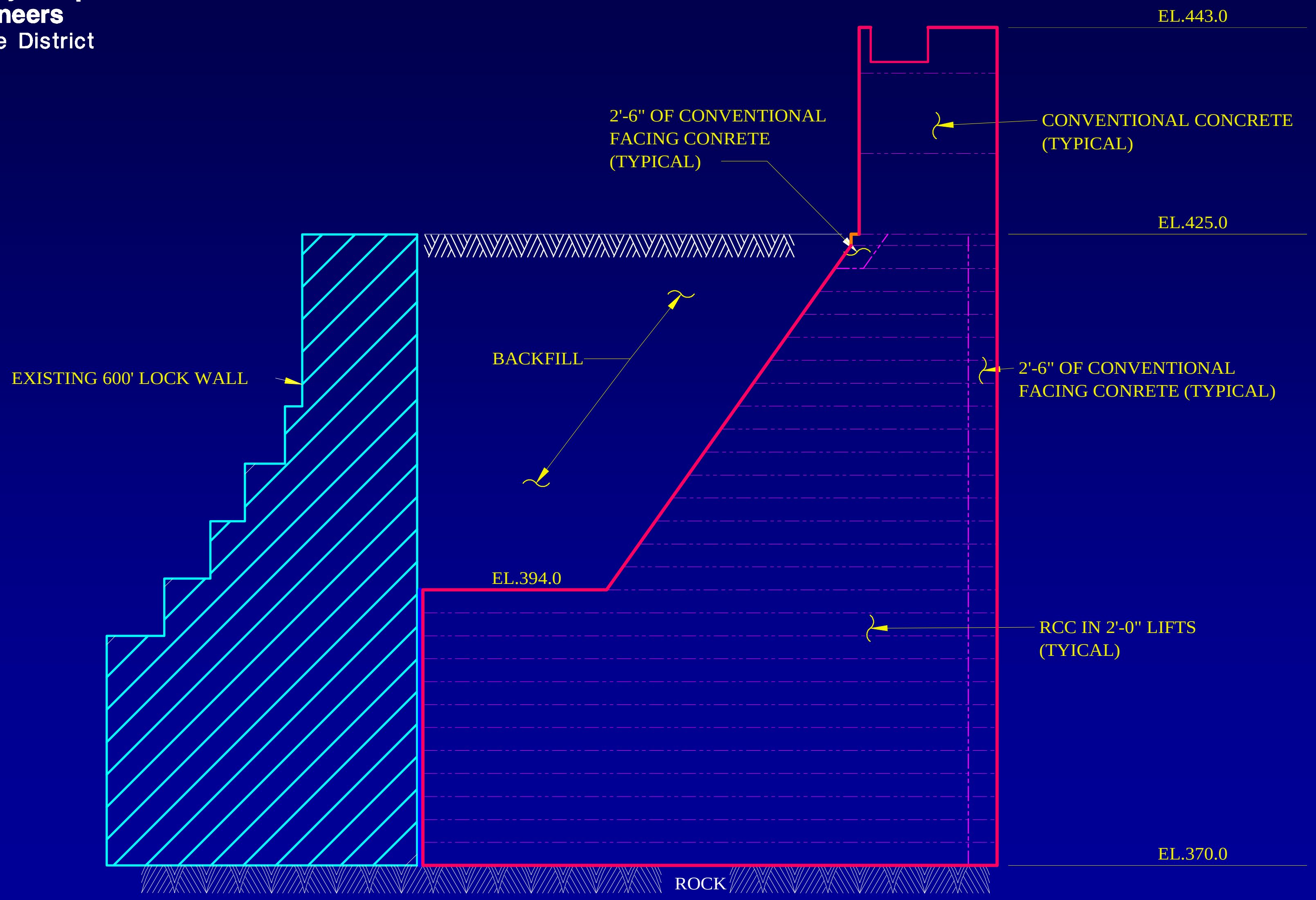

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RCC CONSTRUCTION

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RCC CONSTRUCTION

FACING CONCRETE

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BEDDING MORTAR

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CONSOLIDATION OF INTERFACE

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CONSOLIDATION OF INTERFACE

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PRIMARY ROLLER


CAT

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SECONDARY ROLLER


DEERE

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SEGREGATION

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QC – NUCLEAR DENSITY TESTING

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INSERTING MONOLITH JOINT

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SLOPING BACKFACE


CAT

LOCK WALL FACE

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MIX PROPORTIONS

	MASS	RCC
Cement	259	120
Fly Ash	187	156
Coarse Agg.	2350	2440
Fine Agg.	1070	1132
Water	187	174

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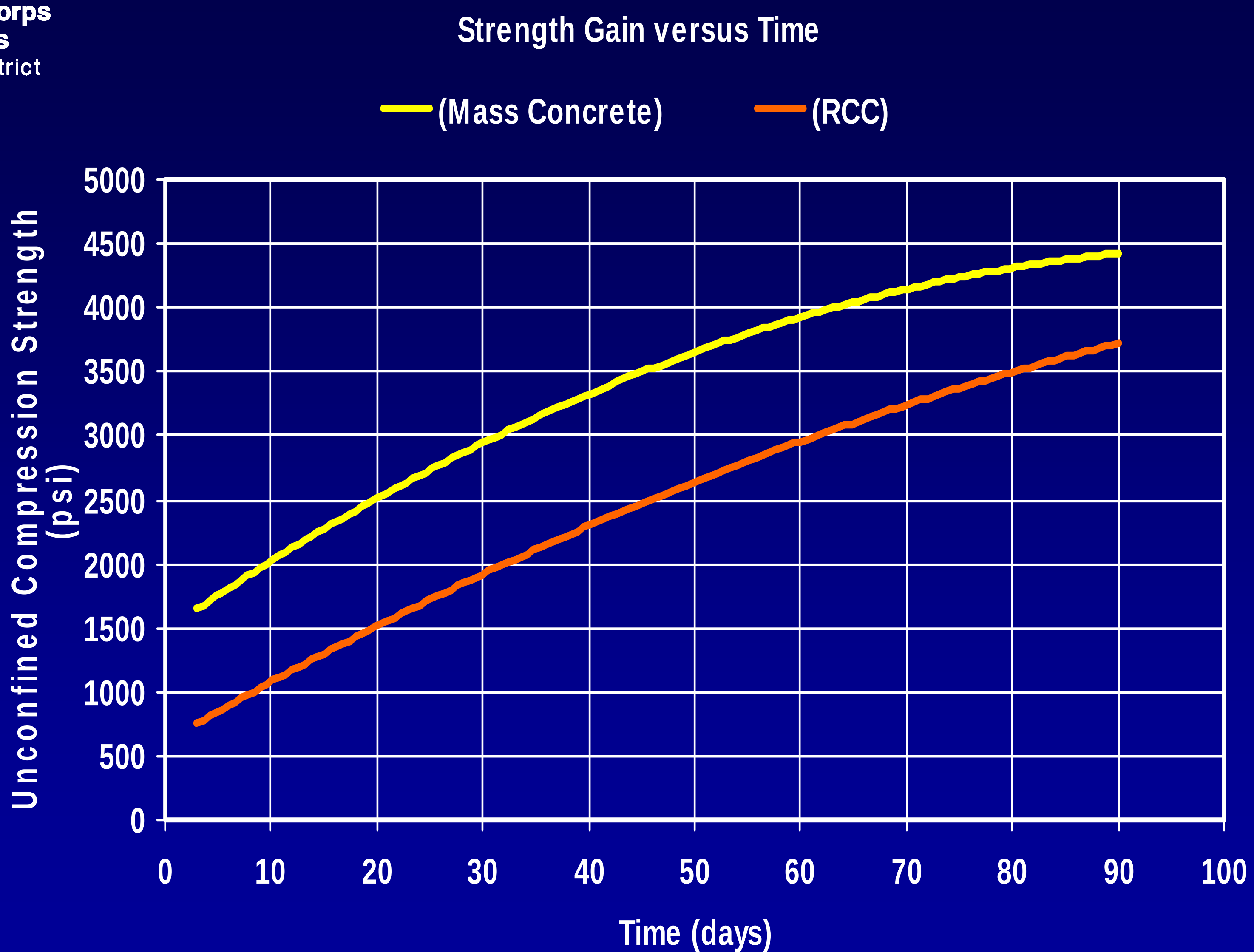

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JULY 2005


McAlpine Locks and Dam
Completed Project
2007

US Army Corps of Engineers
Louisville District

QUESTIONS ???

Using Cement to Reclaim Asphalt Pavements

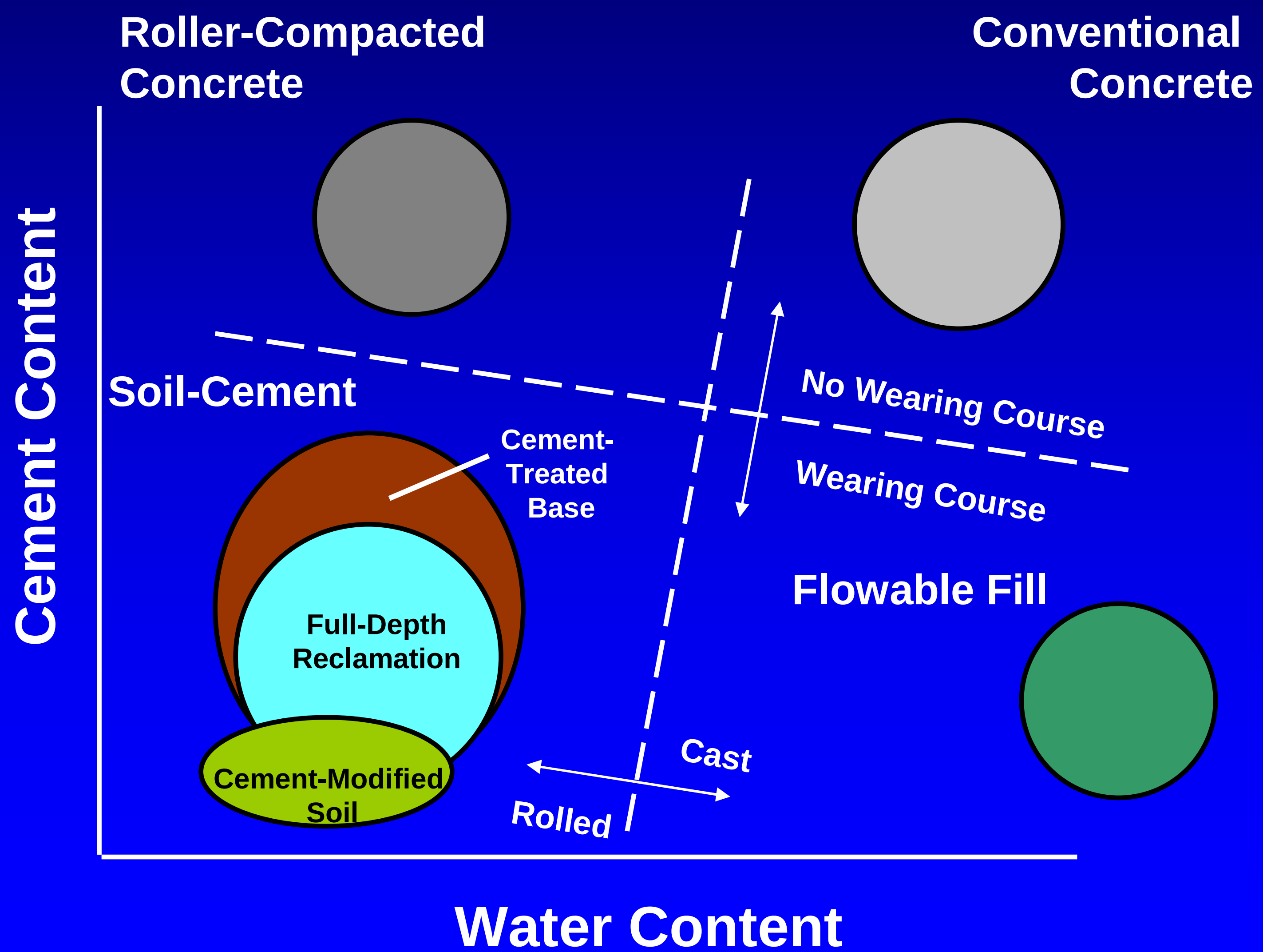
David R. Luhr PhD PE
Pavements Program Manager
Portland Cement Association
(919) 462-0840

What is Cement Stabilization?

- Mixture of portland cement, soil/aggregate and water

- Pulverized, mixed, compacted to high density

Cement-Based Pavement Materials



Full-Depth Reclamation (FDR)

- Pulverization and recycling of asphalt and base
- Utilizes existing materials
- Fast and convenient
- Eliminates new base
- Environmentally friendly

Pavement Distress

Alligator Cracking

Base Failure

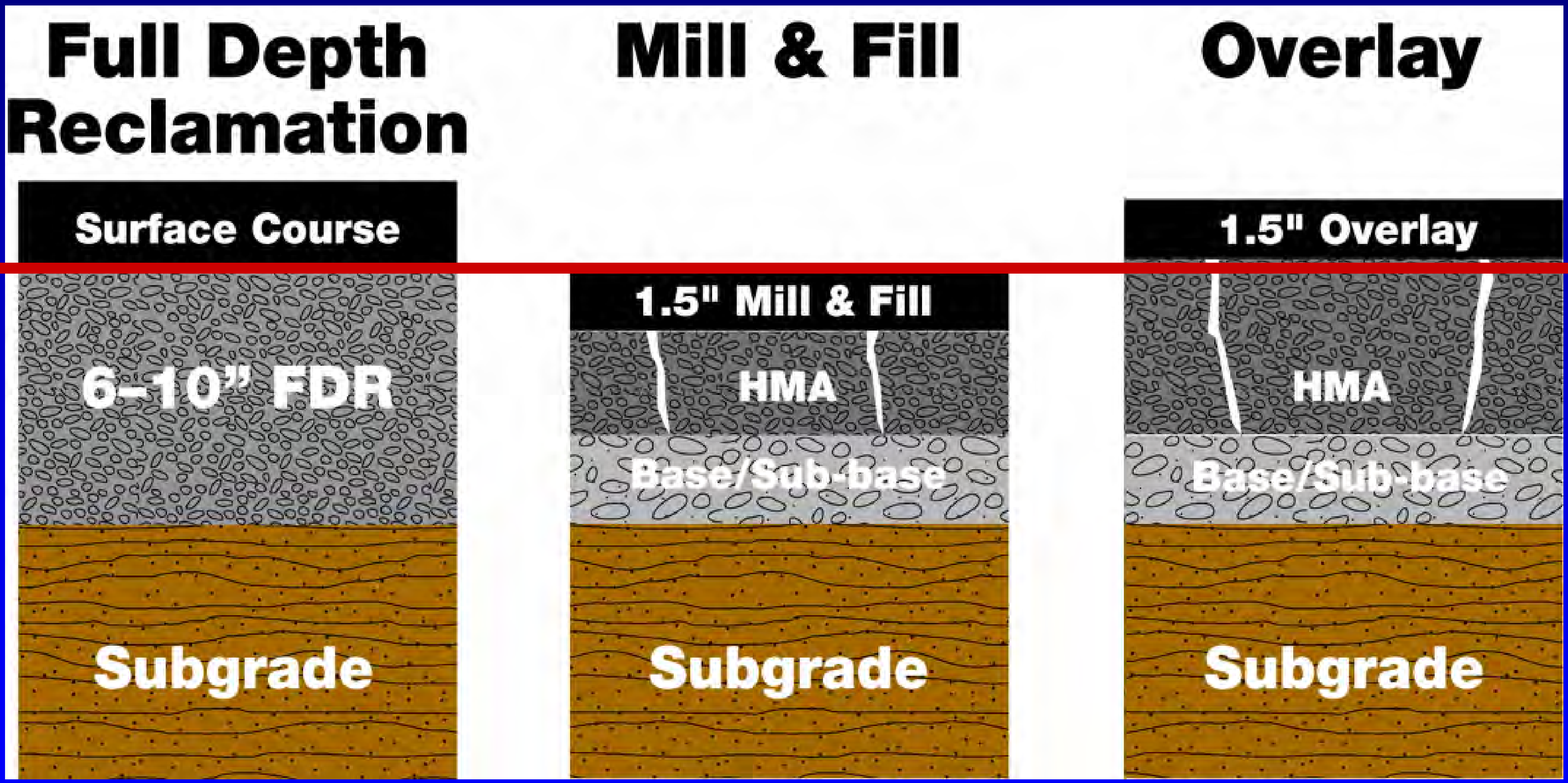
Pavement Distress

Excessive Patching

Advantages of FDR

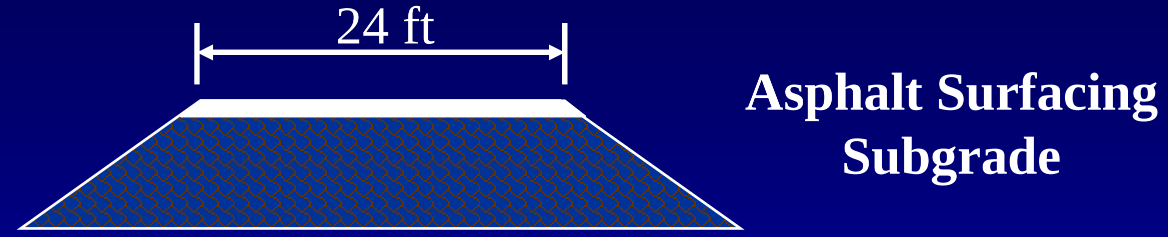
- Use of in-situ materials
- Little or no material hauled off and dumped
- Conserves virgin material
- Saves cost by using in-place “investment”
- Saves energy by reducing mining, hauls

Benefits

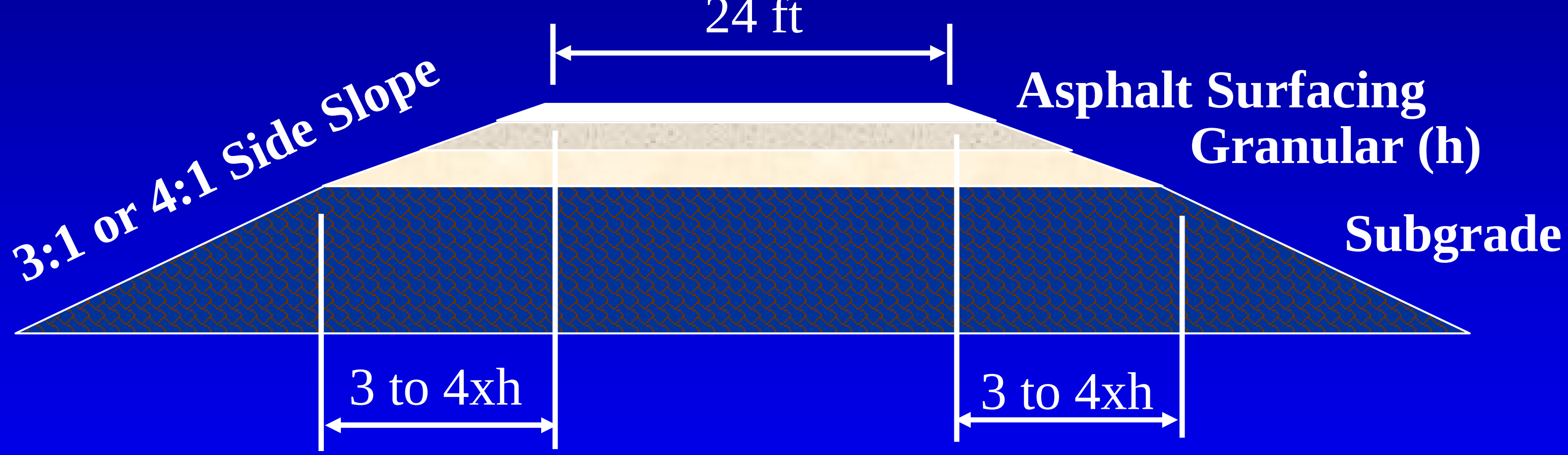


Full Depth Reclamation
Mill & Fill
Overlay
Surface Course
6–10" FDR
Subgrade
1.5" Mill & Fill
HMA
Base/Sub-base
Subgrade
1.5" Overlay
HMA
Base/Sub-base
Subgrade

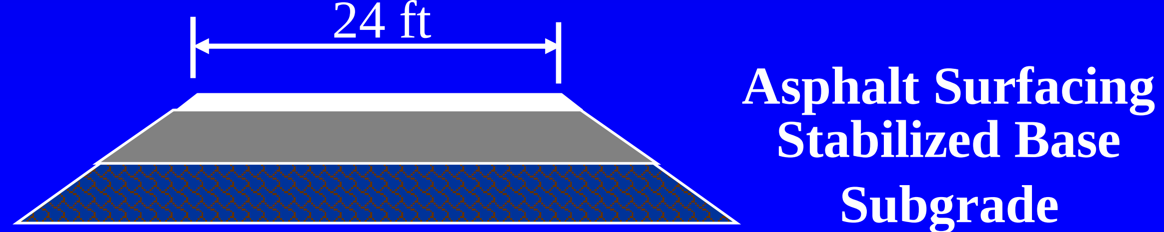
Existing Thin Paved Structure



Conventional Build Up Granular Structure



Full-Depth Recycled Structure



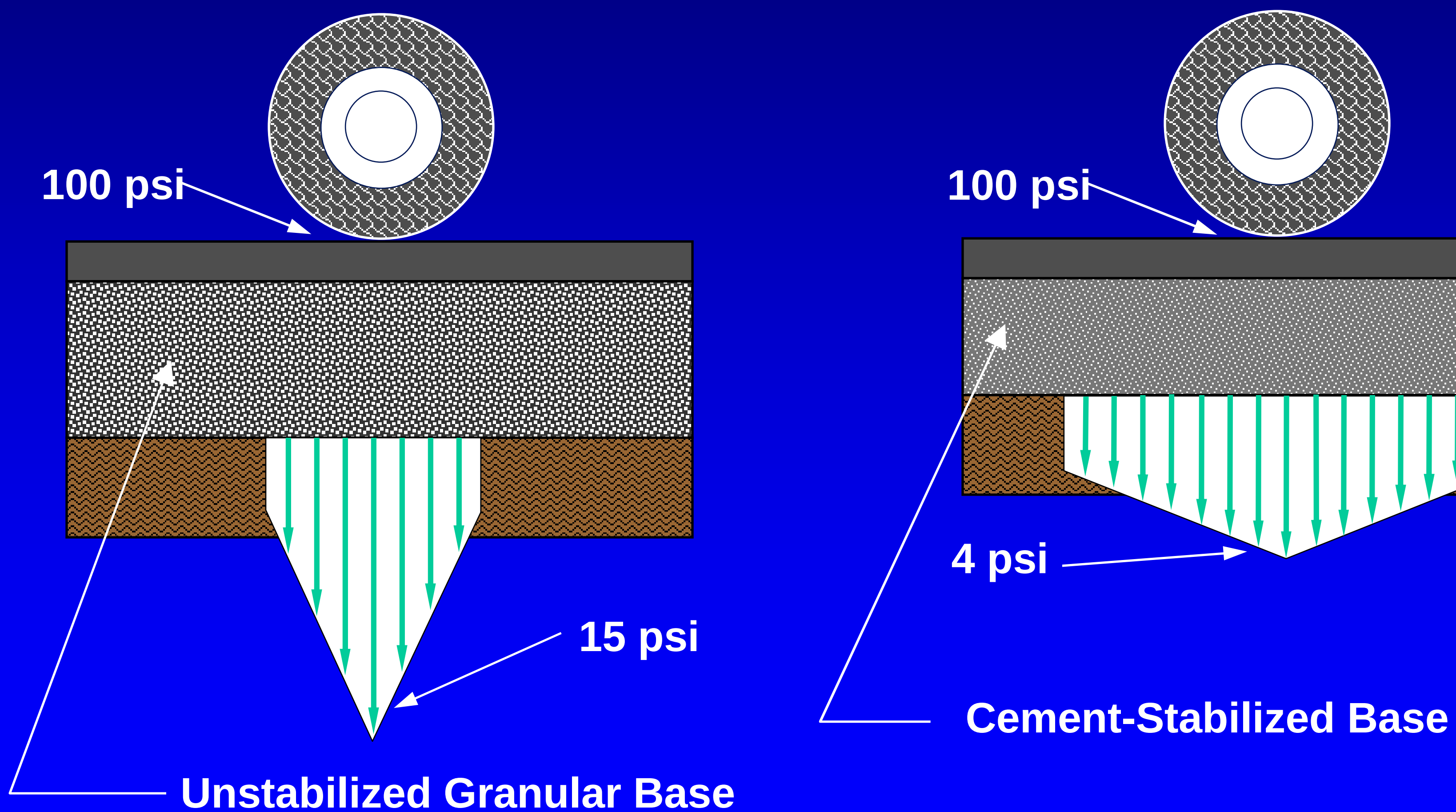
Cement Stabilization History

- 70 years of successful pavements
- Diverse geographic areas (Texas, Florida, California, Montana, Michigan, Canada)
- Wide variety of soil types
  - Gravels
  - Sands
  - Silts
  - Clays

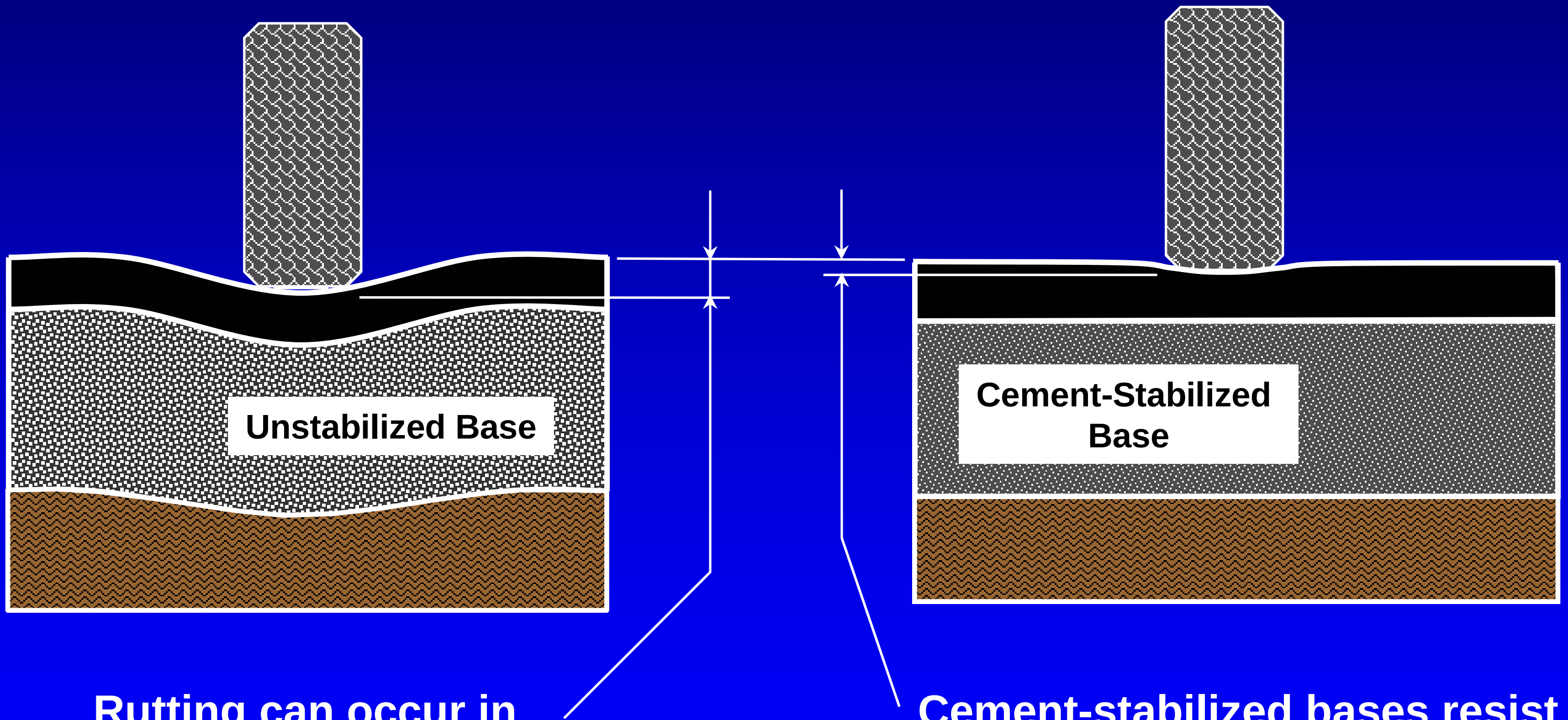
“Portland Cement is probably the closest thing we have to a universal stabilizer.”

From U.S. Army Corps of Engineers report “Chemical Stabilization Technology for Cold Weather”, Sept. 2002

Increased Rigidity Spreads Loads



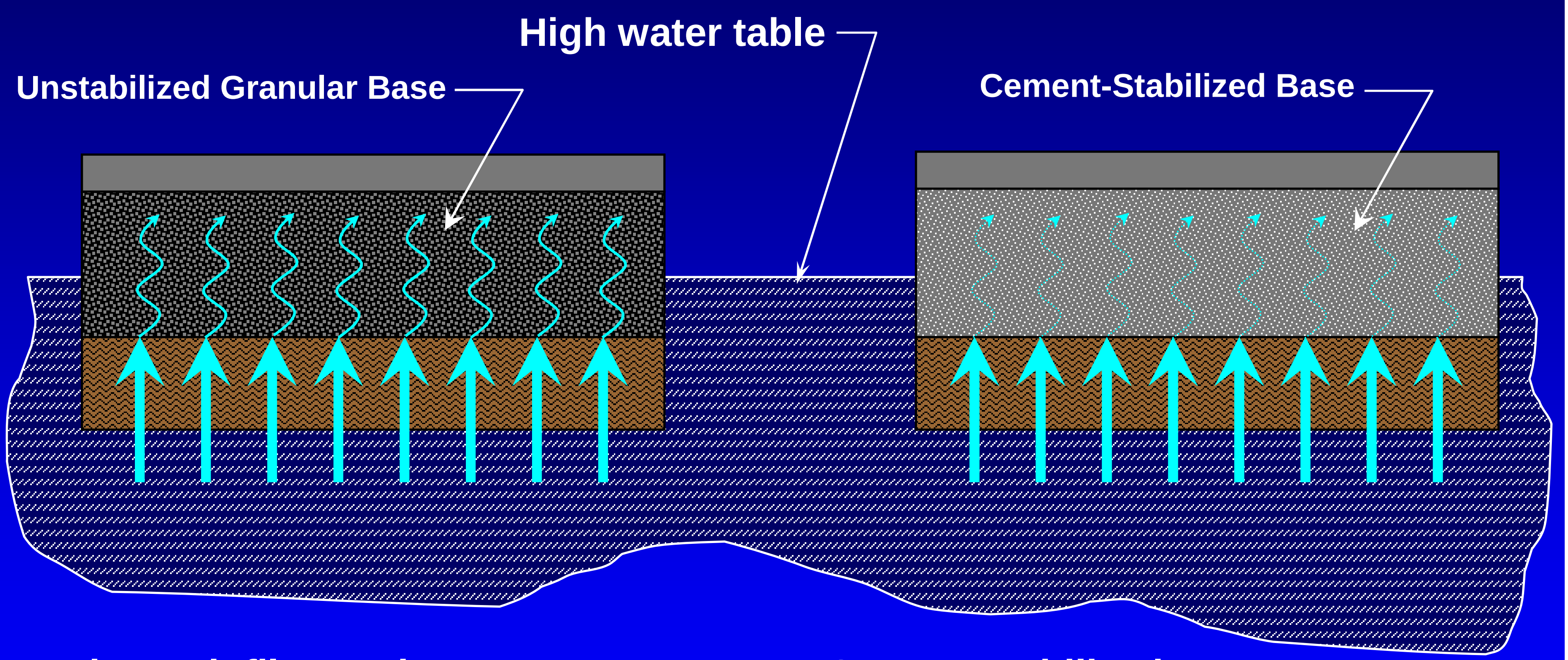
Eliminates Rutting Below Surface



Rutting can occur in surface, base and subgrade of unstabilized bases due to repeated wheel loading

Cement-stabilized bases resist consolidation and movement, thus virtually eliminating rutting in all layers but the asphalt surface.

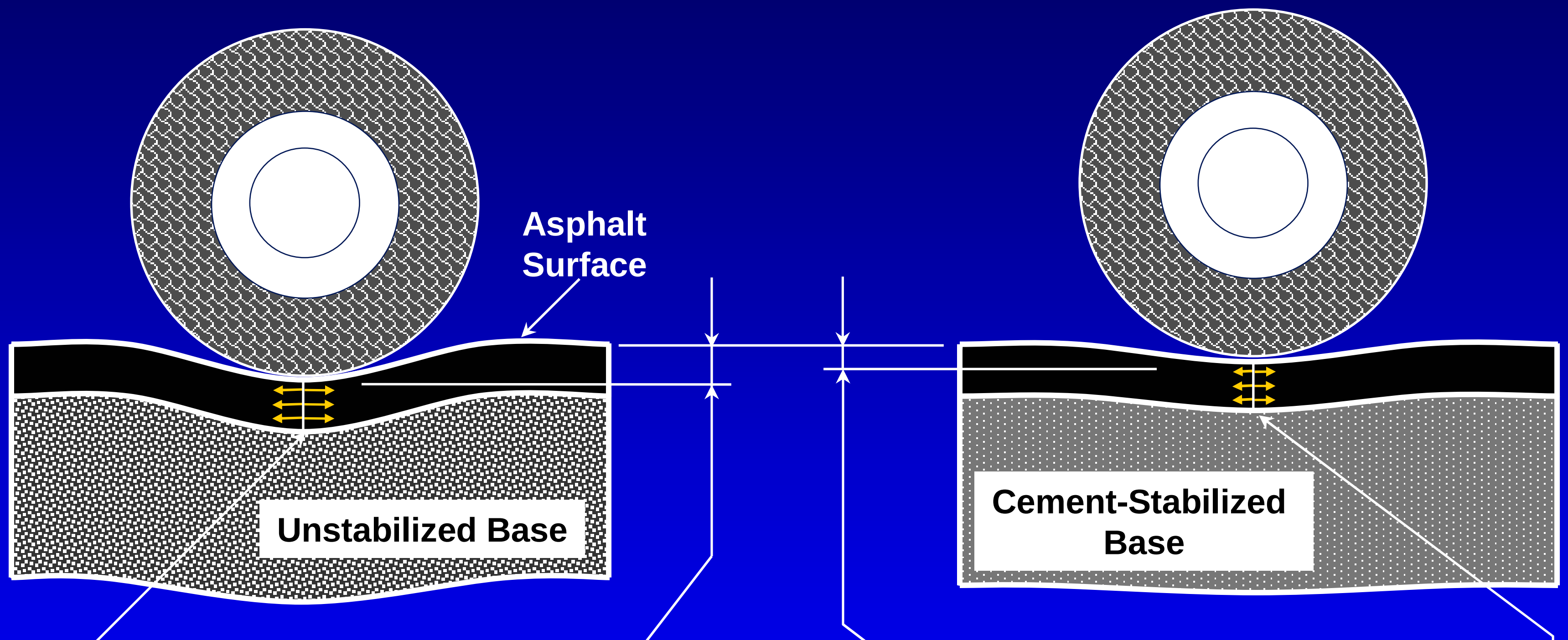
Reduced Moisture Susceptibility



Moisture infiltrates base
- Through high water table
- Capillary action
- Causing softening, lower strength, and reduced modulus

Cement stabilization:
- Reduces permeability
- Helps keep moisture out
- Maintains high level of strength and stiffness even when saturated

Reduced Fatigue Cracking



High deflection due to low base stiffness

Results in high surface strains and eventual fatigue cracking

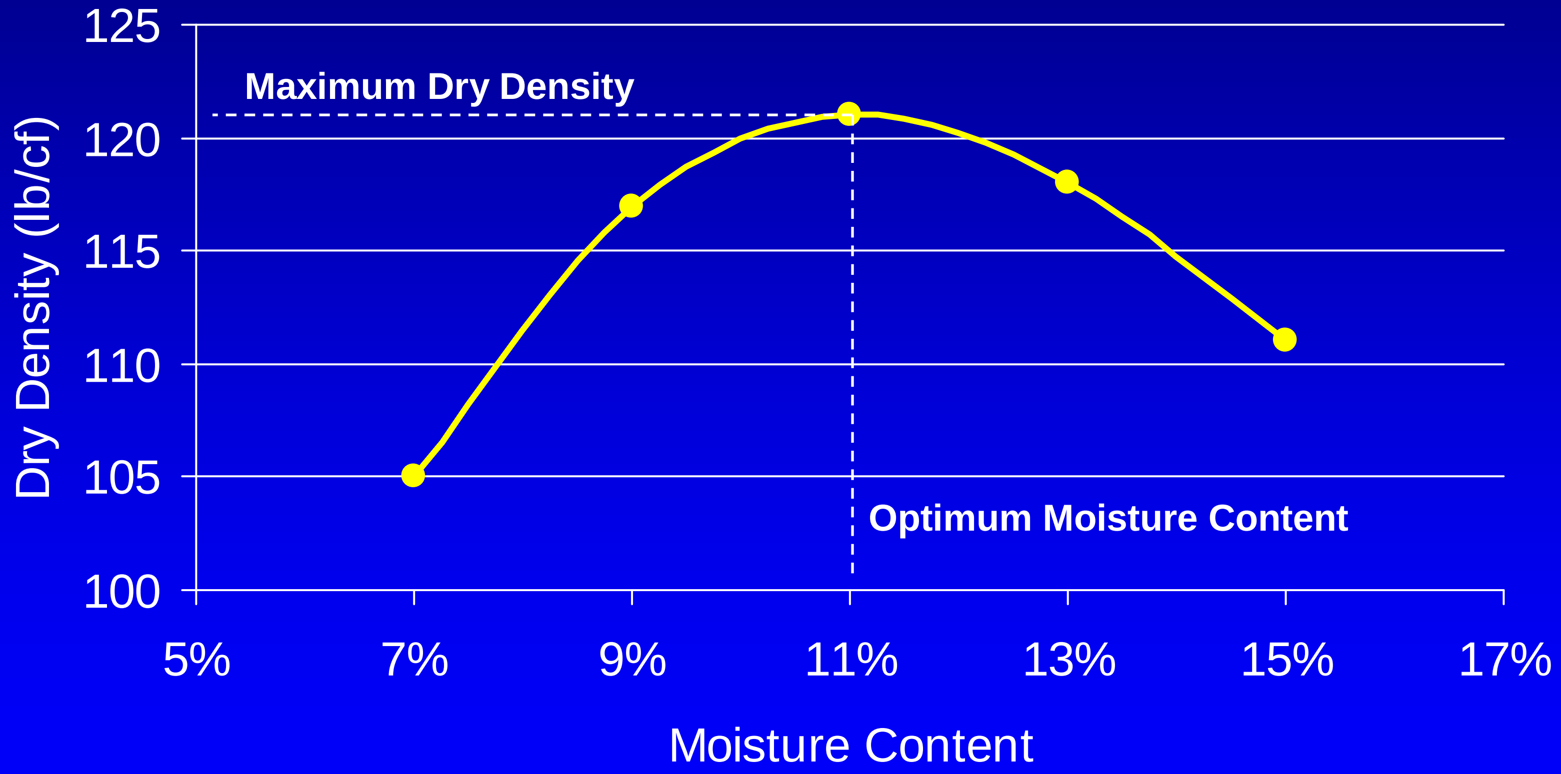
Higher stiffness of cement-stabilized base produces lower deflections

Resulting in lower surface strains and longer pavement life

FDR Engineering

- Evaluation of existing materials
- Design of stabilized mix
- Thickness design
- Construction procedures
- Quality control

Moisture/Density Relationship



ASTM D558

Unconfined Compressive Strength

Typical Recycled Base and Surface Thickness

Road Function	Typical Thickness	Recommended Surface
Residential	5 in	0.75 – 1.5 in
Secondary	8 in	1.5 – 2.5 in
Highway	10 in	2 – 3+ in

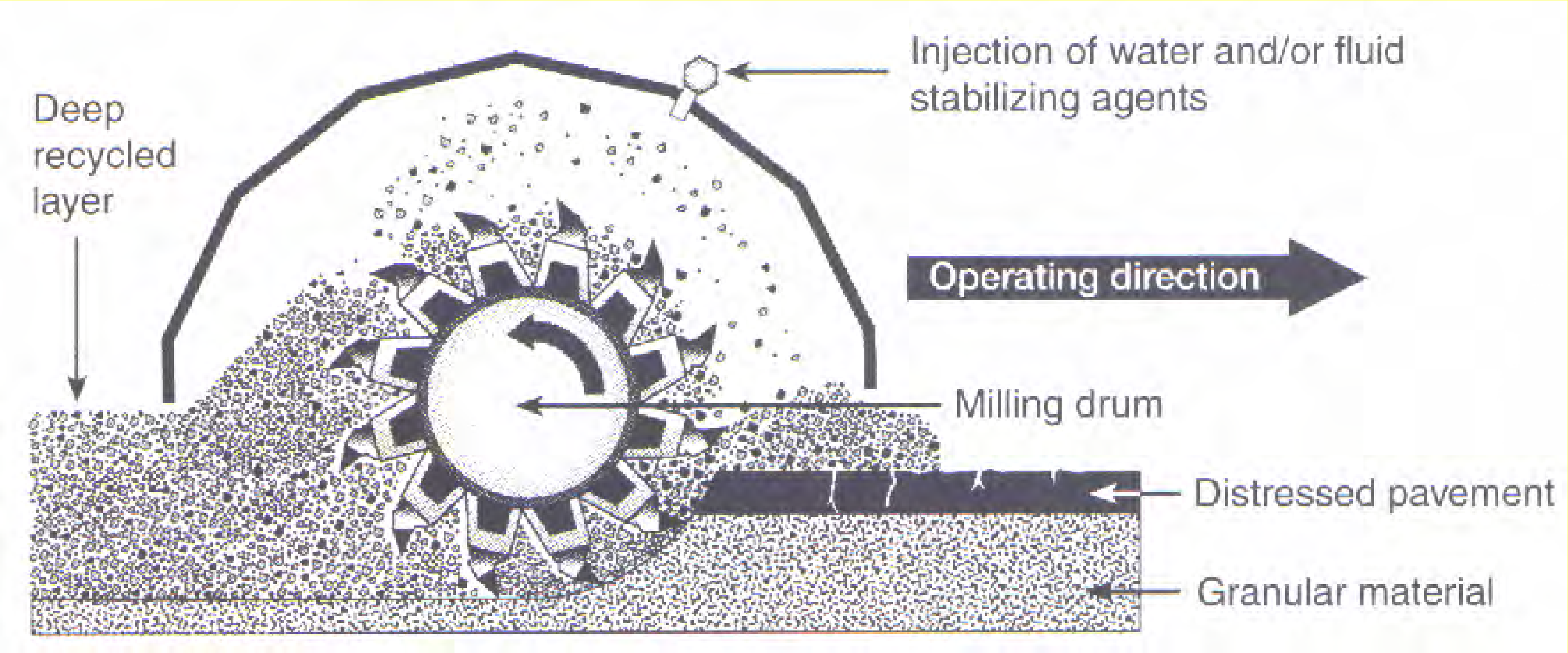
Recycling Process

- Simple process
  - Cement Spreader
  - Motor Grader
  - Pulverizer/reclaimer
  - Water truck
  - Roller/compactor
- Fast

Pulverization

- Pulverize mat to appropriate gradation
- Typically 1-2 passes

Inside a Reclaimer



Aggregate Adjustment

Cement Spreading

- Cement is spread on top in measured amount

Blending and Moisture Addition

- Cement is blended into pulverized, recycled material
- Water is added to optimum moisture

Grading

- Material is graded
- Excess removed

Excellent Time for Widening!!

Example:

Montgomery County, NY

Compaction

- Material is compacted
- 95% Proctor density minimum

Curing

Water

Prime Coat

Surfacing

- Surface course applied
  - Chip seal
  - Asphalt
  - Concrete

Thank You!

www.cement.org/pavements

pca

Portland Cement Association

USDA Forest Service

San Dimas Technology and Development Center

Unpaved Road Stabilization with Chlorides

Unpaved Road Stabilization with Chlorides

- 3 Year Project, FY 2002 - 2004
- Completion Date: 9/2004
- The goal of this project is to evaluate different chloride products, applied at different application rates, using different construction methods as stabilizing agents for aggregate surfaced roads.

