

CE 4990/6990 - *The Paving Process* – Summer 2016 Abbreviated & Slightly Altered Final Presentations for Website Display



Instructor -Isaac L. Howard

This hands on course initiative was financially supported by MAPA, with numerous others shown on the following slides providing, technical support, mentoring, facility access, and many other in-kind services. This course was an industry, agency, and university partnership at the most fundamental level. Thank you to everyone!

The Paving Process

Technical & Logistical Supporting Groups

EUTAW



Hunt
REFINING COMPANY

PHILLIPS
CONTRACTING
COLUMBUS, MS



NEEL-SCHAFFER
Solutions you can build upon

HOHESITY · EXCELLENCE
SINCE 1927
MMIC
MATERIALS, INC.
CONTINUOUS IMPROVEMENT



apac

MDOT
MISSISSIPPI DEPARTMENT OF TRANSPORTATION

Individual Acknowledgements

- Everyone listed below supported this hands-on educational initiative in at least one way.
- Kyle Beckman, Mike Bogue, Dennis Bonds, Jason Brewer, Keith Clark, David Coleman, Don Conrad, Ben Cox, Jennifer Crowe, Codrin Daranga, Mike Hemsley, David Howell, Mark Holley, Jeff Johnson, Jason Keith, Kyle LaPorte, Jamie McDonald, Brandon McGarrity, Mike Miller, Nan Mitchell, Jonathan Myrick, Derrick Olive, Bob Phillips, Saunders Ramsey, Kari Babski-Reeves, Roy Robertson, Mike Tagert, Dennis Truax, Josh Walden, Amy Walker, Travis Wampler, Dan Whatley, and Taylor Wilson

South Entrance or South Gateway Project (i.e. Hail State Boulevard)

- This project served as the project for this class
- Their goal was to understand all aspects of what is required to have a transportation corridor connecting two points
 - Engineering
 - Construction
 - Materials
 - Financing
 - Public relations, public support
 - The list goes on....

The Paving Process – Enrolled Students

Name	Classification	Hometown
Brad Hansen	Graduate	Long Beach, MS
Robert Moore	Graduate	Tupelo, MS
Carl Pittman	Senior	Helena, AR
Jayme Williams	Senior	Carrollton, MS
Corbin Coker	Senior	Petal, MS
Jonathan Buckley	Senior	Brookhaven, MS
Joseph Arthur	Senior	Hernando, MS
Chancedy Pulliam	Senior	Houston, MS
Westin Graves	Junior	Jackson, MS