Project Details

- 12 Project Sites
  - Each project site has 4 to 12 test sections, 800 feet long
  - Minimum of 2” of crushed aggregate surfacing
- 39 Treated Sections
  - 4 chloride products
    - Liquid Magnesium Chloride & Calcium Chloride
    - Solid Calcium Chloride, flakes and pellets
  - 2 chloride application rates, 1.5% and 2.0%
  - 2 different types of mixing, blade and tilling
  - Chloride mixed with the top 2” of surfacing
- 40 Untreated Sections
  - 18 normally bladed and 22 untreated control sections

Project Site Locations

Oregon	4 Projects
Washington	1 Projects
Idaho	4 Projects
Montana	3 Projects

Map of Project Area

Project Construction

- Construction on all 12 projects was completed by 7/15/2003
- Construction and materials cost (cost per mile for 22 foot wide road)
  - $8000 to $10000 per mile

Project Construction Sequence

- Road Preparation
- Chloride Application
- Mixing
- Quality Assurance
- Compaction
- Chloride Surface Application

Road Preparation - Watering

Road Preparation - Blading and Shaping

Chloride Application - Dry Product

Chloride Application - Liquid Product

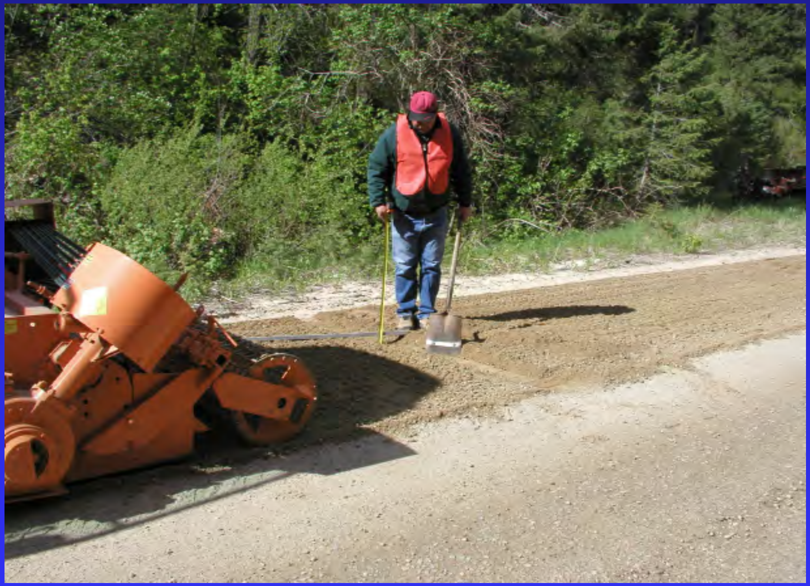
Tiller Mixing Dry Chloride

Blade Mixing Dry Chloride

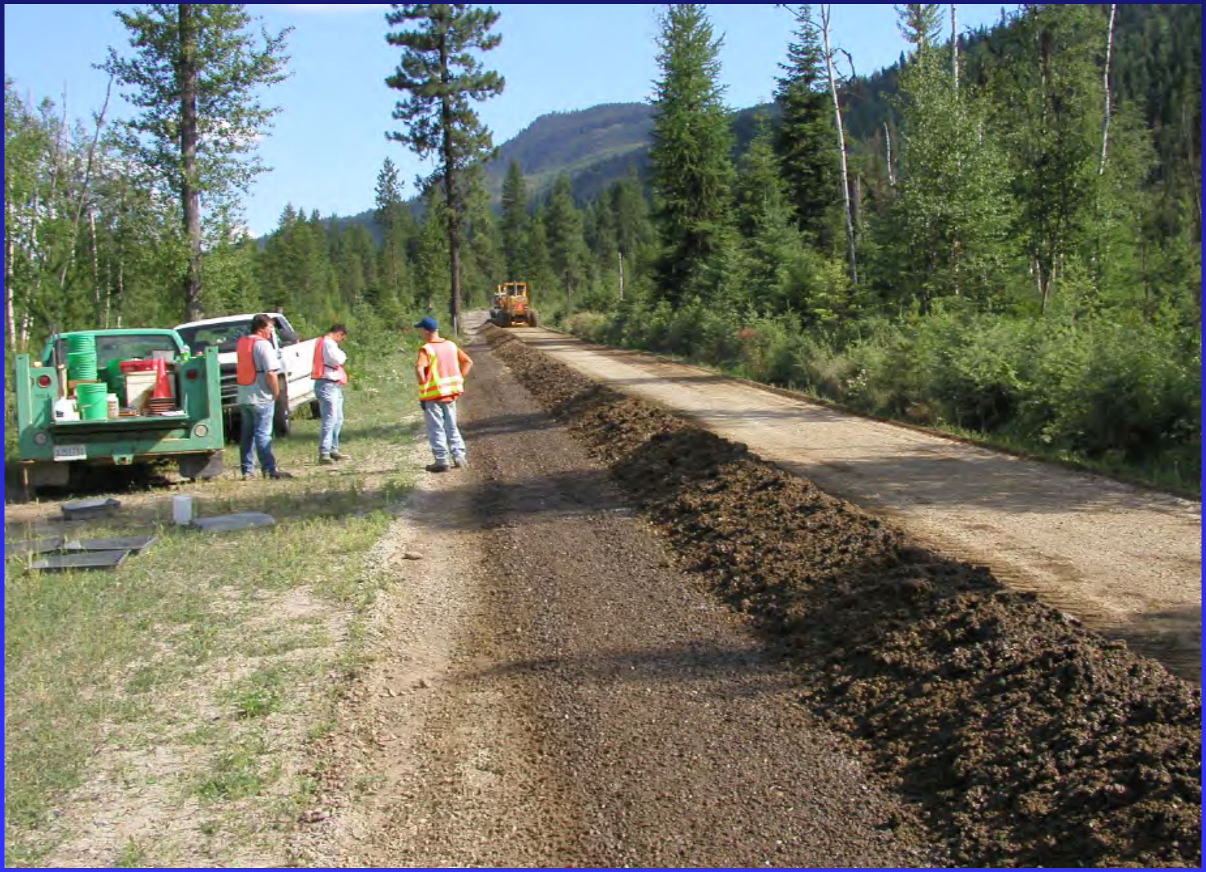
Tiller Mixing - Liquid Chloride

Blade Mixing Liquid Chloride

Quality Assurance - Tiller Mixing Depth Checks



Quality Assurance - Windrow Sizing During Blade Mixing



Quality Assurance - Windrow Measurement & Mixing Consistency

Compaction - Watering

Compaction with Water Truck

Chloride Surface Application

Test Section Photos

Test Section Photos

Monitoring Items

- Performance – Dust, Loose Aggregate, Washboards, Rutting, Potholes and Speed
- Weather – Temperature, Humidity, Rainfall
- Traffic
- Testing of Aggregate & Chlorides
- Vegetation Damage, Stream Water Contamination, Migration in Soil
- Costs – Construction, Maintenance, User Costs, Aggregate Loss

Performance Rating System

- US Army Corps of Engineers “Rating Unsurfaced Roads”
- Measurement intensive process for 100 foot long segment of each test section
- Measured defects are converted to deducts, which are subtracted from 100 to get Condition Index
- Some system modifications made to improve process

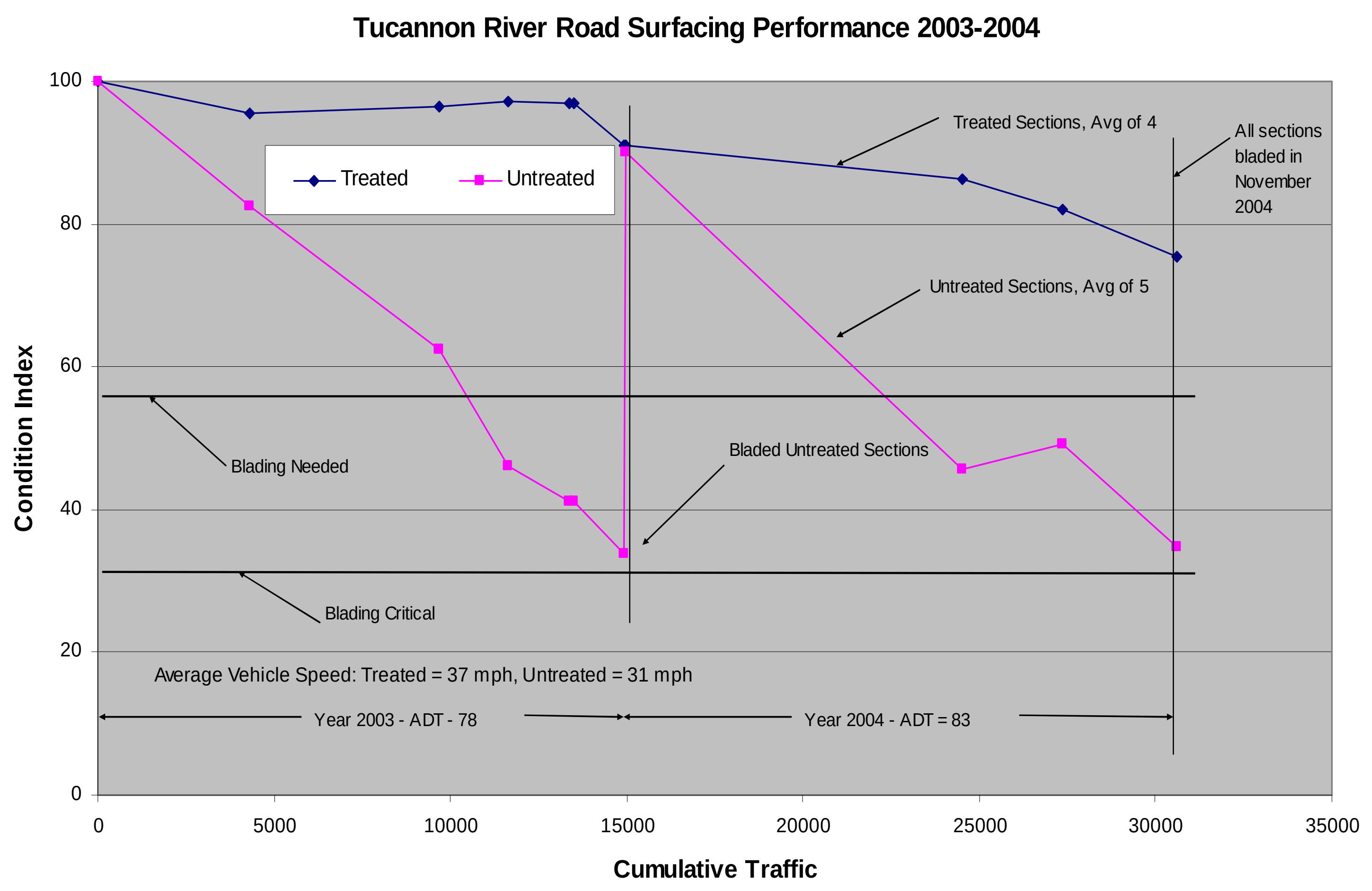
Loose Aggregate & Washboards – Untreated Section

Loose Aggregate – Treated Section

Rutting

Potholes

Performance Curves



General Observations

- All 40 untreated sections needed blading 95% of the time during the first season
- 13 of 39 treated sections needed blading once during the first two seasons
- Dry chloride has advantages over liquid chloride
- Tiller mixing has advantages over blade mixing
- Projects using dry chloride that are tiller mixed had the lowest construction cost

Report - Performance

- Treated segments
  - Needed blading after 22000 vehicles (About 2 to 3 years)
  - Very few defects - potholes, loose aggregate
- Untreated segments
  - Needed blading after 3000 vehicles (About 1 month)
  - Numerous defects most of the time

Report - Environmental Impacts
(Before and After Samples)

- Vegetation - 200 samples on 4 projects, no significant impacts
- Migration in Soil - 96 samples on 12 projects, no significant impacts
- Stream Water Contamination - 8 composite samples on one project, no increase in chloride levels

Final Report - **Costs**

- Construction Costs: $8,000 to $10,000 per mile
  - Costs are recovered by savings during first 3 years
  - Annual spring blading with water truck and roller extends effective life to 10 years.
- Maintenance Savings: $500/mile/year
- User Costs Savings: $900/mile/year
- Aggregate Loss Savings: $1900/mile/year

Report - Intangible Benefits

- Sedimentation - significantly reduced
- Aggregate Resource - conserved
- Road User Safety - improved
- Dust Health Hazard - significantly reduced
- Public Relations - improved

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US Forest Service

San Dimas Technology and Development Center

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Effective Partnering to Overcome an Interruption In the Supply of Portland Cement During Construction at Marmet Lock and Dam

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Toy S. Poole

Anthony A. Bombich

Concrete and Materials Branch
Geotechnical and Structures Laboratory

Joan B. Stclair

U. S. Army Engineer District, Huntington

US Army Corps
of Engineers®

Engineer Research and Development Center

12 October, 2004

We have a problem !

The Problem

- A full silo of type II, HH portland cement at the Armstrong Cement facility in Cabot, PA was ruined by rising flood waters in October 2004.

- The loss occurred approximately 1 to 2 weeks before the cement was scheduled to be delivered to the Marmet construction site

The Time Crunch

- The supply of type II, HH cement remaining at the construction site would be exhausted within 2 weeks, or less
- Armstrong Cement would require approximately 4 to 5 weeks to produce and deliver another shipment of type II, HH cement
- Concrete placements would be halted within approximately 2 weeks unless a suitable alternative could be found

The Challenge

- Find an acceptable solution within less than 2 weeks that would allow concrete placements to continue uninterrupted, while maintaining the integrity and quality of the concrete construction

The Team

- Huntington District
- Kokosing / Fru-Con
- ERDC

Available Options

- Use type II portland cement, without the HH restrictions, from Armstrong (proposed by Kokosing / Fru-Con; preferred by ERDC)
- Procure type II, HH portland cement from another source
- Discontinue concrete placements until a new shipment of type II, HH portland cement could be delivered from Armstrong (last resort)

The BIG Question

- Determine whether a mixture with type II portland cement, without the heat of hydration restriction, and a modest increase in fly ash content will have an acceptably low adiabatic temperature rise comparable to a similar mixture using type II, HH portland cement and a lower amount of fly ash

The Dilemma

- Ongoing placements were guide-wall cells being filled with a high-slump tremie mixture for which no temperature rise data existed
- Temperature rise data existed only on two 3-in. NMSA mass mixtures with type II HH cement
- Not enough time to measure actual temperature rise in the laboratory on any mixtures using type II cement without the HH restriction

A Multi-Pronged Approach

- Kokosing / Fru-Con to cast 2 well-insulated and instrumented test cells of concrete, with the portland cement being the only variable
  - Armstrong type II, HH
  - Armstrong type II
- Kokosing / Fru-Con to review construction schedule looking for ways to
  - Slow demand for concrete, and
  - Move less critical placements forward without severely hindering overall schedule

A Multi-Pronged Approach

- ERDC to conduct a review of literature to estimate potential temperature difference based upon heat of hydration of cement and fly ash content
- ERDC to conduct a review of available project data to estimate potential temperature difference based upon mixture proportions
- ERDC to analyze all available data and make final recommendation on mixtures

A Multi-Pronged Approach

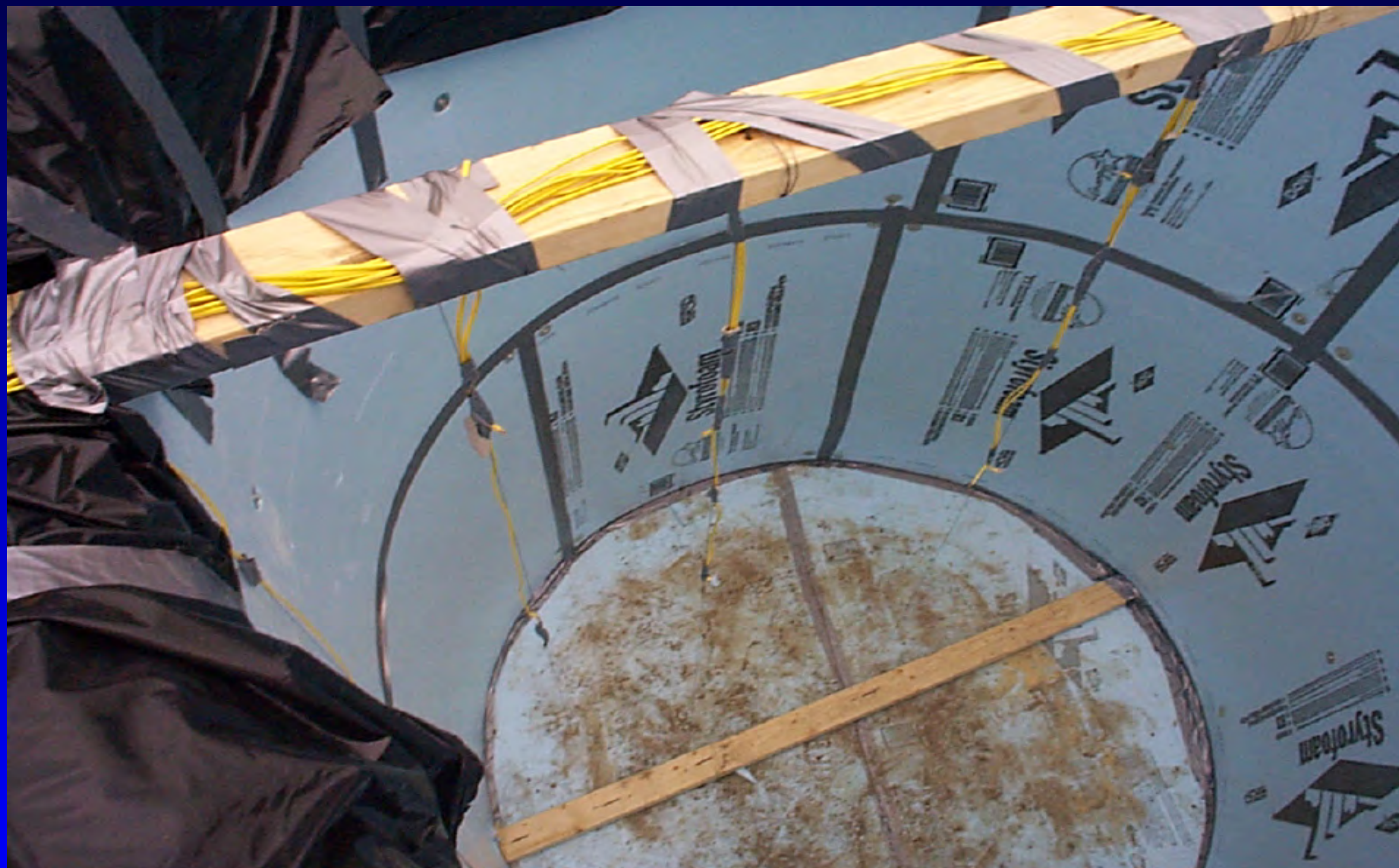
- Huntington to coordinate efforts between Kokosing / Fru-Con and ERDC
- Huntington to make final decision to use of type II portland cement, without the HH restriction, or to terminate concrete placements until type II, HH available again

Test Cells

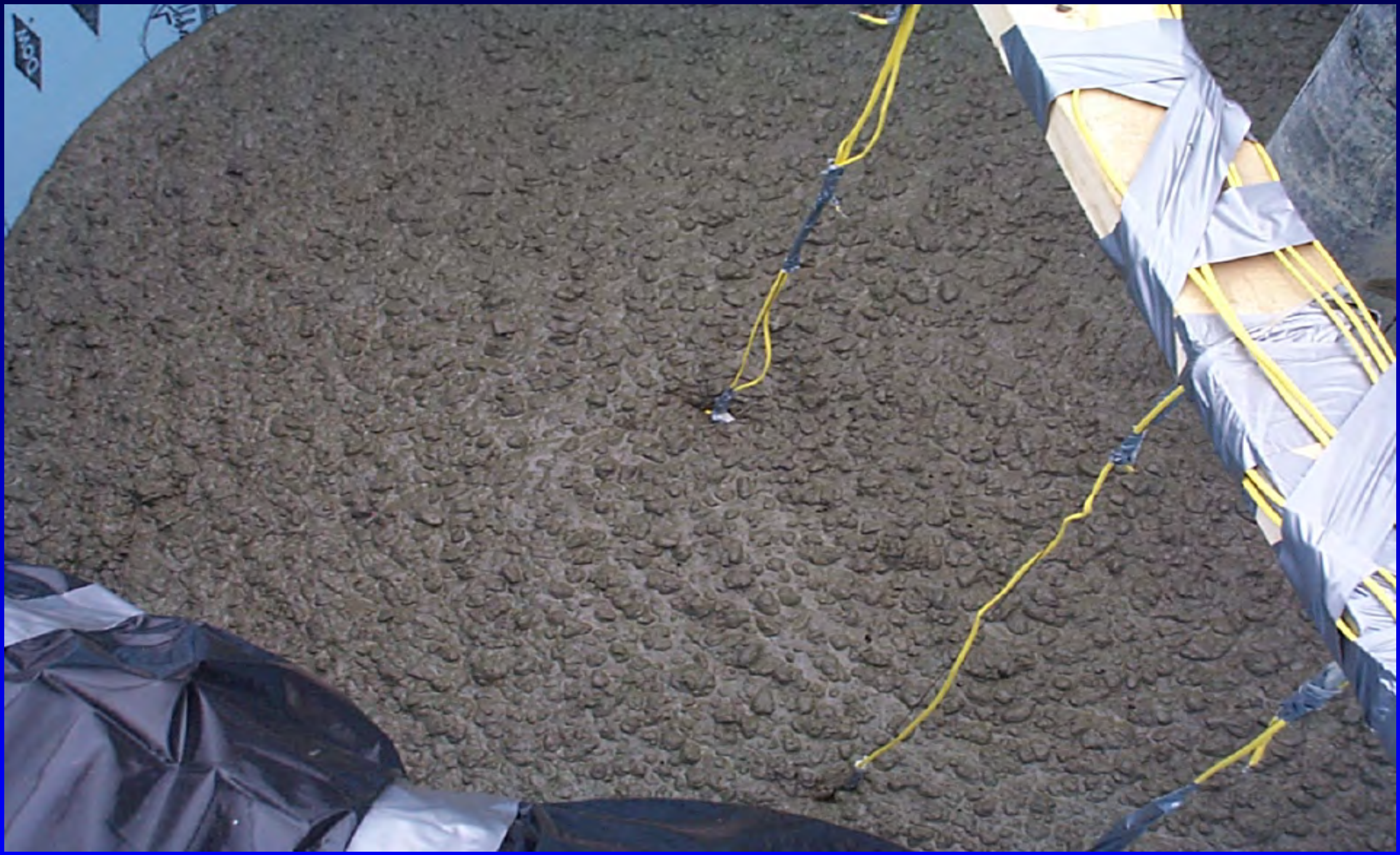
Mixture 348 Used in Test Cells

- Portland cement – 70% by volume
- Fly ash – 30% by volume
- w/(c+m) – 0.485
- Type portland cement
  - Type II, HH
  - Type II

Test Cell



Test Cell



US Army Corps
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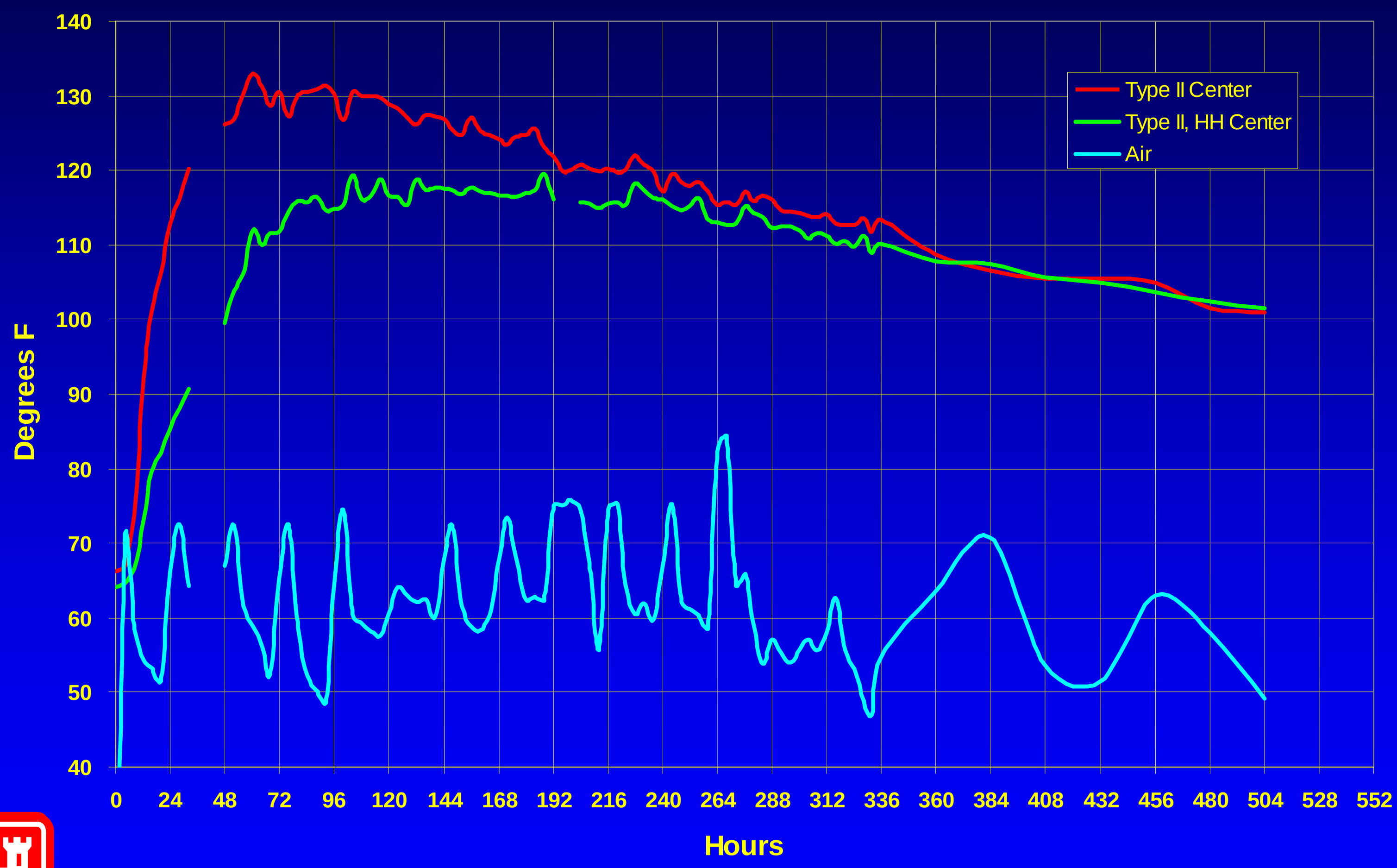
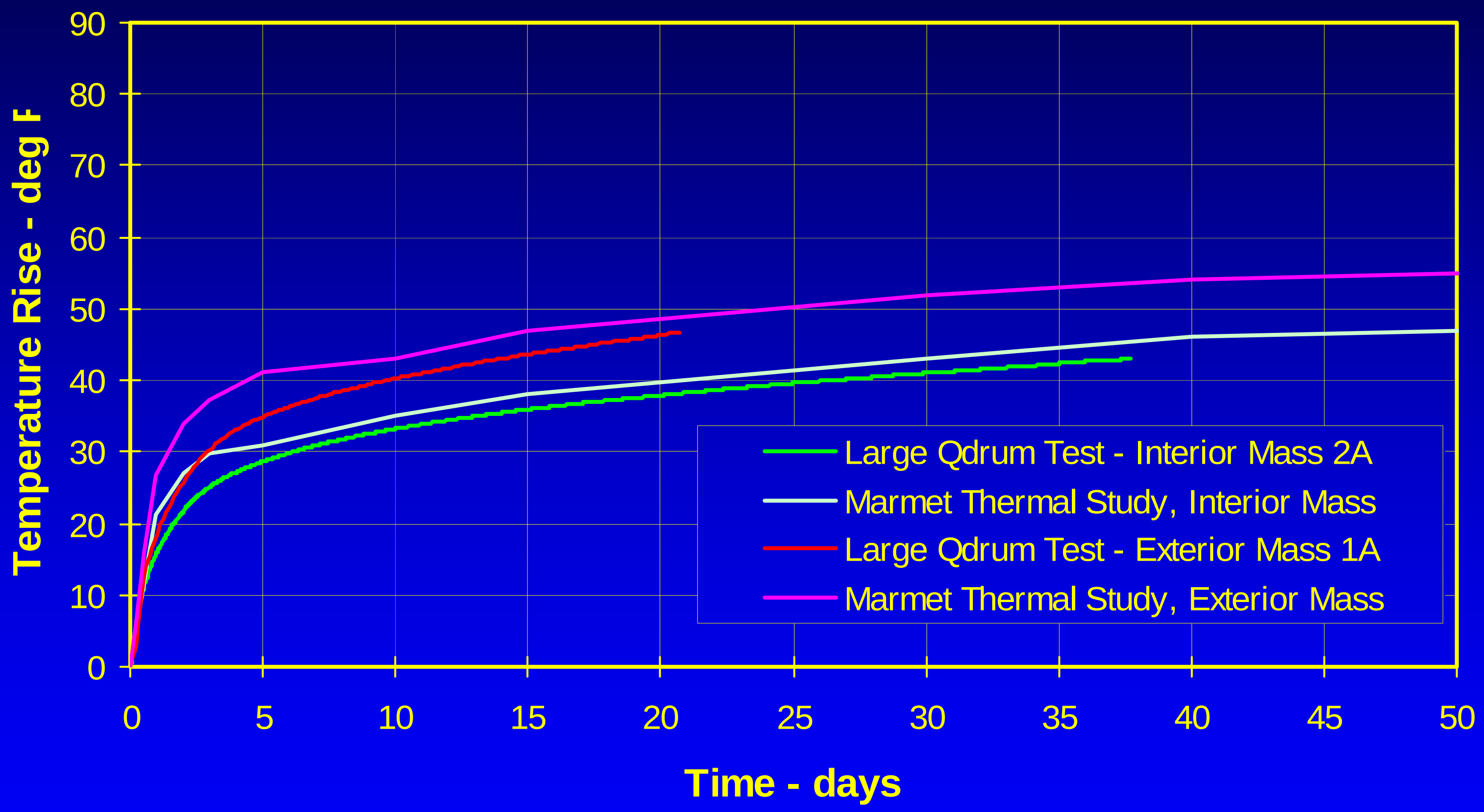
Test Cell

Test Cell

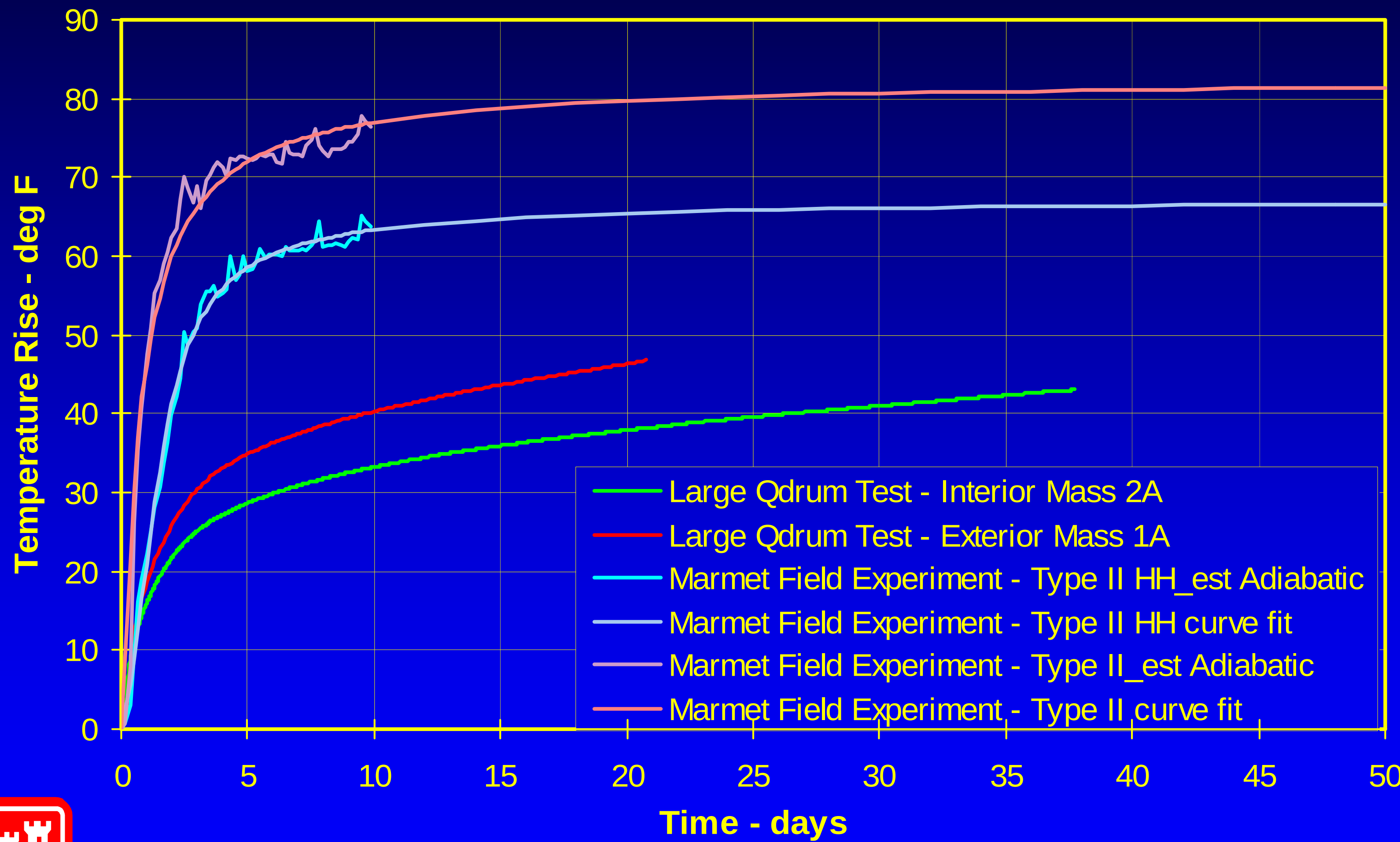
Test Cell Temperatures



Baseline Mass Mixtures with Type II, HH

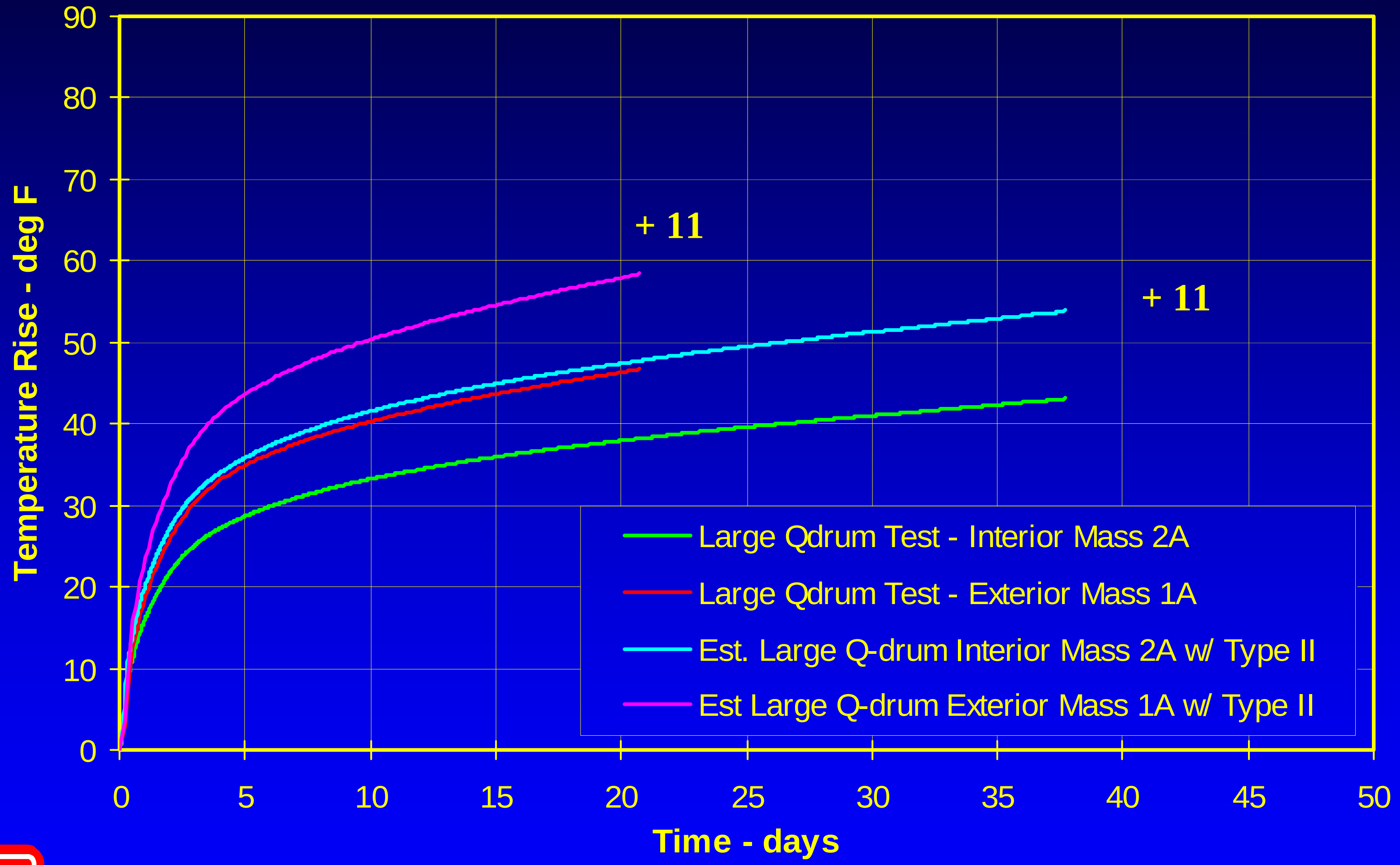


Test Cells



Temperature Rise - deg F
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
35
40
45
50
Time - days
Large Qdrum Test - Interior Mass 2A
Large Qdrum Test - Exterior Mass 1A
Marmet Field Experiment - Type II HH_est Adiabatic
Marmet Field Experiment - Type II HH curve fit
Marmet Field Experiment - Type II_est Adiabatic
Marmet Field Experiment - Type II curve fit

Type II, HH versus Type II



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Engineer Research and Development Center

Analysis of Mixture Proportions

Mix No.	w/(c+m)	Fly Ash %	Quantity per cubic yd, lb PC	Total Cementitious	FA	Water	Estimated maximum temp rise w/ LH cement	Estimated maximum temp rise w/ MH cement	Estimated increase in temp w/ MH ceme
1A	0.49	20	281	329	48	171	51	60	9
1B	0.49	25	263	323	60	172	49	58	9
1C	0.49	30	243	315	72	170	47	55	8
1D	0.46	25	286	351	65	175	52	61	9
2A	0.55	30	223	289	66	175	45	52	7
2B	0.60	30	199	257	58	170	43	50	6
2C	0.60	25	215	264	49	172	44	51	7
2D	0.65	25	202	248	46	175	43	49	7
348	0.435	30	461	596	135	286	66	81	15
347	0.495	30	392	507	115	277	60	73	13

Heat of Hydration Analysis

- Thesis
  - Temperature rise = $\dfrac{\text{HH of cement x cement fraction}}{\text{heat capacity of concrete}}$
  - Adjust cement fraction for % fly ash
  - dT = $\dfrac{(1.3\ \text{HH} + ((1.3 - 0.51(\%\ \text{fly ash}))) \times \%\ \text{cement}}{\text{heat capacity of concrete}}$

Heat of Hydration Analysis

- Example calculations

$$dT = \frac{(1.3\ HH + (1.3 - 0.51(\%\ \text{fly ash}))) \times \%\ \text{cement}}{\text{heat capacity of concrete}}$$

$$dT = \frac{((1.3)(79) + (1.3 - (0.51)(30))) \times 0.1231}{0.24} = \mathbf{45°\ C} = \mathbf{82°\ F}$$

$$dT = \frac{((1.3)(68) + (1.3 - (0.51)(30))) \times 0.1231}{0.24} = \mathbf{38°\ C} = \mathbf{69°\ F}$$

Heat of Hydration Analysis

- Example calculations

$$dT = \frac{(1.3\ HH + (1.3 - 0.51(\%\ fly\ ash))) \times \%\ cement}{heat\ capacity\ of\ concrete}$$

$$dT = \frac{((1.3)(79) + (1.3 - (0.51)(30))) \times 0.1231}{0.24} = 45° C = 82° F$$

$$dT = \frac{((1.3)(79) + (1.3 - (0.51)(45))) \times 0.1231}{0.24} = 42° C = 75° F$$

38° C

69° F

The Conclusion

- Mixtures comprised of type II portland cement, without the HH restriction, combined with a modest increase in fly ash to 40 to 45 % will result in a mixture that has a significantly higher temperature rise than the mixture it would be replacing

- A significantly higher fly ash content will be required to adequately reduce the temperature rise

- The required fly ash content would be higher than anything the Corps had a ready history of using

What's the Bottom Line?

- **The required fly ash content appeared to be approximately 60%, by volume**
  - Would Huntington District be willing to use mixtures with 60% fly ash?
  - Would Kokosing / Fru-Con be willing to use mixtures with 60% fly ash?

Brave Souls
(or was it desperation)

- Huntington District said YES
- Kokosing / Fruj-Con said YES
- ERDC provided a tentative substitute for use in the guide-wall cells

The Result

- Starting on 6 Nov 2004, the mixture with 60% fly ash was used to fill 2-1/2 cells

	7-day	28-day	90-day
30% ash + HH	1,300	4,000	5,500
60% ash + reg II	1,300	3,000	4,800

- Fewer cracks noted on these 2 cells than on previous cells cast with the original mixture

- Armstrong Cement delivered a new shipment of HH portland cement on 13 Nov 04

Summary

- A bizarre problem developed out of the blue that was completely out of everyone's control
- Effective and cooperative partnering was key to finding a workable solution in a very short period of time
- Even though a degree of estimating was involved, the solution was based upon sound engineering principles

Summary

- The interim solution was successful
- You can do it, ERDC can help!

Questions?

US Army Airfield Pavement Assessment Program

Geotechnical and Structures Laboratory
Vicksburg, MS

Haley Parsons
Lulu Edwards
Eileen Velez-Vega
Chad Gartrell

Background

- Initiated in May 1982 by the Department of the Army
- Requested by FORSCOM, TRADOC, and AMC
- Army Airfields (AAFs) last evaluated in the 1960s
- Pavements designed for WWII and Korean War era aircrafts
- Now required to support heavier and larger aircraft

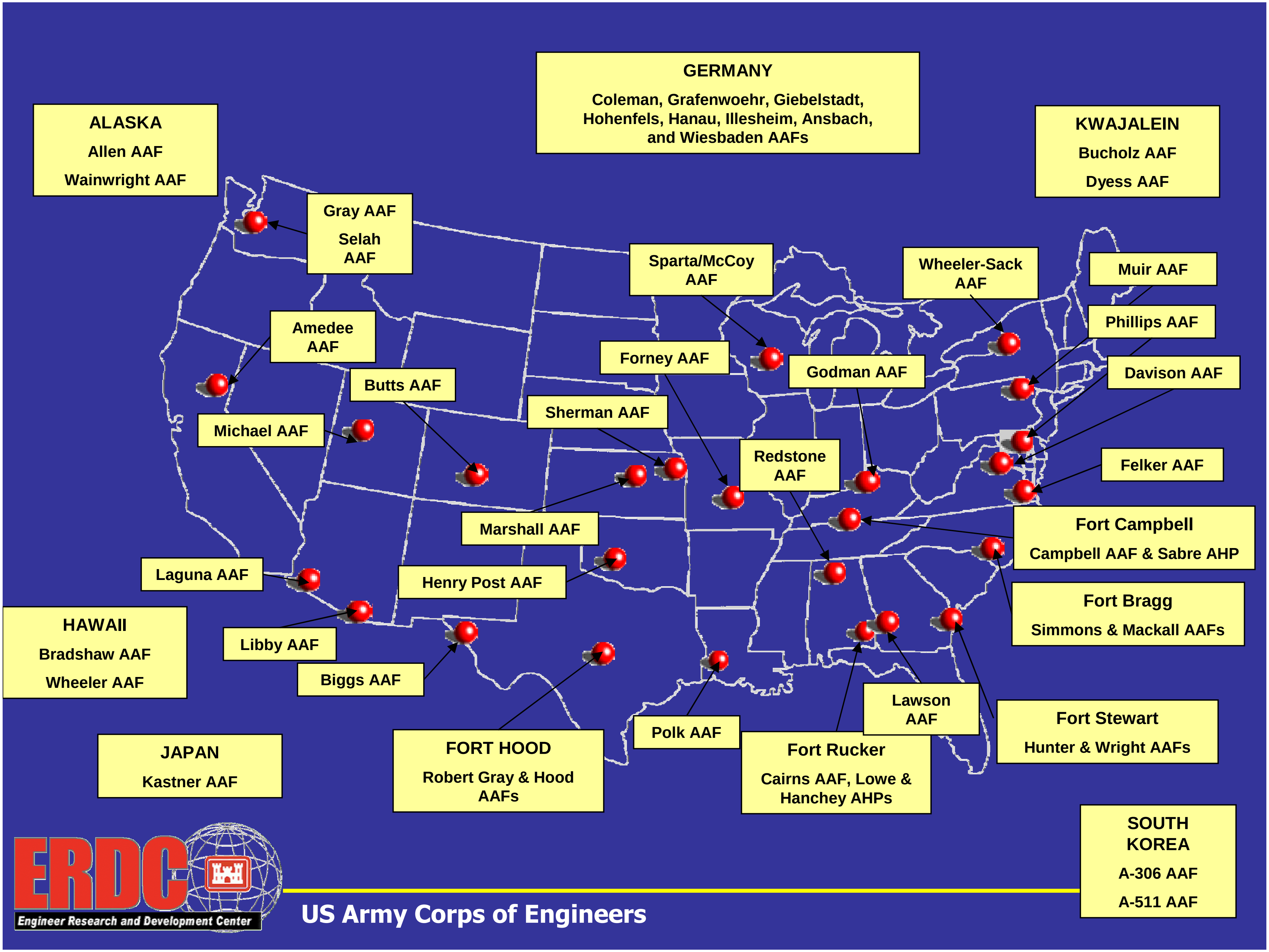
1941-1993 AAF Mission Aircraft

Significance

- Determines the overall mission readiness of the AAFs in support of the Army's force projection mission
- Provides technical data required to quantify airfield pavement maintenance, construction, and repair needs
- Data assists in optimal use of available funding for maintenance and repair (M&R)
- Provides information for establishing work plans necessary to reach and maintain AR 420-72 facility condition requirements
- Provides data for runway-bearing strengths

Why ERDC?

- Leadership in pavement design, evaluation, and research
- Expertise
- Military and security issues
- Database expansion and research validation
- Consistency
- Equipment
  – Dynatest heavy weight deflectometer (HWD)
  – 2 Dynatest falling weight deflectometers (FWDs)
  – dynamic cone penetrometer (DCP)
- State of the art equipment implementation
  – ground-penetrating radar (GPR)
  – portable seismic pavement analyzer (PSPA)



GERMANY
Coleman, Grafenwoehr, Giebelstadt, Hohenfels, Hanau, Illesheim, Ansbach, and Wiesbaden AAFs
ALASKA
Allen AAF
Wainwright AAF
KWAJALEIN
Bucholz AAF
Dyess AAF
Gray AAF
Selah AAF
Sparta/McCoy AAF
Wheeler-Sack AAF
Muir AAF
Phillips AAF
Amedee AAF
Forney AAF
Godman AAF
Davison AAF
Butts AAF
Sherman AAF
Michael AAF
Redstone AAF
Felker AAF
Marshall AAF
Fort Campbell
Campbell AAF & Sabre AHP
Laguna AAF
Henry Post AAF
Fort Bragg
Simmons & Mackall AAFs
HAWAII
Bradshaw AAF
Wheeler AAF
Libby AAF
Biggs AAF
Lawson AAF
Fort Stewart
Hunter & Wright AAFs
Polk AAF
JAPAN
Kastner AAF
FORT HOOD
Robert Gray & Hood AAFs
Fort Rucker
Cairns AAF, Lowe & Hanchey AHPs
SOUTH KOREA
A-306 AAF
A-511 AAF
ERDC
Engineer Research and Development Center
US Army Corps of Engineers

Inspection Intervals

- Critical Category I airfields
  - structural evaluation including nondestructive testing (NDT) every 5 years
  - pavement condition survey to determine the pavement condition index (PCI) every 5 years

- Category I airfields and instrumented heliports
  - structural evaluation including NDT every 8 years
  - pavement condition survey to determine the PCI every 4 years

Objectives

- Structural evaluation
  - determines allowable aircraft loads and design traffic
    - FWD/HWD
    - DCP
- Visual evaluation
  - pavement condition survey
  - identify M&R
- Test new technologies
  - PSPA
  - GPR

FWD/HWD

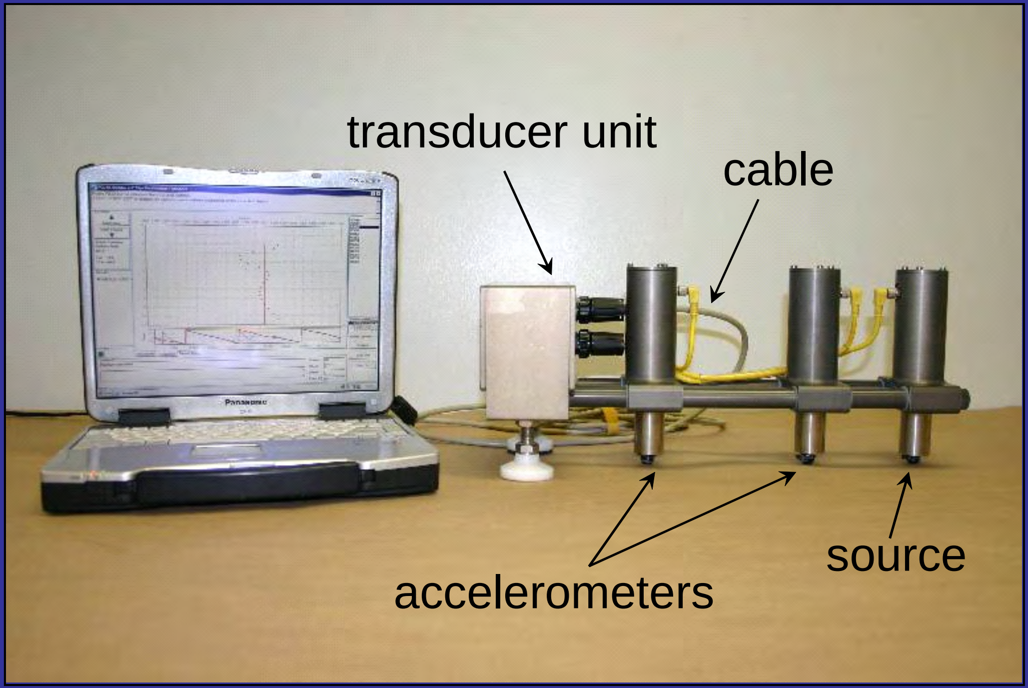
- Trailer mounted, nondestructive, impact load device
- Dynamic force applied to the pavement
  - drop height of 0-15.7 in
  - 0-50,000 lbs
  - 25-30 ms duration
- Applied force and pavement deflections are measured

DCP

- Determines strength (CBR) of underlying soil layers
- Thickness is delineated from changes in strength
- 4 main components
  – cone, rod, anvil, hammer
- Procedure:
  – 1-in drilled hole
  – drop hammer until penetration depth is 20-30 mm
  – record number of blows and depth
  – penetration/mm is correlated to CBR

PSPA

- Measures seismic modulus of concrete pavements
- Quick, simple, nondestructive
- Measurements taken from near surface pavements



GPR

- GPR is used to non-invasively determine thickness of pavements
- Two radar antennas are usually used
  - 1 GHz – penetrates pavements up to 3 ft
  - 500 MHz – penetrates pavements up to 6 ft
- Depth of penetration is dependent on the material type and the dielectric constants

Pavement Condition Survey

- Visual inspection to determine present surface condition
  - types of distress
  - severity of distress
  - quantity of distress
- Airfield broken into features and sample units
- Estimated quantities and severity of distresses are used to compute the PCI for each feature




Micro PAVER

- Developed by USACE, Champaign, IL
- Aids pavement managers in:
  - developing and organizing the pavement inventory
  - assessing the current conditions of pavements
  - developing models to predict future conditions
  - reporting on past and future pavement performance
  - developing scenarios for pavement M&R based on budget or condition requirements

NDT Analysis

- Pre-evaluation
  - climatological data
  - traffic data (critical aircraft and maximum number of passes)
- Load-carrying capacity
  - strength of the pavement
  - gross weight of the aircraft
  - number of applications of the load
- ACN/PCN method is used to report pavement load-carrying capacity
  - ACN – structural effect of an aircraft (single wheel load)
  - PCN – load-carrying capacity in terms (single wheel load)
  - ACN/PCN ratio
    - should be < 1
    - pavement life is greater than the design life

PCASE

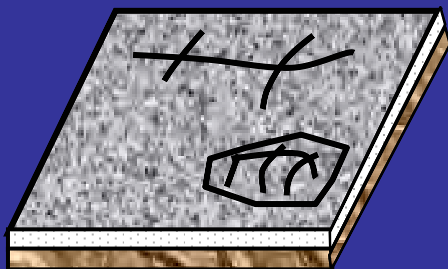
- Developed by USACE, Vicksburg, MS
- Aids in the design and evaluation of transportation systems

- Some capabilities:
  – generate ACN curves for any vehicle
  – analyze DCP data with DCP module
  – generate a design curve for any aircraft
  – determine the load-carrying capacity for any airfield using modulus values
  – backcalculate the modulus using the FWD/HWD data
  – percent-life curves can tell how much damage an aircraft will do to an airfield
  – use the NDT module to analyze deflection data

Determination of M&R Recommendations

STEP 1

INSPECT PAVEMENT: DETERMINE DENSITY AND SEVERITY OF VARIOUS DISTRESS TYPES



STEP 2

COMPUTE PCI (0 - 100)

PCI

STEP 3

DETERMINE CONDITION RATING

- Excellent
- Very Good
- Good
- Fair
- Poor
- Very Poor
- Failed

STEP 4

NDT METHOD OF DETERMINING LOAD-CARRYING CAPACITY (PCN)

STEP 5

DETERMINE M&R ALTERNATIVES BASED ON RESULTS OF 3&4

STEP 6

PERFORM LIFE CYCLE COST ANALYSIS AND IMPLEMENT THE MOST FEASIBLE M&R ALTERNATIVE

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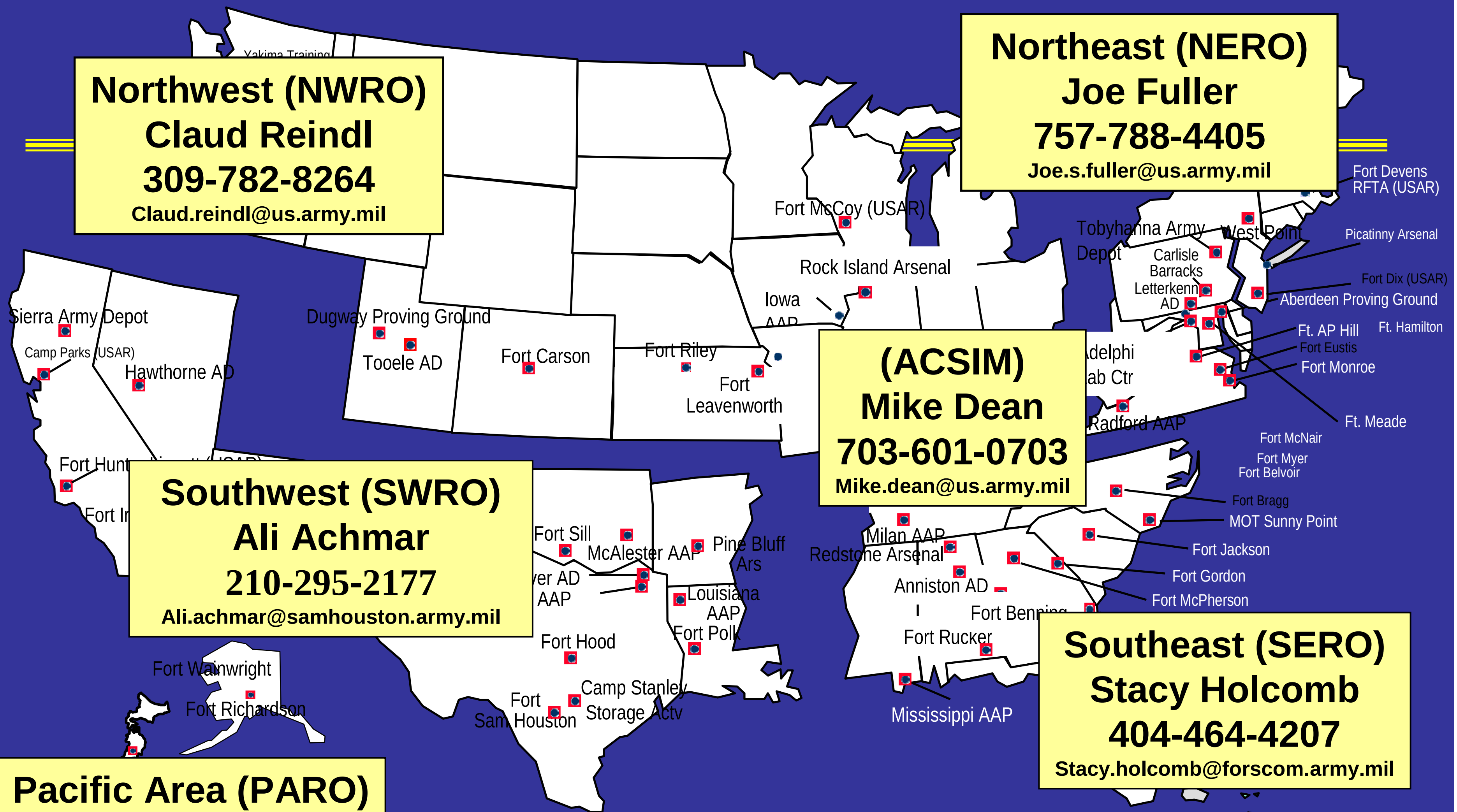

Overseas: Europe
Korea

ERDC Engineer Research and Development Center

US Army Corps of Engineers

Airfield Evaluation Summary

- Review previous reports
- Brief installation personnel
- Get necessary data
- Drive over and identify overall visual condition
- Mark features and sample units
- Survey, NDT
- Review PCI sheets and NDT data
- Enter all information into PAVER, PCASE
- Analyze data
- Generate report

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Curing Practices for Modern Concrete Production

Toy Poole
U.S. Army Corps of Engineers
August 2005

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Problems with Curing?

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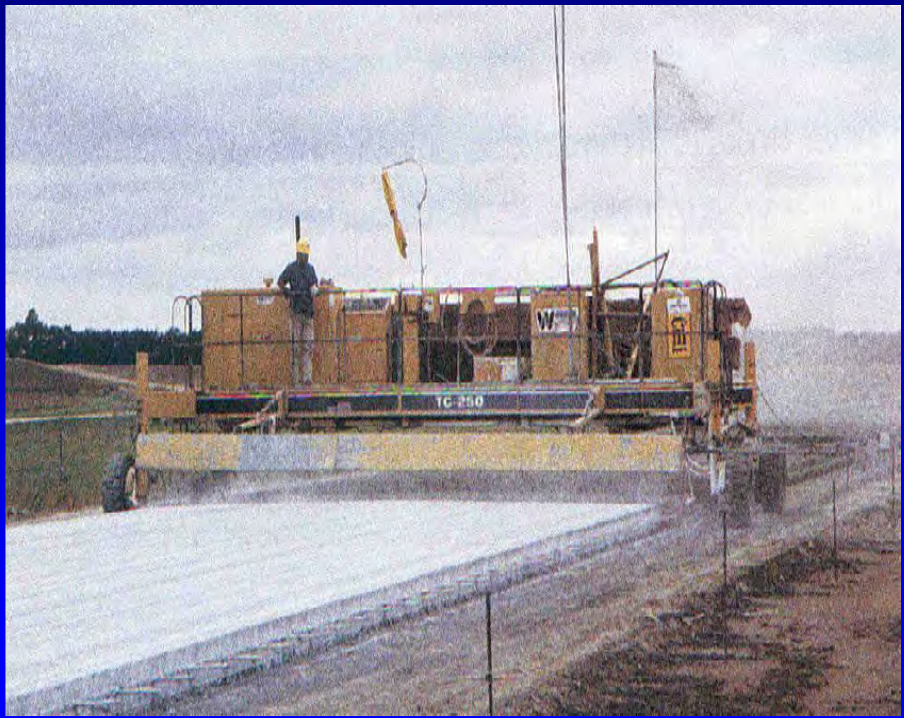
Curing Practices - Need for Revisions??

- Review major points of current practice
- Discuss effects of newer concrete practice



Purpose of Curing

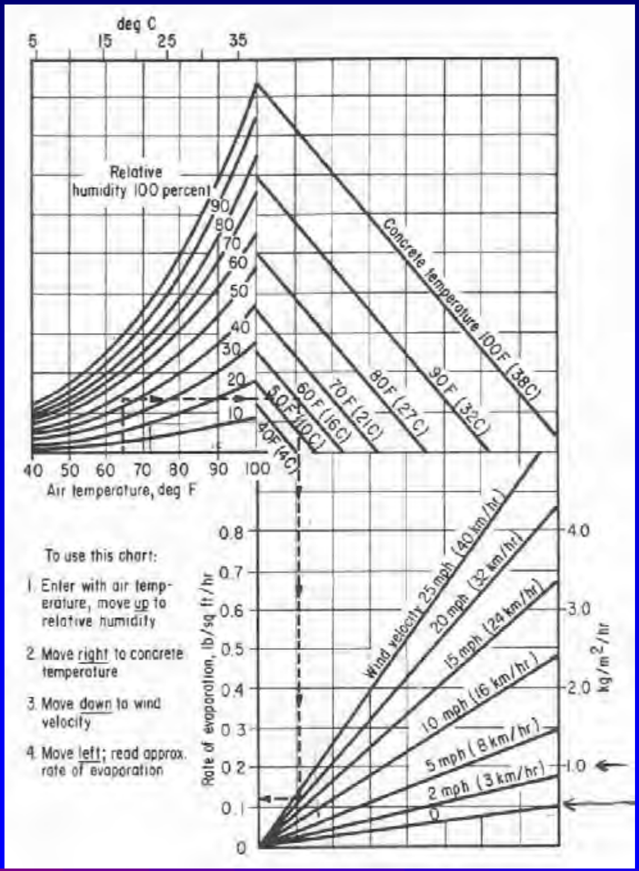
- Conserve water
- Maintain favorable temperatures

Current Practice

- Protect fresh concrete
- Apply final curing
  - After finishing
  - After sheen gone
- Duration of Curing
- Curing materials specs

Protect Fresh Concrete

- Critical evap rate
  - 0.5, 1.0 kg/m²/h
- Based on "old time" bleeding rates



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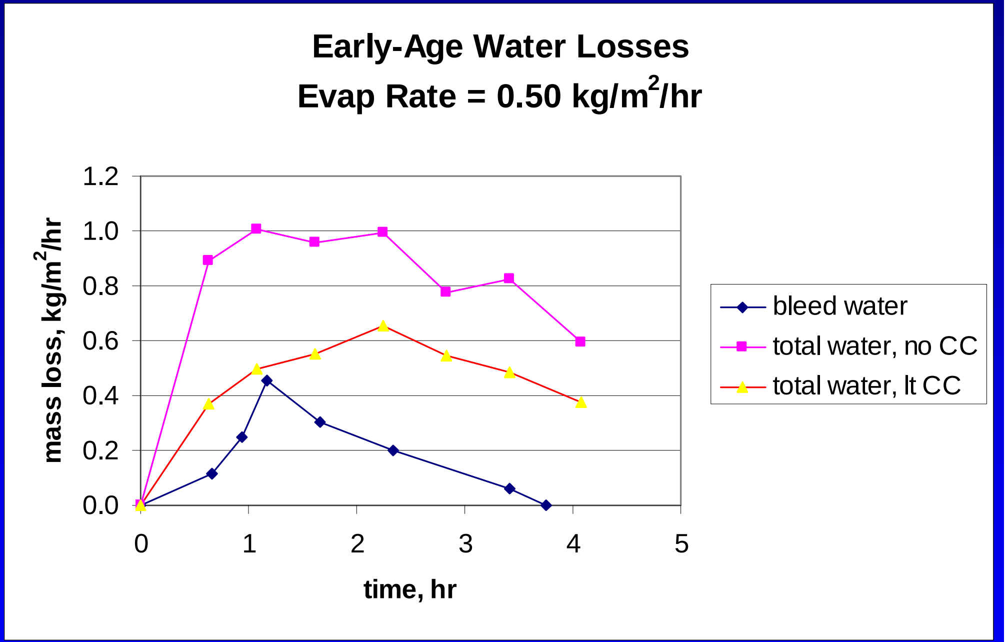
Low w/c Concrete

- Low w/c concretes
  - Evap rates <0.5 kg/m²/h
- Action: More care to reduce drying
- Cool concrete
- Evap reducers
- Misting



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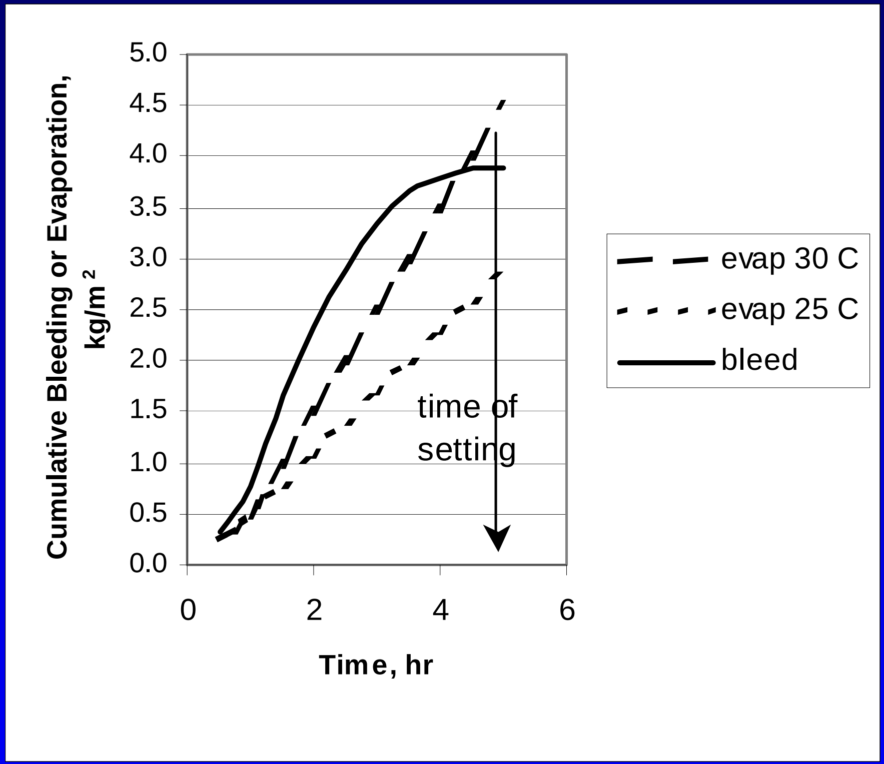
Action

- Action: reduce evaporation
- Cool concrete



Current Practice

- Protect fresh concrete
- Apply final curing
  - After finishing
  - After sheen gone
- Duration of Curing
- Curing materials specs

Apply Final Finishing

- After finishing
- After sheen disappears

Problem

- Pavements
  - Little bleed
  - Finishing ~ placing
- Curing compounds
  - Applied soon after placing
  - May not perform

Uniformity of Application

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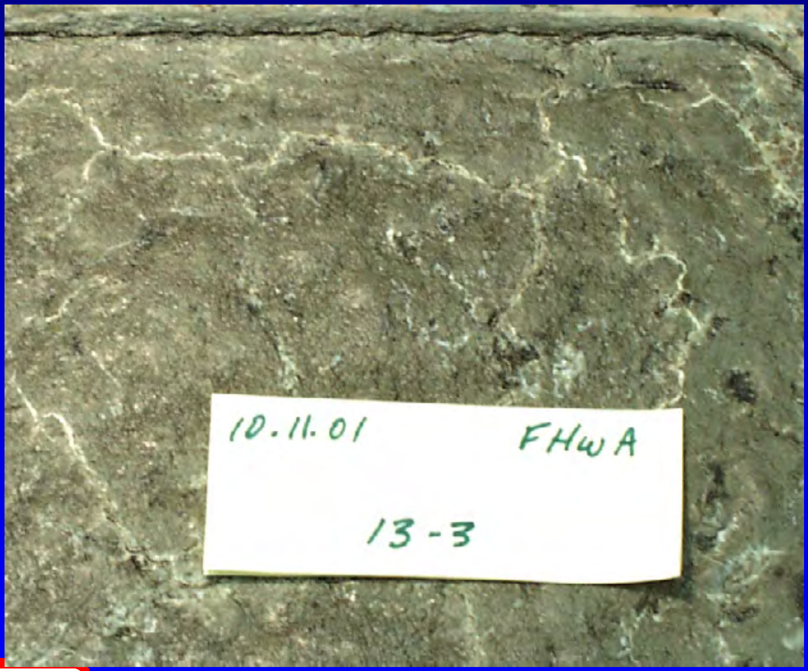
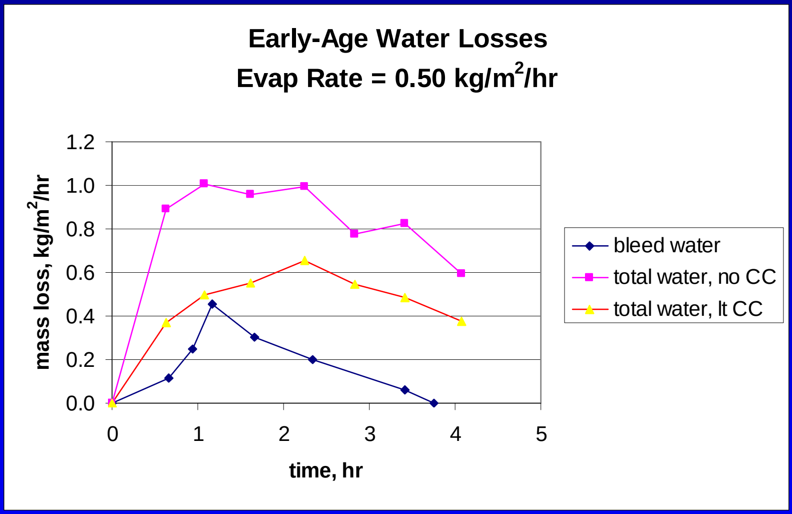
Early Application of Curing Compound





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Early Application of Water, Mats

- If before TOS
  - Erosion
  - Marring

Resolution

- Delay application???!!!
- Live with consequences

Current Practice

- Protect fresh concrete
- Apply final curing
  - After finishing
  - After sheen gone
- Duration of Curing
- Curing materials specs

Duration of Curing

- Corps of Engineers - prescriptive
  - Based on cement type
  - Presence of pozzolan
- State DoT's – prescriptive
  - Based on time – 3 – 10 days
- ACI – mixed spec
  - Time
  - % f'c

Emerging Technologies

- Maturity
  - ASTM C 1074 based
- NDT
  - ultrasonic

Current Practice

- Protect fresh concrete
- Apply final curing
  - After finishing
  - After sheen gone
- Duration of Curing
- Curing materials specs

Curing Materials – Curing Compounds

- Water Retention
  - CE: 0.31 kg/m^2 @ 7 days
  - Old Bu Rec: 0.86 kg/m^2 @ 7 days
  - ASTM:
    - C 309: 0.55 kg/m^2 @ 3 days
    - C 1315: 0.40 kg/m^2 @ 3 days
  - State DoT's: <0.3 kg/m^2 @ 3 days
- Drying Time – 4 hours

Water Retention (?, Loss?) Requirements

- True value??
  - Some early work – 0.7 kg/m^2
  - Other work - 1.0 kg/m^2 in several days
- Major problems with testing
  - Often not done
  - Precision of TM (C 156)
    - d2s = 0.20 kg/m^2

Drying Time Problems
Low VOC Materials

Evaporation Reducers

- No Specs
- No TM's
- ASTM C 9.22

The End!

Concrete Damage at Carters Dam

January 2005

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Reregulation Dam – Downstream View

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Reregulation Dam – Downstream View

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Downstream D-2, Lifts 23, 24?

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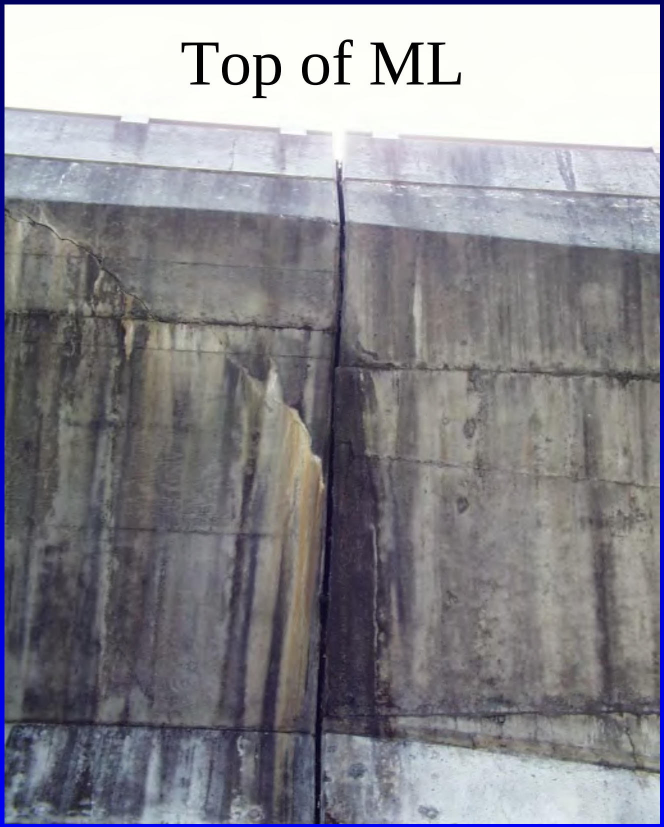
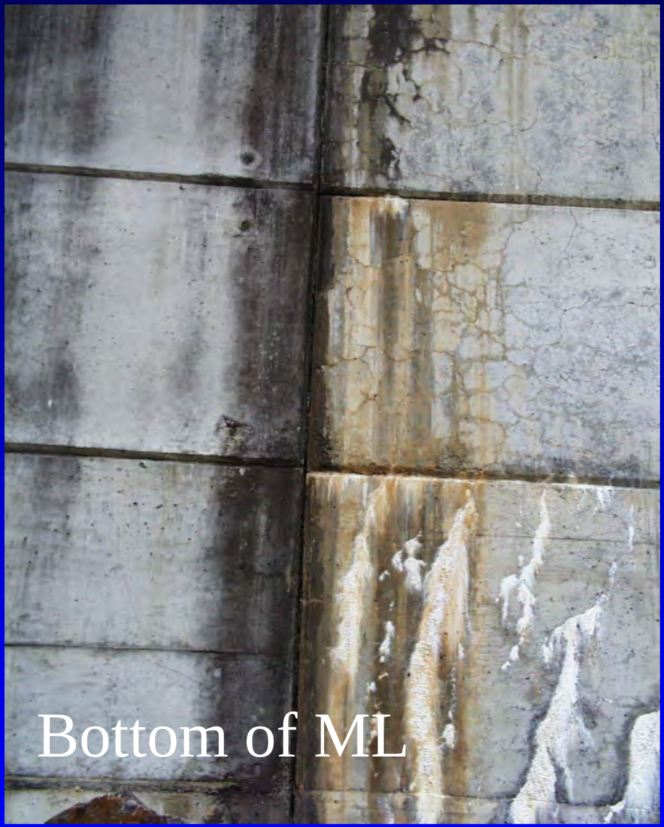
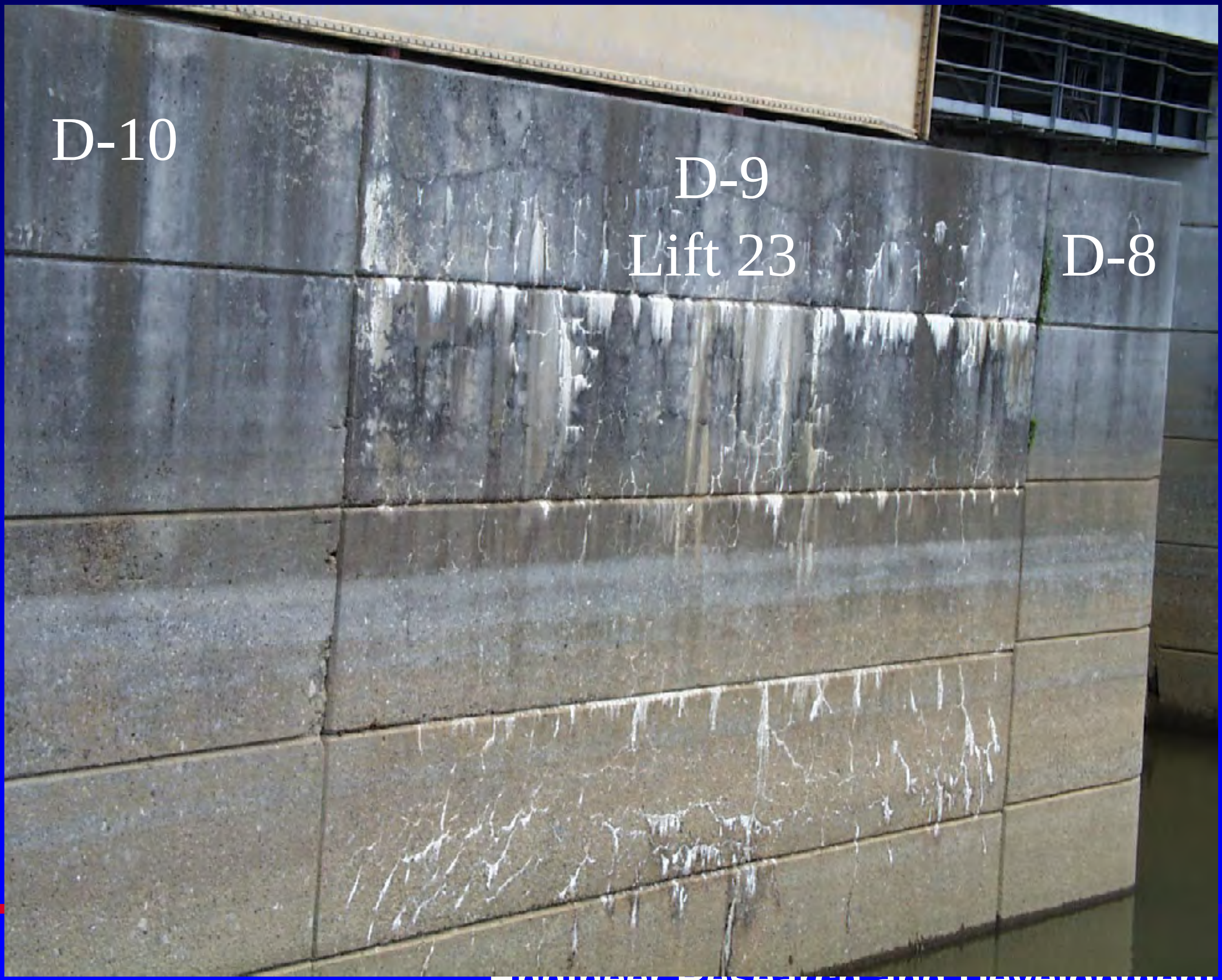
Upstream D-2

Downstream Joint - D-8 and D-9





Upstream D-9



Upstream D-1

Trunnion Block, ML D-8

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Emergency Spillway

Shaft in ML 11

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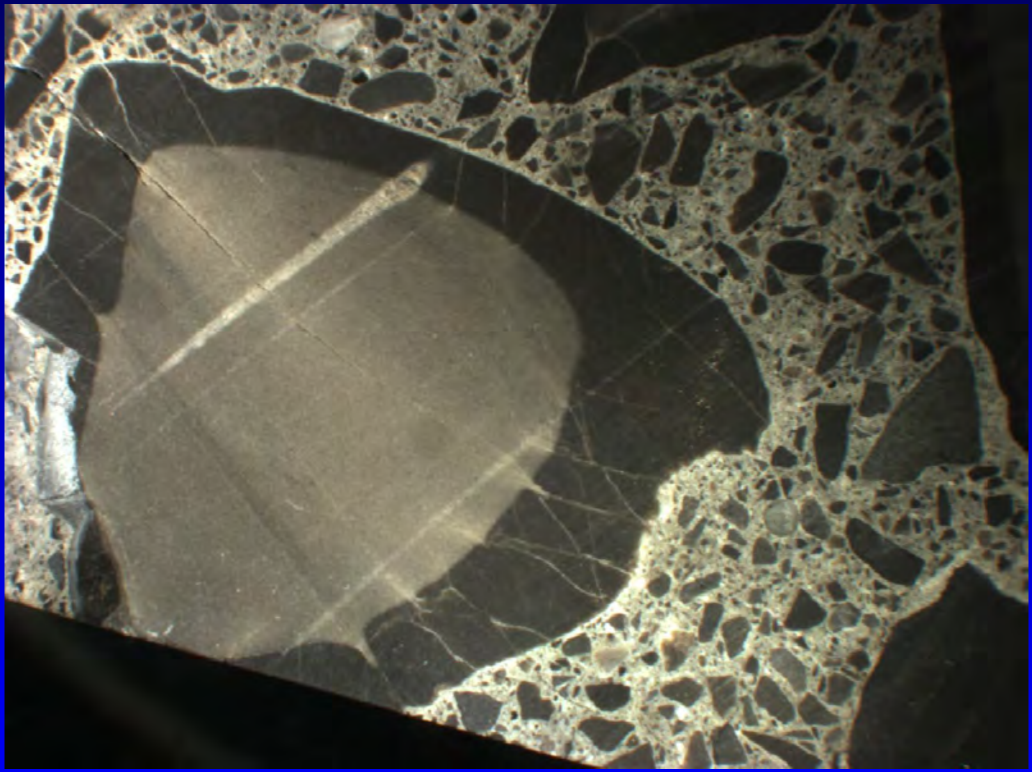
Aggregate

- Single source – Dalton Quarry
- At least 3 distinct types in the 1.5 and 3 inch sizes
  - One suspected of ACR
  - Problems with ACR rock: Sep – Nov 71

Portland Cement

- 3 sources
  - All low alkali
  - 0.45 – 0.55 Na_2O_{eq}
- Pozzolan
  - Probably not

Reactive Pieces



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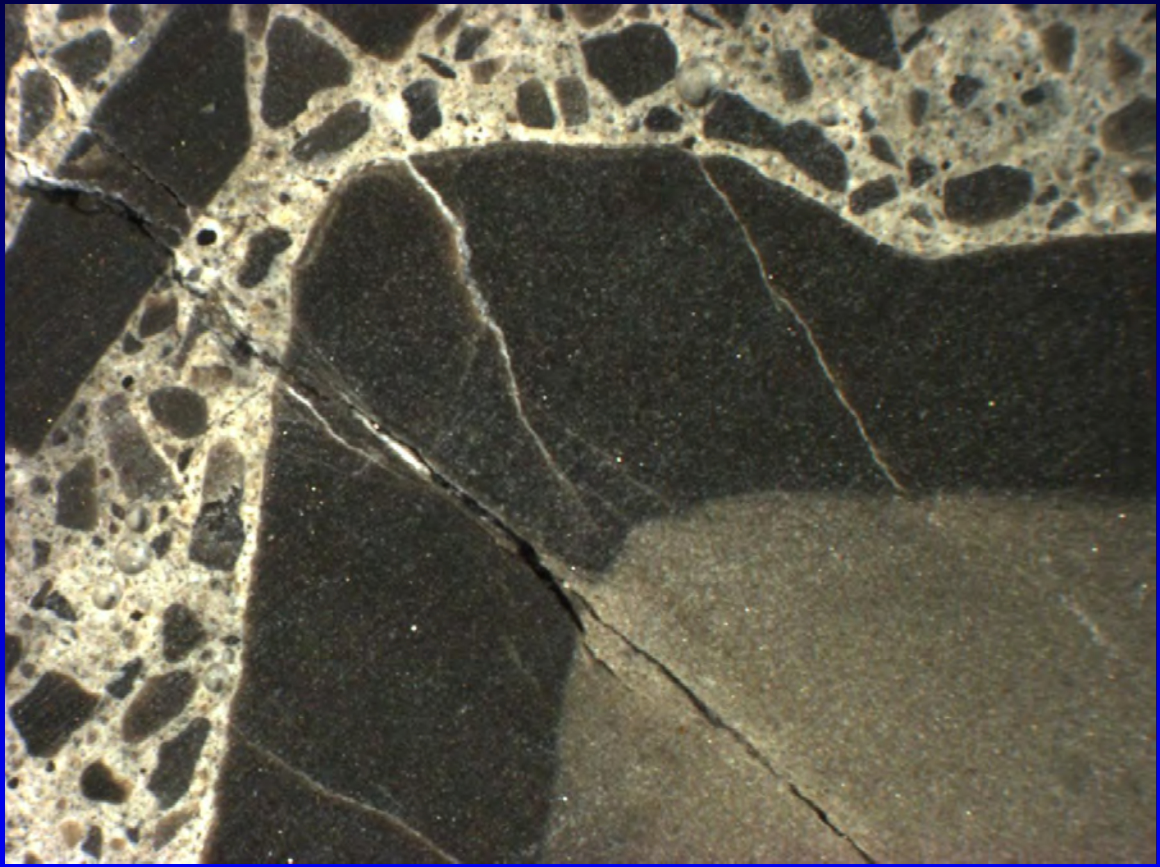

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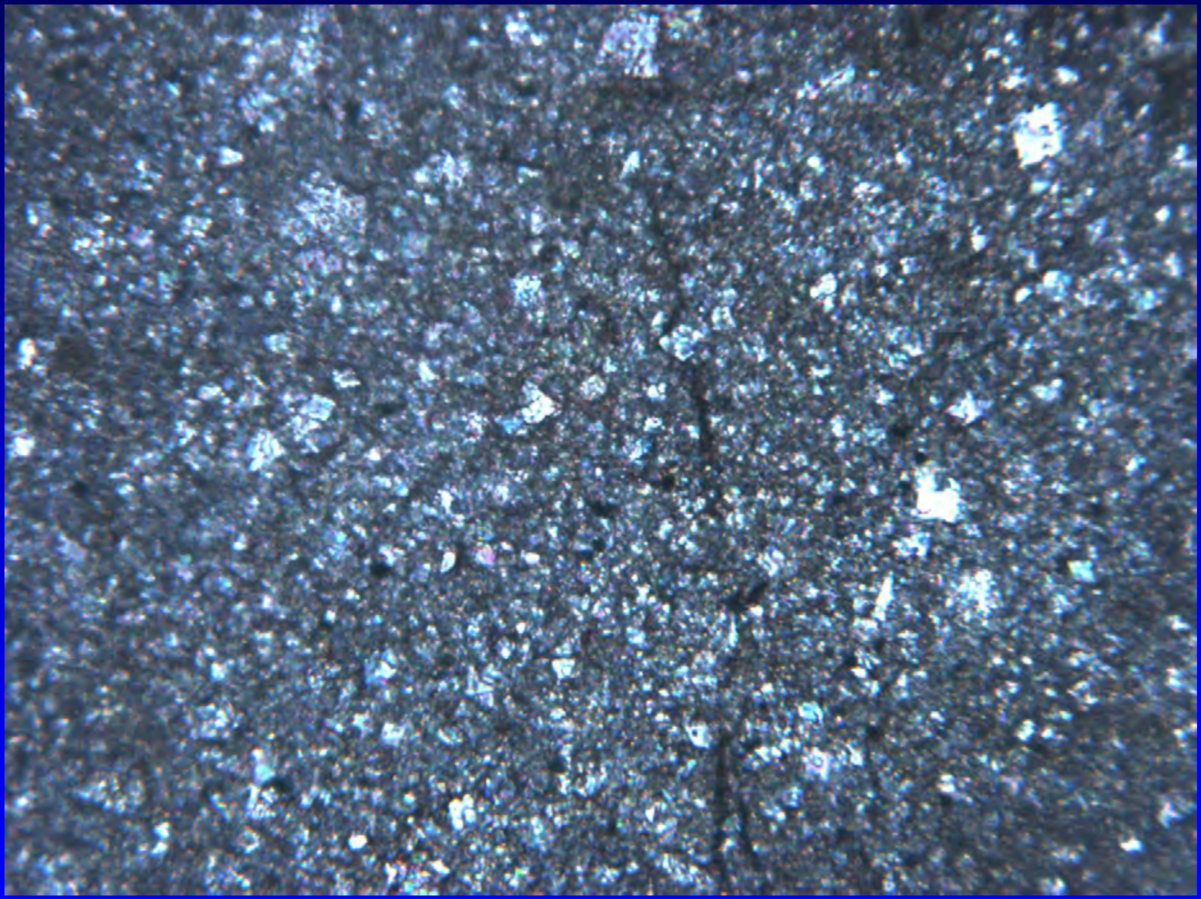
Rhombs



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Reaction Products

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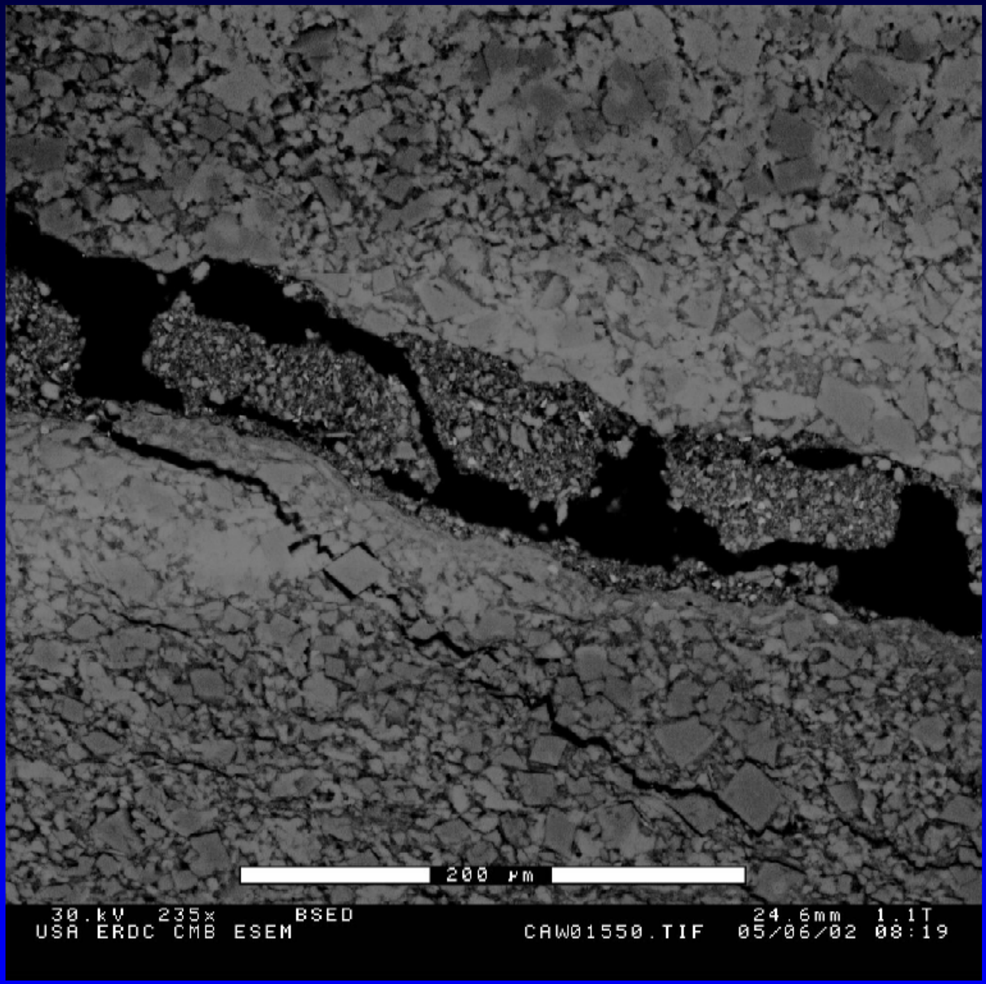
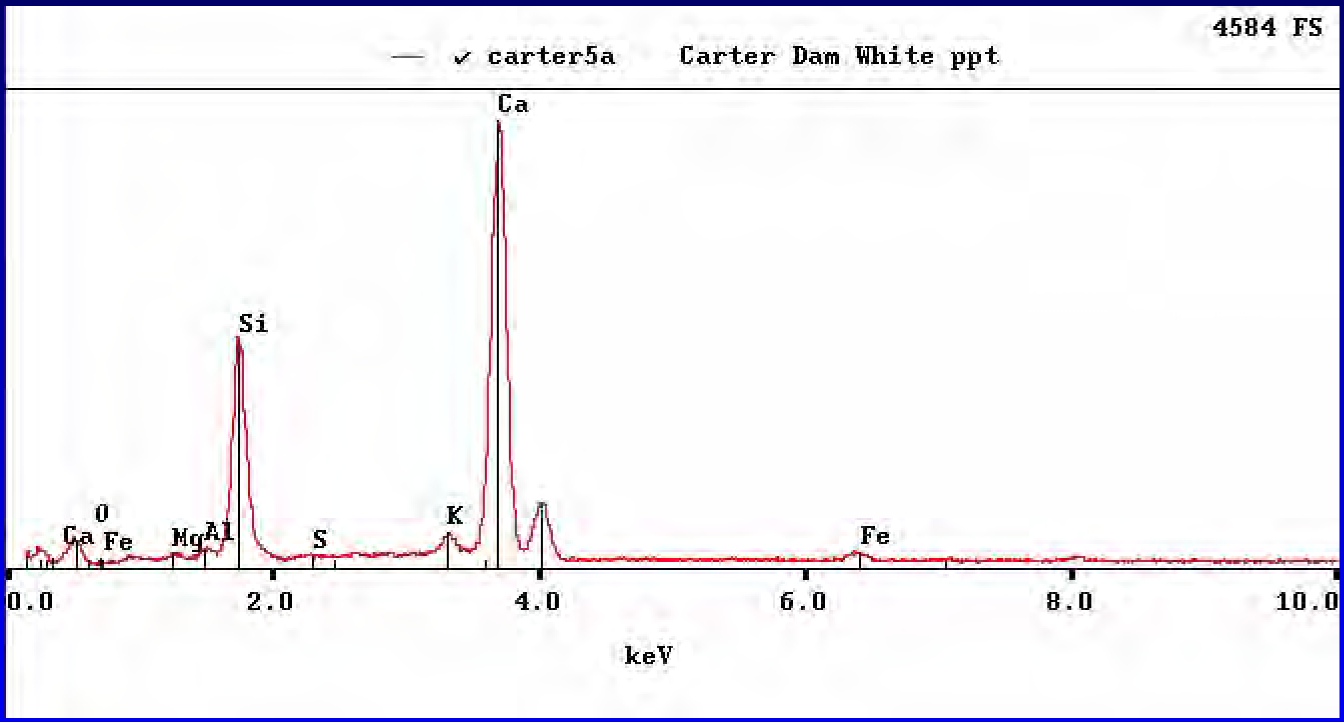
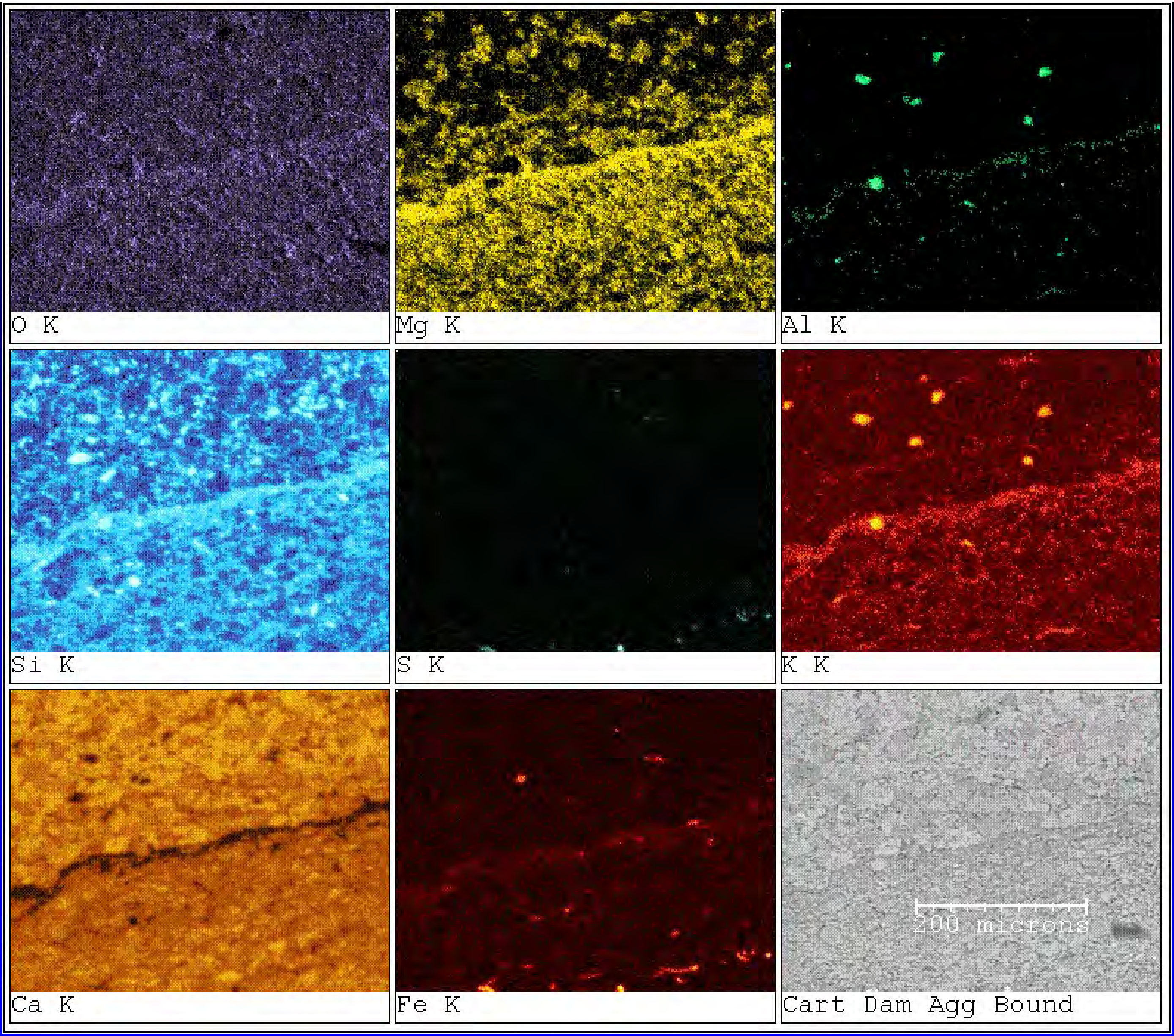
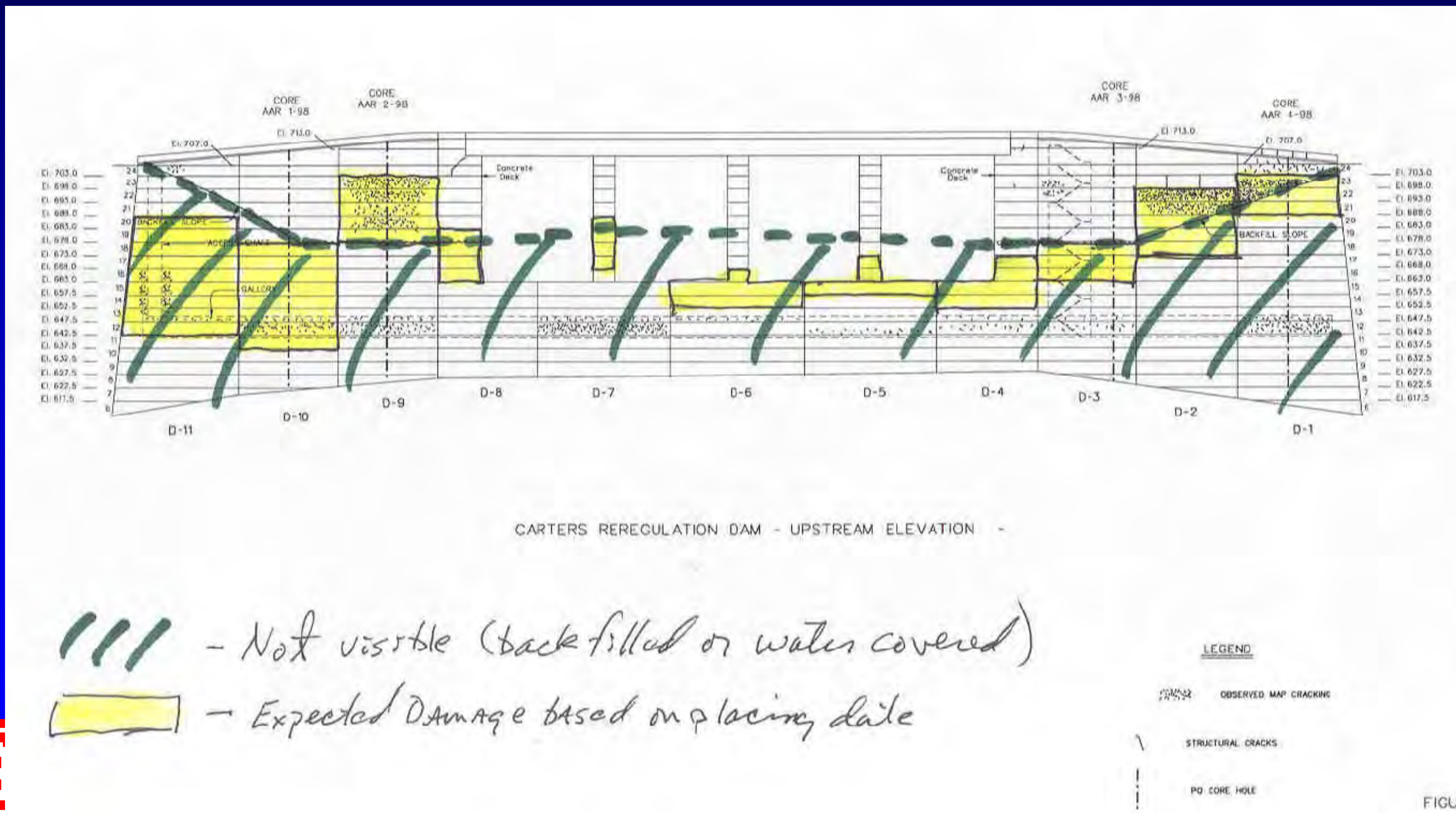

200 µm
30.kV 235x BSED
USA ERDC CMB ESEM
24.6mm 1.1T
CAW01550.TIF 05/06/02 08:19

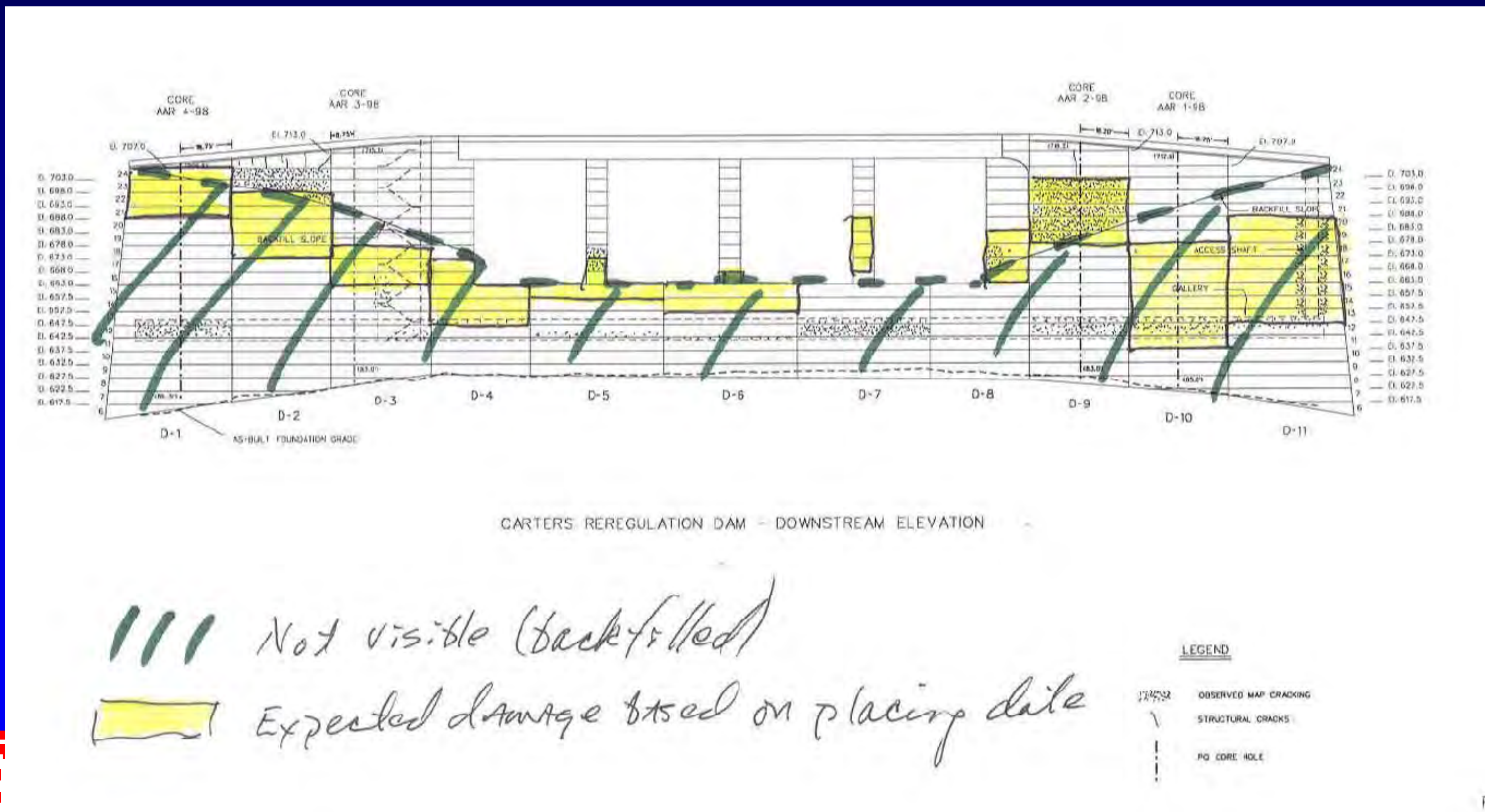

4584 FS
carter5a Carter Dam White ppt
Ca
Si
O
Ca Fe
Mg Al
S
K
Fe
0.0
2.0
4.0
6.0
8.0
10.0
keV


O K
Mg K
Al K
Si K
S K
K K
Ca K
Fe K
200 microns
Cart Dam Agg Bound

Expected Damage – Upstream Face



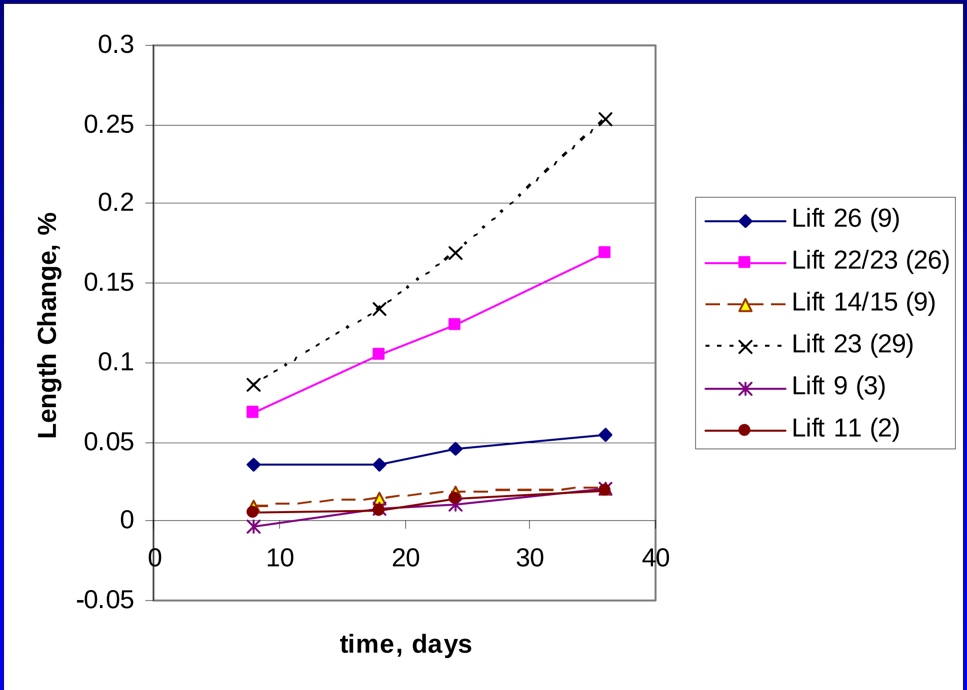
Expected Damage - Downstream Face



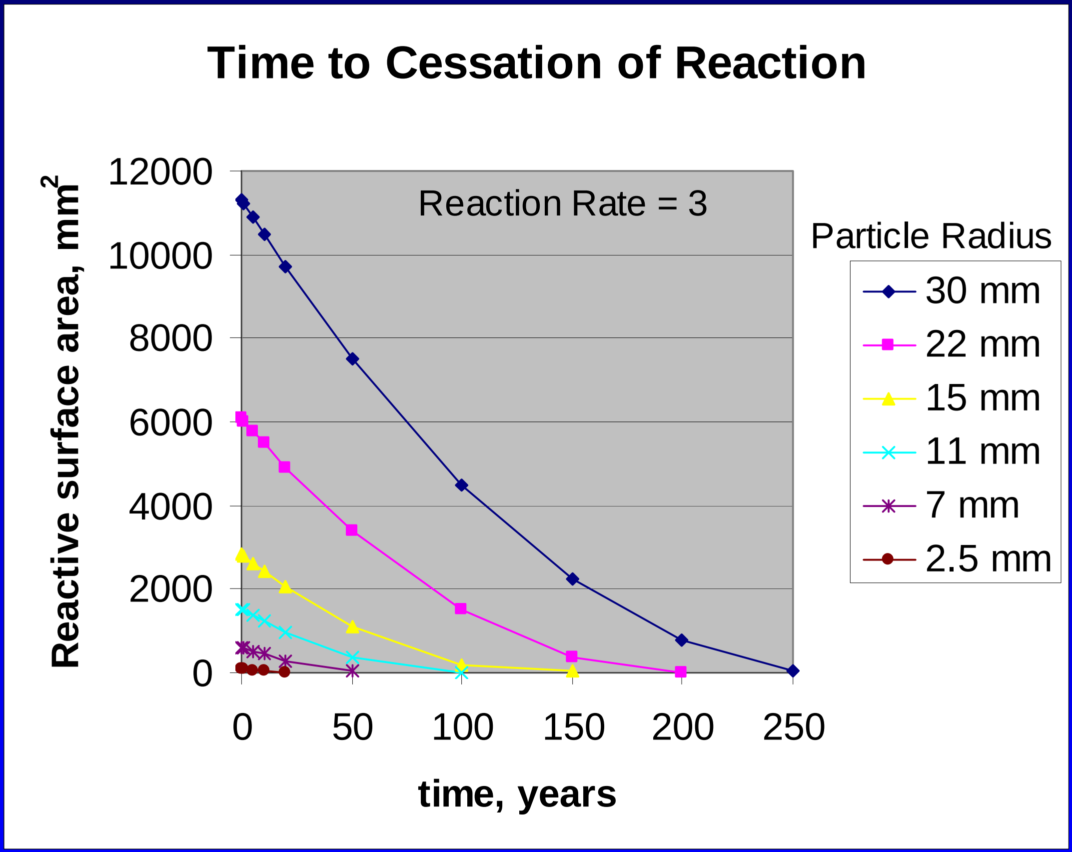
Strength

- Strength ~ number reactive particles/ft
  - Low counts: 3935 psi
  - Moderate counts: 3357 psi
  - High counts: 2884 psi (best of the worst!!)

Residual Expansion



Remaining Reaction



Similar Structures

- Chickamauga
  – Lock soon to be replaced
- Center Hill

Major Materials Issue

- Aggregate QC
- Alkali Carbonate Reaction
  - First analysis suggests
  - Bad news for aggregate sources
- Alkali Silica Reaction
  - Similar in some features
  - Better news for aggregate sources
- AAR - Do we really know what we're doing?

Damaging Interactions Among Concrete Materials

Toy Poole

U.S. Army Corps of Engineers

August 2005

US Army Corps of Engineers®

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Interactive Effect

- Ad hoc definition: Effect of two or more materials acting on each other in unexpected ways.
- Focus on the negative
- Usually are problematic because of lack of understanding of mechanism
- Tend to defy specifications

AAR: One of the Older Ones

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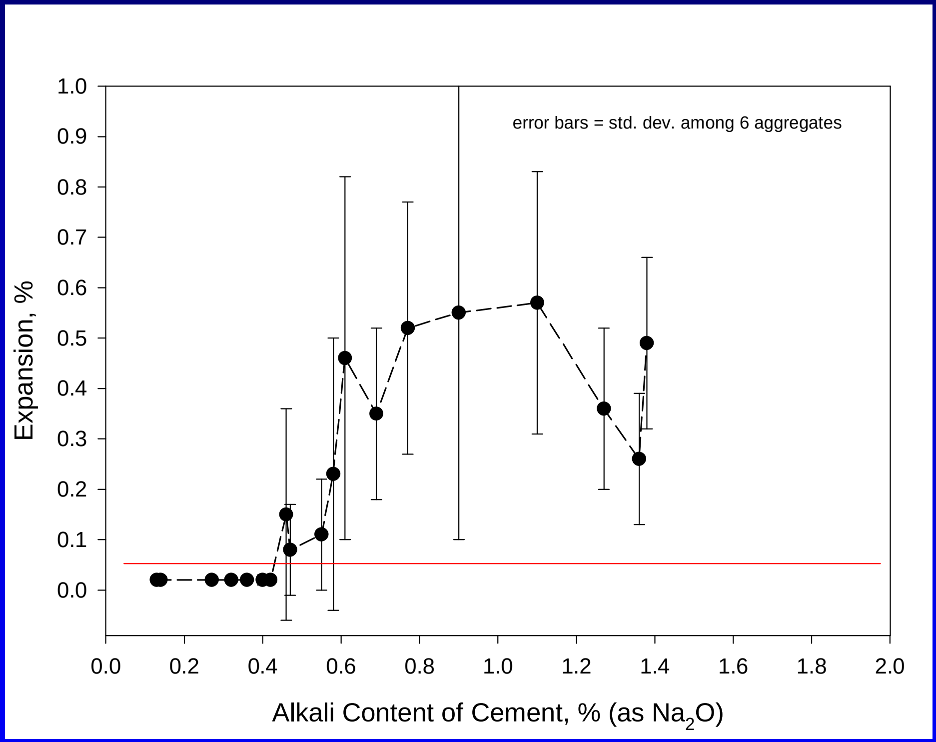
AAR

- Cement alkalis
  - Solution: Total alkalis < 0.60%
- Reactive Constituents



Low Alkali Didn't Work!

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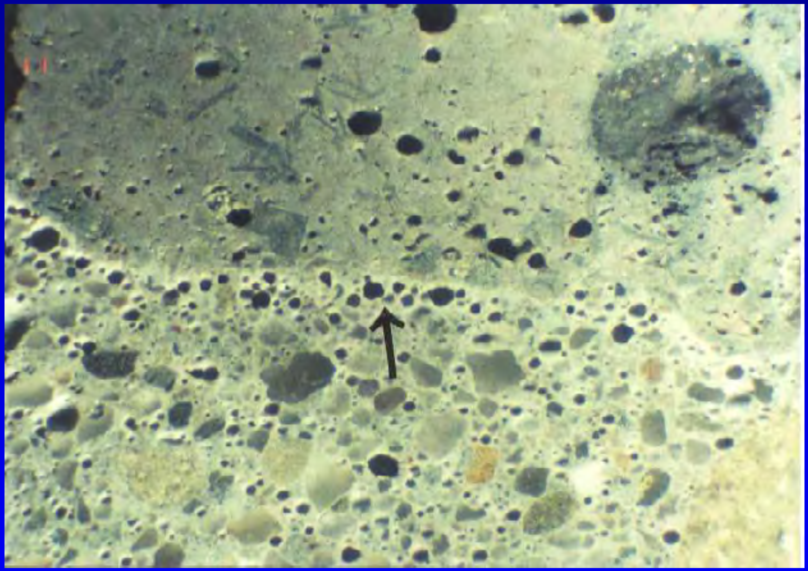
Cement – Air Entraining Admixture (relatively new)

- Some AEA's?
- Some concrete materials?
- Some conditions?
- Air voids collapse around aggregate



Failure of Air Void Systems

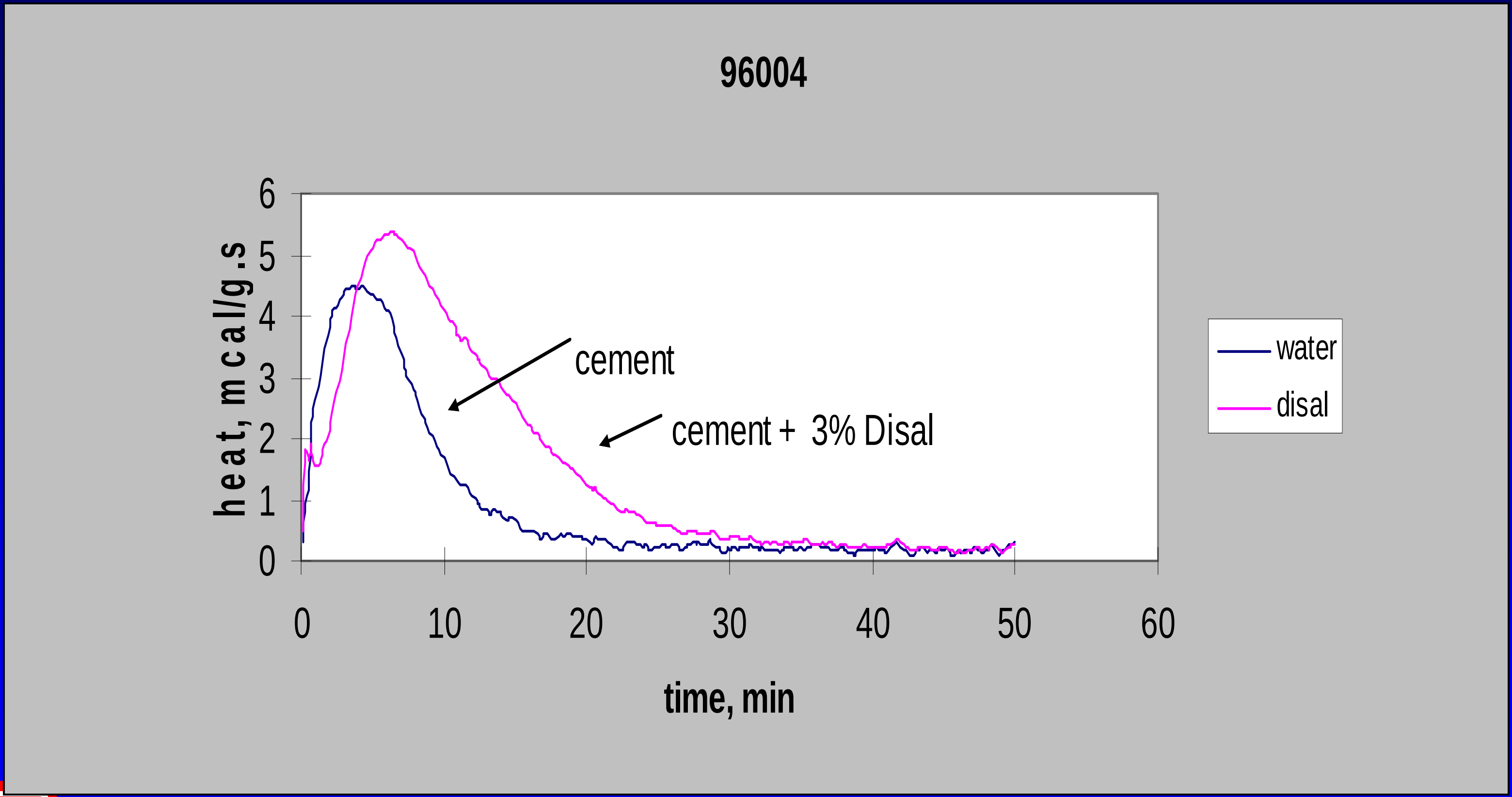
Early Stiffening Reactions

- Portland Cement –WRA Reactions
- Portland Cement – Fly Ash Reactions
- Vary from mild to severe
  - Mild – nuisance
  - Intermediate – often most problem
  - Severe – total show stopper!

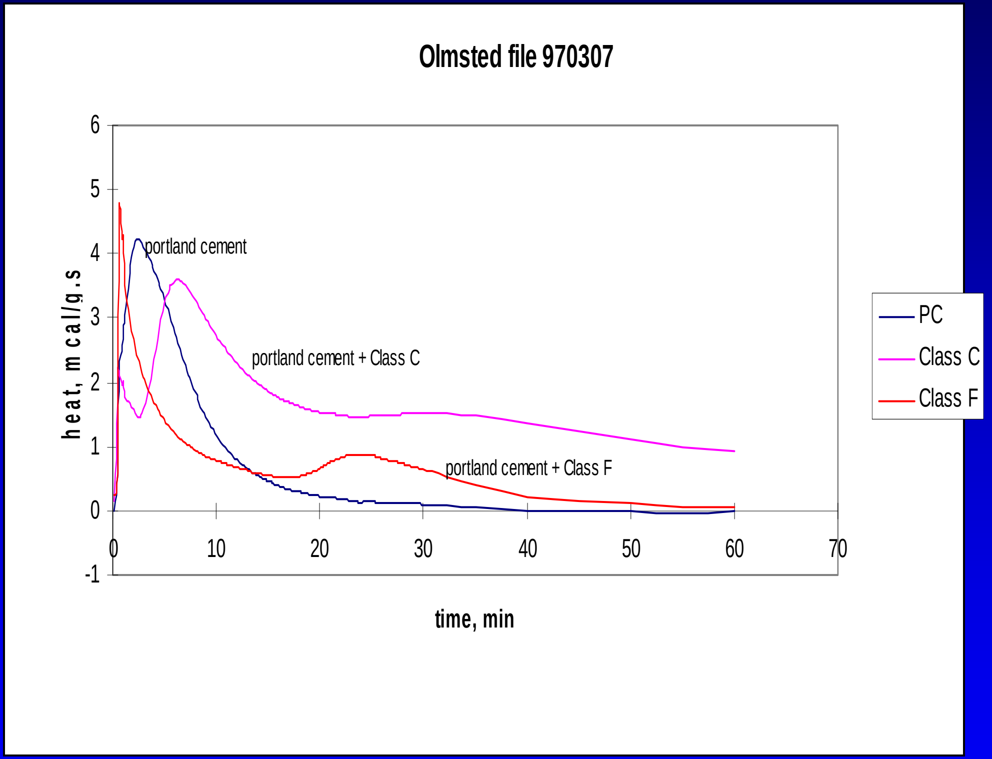
Flash Setting vs False Setting

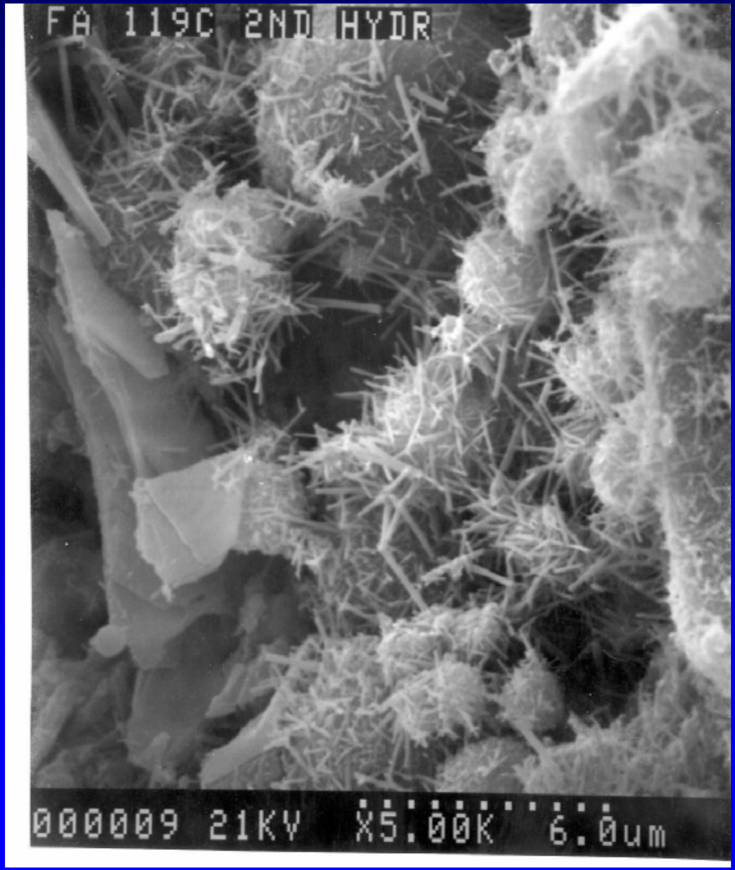
- Flash setting – doesn't disappear on extended mixing – usually caused by accelerated cement hydration
- False setting – disappears with extended mixing – caused by plaster in cement

Cement – WRA: Flash Setting



Cement – Fly Ash Reaction





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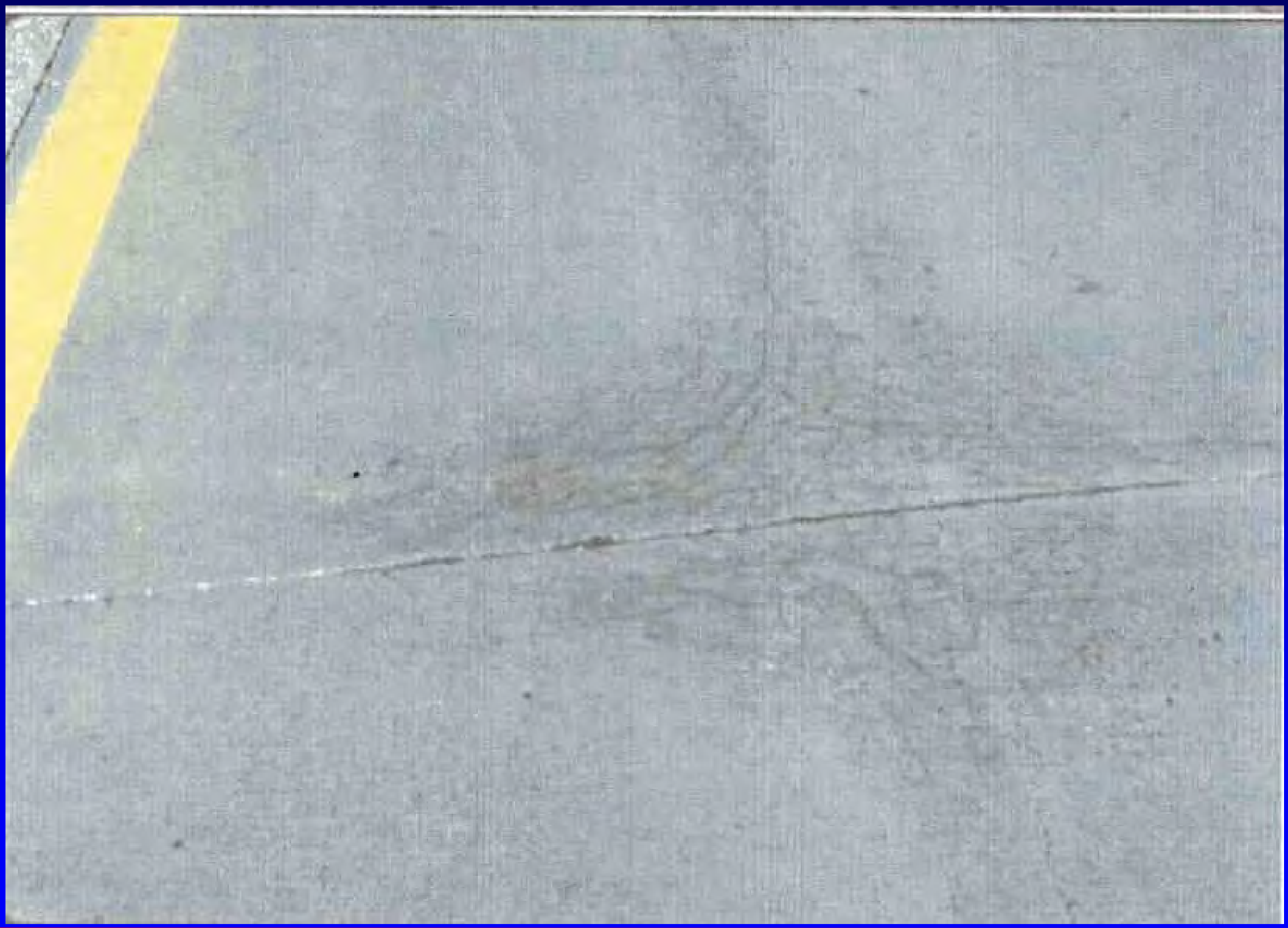
Damage Factors

- Poor compaction
- Temptation to add water
- Economic - Lost productivity

Poor Compaction



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Extra Water

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Lost Productivity

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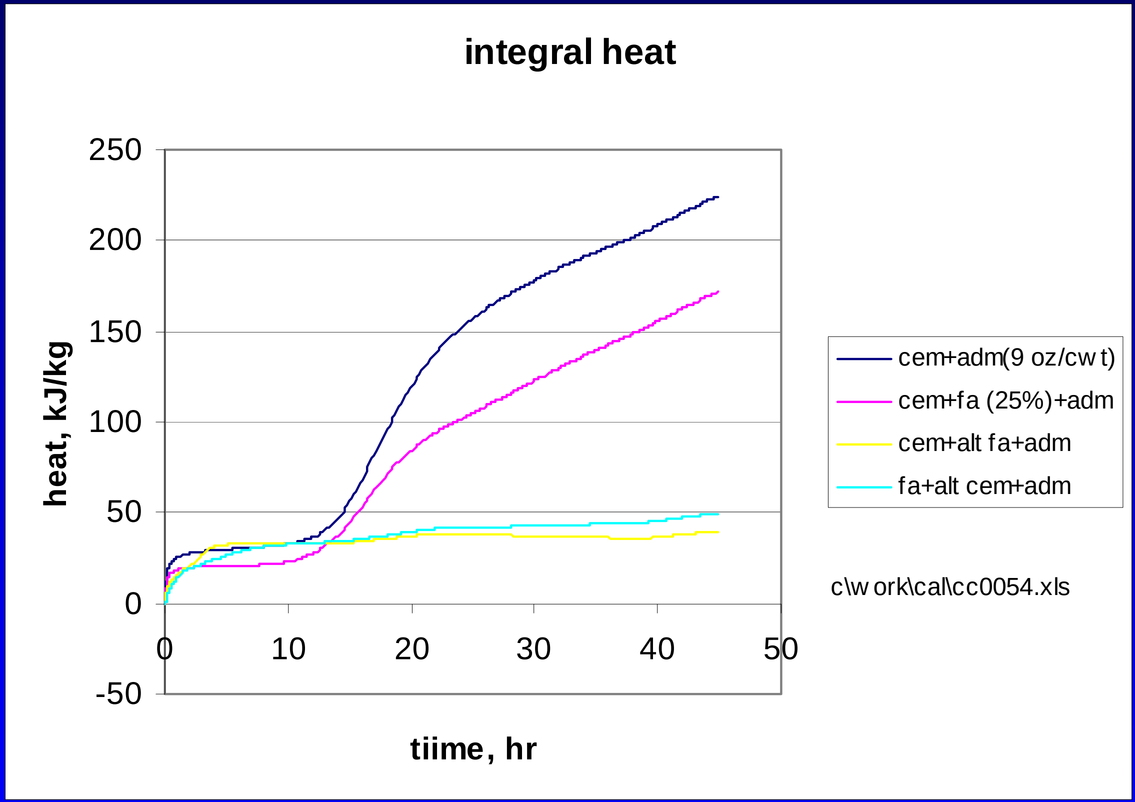
Extreme Retardation

- Cement – WRA Reactions
- Cement – Fly Ash – WRA Reactions

Inhibition of C_3S Hydration



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Damage Factors

- Plastic Shrinkage Cracking
- Economic – Lost Productivity

ASTM Task Group on Interactions

- Developing test methods
  - Early stiffening
  - Delayed setting
- No specification activity
  - Plausible with fly ashes
  - No clear responsibility tag with admixtures

The End

Economic Effects on Construction of Uncertainty in Test Methods

Toy Poole
U.S. Army Corps of Engineers

August 2005

Selected Examples

- CRD-C 114 - F/T dur of aggregates
- ASTM C 78 – flex beam
- ASR testing
- Curing compound testing
- Heat of hydration testing

Test Method Uncertainty

- Within-laboratory variation
  - Operator
  - Equipment
- Between-laboratory variation
- Simple bias
- Material-dependent bias

ASTM

- Requires precision and bias statement
  - Within laboratory - repeatability
  - Between laboratory – reproducibility
- d2s – based on std dev
- d2s% - based on CV

d2s

- Maximum difference among a set of determinations in 95% of cases
- For duplicate determinations,
  – d2s = 2.8*s, or 2.8*CV
- For triplicate determinations,
  – d2s = 3.3*s, or 3.3*CV
- Multipliers for larger sets in ASTM C 670

Example – ASTM C 138 Density of Concrete

- Within-lab std dev = 0.65 lb/ft^3
  - d2s (n=2) = 1.85 lb/ft^3
  - d2s (n=3) = 2.15 lb/ft^3
- Between-lab std dev = 0.82 lb/ft^3
  - d2s (n=2) = 2.31 lb/ft^3

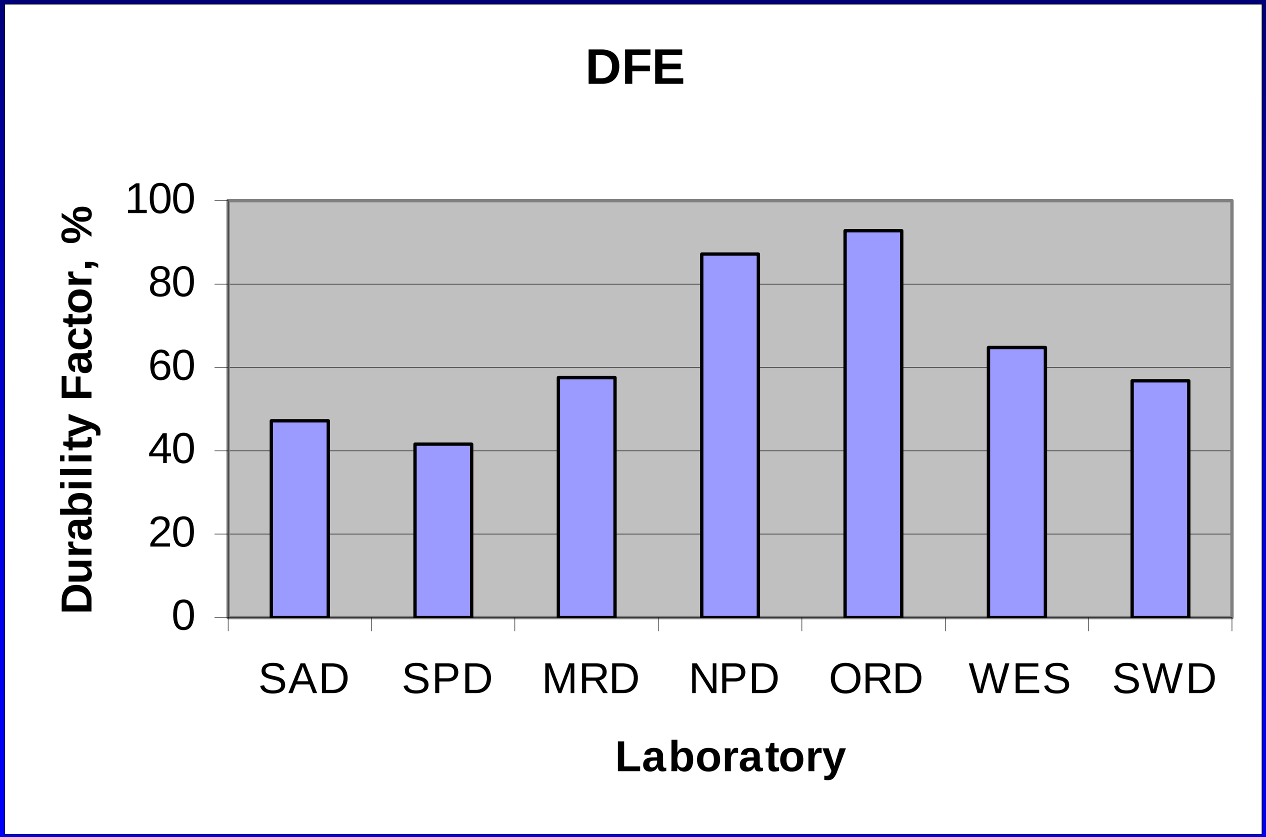
CRD-C 114
Durability of Aggregates to Cycles of Freezing and Thawing

- Acceptance testing of concrete aggregate
- Based on ASTM C 666
  - Air-entrained concrete
  - Results reported as a Durability Factor 0 – 100%
  - 100% Specifications typically 50 – 75%
- No reported precision estimate

CRD-C 114
Durability of Aggregates to Cycles of Freezing and Thawing

- Significant between-laboratory disagreements
- Changes in use of durability factor specifications

Mather 1954



DFE
Durability Factor, %
100
80
60
40
20
0
SAD
SPD
MRD
NPD
ORD
WES
SWD
Laboratory

Precision CRD-C 114

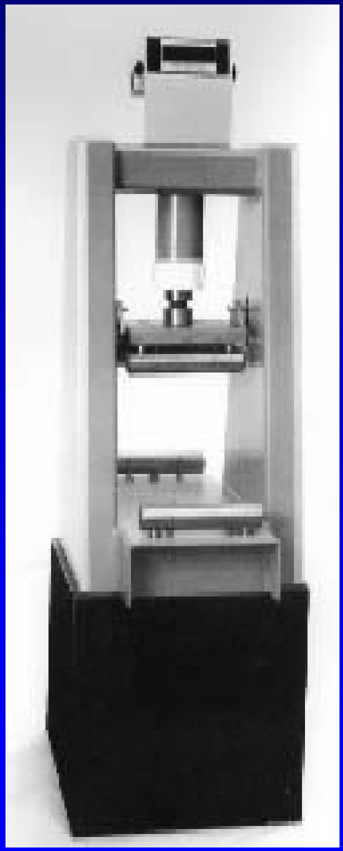
- Standard deviation among labs
  - 19.3%
- d2s among labs
  - 54%

Economic Consequences of Rejection

- Hauling distance to secondary source
- 10 mi of 4 lane highway
  - 120,000 yd^3 of concrete at $0.15/ton/mi
  - 25 mi haul = $450,000
  - 50 mi haul = $900,000

ASTM C 78
Flexural Strength

- Basis for acceptance of mix design
- CV = 7% between laboratory
- At 650 psi
  - d2s ~ 125 psi



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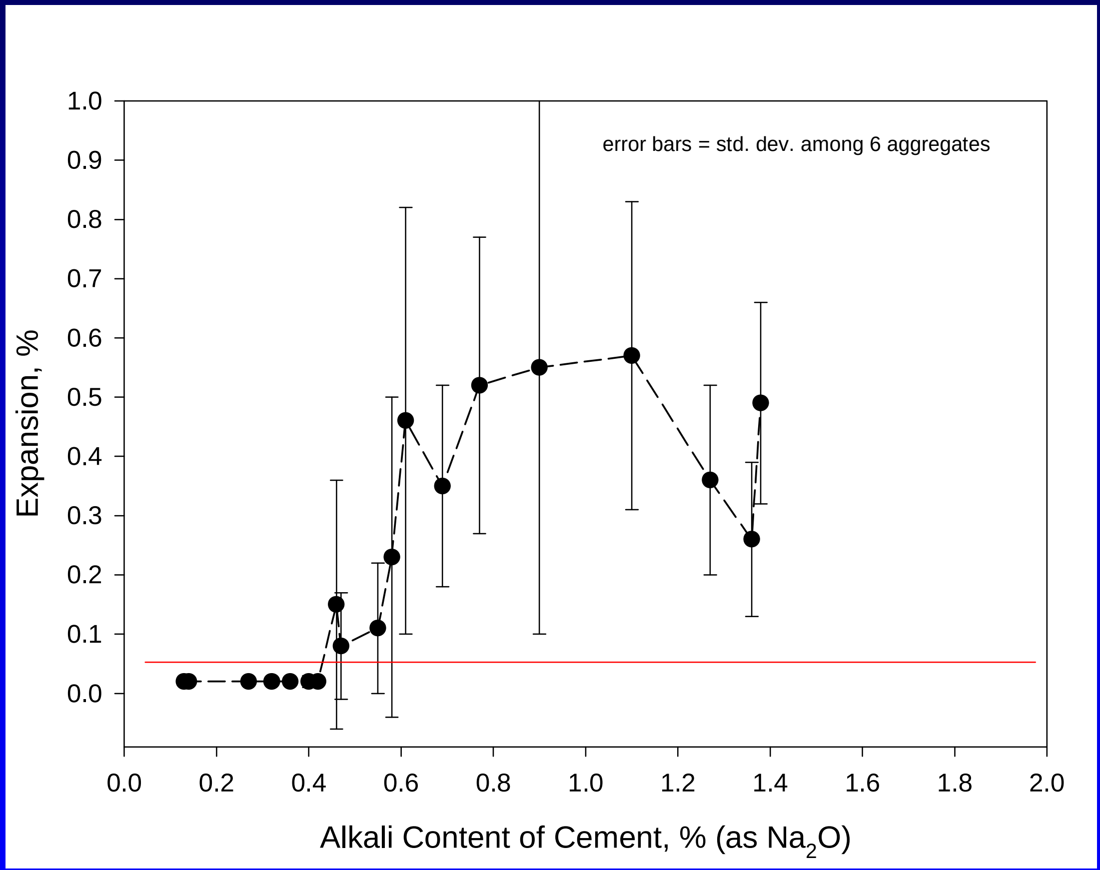
Economic Consequences

- Delays over mixture acceptance
- Add extra 100 lb/yd^3 to insure compliance
- 10 mi of 4 Lane
- ~$1,000,000 in cement cost

AAR

ASTM C 150 – Low Alkali



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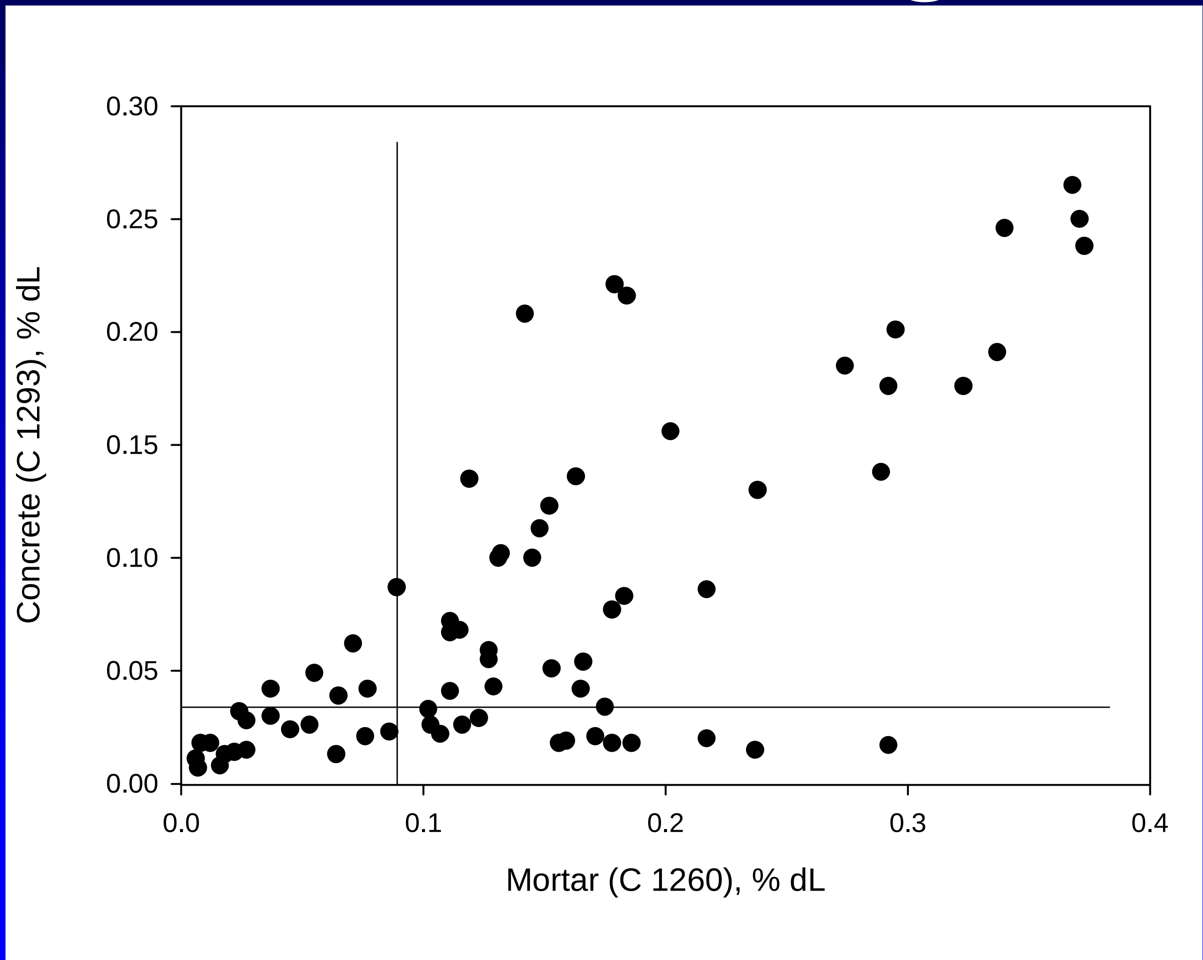
ASR Testing

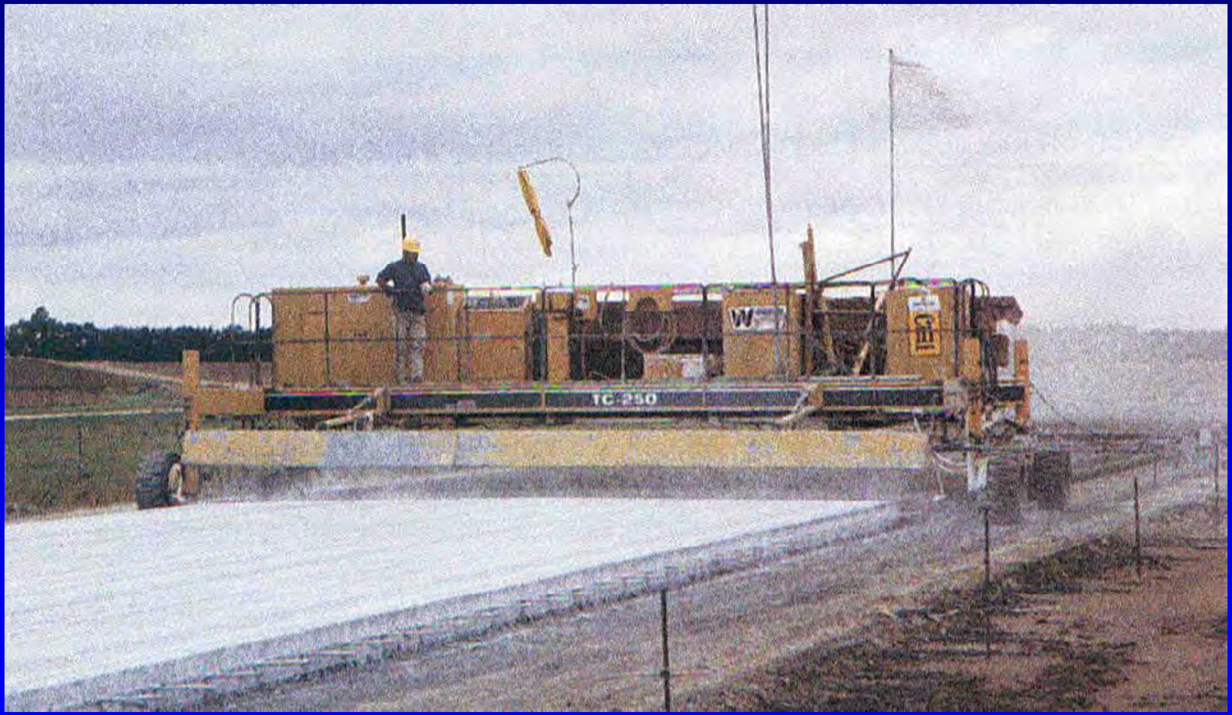


0.30
0.25
0.20
0.15
0.10
0.05
0.00
Concrete (C 1293), % dL
0.0
0.1
0.2
0.3
0.4
Mortar (C 1260), % dL

AAR Cost Factors

- Rejection of acceptable aggregate
  - Short term $$
- Acceptance of inadequate aggregate
  - Long term $$

ASTM C 156 – TM for Curing Compounds



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ASTM C 156

- Typical limit: 0.55 kg/m^2
- Typical production: 0.45 - 50 kg/m^2
- Between Lab Std dev = 0.07 kg/m^2
- Between Lab d2s = 0.20 kg/m^2

Error > Safety Margin!!

C 156 Cost Factors

- User – producer disputes
- Over conservative specification
  - High solids materials
  - Difficult to apply
- May not perform
- Little testing by Federal Gov't

ASTM C 186
Heat of Hydration of Hydraulic Cement

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ASTM C 186
Heat of Hydration of Hydraulic Cement

- Between Lab std dev = 4 cal/g
- d2s = 11 cal/g
- Represents ~1,000 psi strength difference
- Target strength = 1500 psi, 3 days
- Specification limit = 1000 psi, 3 days

Cost Issues

- Uniformity in Strength Gain
  – Weekly variation ~1,000 psi
- Uncertainty in Form Removal

Trends in Concrete Materials Specifications

Toy Poole
U.S. Army Corps of Engineers

August 2005

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Hydraulic Cement

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Hydraulic Cement
Portland Cement

- Type I – general purpose → Increasing strength
- Type II – mod SO_4, mod heat → Increasing heat (↑ Increasing strength)
- Type III – high early
- Type IV – low heat → FAPP doesn't exist
- Type V – high SO_4

AASHTO – ASTM Harmonization

- Current Activity
- Develop a common PC spec
- Major revision of Type II
  - Limit on heat of hydration
  - Limit on fineness

Hydraulic Cement
P2P

- C 150 – Portland Cement
- C 595 – Blended Cement
- C 1157 – Hydraulic Cement

Prescriptive

↓

Performance

Major Industry Trends

- Strength
  - Increasing 1970 - 1995
- Fuel costs
  - Waste fuel initiatives
- Waste management
  - Dust recycling – high alkali levels
- CO_2 Emissions
  - Non PC additions

Additions

- Carbonate rock dust - 2004
- Slag – as a processing addition
- CKD - ???

Pozzolan

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Major Industry Trends

- Increasing Class C
- "Spot Market" coal supplies
- SO_2 emissions
- Ash from alternative fuels
- Development of **Performance** stds

Slag

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Industry Trends

- Increased marketing
- Shifting emphasis to finer materials
  - Grade 80 uncommon
  - Grades 100 & 120
- Name: GGBFS → Slag Cement

Aggregate

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Industry Trends

- ASR testing
  - Mortar bar → C 1260 – accel mortar ←
    C 1293 – concrete prism
- Manufactured Fine Aggregate
  - High fines concrete
  - Appendix to ASTM C 33

Admixtures

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Industry Trends

- New Products, new versions of old products
  - SCC
  - Antiwashout
  - Antifreezing
  - Anticorrosion
- Cement – Admixture Interaction
  - Early stiffening
  - Delayed setting HRWRA
  - polycarboxylate

Repair Materials

- Historically: few or no spec's
- Rapid-strength-gaining cements
- Corps of Engineers – REMR
  - Focus on compatibility
    - Modulus
    - Thermal expansion
    - Volume stability

The End

PRESENTER:

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CELL: (251) 422-3536

MODULAR GABION SYSTEMS

gragazzo@gabions.net

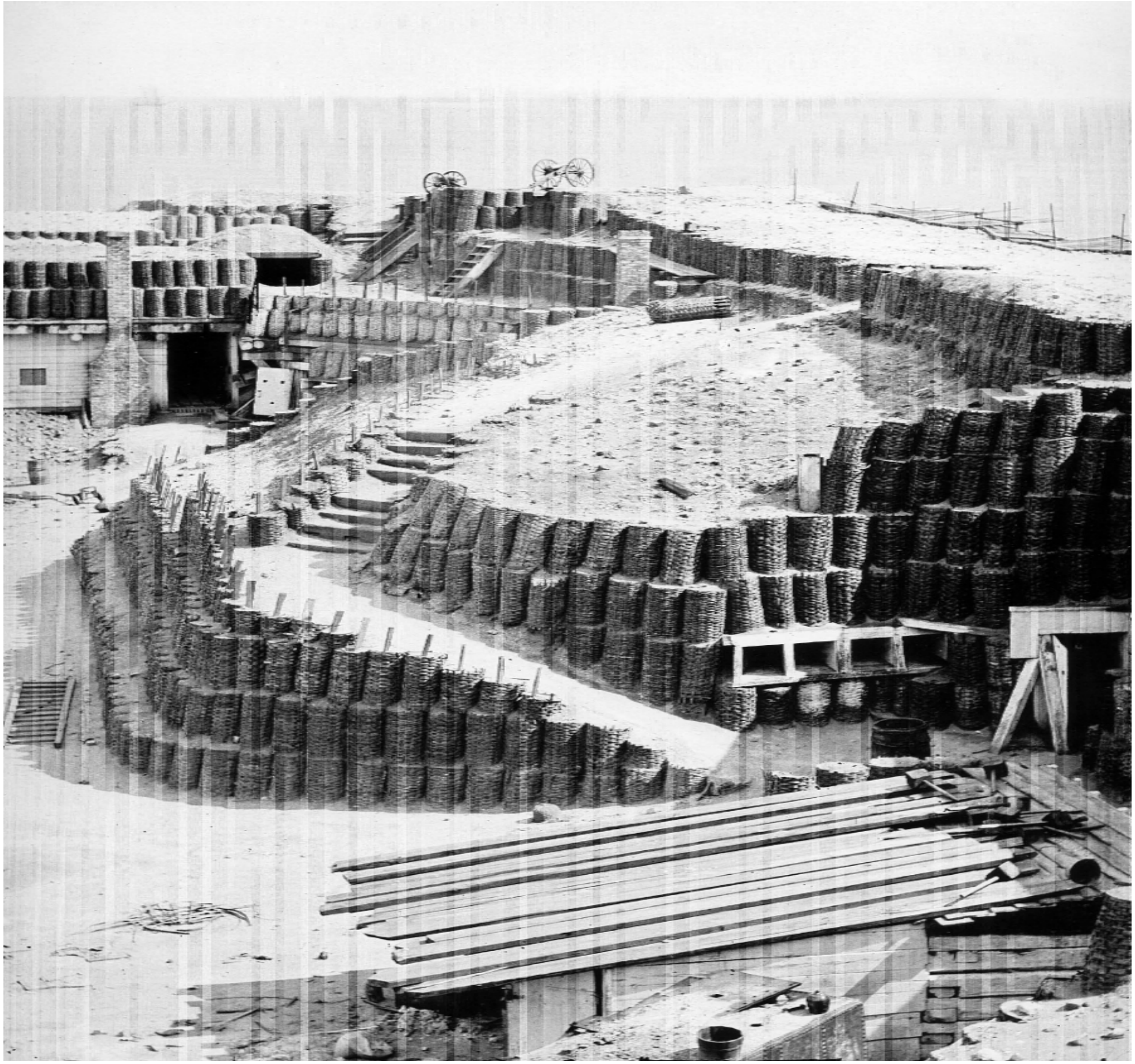
“GABION”
THE WORD ORIGINATED FROM:

- **LATIN - “CAVEA” = CAGE**
- **ITALIAN - “GABBIA” = CAGE**
- **ITALIAN - “GABBIONE” = LARGE CAGE**
- **ENGLISH - “GABION” = LARGE CAGE**

“GABION”

WEBSTER’S DEFINITION:

1. **A cylinder of wicker filled with earth or stones, formerly used in building fortifications.**
2. **A similar cylinder of metal, used in building dams, dikes, etc.**

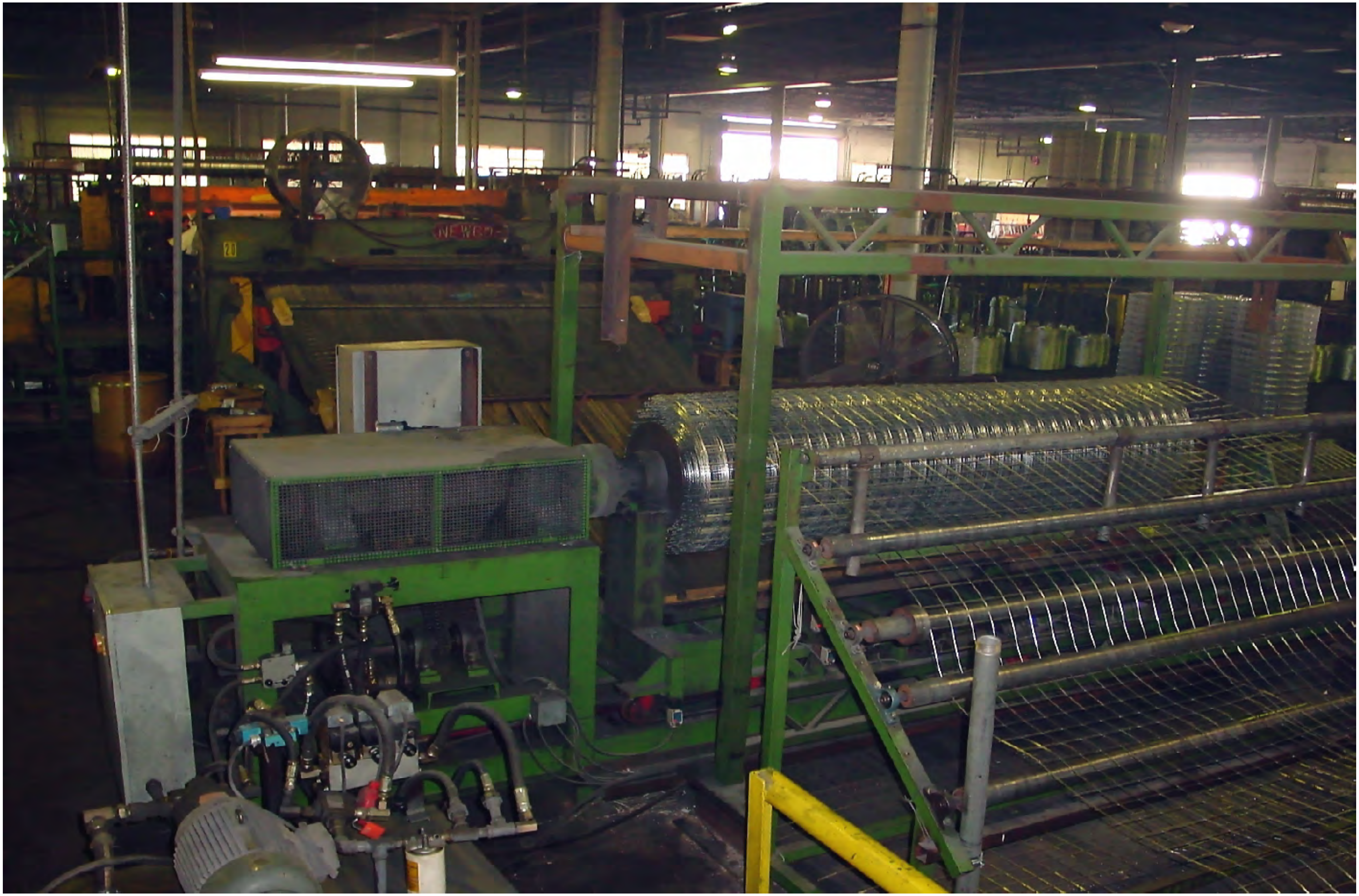


GABION FORTIFICATION – FT. SUMTER, SC
CIVIL WAR 1865

GABIONS are steel wire mesh “large cages”, “baskets” or “containers”, which when interconnected and rock-filled form monolithic, flexible, permeable structures unique to solve the complex problems of erosion control, flood control, earth retention, bank stabilization, etc. at relatively low cost.

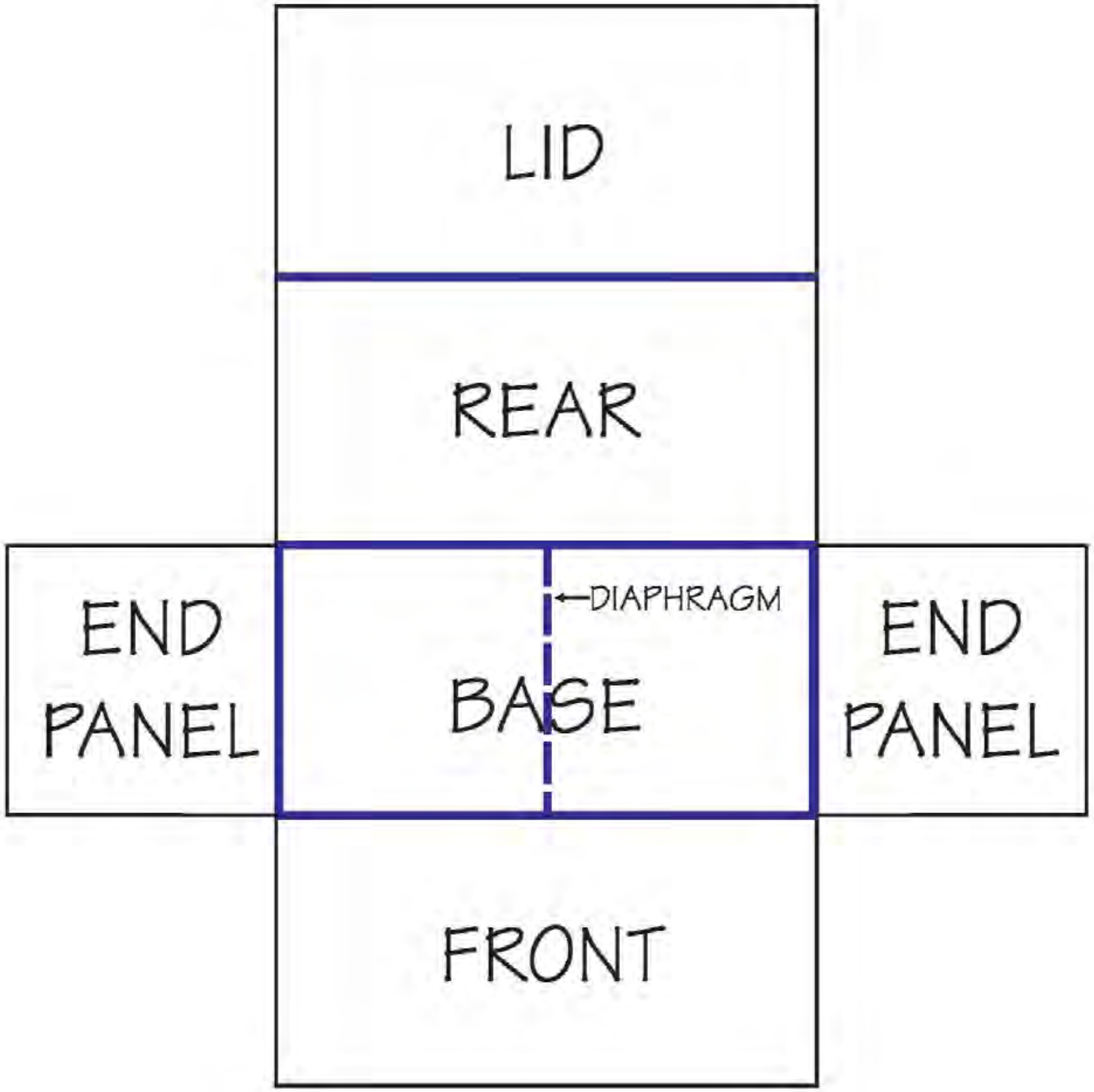
GABION WIRE
TYPES AVAILABLE

- Galvanized wire – class 3 zinc coated
- Bezinal coated wire – 95% zinc
  ± 5% aluminum
- PVC coated wire – zinc or bezinal & PVC
- Stainless steel wire

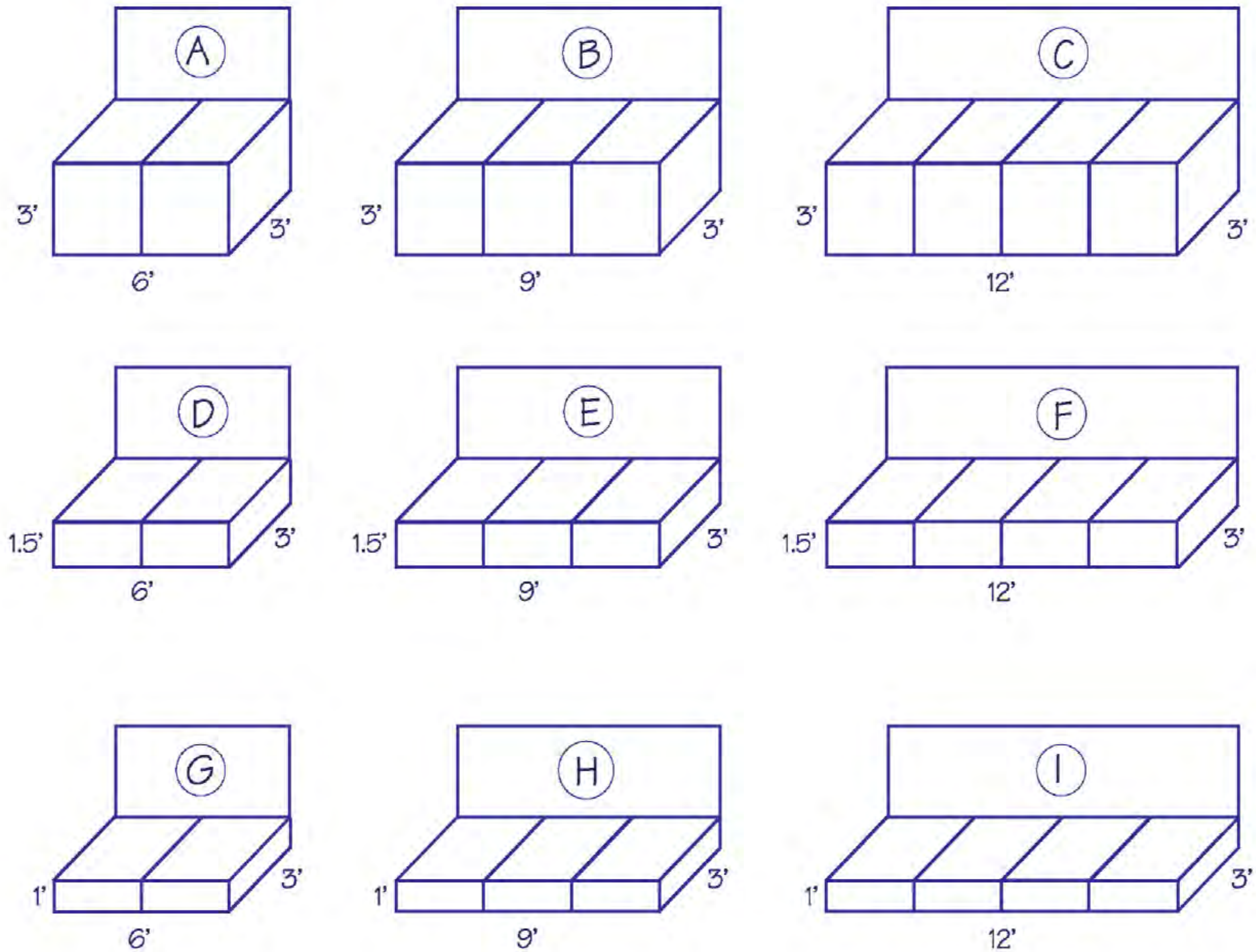


WELDED WIRE MESH GABION MACHINE
MESH IS PRODUCED IN ROLLS

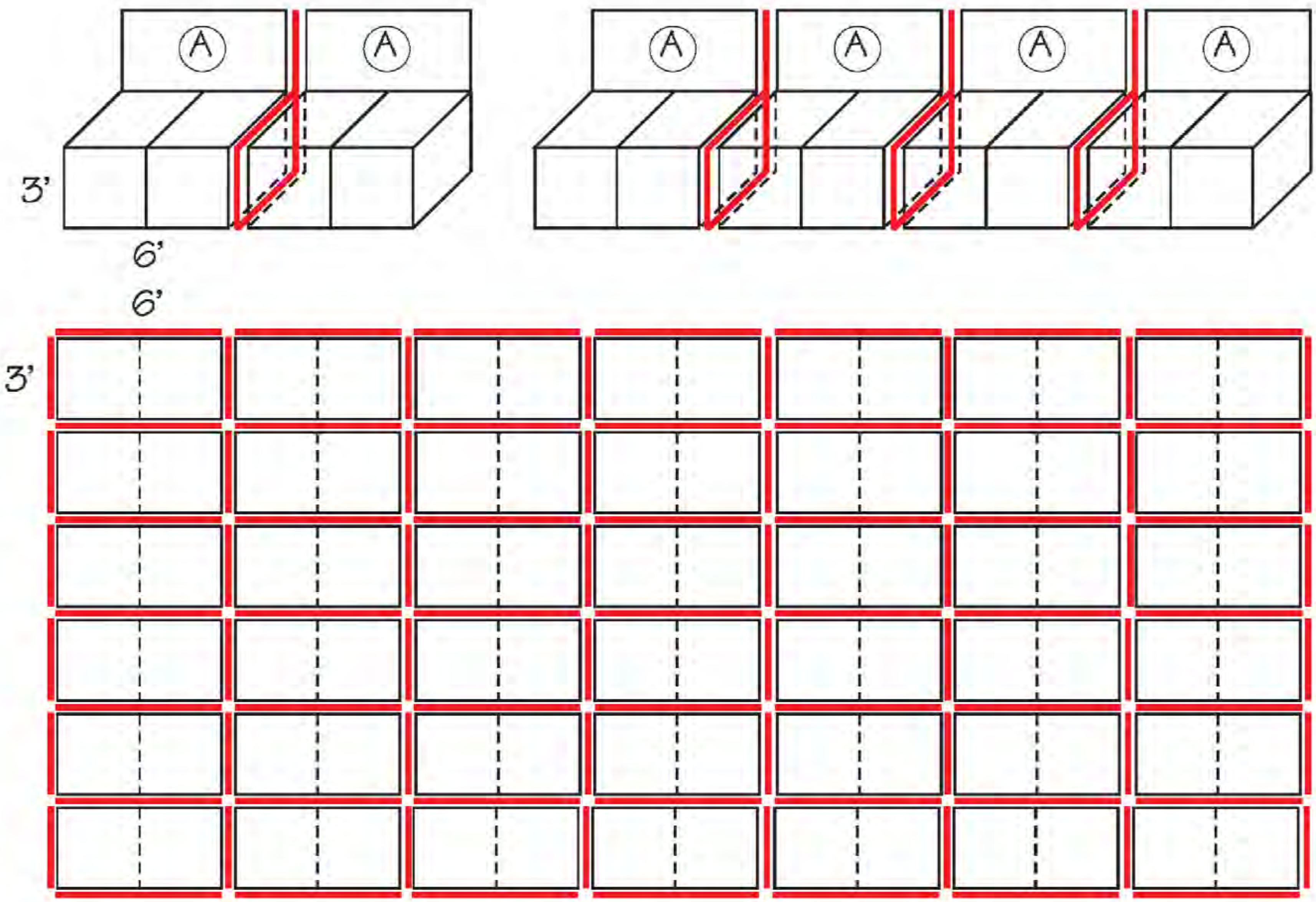
TWISTED WIRE MESH GABION MACHINE
MESH IS PRODUCED IN ROLLS



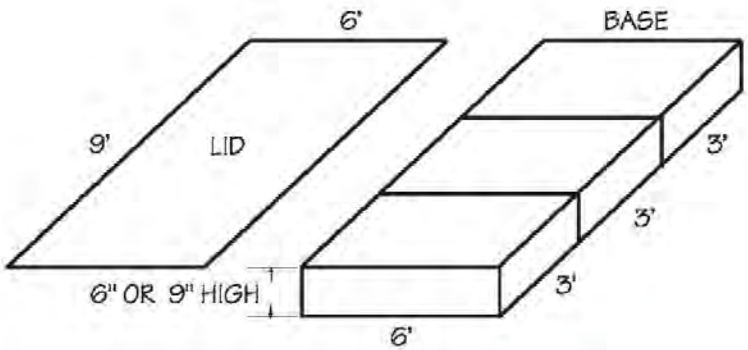
UNFOLDED-UNASSEMBLED GABION

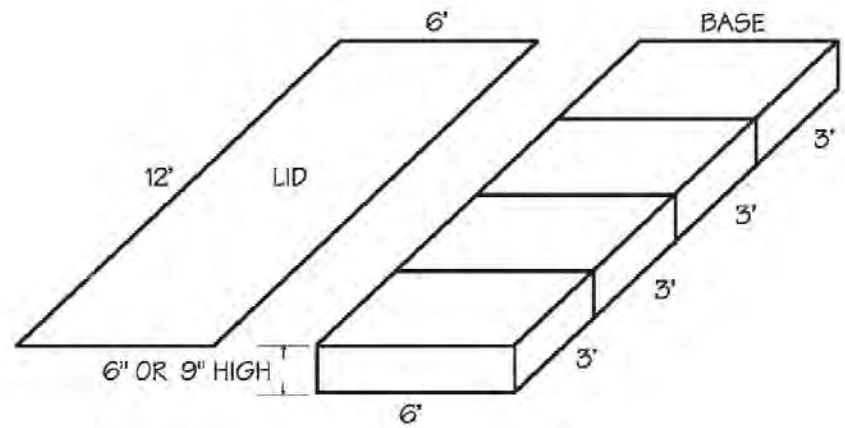


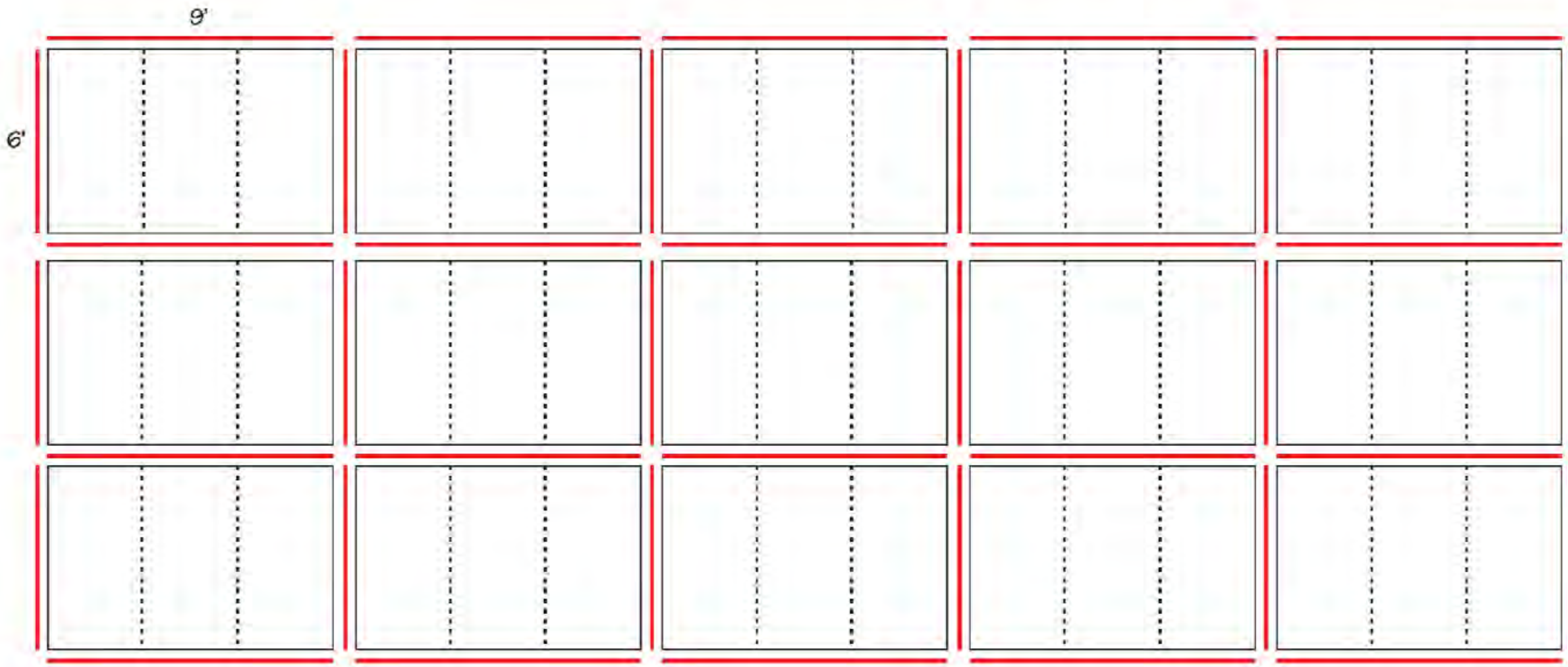
STANDARD GABION SIZES



GABION LAYOUT - ISOMETRIC & PLAN VIEW







GABION MATTRESS LAYOUT
ISOMETRIC & PLAN VIEW

JOINTLESS GABIONS

Trapezoidal channel revetment constructed with PVC coated Gabion Mattress utilizing jointless gabions from “Roll-Stock” material.

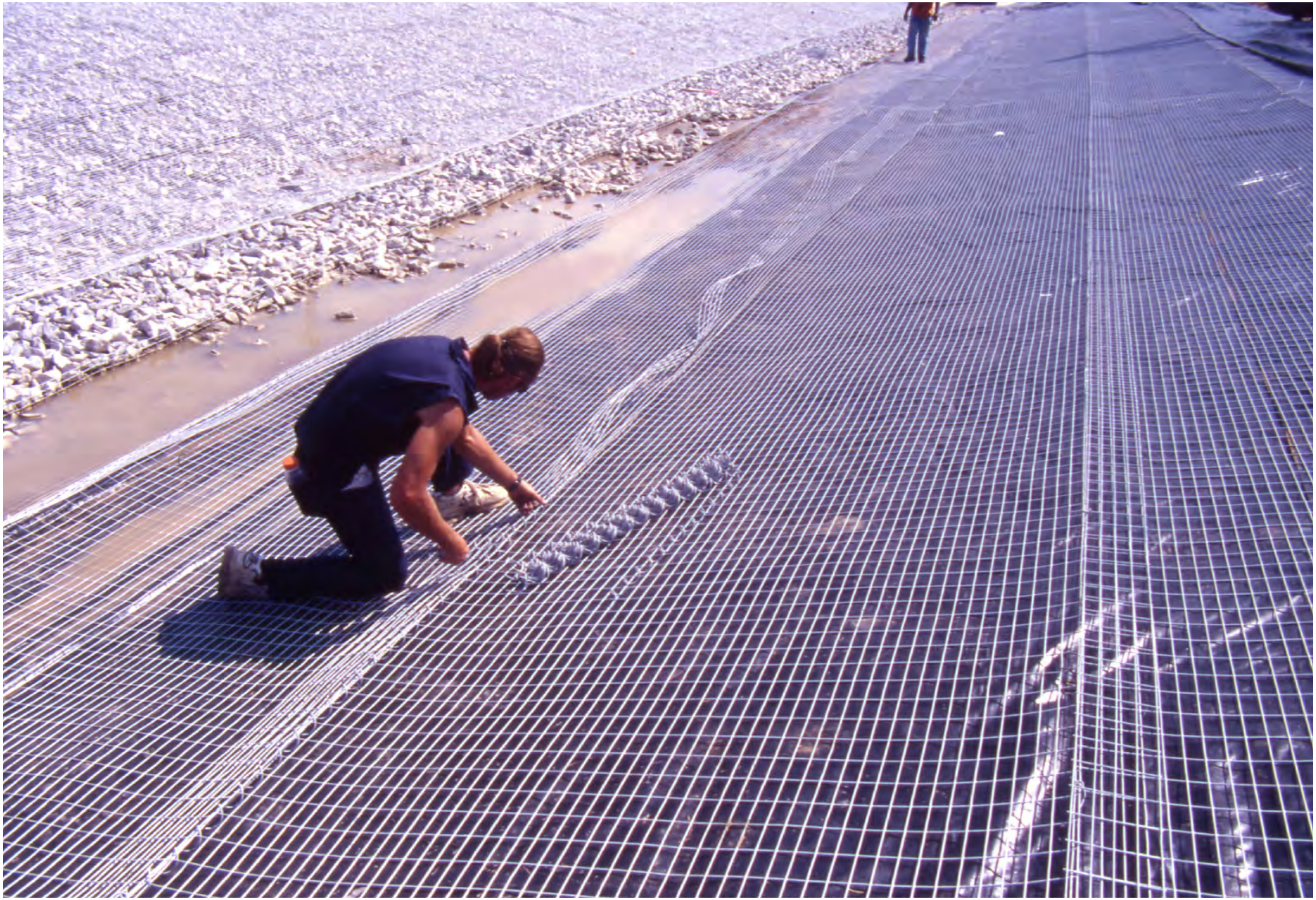
TRAPEZOIDAL CHANNEL REVETMENT - COMPLETED

“ROLL-STOCK” GABION MATERIAL DELIVERED TO JOBSITE

GABION MESH BEING UNROLLED OVER GEOTEXTILE

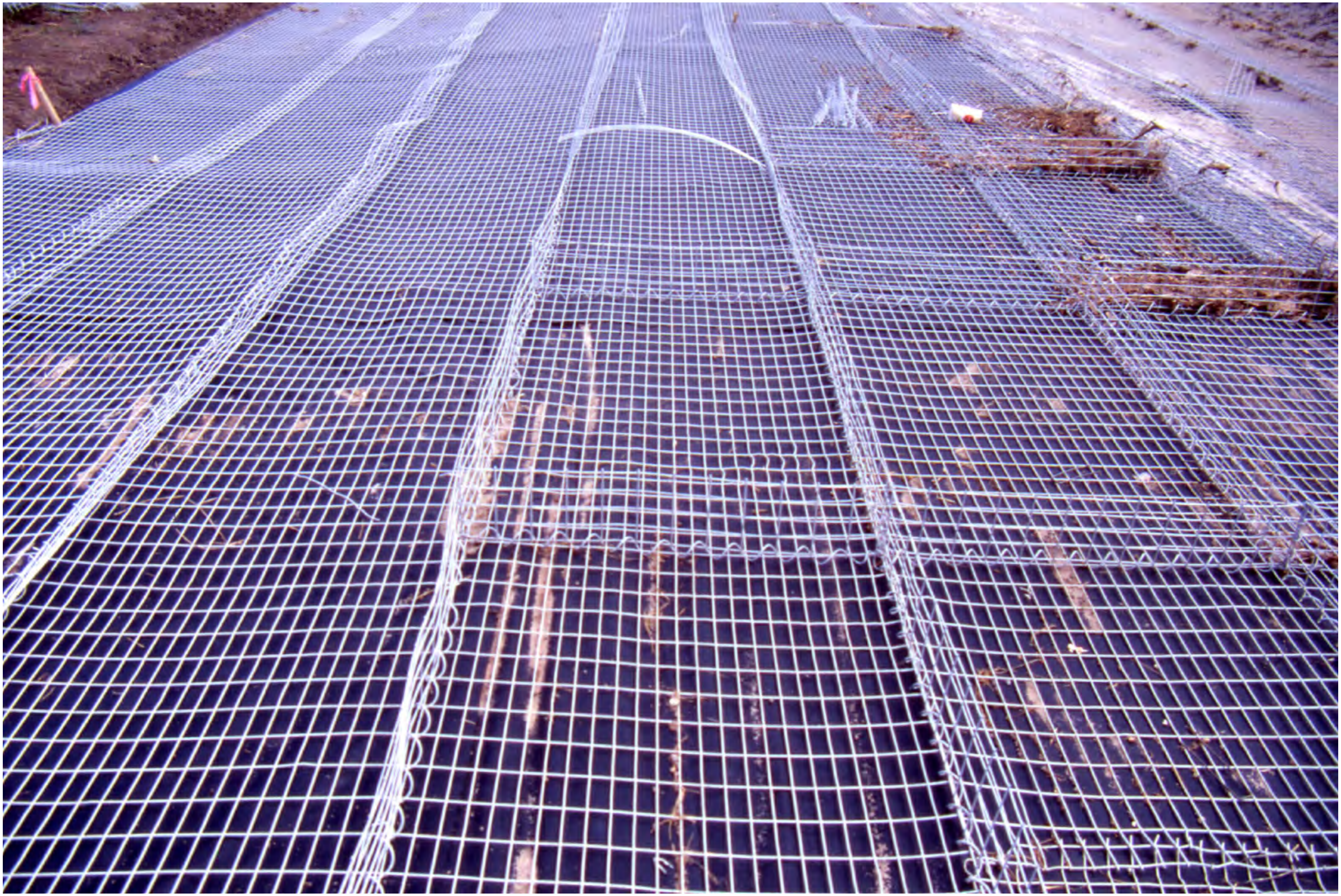
UNROLLING CONTINUOUS DIVIDER PANEL

UNROLLING CONTINUOUS EDGE PANEL



SPIRAL CONNECTING DIVIDER TO BASE PANELS

DETAIL OF SPIRAL CONNECTION



SUBDIVIDING BASE INTO 6’ X 3’ COMPARTMENTS

DIAPHRAGMS ARE CUT FROM "ROLL-STOCK"

ROCK-FILLING THE GABION MATTRESS

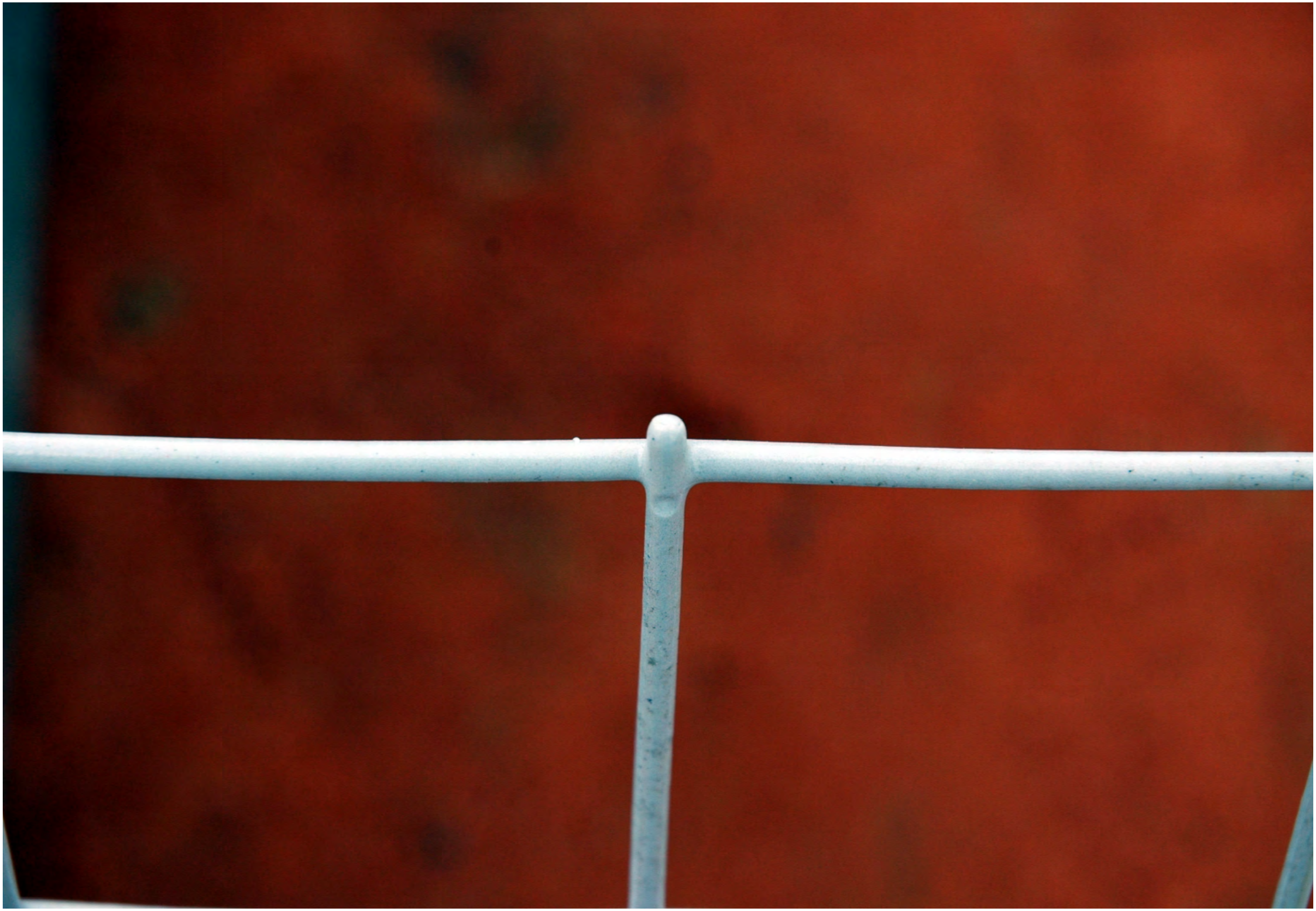
WOOD FORMS PROTECT TOP OF DIAPHRAGMS

LEVELING ROCK-FILL & LID CLOSING

SPIRAL CONNECTING LIDS TO DIAPHRAGMS

JOINTLESS LIDS FROM “ROLL-STOCK”

COMPLETED SECTION OF JOINTLESS GABIONS



ALL WIRE TERMINALS PROTECTED WITH PVC

ALL WIRE TERMINALS PROTECTED WITH PVC

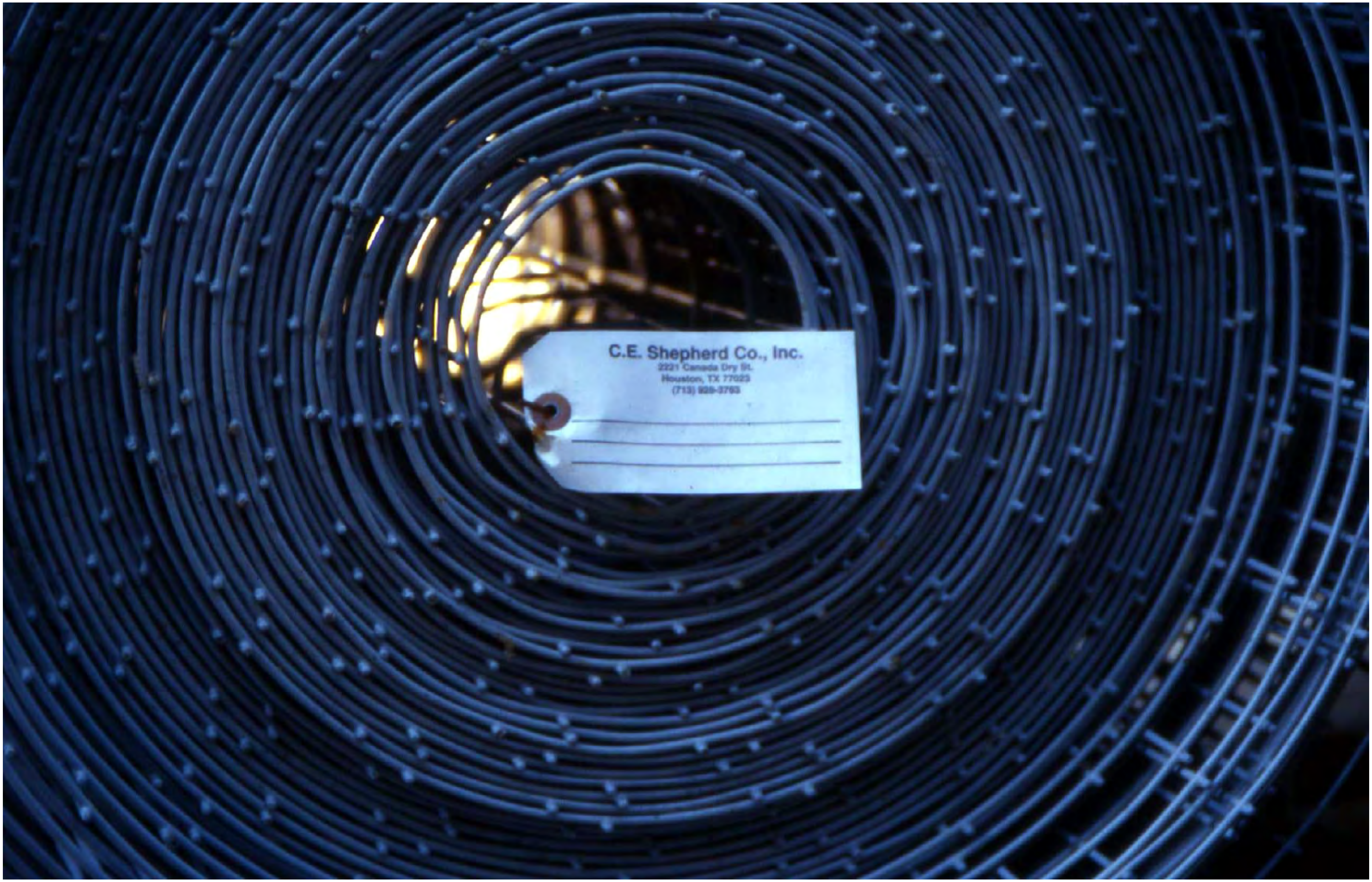
PRE-CUT PANELS
TERMINALS PROTECTED WITH PVC

MECHANICALLY STABILIZED EARTH (MSE) GABION WALLS

48 ft. high MSE wall, constructed from PVC coated Gabion-Faced Welded Wire Reinforced Soil Wall, supporting a new building.

MSE GABION WALL COMPLETED MARCH 1998

SITE EXCAVATED-DRAIN PIPE-GRAVEL BEDDING



6' WIDE PVC "ROLL-STOCK" UTILIZED FOR SOIL REINFORCING – 3" X 3" MESH – 12 GAUGE WIRE

33’ LONG X 6’ WIDE PANELS CUT FROM “ROLL-STOCK” FOR BASE COURSE SOIL REINFORCING

JOINTLESS GABION BASE COURSE ASSEMBLED OVER SOIL REINFORCEMENT PANELS

18” WIDE X 300’ LONG “ROLL-STOCK” UTILIZED FOR JOINTLESS GABIONS CONSTRUCTION

SPIRALS CONNECTING GABION DIAPHRAGMS
TO SOIL REINFORCEMENT GRID

ROCK-FILLING GABIONS WITH 4” TO 8” STONE

TYPICAL MSE GABION WALL CONSTRUCTION

SOIL BACKFILL COMPACTION TO 98% PROCTOR

WELDED WIRE MESH SOIL REINFORCING EXTENDED TO FRONT OF GABIONS

MSE GABION WALL ABOUT 1/2 COMPLETED

ONE STORY BUILDING ADDITION CONSTRUCTED TO WITHIN 6' FROM EDGE OF WALL

48’ HIGH MSE GABION WALL COMPLETED 03/1998

AERIAL VIEW OF MSE GABION WALL & BLDGS.

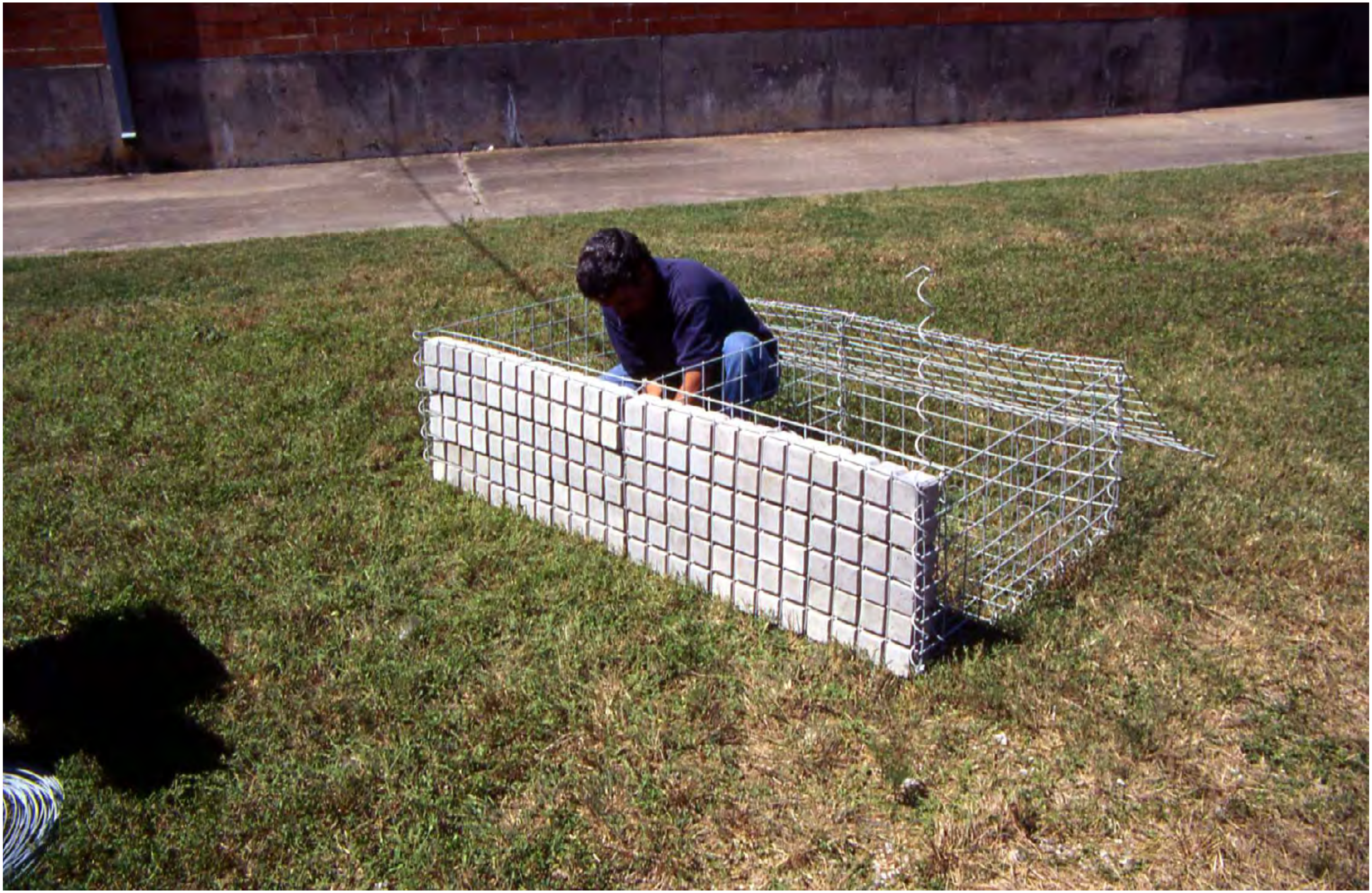
MSE GABION WALL AS SEEN IN JUNE 2005, SEVEN YEARS AFTER COMPLETION

CONCRETE BLOCKS FACED GABION WALLS

6 ft. high Gabion Walls faced with "Ragazzo Blocks" supported by a conventional 12 in. thick Gabion Mattress. All Gabion material is PVC coated after galvanizing.

CONCRETE ”RAGAZZO” BLOCKS FACED GABION WALLS – QUICK CONSTRUCTION DEMO

EMPTY GABION – NOTICE THE DOUBLE WIRE MESH FACING TO HOLD THE BLOCKS



BLOCKS PLACED BETWEEN THE TWO FRONTAL GABION MESH PANELS

GABIONS ARE ROCK-FILLED BEHIND THE CONCRETE ”RAGAZZO” BLOCKS FACING

COMPLETED GABION WITH CONCRETE BLOCKS FACING

GABION LIDS ARE SECURELY CLOSED

CONCRETE BLOCKS FACED GABION WALLS PROJECT AT THE U.S.A. CAMPUS

CONCRETE BLOCKS FACED GABION WALLS

CONCRETE “RAGAZZO” BLOCKS AND GABION “ROLL-STOCK” MATERIAL AT JOBSITE

CONCRETE "RAGAZZO" BLOCK DETAIL MEASURING 6" W. X 12" L. X 3" DEEP

PVC COATED GABION MATERIAL IN "ROLL-STOCK" FORM

12” THICK GABION MATTRESS SUPPORT FOR THE CONCRETE BLOCKS FACED GABION WALLS

ROCK-FILLING THE 12" GABION MATTRESS

12" THICK MATTRESS READIED FOR WALL BASE

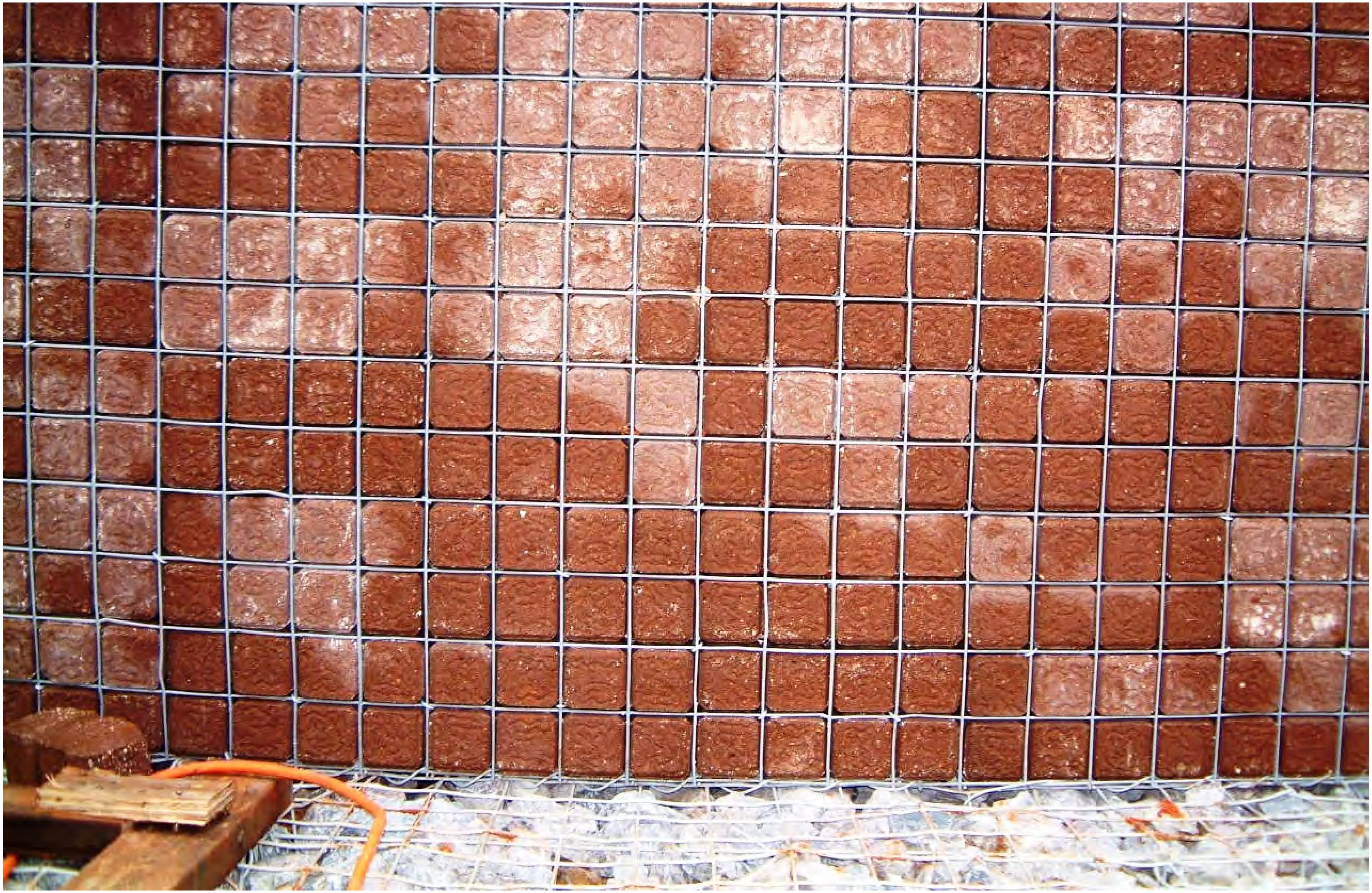
TWO 3' HIGH GABION PANELS, 3" APART, TIED TO THE MATTRESS & READY FOR CONCRETE BLOCKS

FIRST TWO CONCRETE BLOCKS PLACED

LEVELING THE CONCRETE BLOCKS FACING

CONCRETE BLOCKS PLACEMENT

CONCRETE “RAGAZZO” BLOCKS WALL FACING



DETAIL OF GABION MESH RECESSED INTO CONCRETE BLOCKS GROOVES

BLOCKS CUT TO FIT CORNERS

BLOCKS CUT & SHAPED TO FIT CORNERS

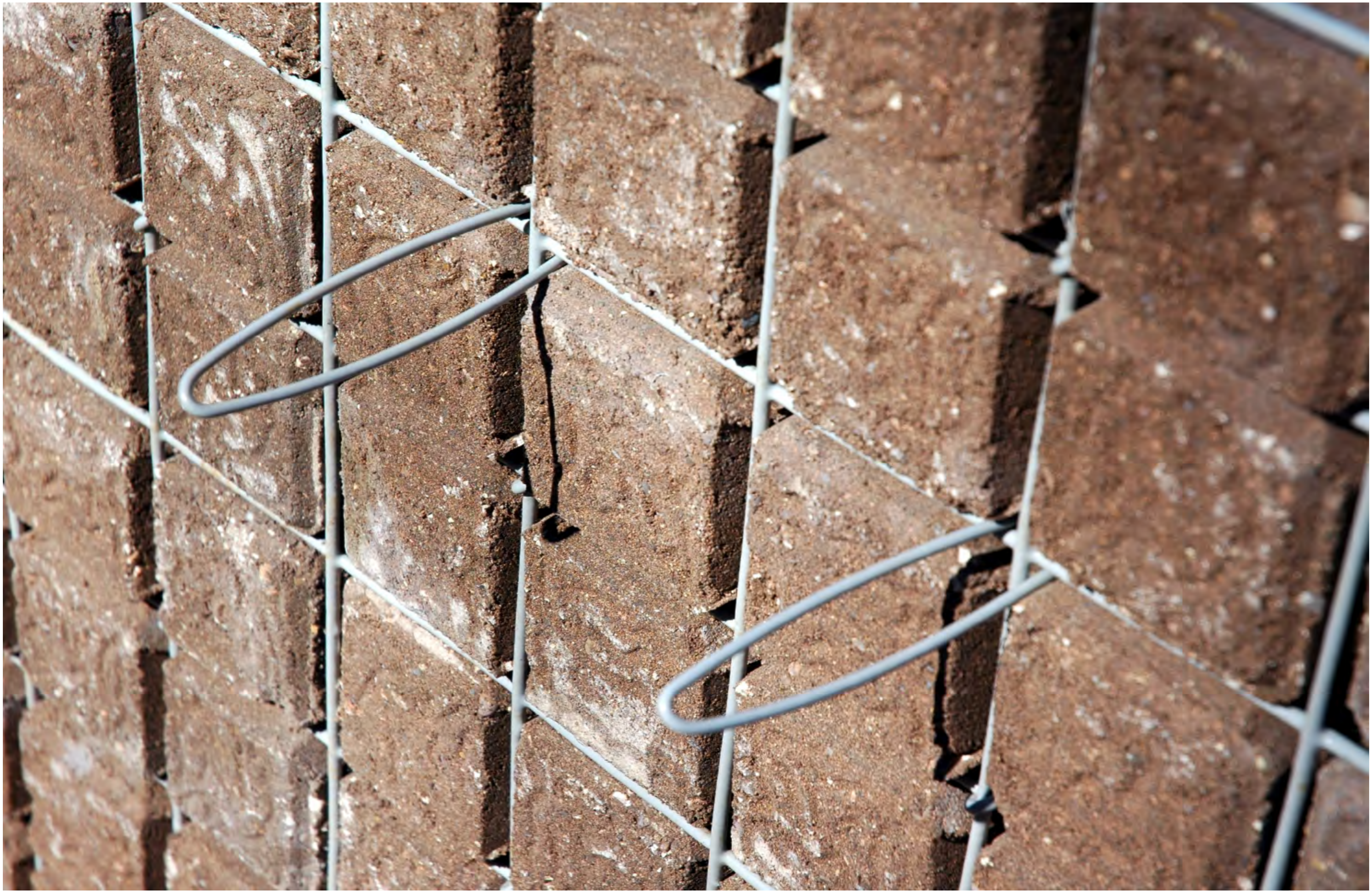
BASE COURSE GABIONS ARE ROCK-FILLED & READY FOR HORIZONTAL BLOCKS LAYER

BLOCKS PLACED HORIZONTALLY
ON GABION WALL SETBACK

GABION MESH SECURES HORIZONTALLY PLACED BLOCKS IN THEIR POSITION

TOOL DESIGNED TO RECESS GABION MESH INTO BLOCK GROOVES

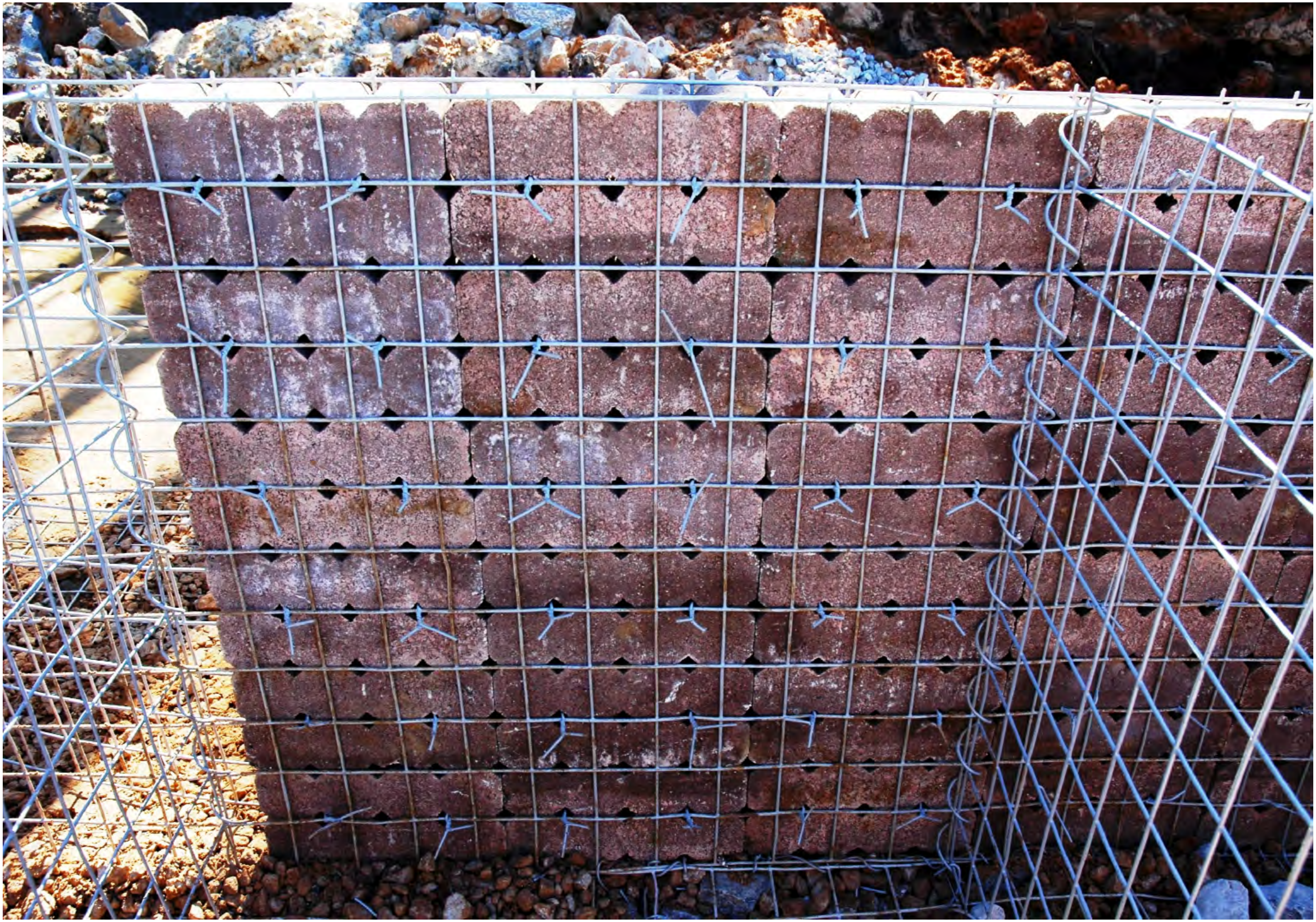
SHAPED WIRE CONNECTS FRONT & REAR MESH PANELS THROUGH BLOCKS DRAINAGE HOLES



SHAPED WIRES PLACED AT 6” O.C. THROUGH CONCRETE BLOCKS DRAINAGE HOLES

SHAPED WIRE TIES FASTENED TO
REAR MESH PANEL

TWO MAN CREW SECURES BLOCKS IN PLACE



REAR VIEW OF CONCRETE BLOCKS INSTALLED

CORNER DETAIL OF CONCRETE “RAGAZZO” BLOCKS FACED GABION WALL

SECOND TIER BLOCKS FACED GABION WALL BEING INSTALLED

DETAIL OF A CONCRETE BLOCK
NOTICE THE DRAINAGE HOLES

SPIRAL BINDERS – VERTICAL JOINTS

COMPLETED WALL SECTION

SECTION OF CONCRETE "RAGAZZO" BLOCKS FACED GABION WALL NEAR COMPLETION

SECTION OF CONCRETE “RAGAZZO” BLOCKS FACED GABION WALL COMPLETED

ECOMATTRESS

12 in. thick PVC coated Gabion Mattress partially rock filled, saturated with top soil, seeded and covered with a coconut fiber mat before closing with Gabion mesh lid.

GRADING THE SLOPE FOR A 12” HIGH “ECOMATTRESS”

PLACING GEOTEXTILE & "ROLL-STOCK" PVC MESH FOR THE ECOMATTRESS BASE

FORMING JOINTLESS ECOMATTRESS WITH BASE & LONGITUDINAL DIVIDER PANELS

3’ LONG PVC SPIRAL BINDERS FASTEN DIVIDER PANELS TO BASE PANELS

3’ LONG PVC SPIRAL BINDERS FASTEN TRANSVERSE DIVIDER PANELS TO BASE PANEL

PVC SPIRAL BINDERS FASTEN LONGITUDINAL DIVIDERS TO TRANSVERSE PANELS

GEOTEXTILE PREVENTS SOIL MIGRATION
ECOMATTRESS IS PARTIALLY ROCK-FILLED

ECOMATTRESS IS SATURATED
& LEVELED WITH TOP SOIL

TOP SOIL SEEDED WITH SELECTED GRASS SEED

TOP SOIL IS IRRIGATED FOR COMPACTION
TOP SOIL IS ADDED AS REQUIRED

WIRE TIES ARE PLACED ALONG TOP OF DIVIDERS FOR FASTENING TO ECOMATTRESS MESH LIDS

COCONUT FIBER BLANKET PLACED OVER TOP SOIL FOR GRASS GROWTH SUPPORT

PVC GABION MESH
SECURES TOP OF ECOMATTRESS

ECOMATTRESS LID FASTENED TO DIVIDER'S TOP

ECOMATTRESS IRRIGATION
HELPS GRASS SEED GERMINATION

GRASS GROWTH BEGINS IN TWO WEEKS TIME

ECOMATTRESS GRASS CONTINUES TO GROW

A VIEW OF THE ECOMATTRESS OVER THE CONCRETE BLOCKS FACED GABION WALL

ECOMATTRESS GIVES THE ENGINEER HIS CHOICE OF VEGETATION GROWTH DESIRED

STAINLESS STEEL WIRE MESH GABIONS

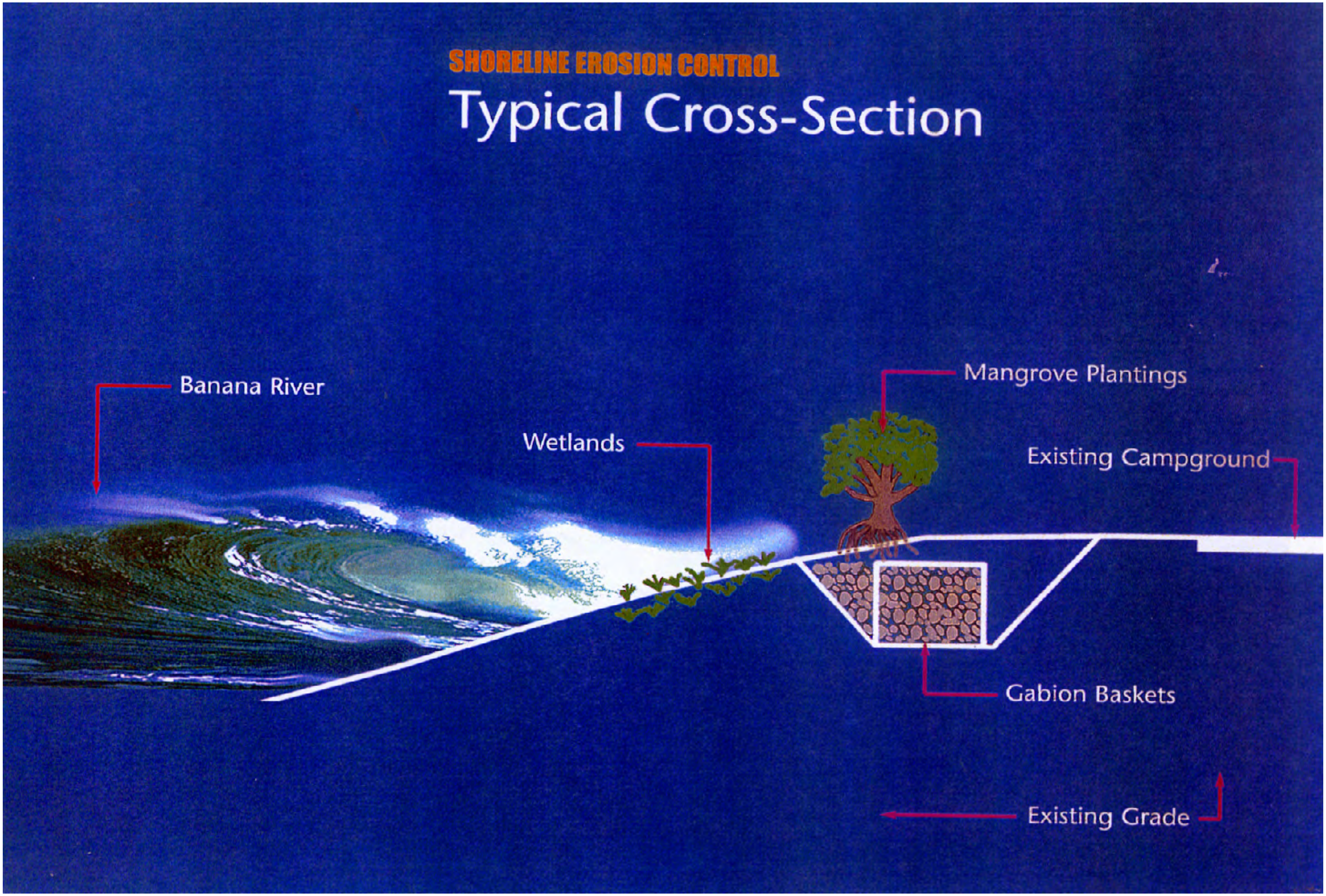
UTILIZED IN MARINE WORKS, COASTAL PROTECTION, SEA WALLS, HEAVILY POLLUTED WATERS AND WHEREVER HEAVY ABRASION IS PREVALENT

FAMILY CAMP SHORELINE STABILIZATION
PATRICK AFB, FLORIDA

Client:

45CES/CECC, U.S. Air Force
Patrick AFB, Florida
Completed: June 30, 2001

Value of work for which AMEC was responsible: $500,000



GABIONS ARE PLACED BELOW BEACH LEVEL

DETAIL OF STAINLESS STEEL GABIONS PLACED BELOW THE WATER TABLE

GABION ROCK-FILLING

GABION WALL WRAPPED IN GEOTEXTILE AND PLACED BELOW THE BEACH LEVEL

TREES TO BE PLANTED INSIDE THE SONOTUBES

PROJECT COMPLETED – SHORELINE AND WETLANDS PROTECTED WITH GABIONS

STAINLESS STEEL WIRE GABION SEA WALL

GABION SEA WALL SURVIVED CATHEGORY 3 HURRICANES: IVAN 9-04 & DENNIS 7-05

STAINLESS STEEL WIRE GABIONS AT M.I.T.
CAMPUS LANDSCAPING STRUCTURES

M.I.T. CAMPUS - S. S. GABION WALLS
CONSTRUCTION DETAIL

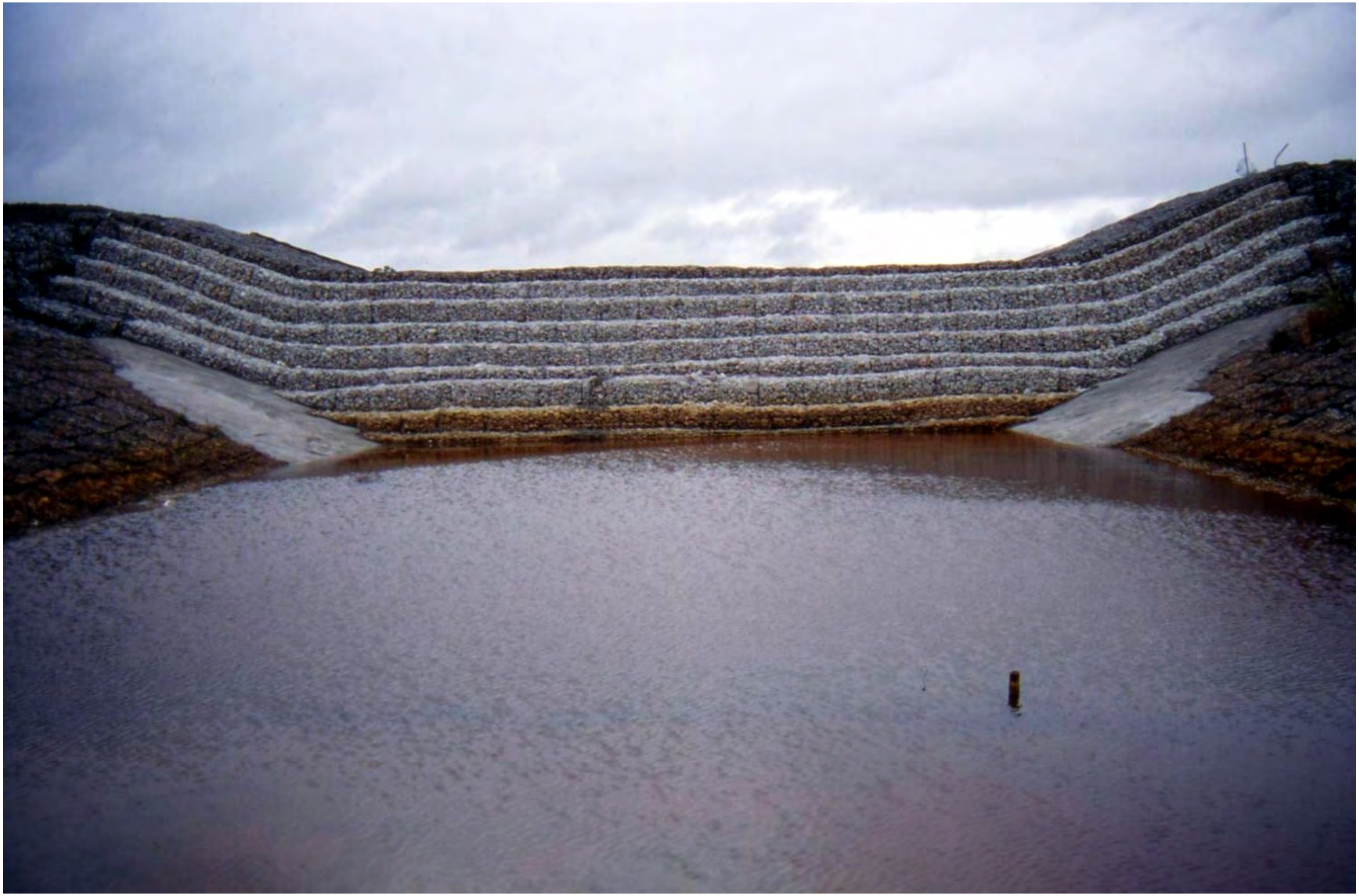
M.I.T. CAMPUS ARCHITECTURAL LANDSCAPING
S. S. GABIONS DETAIL

M.I.T. CAMPUS CAMBRIDGE, MA
S. S. WIRE GABIONS LANDSCAPING DETAIL


LAND RECLAMATION PROJECT
MISSOURI DEPARTMENT
OF
NATURAL RESOURCES
LAND RECLAMATION COMMISSION

GABION WEIR STEPS REPLACED WITH STAINLESS STEEL WIRE MESH DUE TO SOIL ABRASION

NEW S. S. WIRE GABION WEIR REPLACING THE PREVIOUS ONE FAILED DUE TO SOIL ABRASION



DOWNSTREAM VIEW OF THE NEW STAINLESS STEEL WIRE GABION WEIR

AUDUBON LAKE BIRD SANCTUARY
GABION BREAKWATERS BUILT AROUND ISLANDS

OTHER GABION PROJECTS CONSTRUCTED WITH "ROLL-STOCK" CONTINUOUS JOINTLESS GABIONS

BANK STABILIZATION - CAPE MAY CANAL, NEW JERSEY USA – U.S. ARMY CORPS OF ENGINEERS


Design and Construction Supervised by
US Army Corps of Engineers
South Atlantic Division
Mobile District
Tuscaloosa Bank Stabilization and Mooring Facility
Black Warrior River, Alabama
Location: Tuscaloosa, Alabama
Designed By:
US Army Corps of Engineers
Mobile District
Contractor:
Misener Marine Construction, Inc.
Tampa, Florida

GABION MATTRESS UNDERWATER PLACEMENT

MEMPHIS AIRPORT – HURRICANE CREEK

TYPICAL GABION WALL

TOMBIGBEE RIVER – BANK PROTECTION

DIVERSION DAM
PECOS RIVER

NALL STREET - GABION CHANNEL LINING

MOUNTAIN BROOK – GOLF COURSE

SPRING CREEK - FLOOD CONTROL

SAN MARCOS RIVER – LULING, TX

PRESENTER:

GEORGE RAGAZZO

PHONE: (251) 380-0332

CELL: (251) 422-3536

MODULAR GABION SYSTEMS

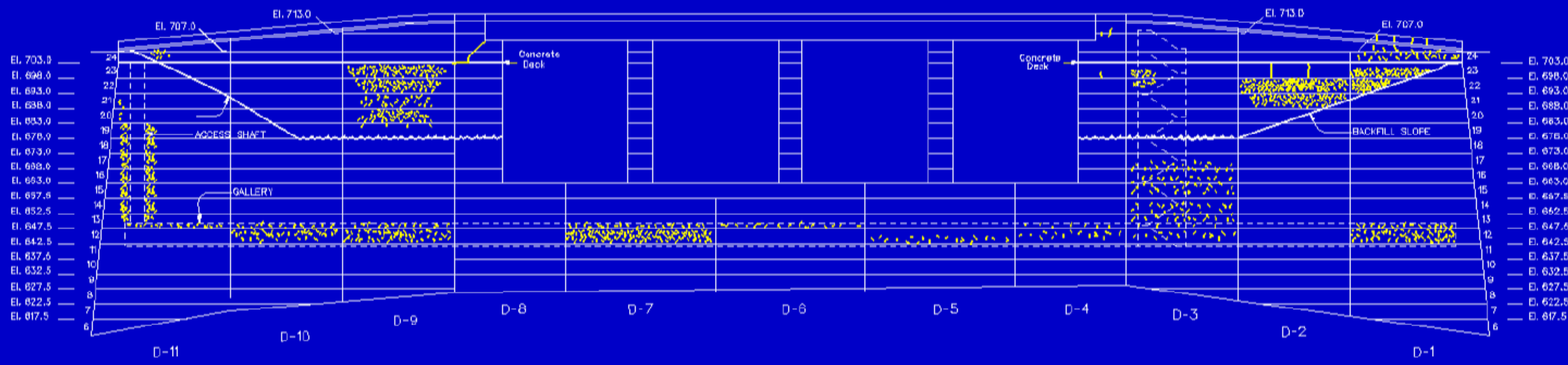
gragazzo@gabions.net

AAR AT CARTERS DAM

DIFFERENT APPROACHES
(ONE OLD, ONE NEW)

Carters Main and Reregulation Dams


Vulcan
Materials Company
Dalton Quarry



CARTERS REREGULATION DAM - UPSTREAM ELEVATION

LEGEND

OBSERVED MAP CRACKING

Weather FAIR

Air 70 °F to 76 °F

Conc 72 °F to 77 °F

U. S. ARMY ENGINEER DISTRICT, MOBILE

CONCRETE PLACING CARD

DATE: April 21, 1971

CONCRETE PLACED			
TYPE	1ST SHIFT RECEIVED	2ND SHIFT RECEIVED	3RD SHIFT RECEIVED
GROUT	2		
3/4" 3000			
1½" 3000			
1½" 4000			
3" ~~3000~~ 2000	353 5		
3" 4000			
6" EXTERIOR			
6" INTERIOR			

LOCATION	
Mono D-9, Lift 9	
PAY ITEM NO.	
15, 11, 19, 12B	
TIME	
STARTED	COMPLETED
1245	2020
ELEVATION	
BOTTOM	TOP
Rock	632 5

REJECTED MATERIAL			
TIME	TYPE	QUANTITY	REASON
		0	

Chas Morgan INSP

_______________ INSP

_______________ INSP

MOB FORM 710
APR 67

Use other side for remarks or sketch

Weather P. Cloudy's Warm

Air 80 °F to 85 °F

Conc 79 °F to 82 °F

U. S. ARMY ENGINEER DISTRICT, MOBILE

CONCRETE PLACING CARD

DATE: MAY 19, 1971

CONCRETE PLACED

TYPE	1ST SHIFT RECEIVED	2ND SHIFT RECEIVED	3RD SHIFT RECEIVED
GROUT	1cy	0	0
3/4" 3000	0		
1½" 3000	13cy		
1½" 4000	0		
3" 3000	80cy		
3" ~~4000~~ 2000	196		
6" EXTERIOR			
6" INTERIOR			

LOCATION

MONO D-9, LIFT 11

PAY ITEM NO.

15 & 19

TIME

STARTED	COMPLETED
1115	1625

ELEVATION

BOTTOM	TOP
631.5	642.5

REJECTED MATERIAL

TIME	TYPE	QUANTITY	REASON
	NONE		

CHARLES MORGAN INSP

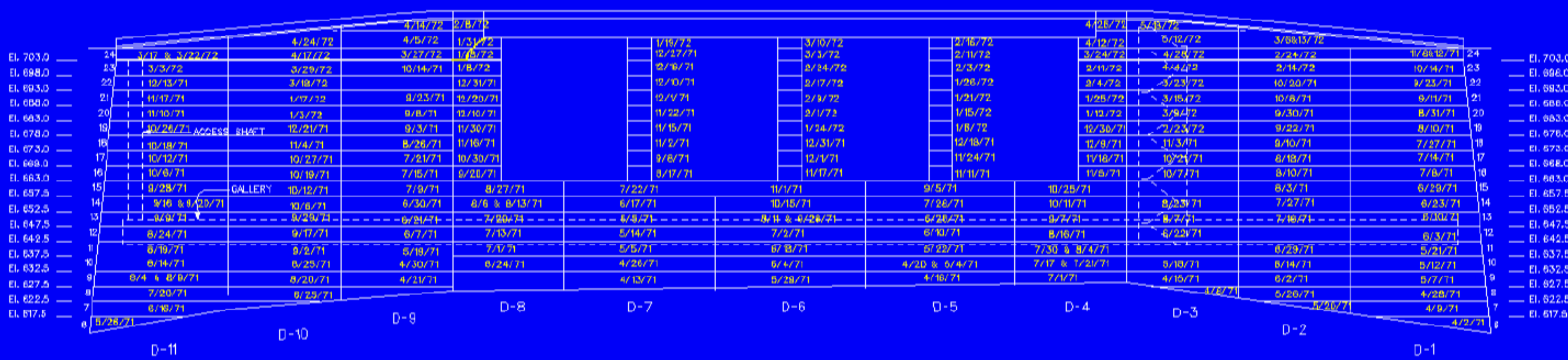
KANOY INC, DACW01-71-C-0014

_______________ INSP

_______________ INSP

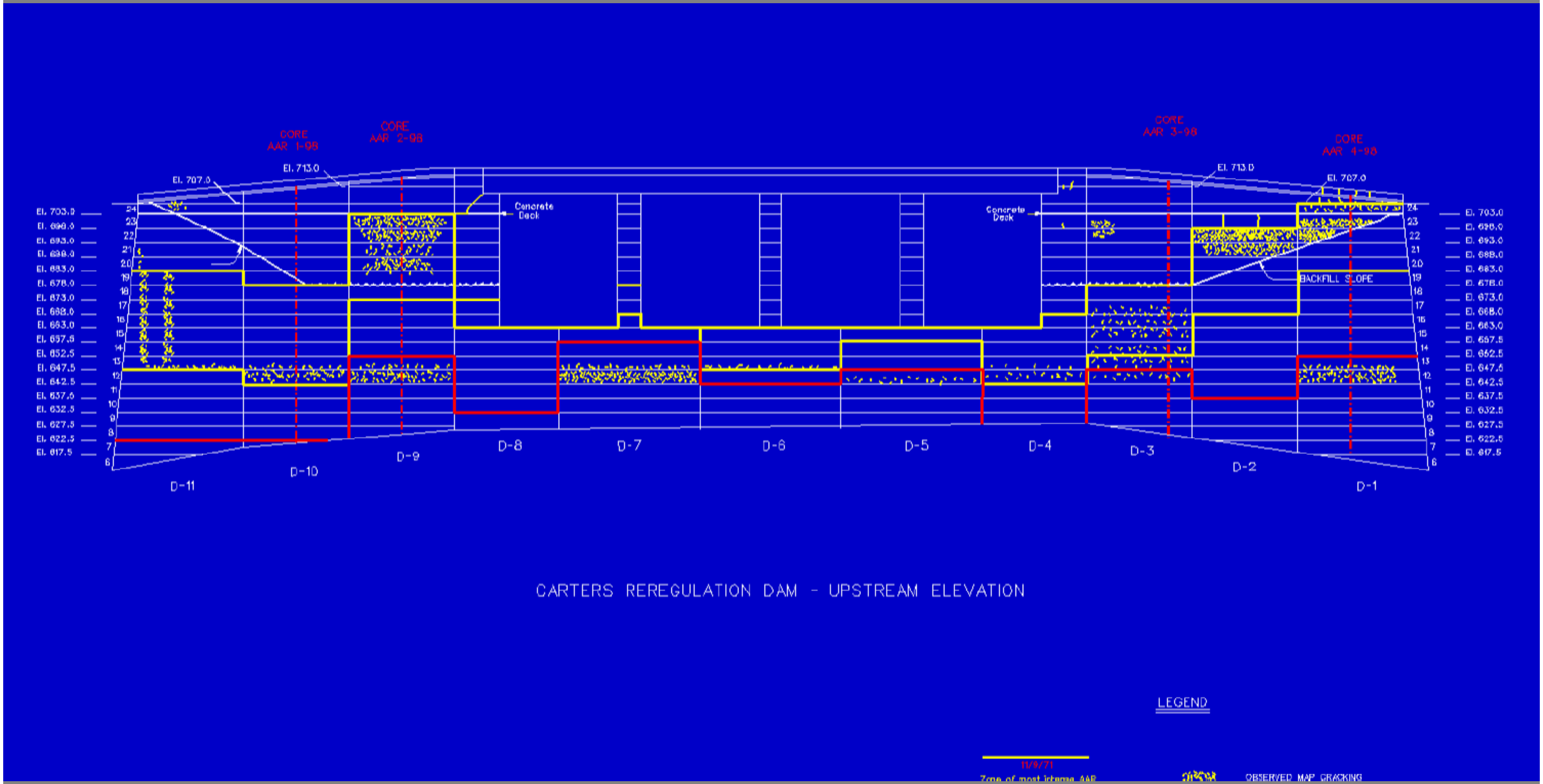
MOB FORM 710
APR 67

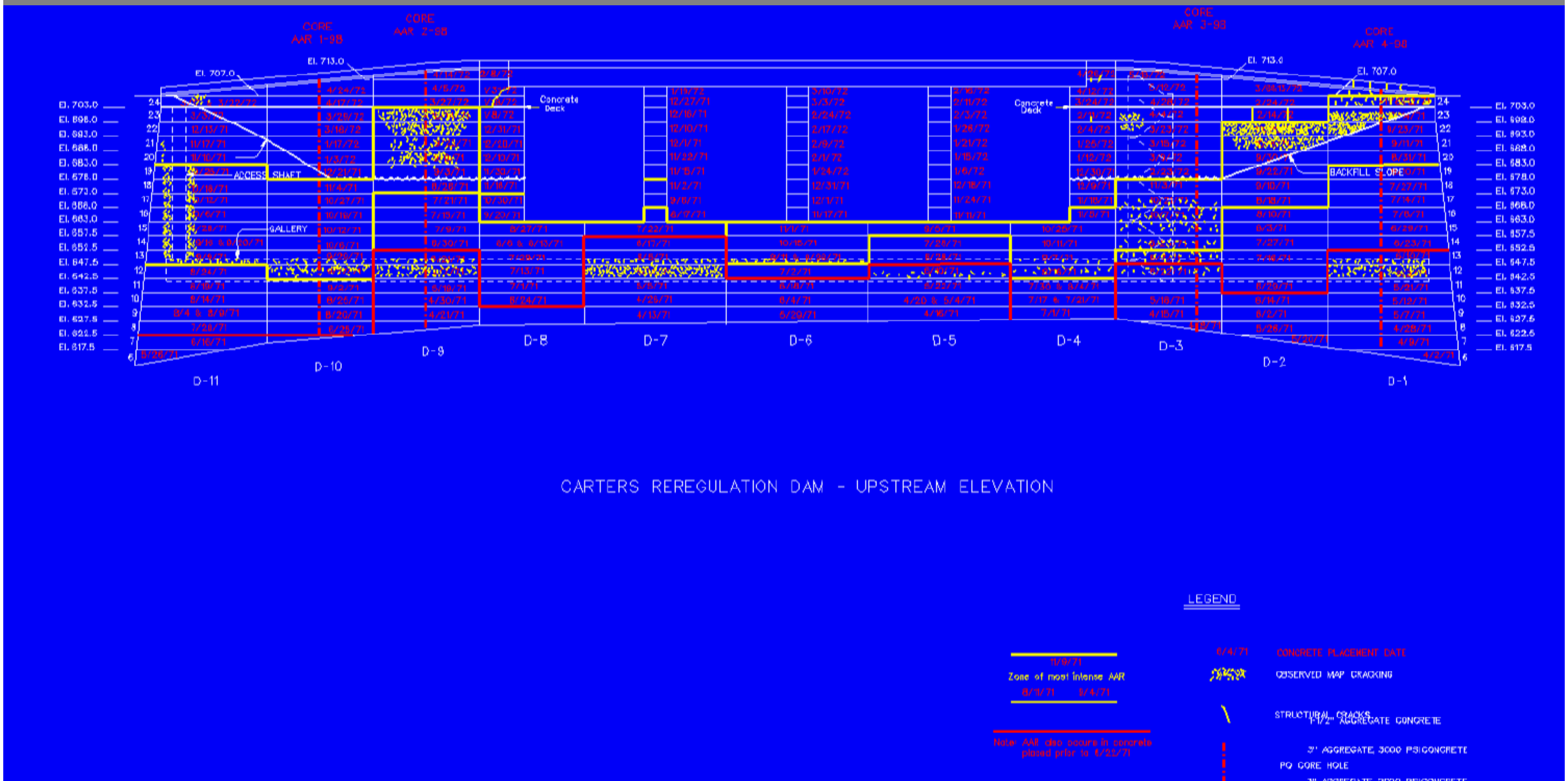
Use other side for remarks or sketch



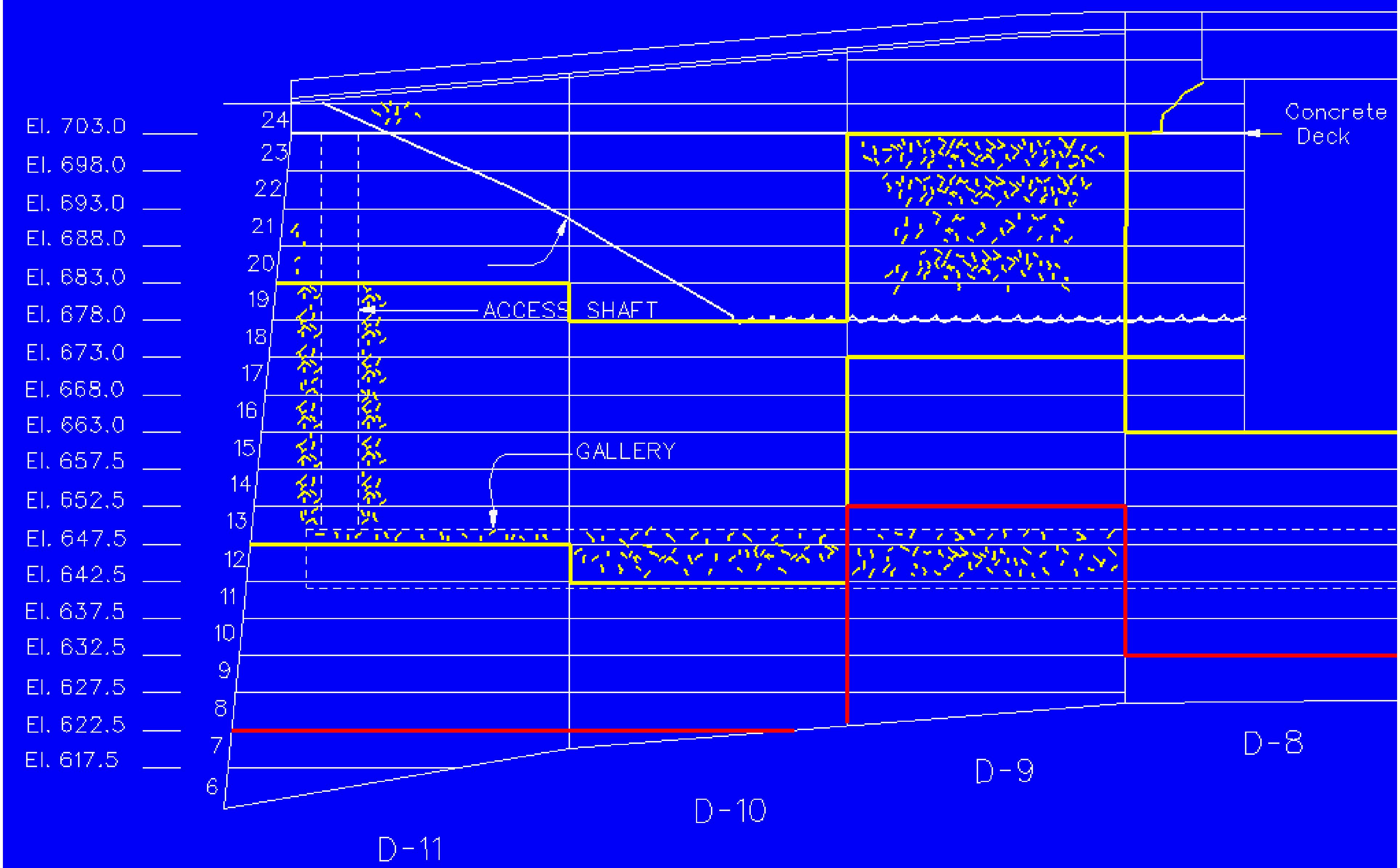
CARTERS REREGULATION DAM - UPSTREAM ELEVATION

LEGEND

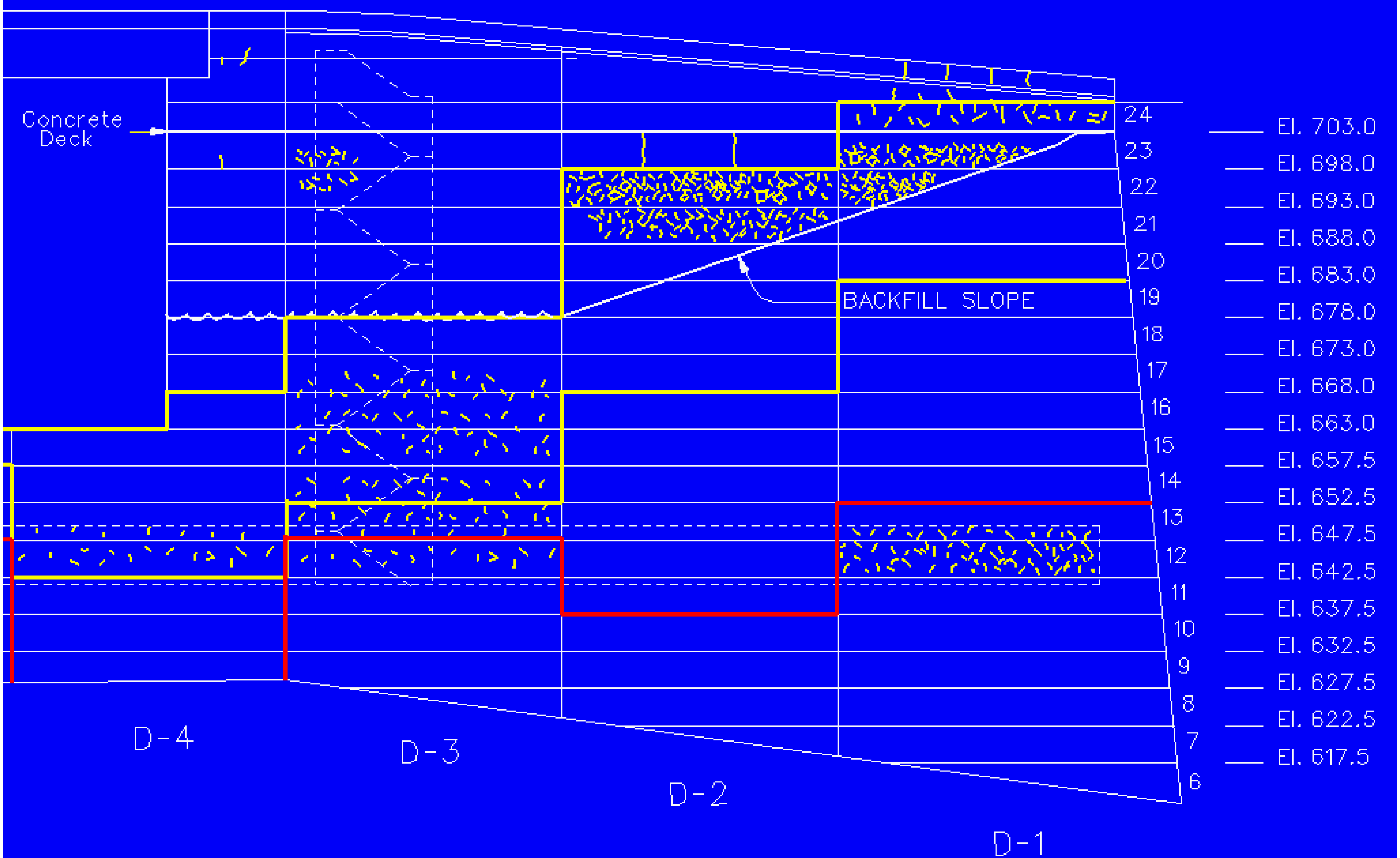

CORE AAR 1-98
CORE AAR 2-98
CORE AAR 3-98
CORE AAR 4-98
El. 707.0
El. 713.0
El. 713.0
El. 707.0
Concrete Deck
Concrete Deck
BACKFILL SLOPE
El. 703.0
El. 698.0
El. 693.0
El. 688.0
El. 683.0
El. 678.0
El. 673.0
El. 668.0
El. 663.0
El. 657.5
El. 652.5
El. 647.5
El. 642.5
El. 637.5
El. 632.5
El. 627.5
El. 622.5
El. 617.5
D-11
D-10
D-9
D-8
D-7
D-6
D-5
D-4
D-3
D-2
D-1
CARTERS REREGULATION DAM - UPSTREAM ELEVATION
LEGEND
11/9/71
Zone of most intense AAR
OBSERVED MAP CRACKING


CORE AAR 1-98
CORE AAR 2-98
CORE AAR 3-98
CORE AAR 4-98
El. 707.0
El. 713.0
Concrete Deck
ACCESS SHAFT
GALLERY
BACKFILL SLOPE
D-11
D-10
D-9
D-8
D-7
D-6
D-5
D-4
D-3
D-2
D-1
CARTERS REREGULATION DAM - UPSTREAM ELEVATION
LEGEND
Zone of most intense AAR
CONCRETE PLACEMENT DATE
OBSERVED MAP CRACKING
STRUCTURAL CRACKS
PQ CORE HOLE

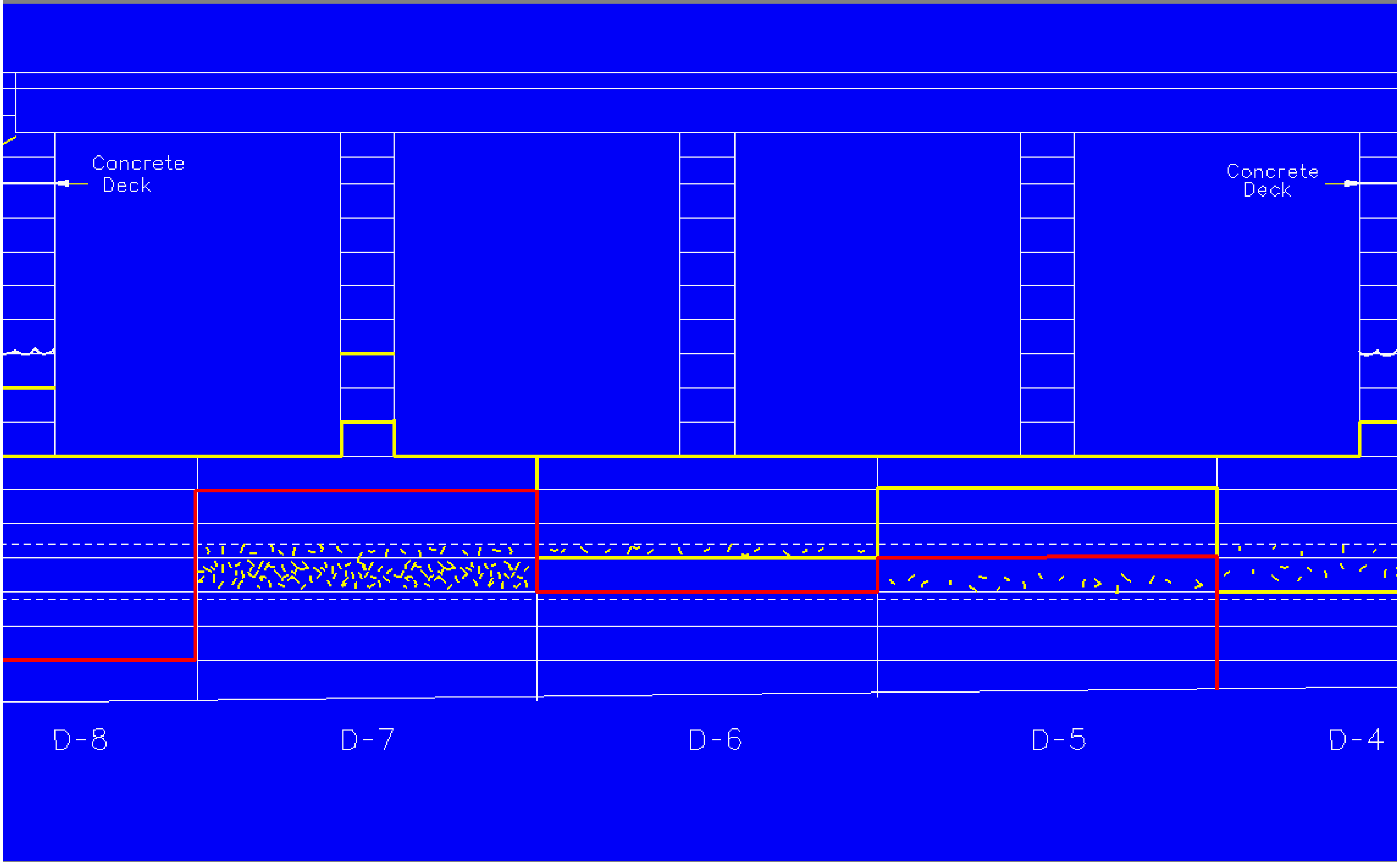
Left Abutment



Right Abutment



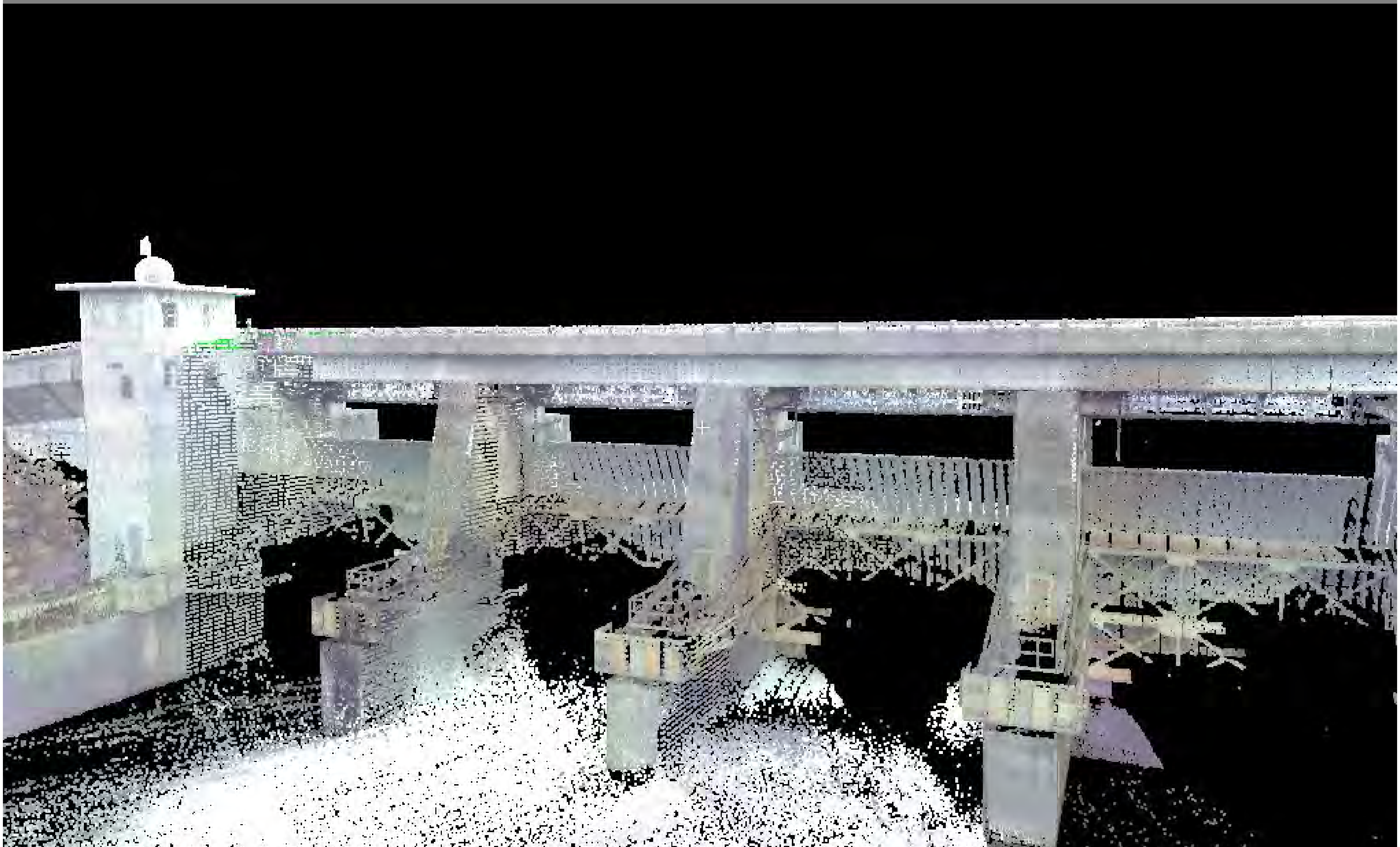
Gate Area



Lidar Survey

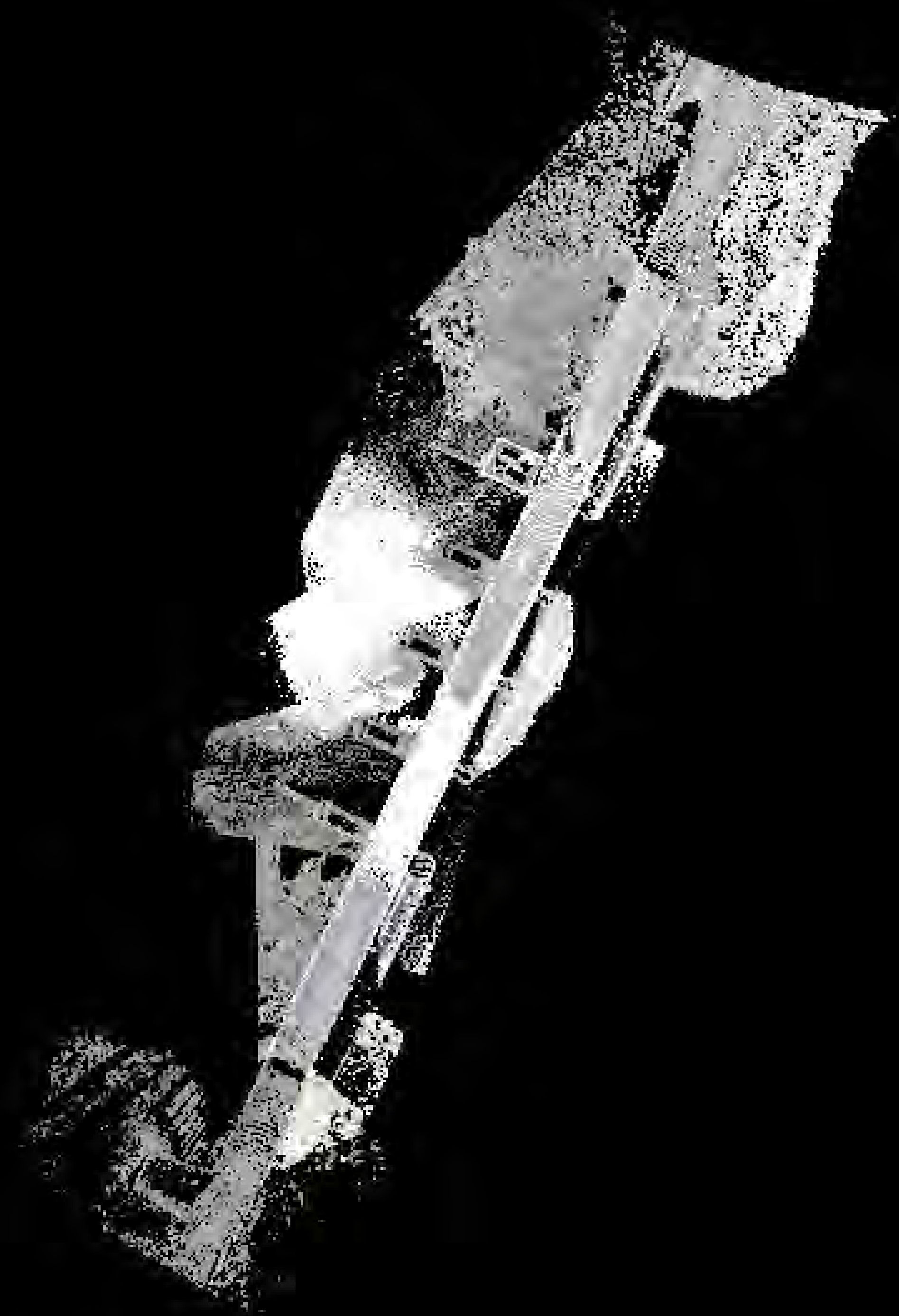
Lidar Survey

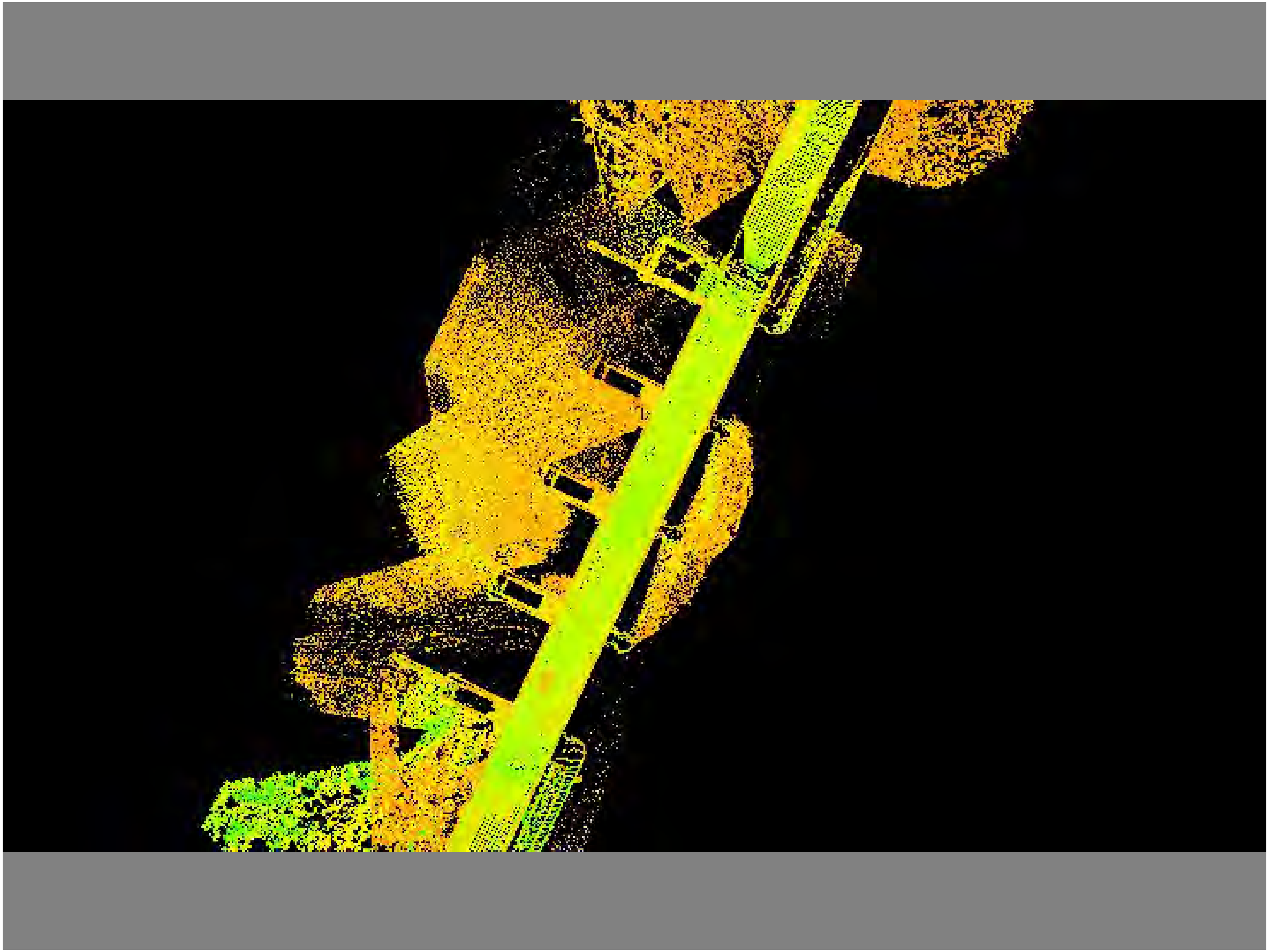
Cyclone oblique view



CloudWorx

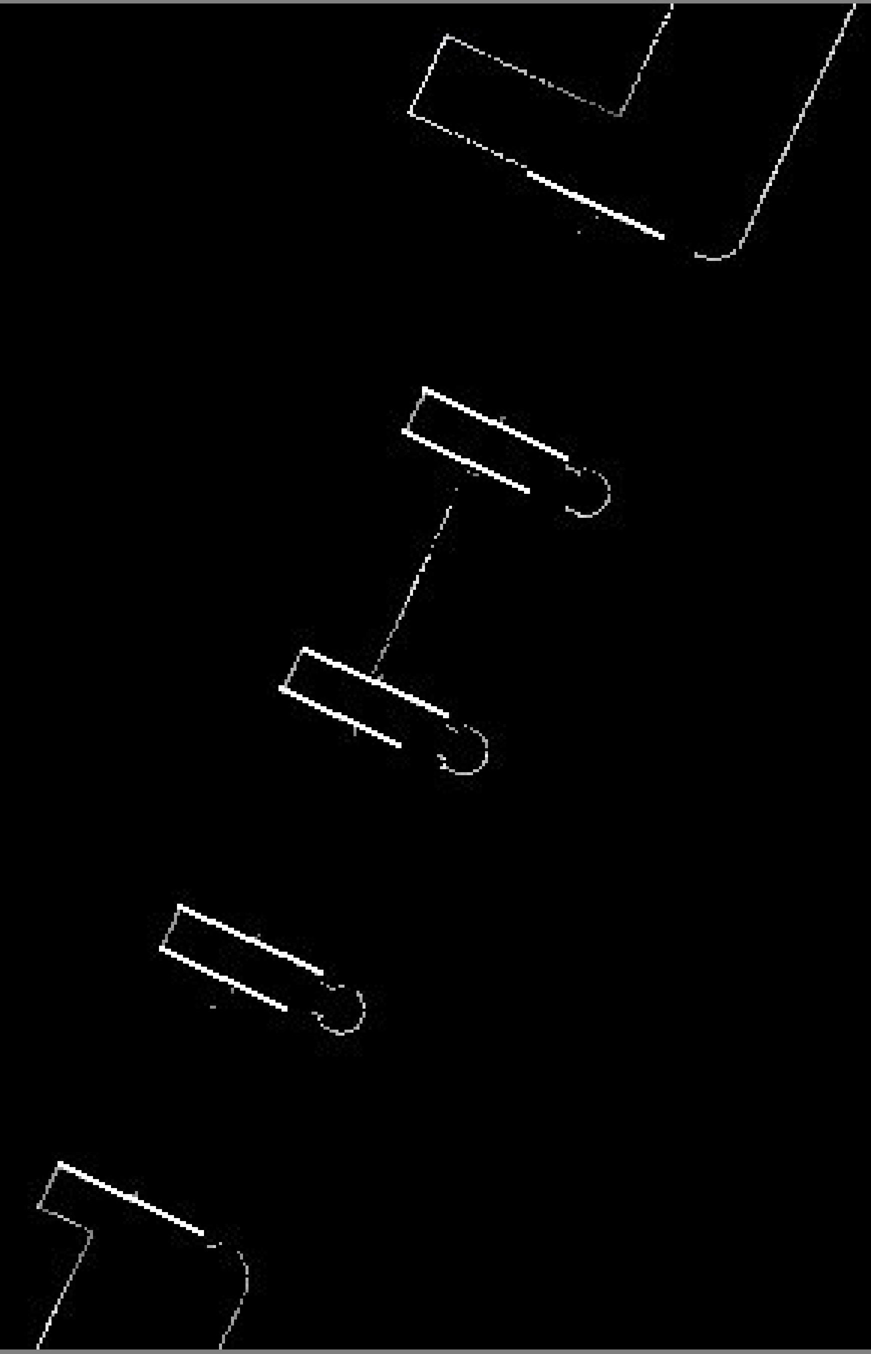
Plan View





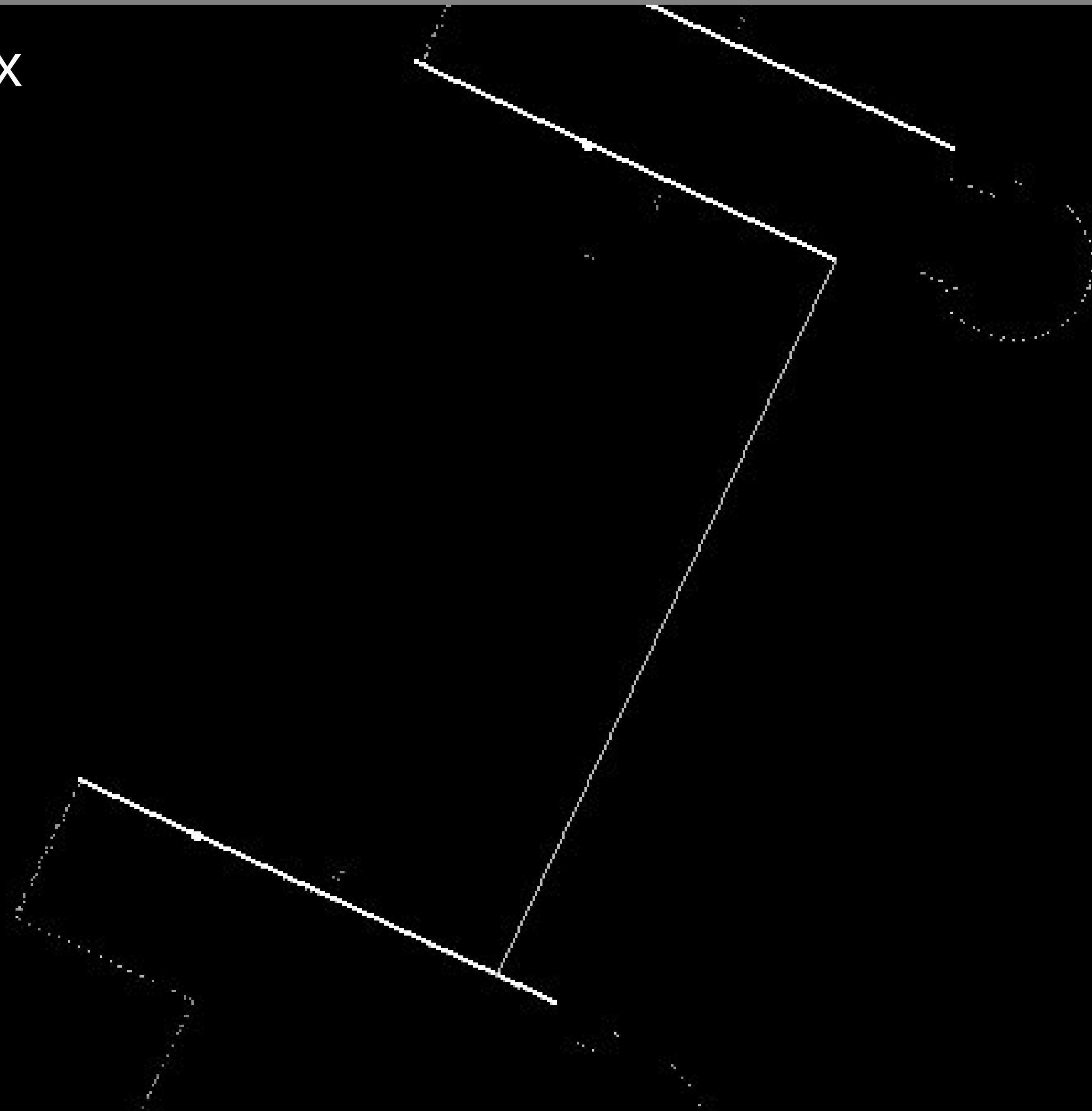
CloudWorx

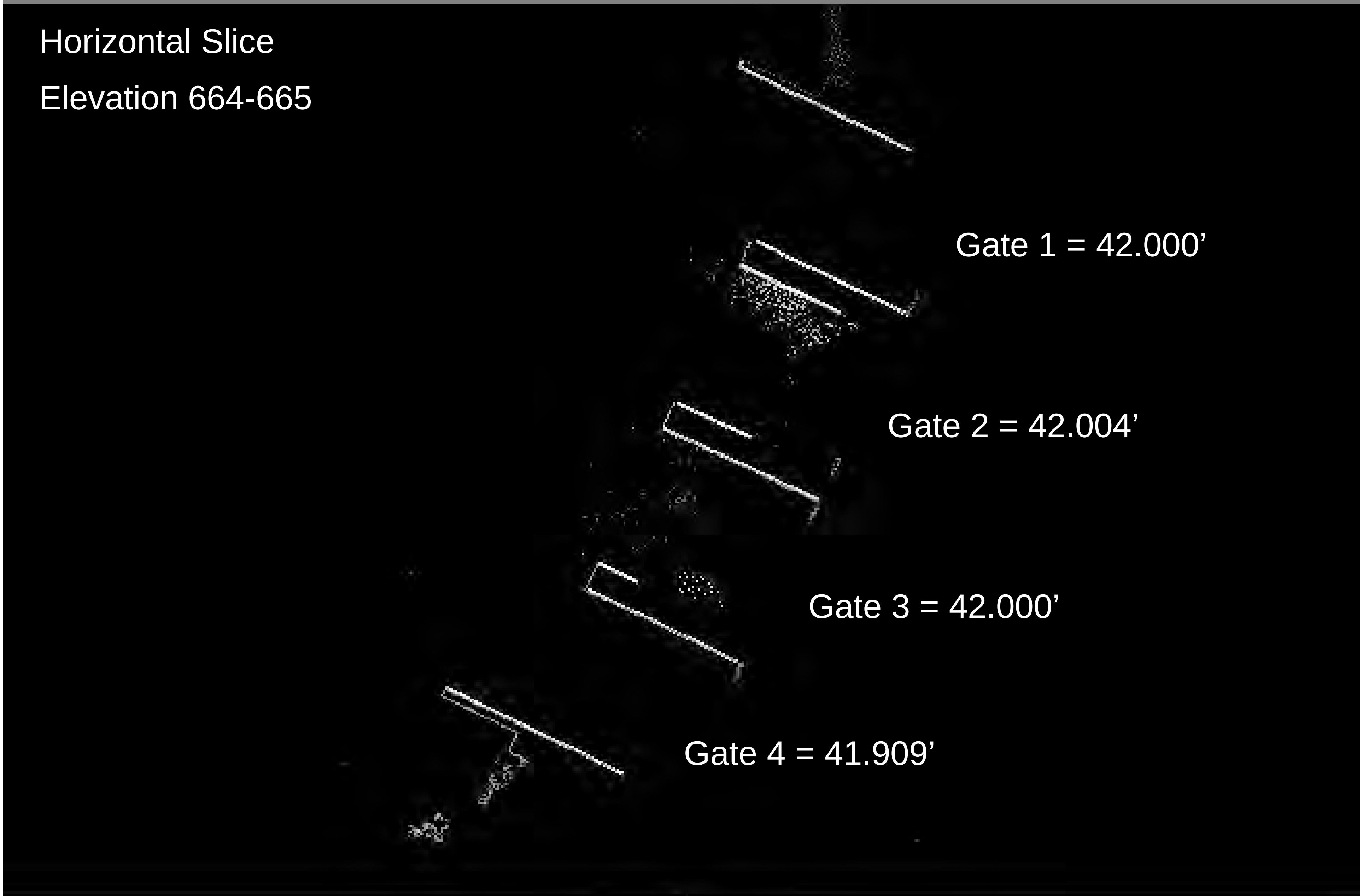
Horizontal Slice



CloudWorx

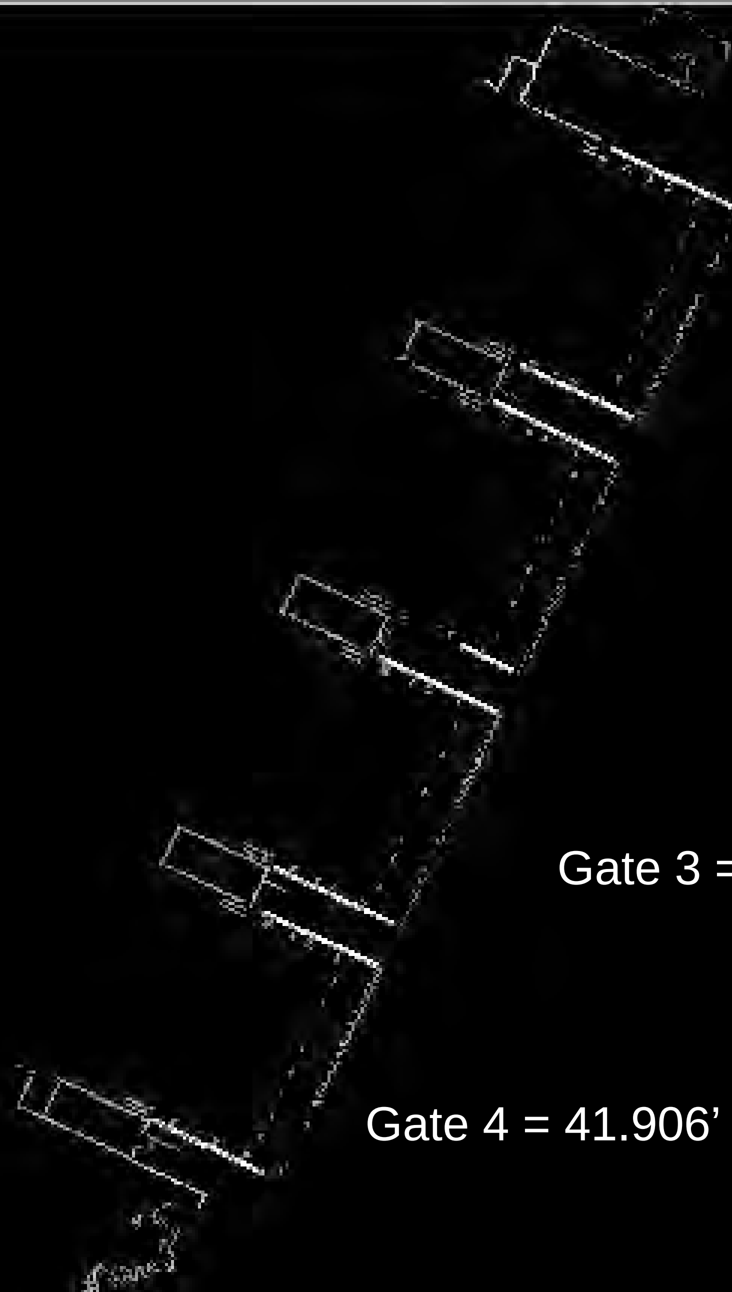
Fit Line




Horizontal Slice
Elevation 664-665
Gate 1 = 42.000’
Gate 2 = 42.004’
Gate 3 = 42.000’
Gate 4 = 41.909’

Horizontal Slice

Elevation 679-680

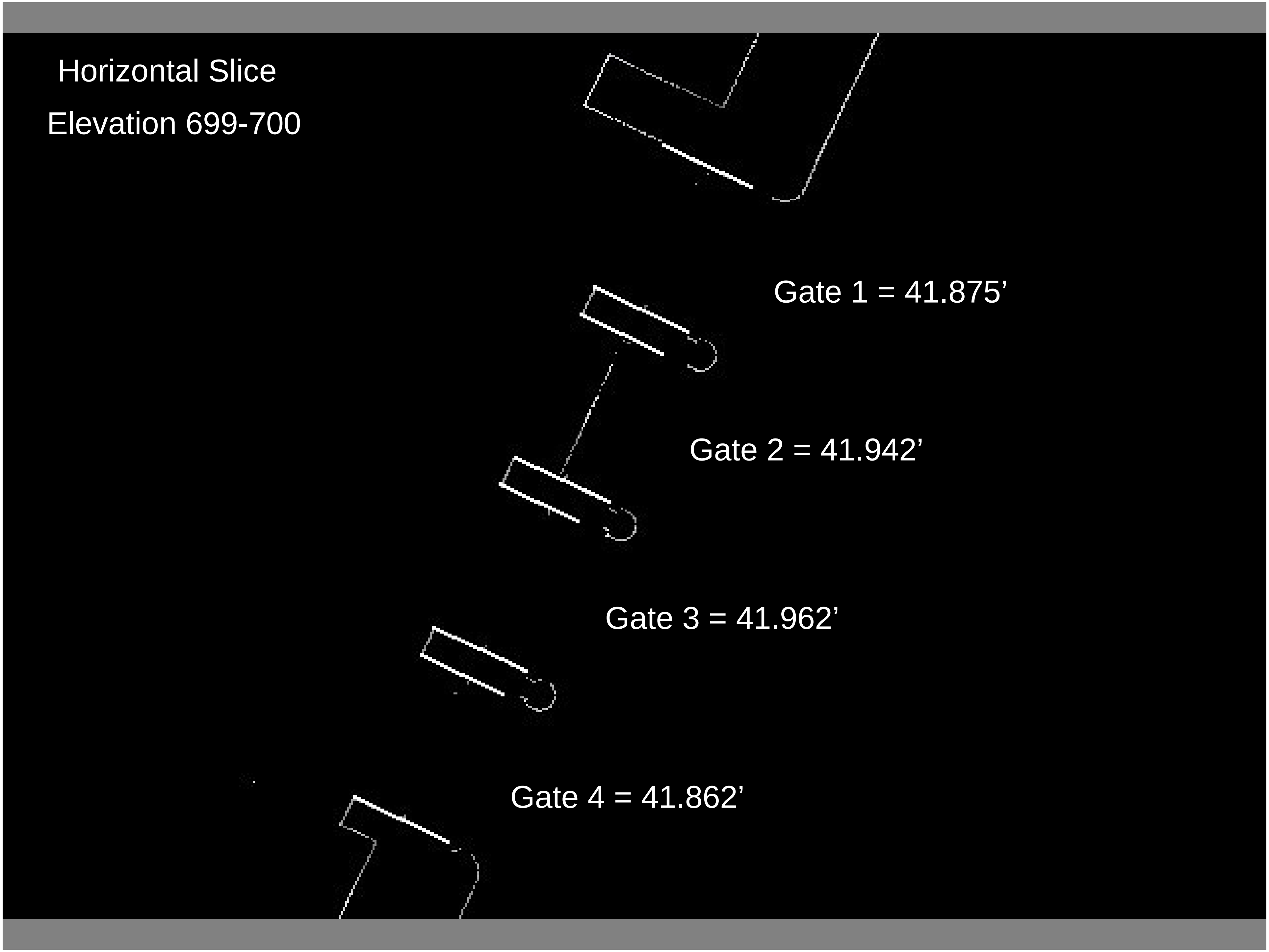


Gate 1 = 41.945’

Gate 2 = 41.914’

Gate 3 = 41.969’

Gate 4 = 41.906’



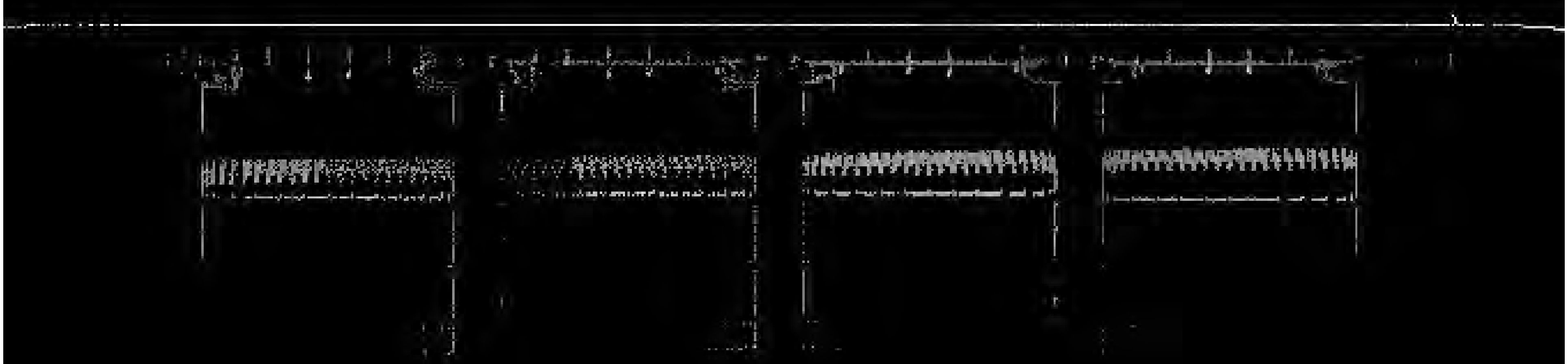
Horizontal Slice
Elevation 699-700
Gate 1 = 41.875’
Gate 2 = 41.942’
Gate 3 = 41.962’
Gate 4 = 41.862’

CloudWorx

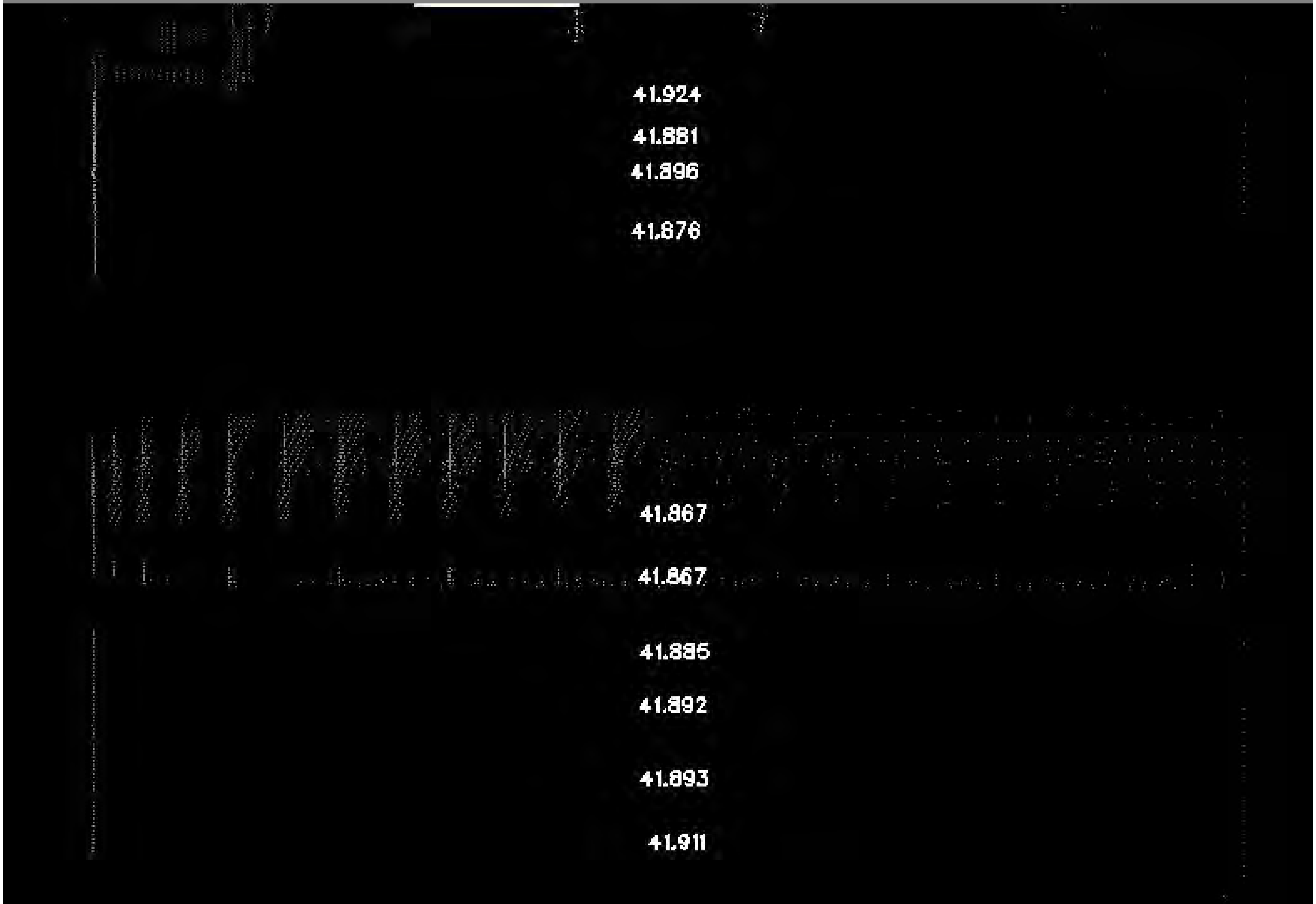
Front View

CloudWorx

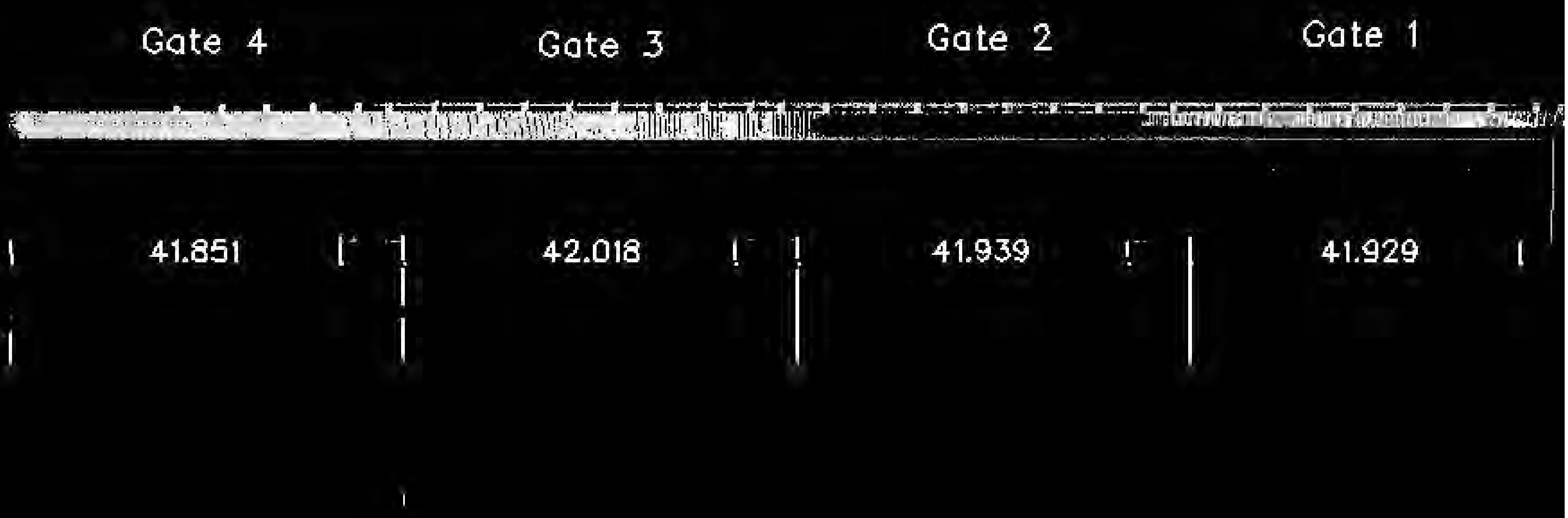
Vertical Slice



Vertical Slice - downstream piers


41.924
41.881
41.896
41.876
41.867
41.867
41.885
41.892
41.893
41.911

Vertical Slice - upstream piers



2005 Tri-Service Infrastructure Systems Conference & Exhibition
August 1-4, 2005

Rubblization of Airfield Concrete Pavements

By

Eileen M. Vélez-Vega
Research Civil Engineer
Airfields and Pavements Branch

Overview

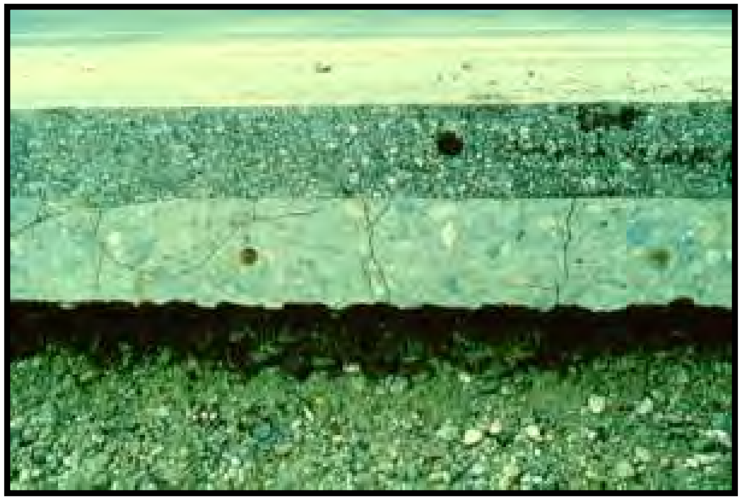
- **Introduction**
  - FY 03-04 AFCESA Research
  - FY 05 AMC Research
- **FY 03-05 Research Approach**
  - Phase 1
    - Equipment & Procedure
  - Phase 2
    - Highway and Airfield Rubblization Evaluations
    - Cost Analysis
      - Grand Forks Air Force Base Study
  - GF AFB Guidelines and Specifications
    - Runway Reconstruction Project
- **Results and Conclusions**
- **Future Research Studies**
- **Questions**

Rubblization

- ***<u>Main Objective:</u>***
  - Develop a design procedure and criteria for the design of asphalt overlays over rubblized, and crack and seat PCC pavements.
- Project History:
  - FY 03-04 AFCESA: Rubblization Design Procedure
  - FY 05 AMC: Grand Forks AFB Runway Reconstruction Project
- ***Rubblization…***
  - …is a relatively "new" rigid pavement rehabilitation technique.
  - …eliminates existing slab action by breaking the PCC pavement into small particles ranging from:
    - sand size to 75 mm (3 in) at the surface,
    - 150 to 230 mm (6-9 in) on the top half,
    - 305 to 380 mm (12-15 in) at the bottom half of the PCC layer.
- ***<u>Crack and Seat</u>*** has almost been replaced with Rubblization due to the significant advantages that it proves to have in the rehabilitation of PCC pavements.

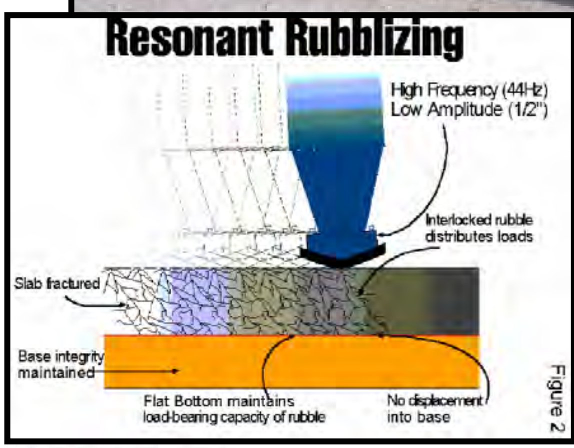
Why Rubblization?

- ***Pavement Distresses***
  - – Reflective Cracking
  - – Severe Joint Deterioration
  - – Slab Settlement
  - – Excessive Patching
  - – “Pop-outs”, etc.



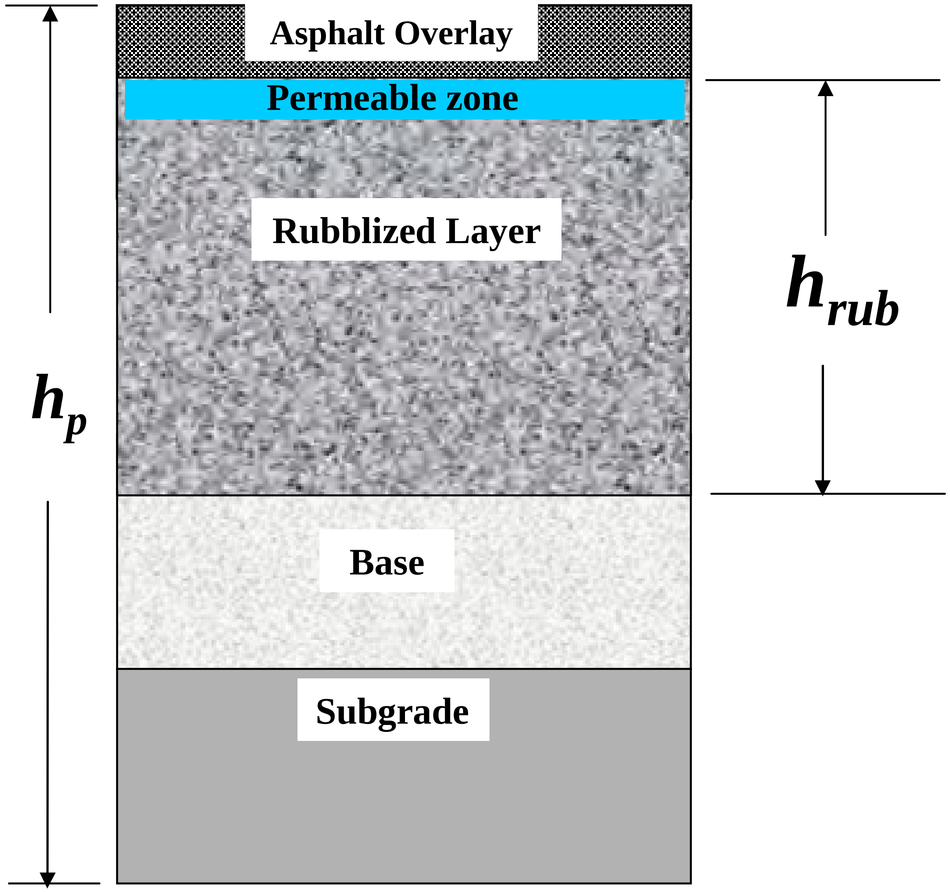
Rubblization Equipment *

- ***<u>Current U.S. major contractors:</u>***
  - Resonant Machines Inc. (RMI)
    - Resonant Breaker, RB-500
      - Low Amplitude
        - » 12 to 20 mm (1/2-3/4 in)
      - High Frequency Hammer
        - » 44-47 Hz
  - Antigo Construction, Inc.
    - Guillotine Type Breaker
      - 5,440 kg (12,000 lb), 2.4 m (8 ft) hammer
    - Multi-Head Badger Breaker®
      - 16-450 kg (1,000 lb) hammers
      - 4 m (13 ft) wide
      - 1.5 m (5 ft) individual drops



*** Pictures from Antigo and RMI Website**

Particle Size Distribution



h_{rub} *= maximum depth of the slab*

h_p *= pavement thickness*

RMI Particle Size Specifications:

- Particle Size Range:

  Sand size to 6 inches not greater than 1.25 times h_{rub}

- Majority of the pieces:

  Sand size to 0.75 times h_{rub}

- For reinforced PCC:

  Larger pieces are accepted and reduced to the best possible size.

Antigo Construction Inc. Particle Size Specifications:

- Size Range:

  Sand size to 3 inches or less in the top half of the slab.

  9 inches or less in the bottom half of the slab.

- For reinforced PCC:

  Similar to the RMI Specifications

Highway Rubblization Projects

- **I-10 Louisiana Rehabilitation Project**
  - **11.0 km (7-mi) pavement rubblization**
  - **Contractor: Resonant Machines, Inc.**
  - **Pavement Structure:**
    - **250 mm (10 in) AC O/L**
    - **230 mm (9 in) Rubblized PCC**
    - **Subgrade: Sandy Soil**
- **I-65 Alabama Rehabilitation Project**
  - **Contractor: Antigo Construction, Inc.**
  - **Pavement Structure:**
    - **280 mm (11 in) AC O/L**
    - **250 mm (10 in) Rubblized PCC**
    - **Subgrade unknown**
  - **Test Pits required every 305 m (1000 ft)**

I-10 Louisiana

I-65 Montgomery

Airfield Rubblization Projects

- **Hunter Army Airfield, Savannah, GA**
  - East Taxiway Rubblized in 2003
  - Equipment (Antigo Construction Inc.):
    - Guillotine type breaker
    - Multi-Head Badger Breaker
  - Pavement Structure
    - 250 mm (10 in) AC O/L
    - 11,000 m^2 (13,167 yd^2) of 200 mm (8 in) Rubblized PCC
    - Subgrade: Poorly Graded Sand

- **Selfridge Air National Guard Base, MI**
  - Runway Reconstruction, Summer 2002
  - Equipment (Antigo Construction Inc.):
    - Guillotine type breaker
    - Multi-Head Badger Breaker
  - Pavement Structure
    - 180 mm (7 in) AC O/L
    - 115 mm (4.5 in) Crushed Concrete Base Course (leveling course)
    - Rubblized PCC thicknesses varied from 330 to 530 mm (13-21 in)
    - Subgrade: Silty Sand soils

*

Selfridge ANG Base Rubblization Project

* Picture from the Antigo Construction, Inc. Website

Rubblization Evaluation Results

- **Pavement Structural Evaluation**
  - Collect and analyze HWD data
    - Maximum load: 114,400 kg (52,000 lb)
    - Data analyzed in the PCASE program
      - Back-calculate Modulus values using WESDEF
- **Airfield Evaluation Results**
  - Hunter Army Airfield
    - Average Rubblized PCC Modulus values:
      - 4,070 MPa (590 ksi)
  - Selfridge ANG Base
    - 530 mm (21 in) Rubblized PCC Modulus values:
      - 8,700 MPa (1,260 ksi)

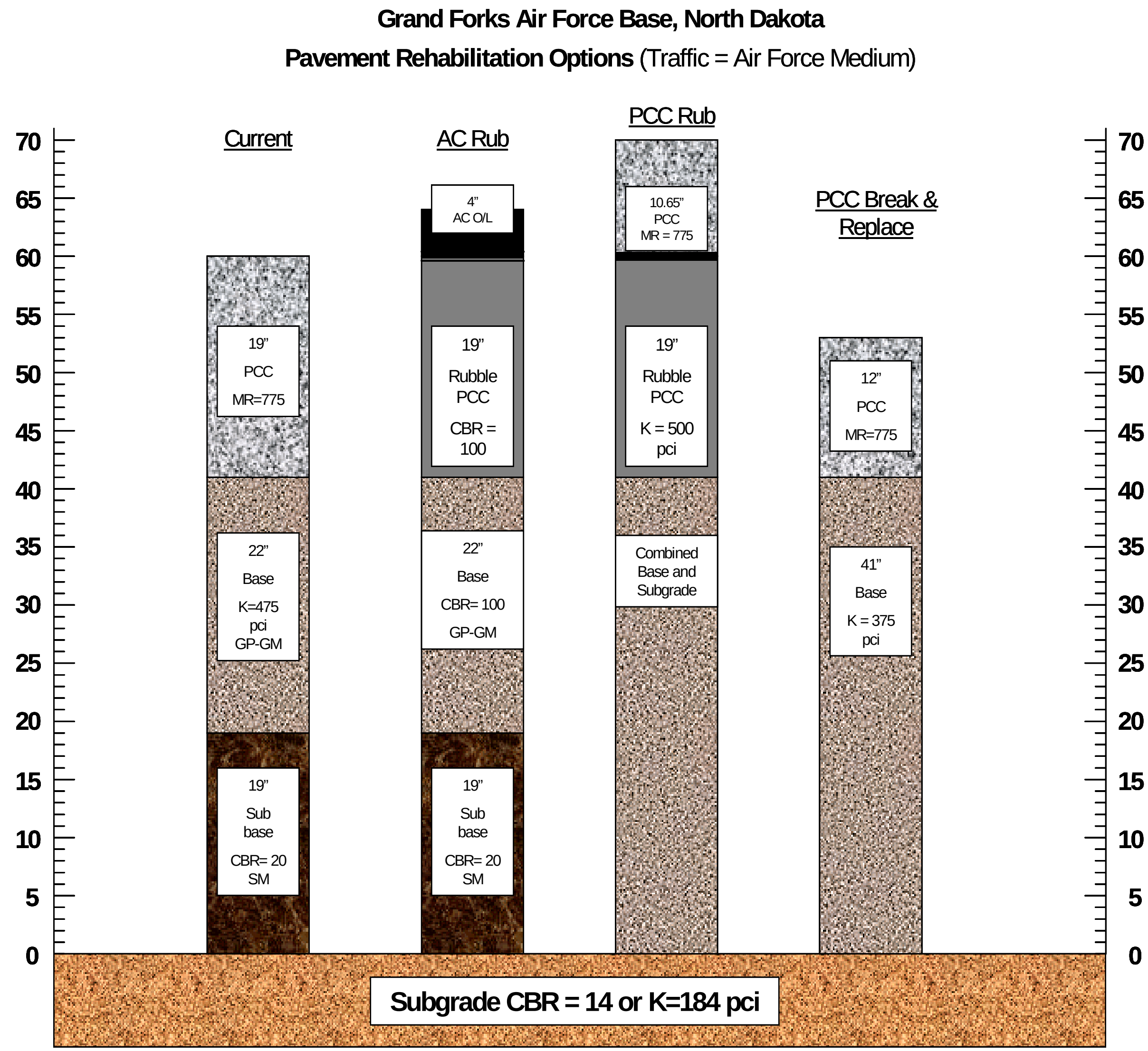
Heavy Weight Deflectometer

- **Additional FWD data:**
  - Niagara Falls Joint Air Reserve Station
    - Data provided by AFCESA
    - Runway Pavement Structure:
      - 130 mm (5.0) AC O/L
      - 240 mm (9 in) Rubblized PCC
      - Subgrade: Silty Gravelly Sand
- Average Rubblized PCC Modulus values:
  - 700 to 1,080 MPa (100-157 ksi)
  - Variations:
    - High Water Table
    - Shallow Depth to Bedrock

Grand Forks AFB Cost Analysis

Based on the rehabilitation of a 480 mm (19 in) PCC pavement:

- **Grand Forks Air Force Base pavement design:**
  - Air Force Medium Traffic
    - 400 passes B-52
    - 400,000 passes C-17
    - 100,000 passes F-15E
- **Costs**:
  - Rubblization:
    - $1.15 - $5.50 per square meter ($0.95-$4.50 per square yard)
  - Break & Remove:
    - $3.95 - $7.50 per square meter ($3.30 - $6.50 per square yard)
  - Rubblization cost is approximately 40% of the cost of break and removal.



Grand Forks AFB Runway Reconstruction Project

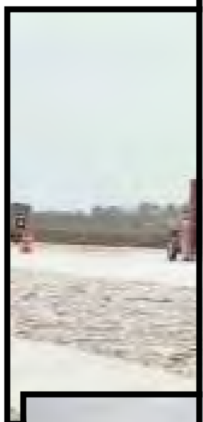
- **Monitor Ongoing Rehabilitation Project in Grand Forks Air Force Base, North Dakota**
  - Interesting Facts:
    - 250,000 sq. yards of PCC Rubblization
    - Average PCC layer thickness = 16-19 inches
    - Rubblization contract
      - Replaced RMI for Antigo Construction Inc.
    - New pavement will consist of AC and PCC overlays
  - Measure pavement response (HWD/FWD):
      - Before rubblization
      - After rubblization, before seating
      - After seating/ before AC/PCC overlay
      - After AC/PCC Overlay
  - Material characterization
    - Particle size distribution
      - Test pit particle sampling
  - Verify existing Rubblization guidelines and specifications

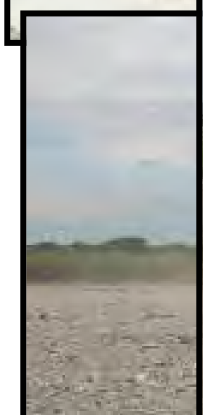
GF AFB Rub. Phase 1

Grand Forks AFB Rubblization Process

Step 1

Ru



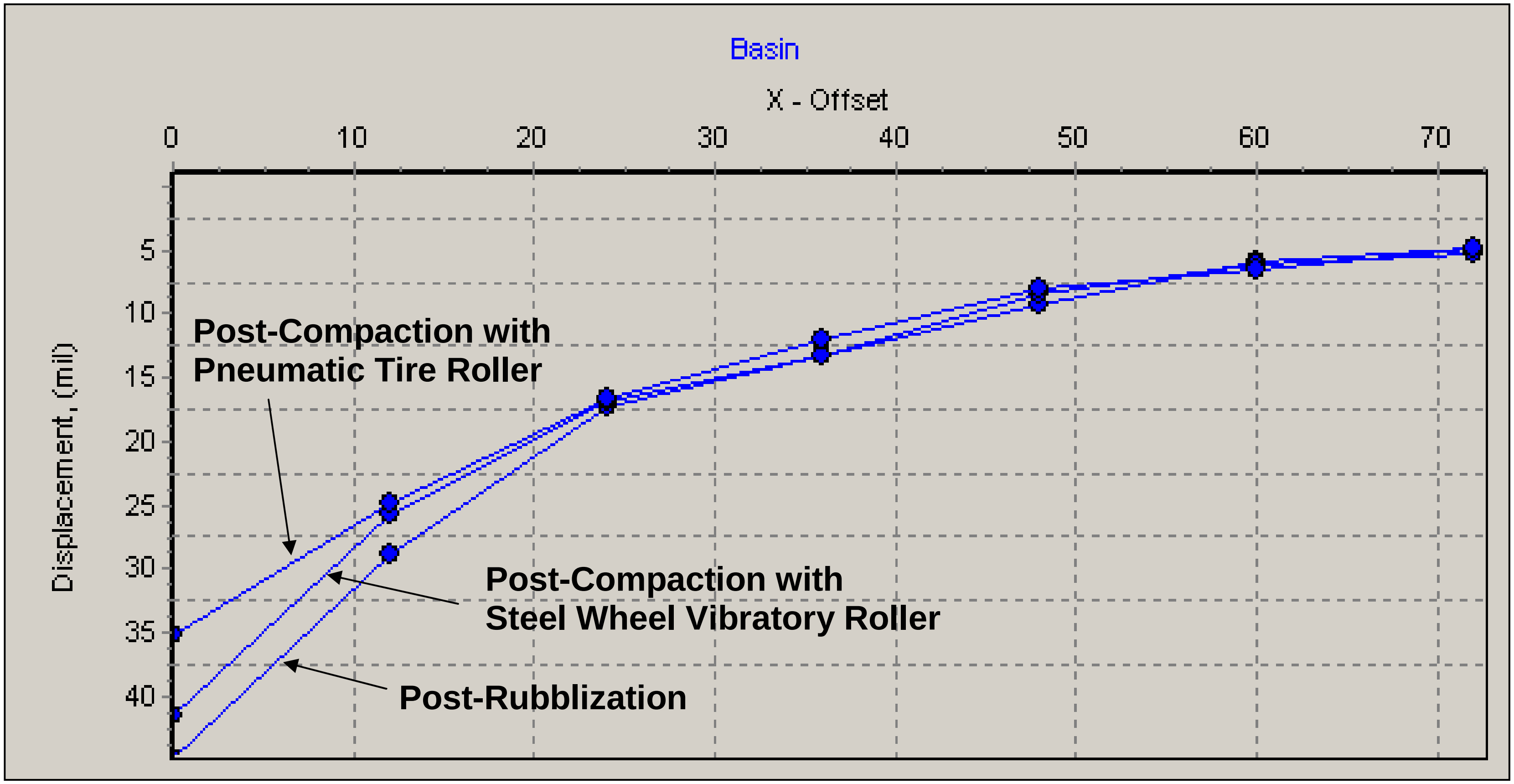


e

3

verlay

Grand Forks AFB - FWD Test Results



- GF AFB Phase I Runway Rubblization: 14-inch PCC pavement

Results and Conclusions

- Without proper guidance rubblization may not be considered a practical solution and there is substantial risk of premature failures.
- Overall cost of rubblization represents a 10% cost savings.
- Important Considerations:
  - Concrete slab
    - Thickness
    - Reinforcement type (if any)
    - Underground utilities
  - Base and Subgrade Strength
    - Soil moisture
    - Type of material
    - Subgrade Modulus >15,000 psi.
  - Proper drainage system
- The engineer may require more roller passes to achieve proper compaction. Over-compaction will break particle interlock.

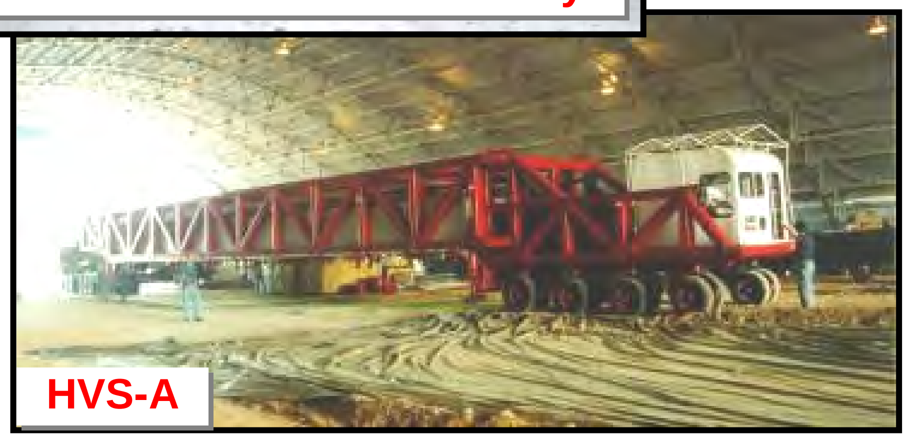
Proper drainage is required

Test Pits – Verify Cracked Pattern

Traffic Control

Future Research Studies

- **FAA Pavement Test Facility, New Jersey**
  - Load/Rolling tests
    - HVS
    - Aircraft loading
- **Monitor Long-term Rubblization Projects**
  - Existing condition evaluations
  - Non destructive testing:
    - HWD/FWD
  - Evaluate “old” crack & seat projects
    - Aberdeen Proving Grounds
  - Traffic responses
    - 5 (+) year term
    - HVS-A
      - Full-Scale Accelerated Pavement Testing
  - Other projects:
    - USAF – Elimination of Alkali-silica Reaction (ASR)
    - Travis AFB, California



Acknowledgements

- This past and ongoing research is sponsored by the Air Force Civil Engineering Support Agency (AFCESA) and conducted by the Geotechnical and Structures Laboratory in Vicksburg, Mississippi.

- For additional information on rubblization specifications:
  - Asphalt Institute Website, www.asphaltinstitute.org
  - Engineering Brief No.66 *Rubblized Portland Cement Concrete Base Course*, February 13, 2004 Federal Aviation Administration

- US Army Corps of Engineers Rubblization Specifications are currently under development. For more information please contact Eileen M. Vélez-Vega at **Eileen.M.Velez-Vega@erdc.usace.army.mil**

Thank you for your time!

QUESTIONS?

Contact Information

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Airfields and Pavements Branch

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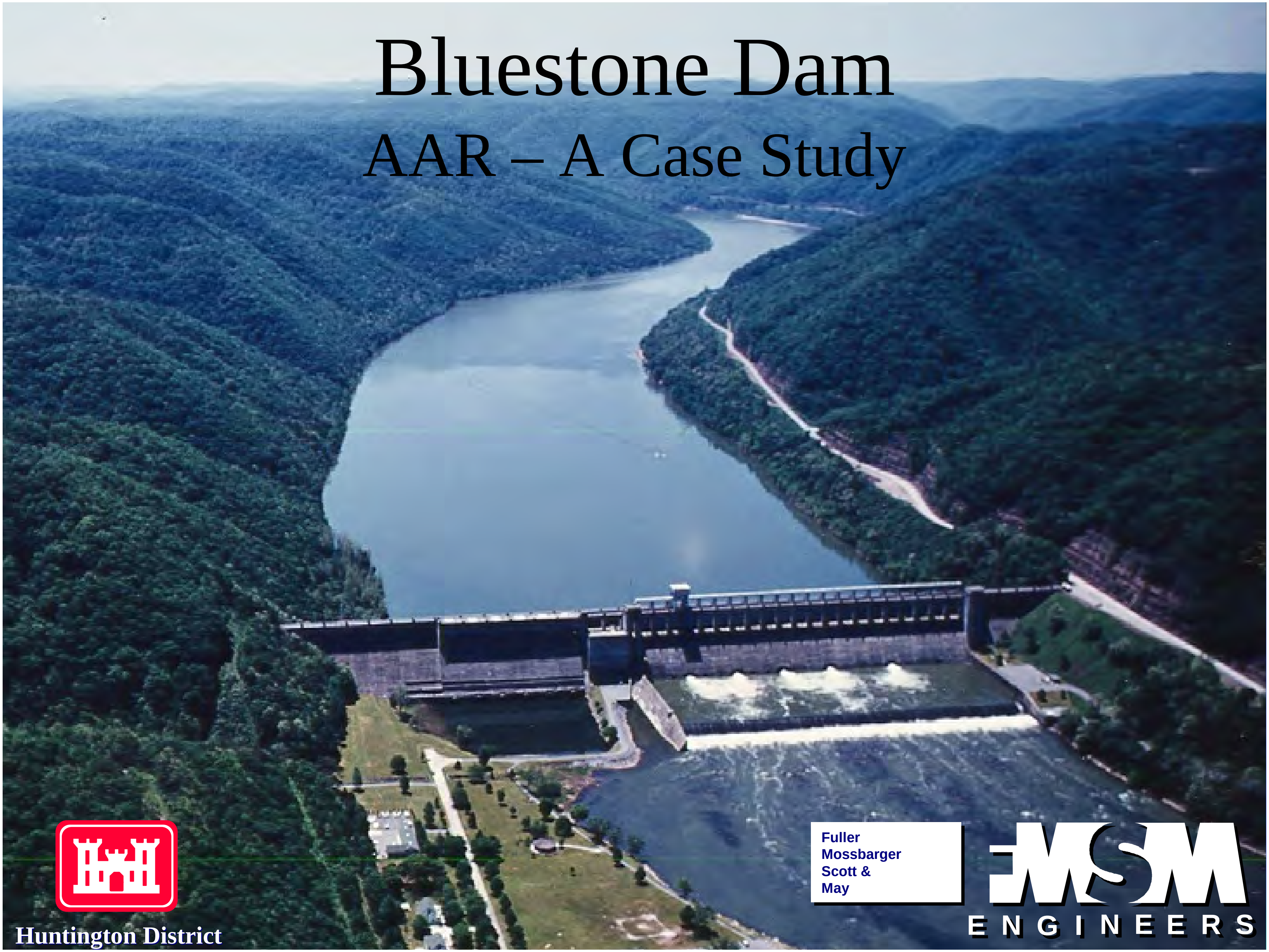
Bluestone Dam

AAR – A Case Study



Huntington District

Fuller
Mossbarger
Scott &
May

FMSM
ENGINEERS

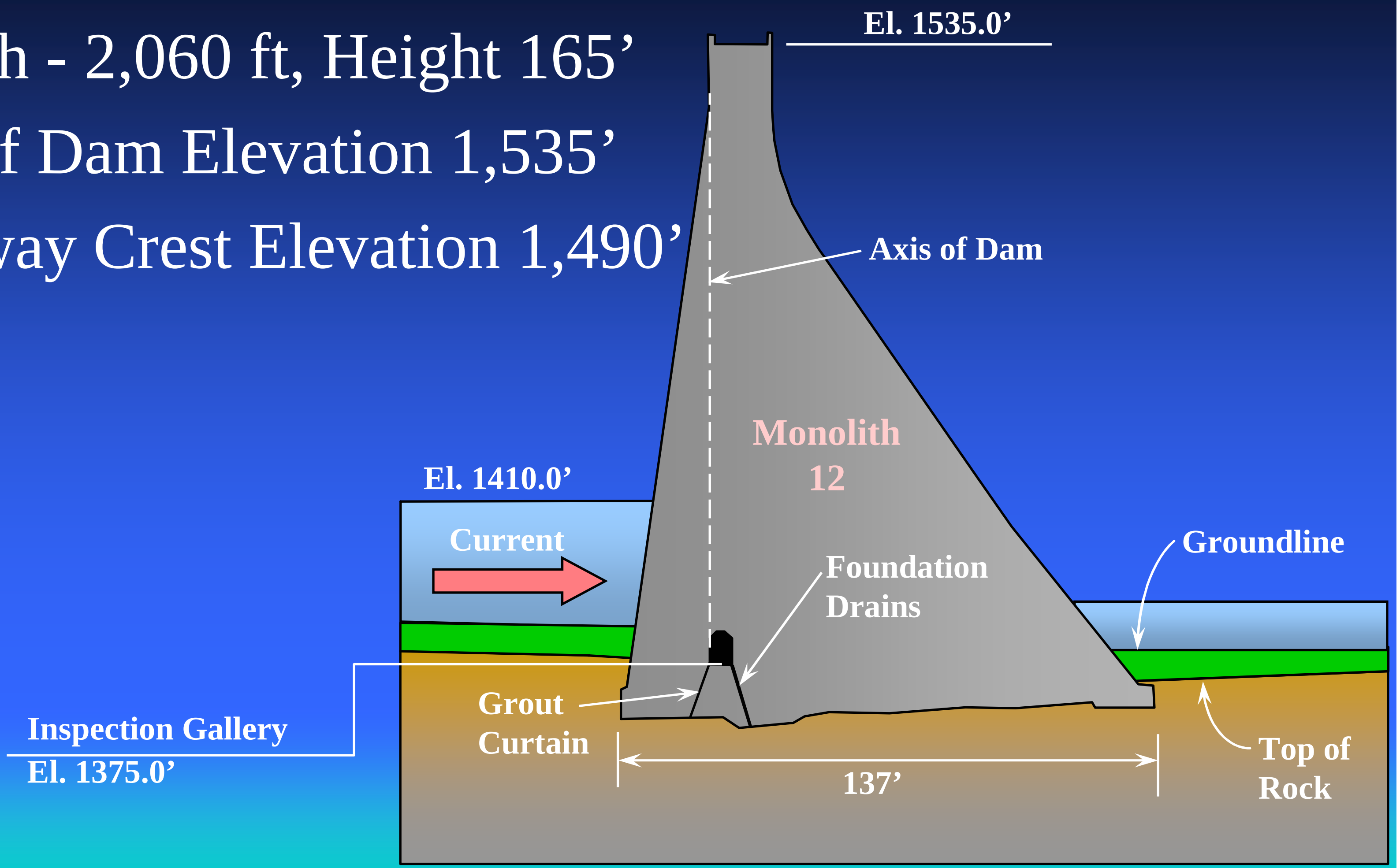
OHIO
Akron
Charles Mill
Atwood
Pleasant Hill
Beach City
Leesville
Delaware
North Branch of Kokosing
Tappan
Alum Creek
Clendening
Columbus
Wills Creek
Dillon
Piedmont
Dayton
Senecaville
Deer Creek
Tom Jenkins Dam
Willow Island Locks & Dam
Cincinnati
Paint Creek
Parkersburg
WEST VIRGINIA
Burnsville
Sutton
Grayson
Huntington
Charleston
Beech Fork
Summersville
Yatesville
East Lynn
Paintsville
Beckley
KENTUCKY
Dewey
Bluestone
VIRGINIA
Fishtrap
R.D. Bailey
Lynchburg
Flannagan
Roanoke
North Fork of Pound
Lakes
Dry Dams
Lock & Dams
State Capitals
Major Cities
District HQ
Regional HQ
District Boundary

Presentation Overview

- Site Overview
- Ongoing DSA Projects
- AAR Project Issues
- Sample Retrieval
- Laboratory Testing
- Conclusions

Bluestone Dam – Existing Project

- Concrete Gravity Dam - 1940's
- Length - 2,060 ft, Height 165'
- Top of Dam Elevation 1,535'
- Spillway Crest Elevation 1,490'

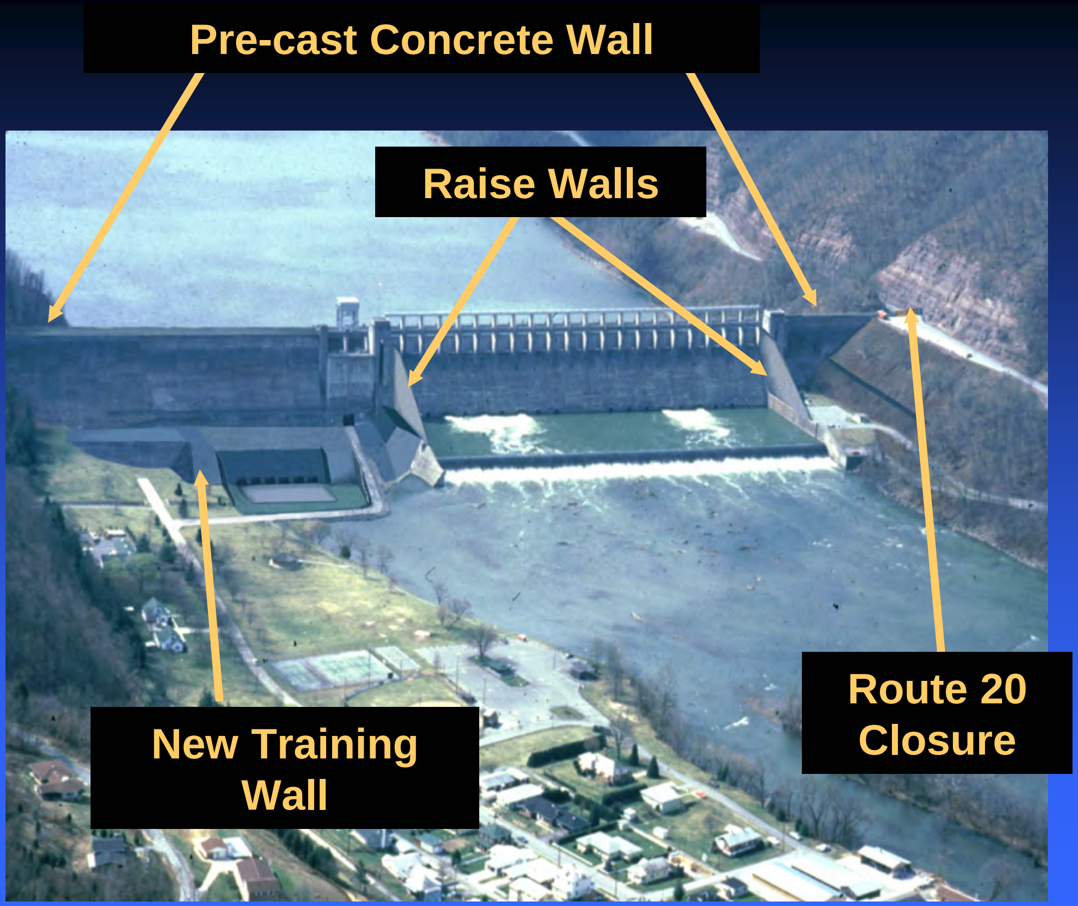


Bluestone DSA Phase I

- Project Features
  - 2 Lane Bridge
  - Thrust Blocks
  - Extending Penstocks
  - Sacrificial Bulkheads

Bluestone DSA Phase II

- Project Features
  - Rock Anchors
  - Parapet Wall
  - Rt 20 Gate Closure
  - New and Modified Training Walls



What is AAR?

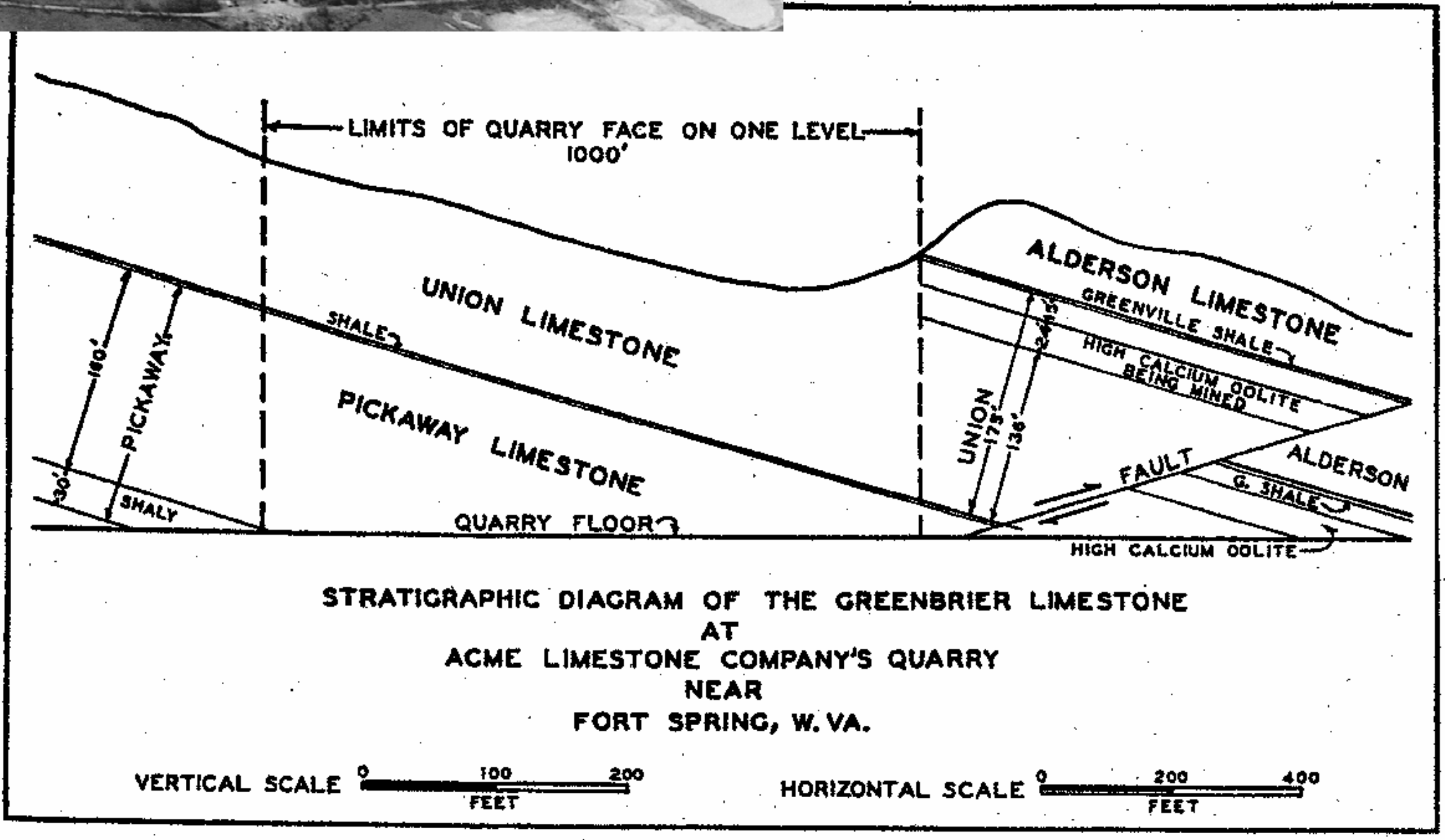
- Alkali Reaction with Silica (ASR)
- Alkali Reaction with Carbonates (ACR)
- Severity Influenced by:
  - Aggregate
  - Cement – Alkali
  - Humidity
  - Temperature
  - Stress Level
  - Time
- Decreased Serviceability and Design Life

Issues for Bluestone Dam

- Growth Mechanism – ASR or ACR?
- Growth Rate
- Impacted Areas of the Dam
- Compressive Strengths
- Influence on Planned Construction
- Same Quarry OK?


18
17
16
15
14
13

Snowflake Quarry - Potentially ASR Reactive



Sample Retrieval from Dam

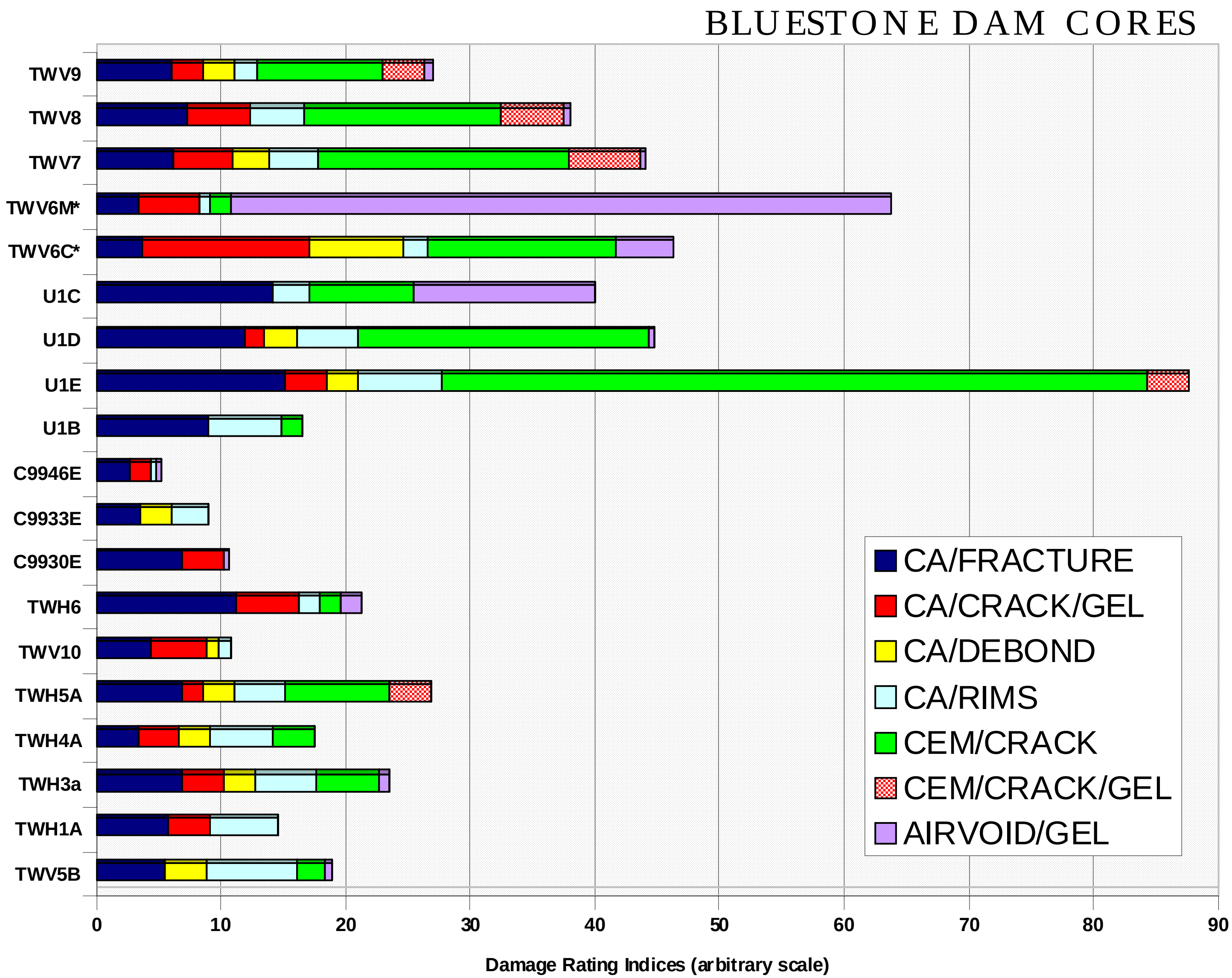
- Roughly 30 Sample Locations
- 4” and 6” Thin Wall
- NQ, PQ and 3”
- Positioned Primarily in Spillway Bridge
- Selected other Locations
  - Galleries
  - Abutments

Damage Rating Indicies

- Stereobinocular MS
- Mag = 16x
- Natural and UV Light
- Uranyl Acetate
- Gel Fluoresces
- DRI ~ 30

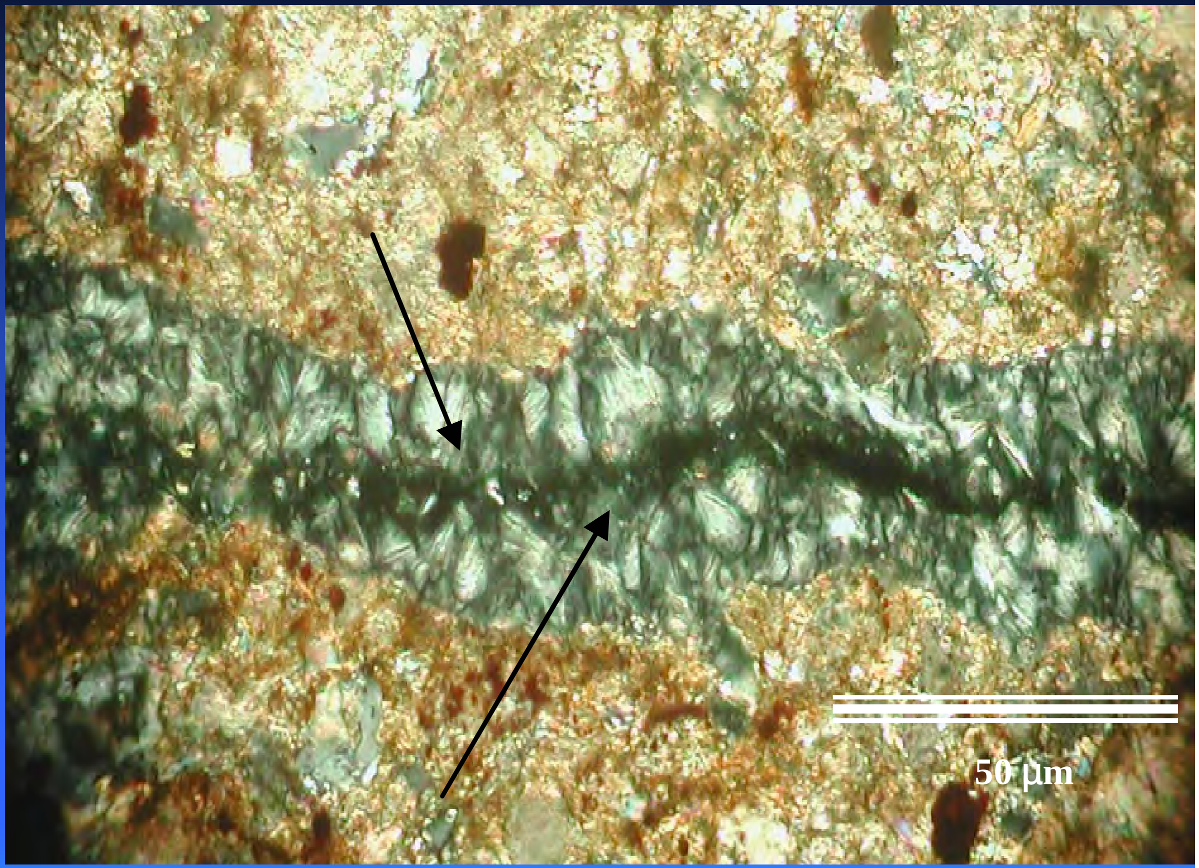
Weighting Factors for Determination of DRI	
Feature measured	**Factor**
Cracks in coarse aggregate	X 0.25
Cracks in coarse aggregate + gel	X 2.0
Open cracks in coarse aggregate	X 4.0
Coarse aggregate debonded	X 3.0
Reaction rims	X 0.5
Paste with cracks	X 2.0
Paste with cracks + gel	X 4.0
Gel in air voids	X 0.5

DRI Results


BLUESTONE DAM CORES
TWV9
TWV8
TWV7
TWV6M*
TWV6C*
U1C
U1D
U1E
U1B
C9946E
C9933E
C9930E
TWH6
TWV10
TWH5A
TWH4A
TWH3a
TWH1A
TWV5B
0
10
20
30
40
50
60
70
80
90
Damage Rating Indices (arbitrary scale)
CA/FRACTURE
CA/CRACK/GEL
CA/DEBOND
CA/RIMS
CEM/CRACK
CEM/CRACK/GEL
AIRVOID/GEL

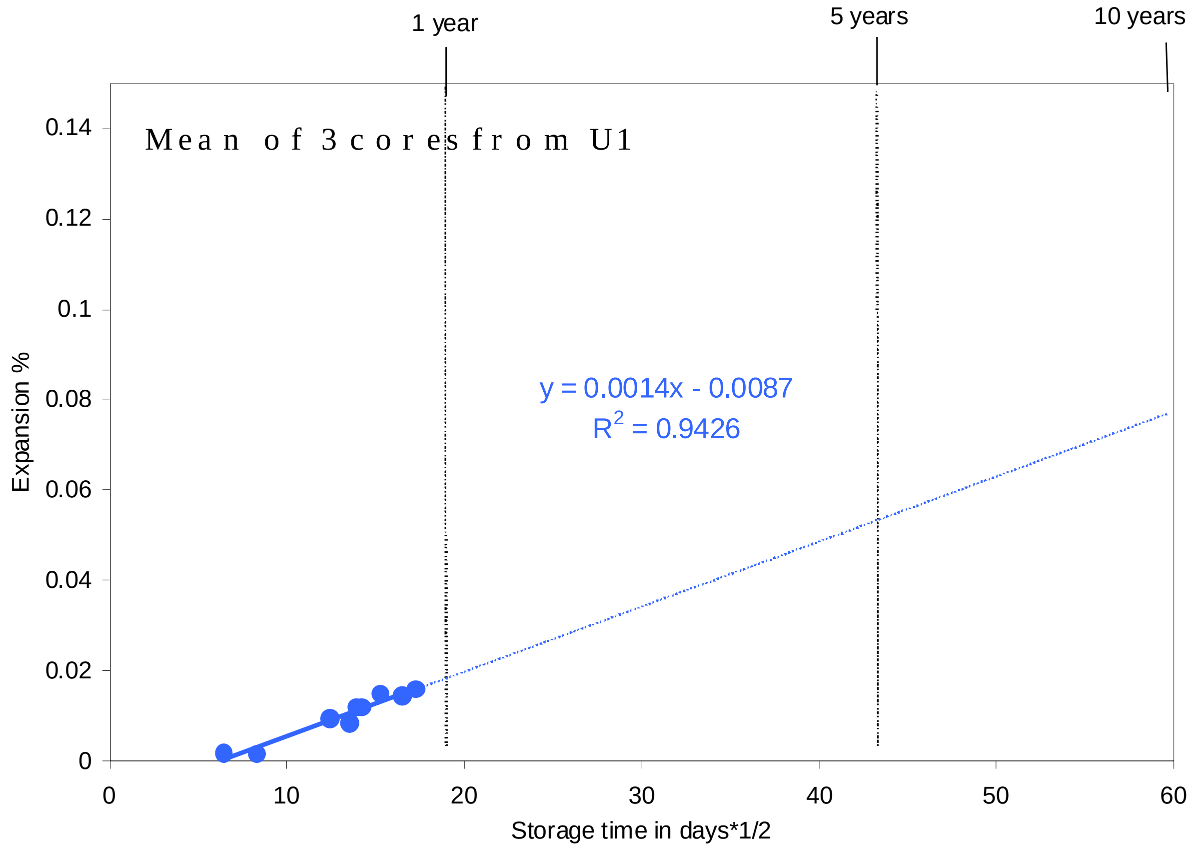
Petrography

- Alkali Silica Gel Observed
- Chert
- Chalcedony
- Greywacke
- Alkali Contents $< 2\ kg/m^3$

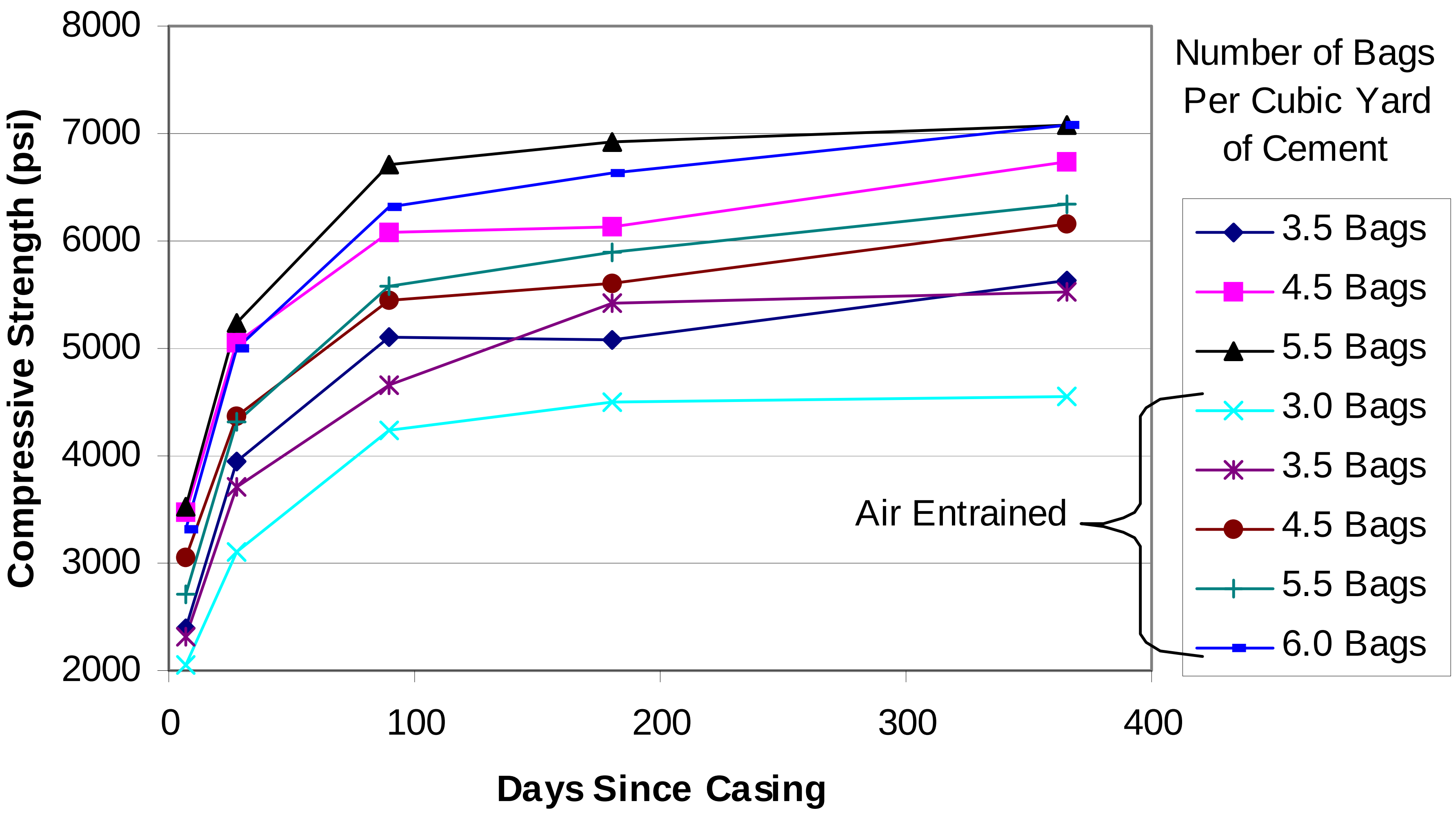


Expansion Tests

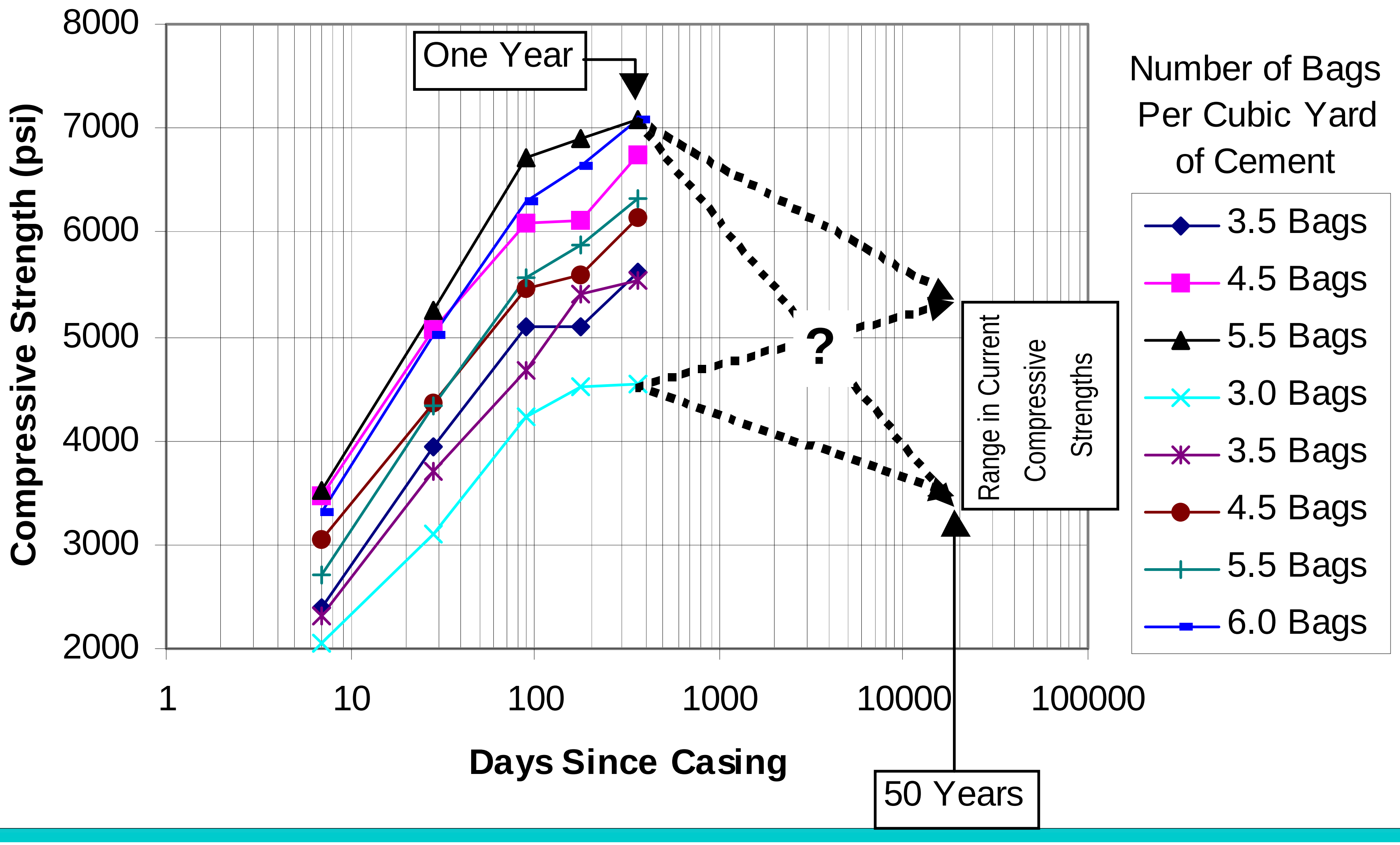
- On Cores, CSA A864-00
- 100% Relative Humidity, 38 C
- Over Water and w/NaOH Added – Insufficient Alkalis



Compressive Strengths – 1940s



Compressive Strengths – 2000



Conclusions

- Growth Mechanism – ASR
- Growth Rate ~ Very Small
- Insufficient Alkalis to Support any Further Significant Expansion
- Compressive Strengths Decreased – Consider in Future Designs
- Spillway Bridge Capacity

Fuller
Mossbarger
Scott &
May

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