Introduction & Background

Presenter:
Carl Pittman

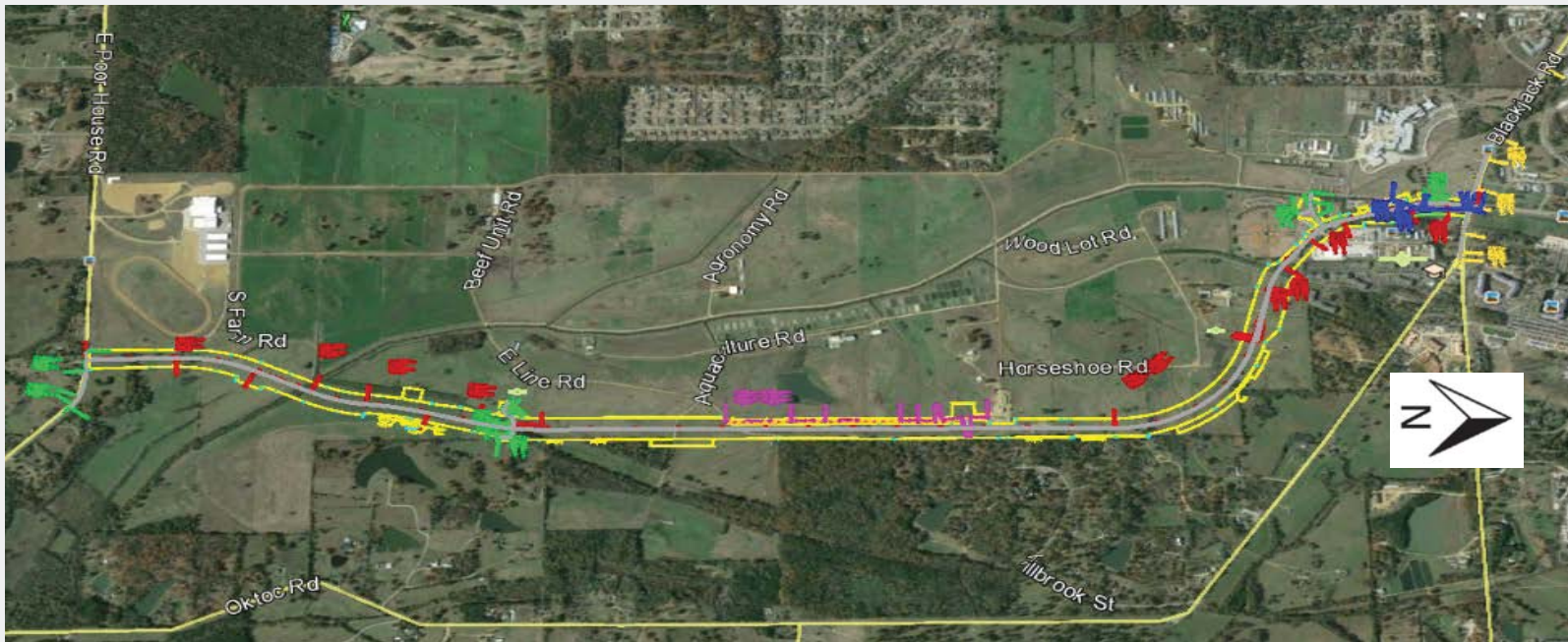


Undergrad Research Assistant for CMRC
Undergrad Civil Engineering Student
Mississippi State University



MSU South Entrance

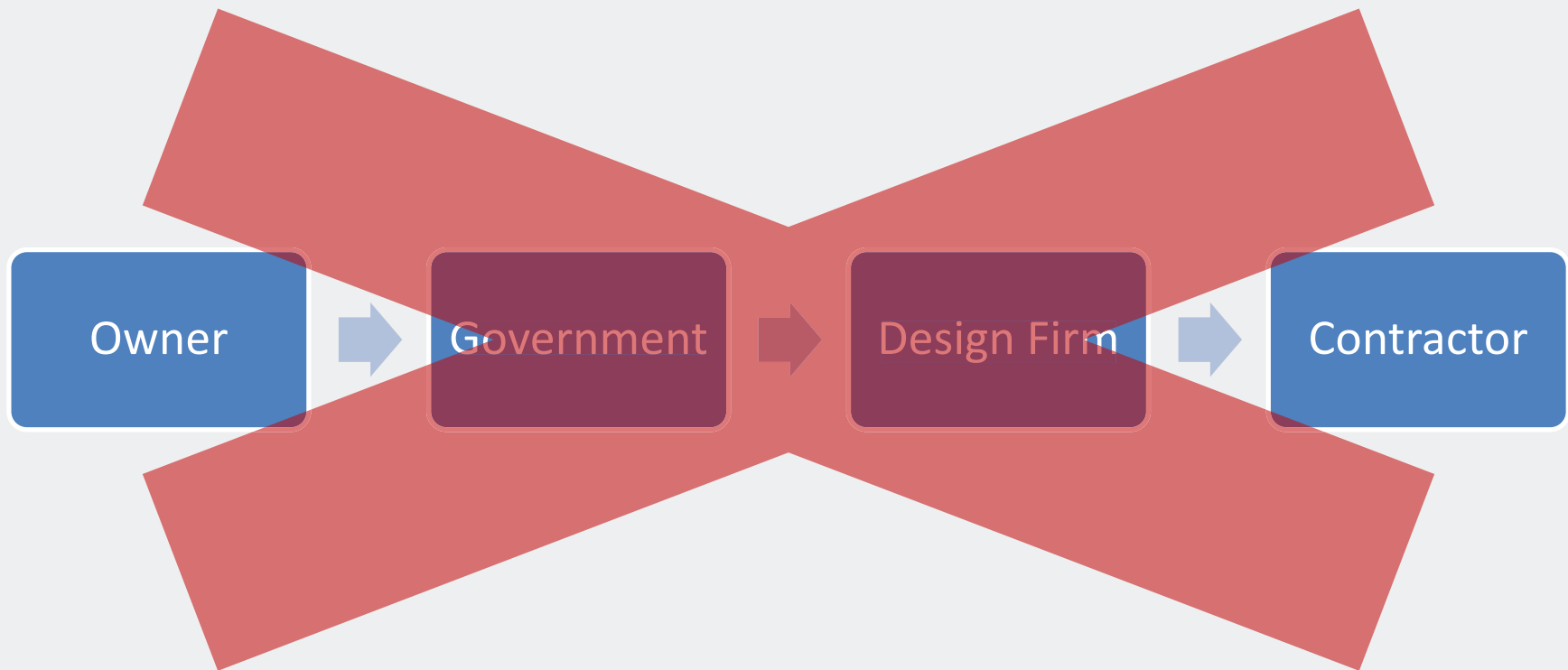
- 3.5 miles long
- 1 bridge
- 2 box bridges
- 3 box culverts
- Primary Contractor- Eutaw
- \$18 million total budget



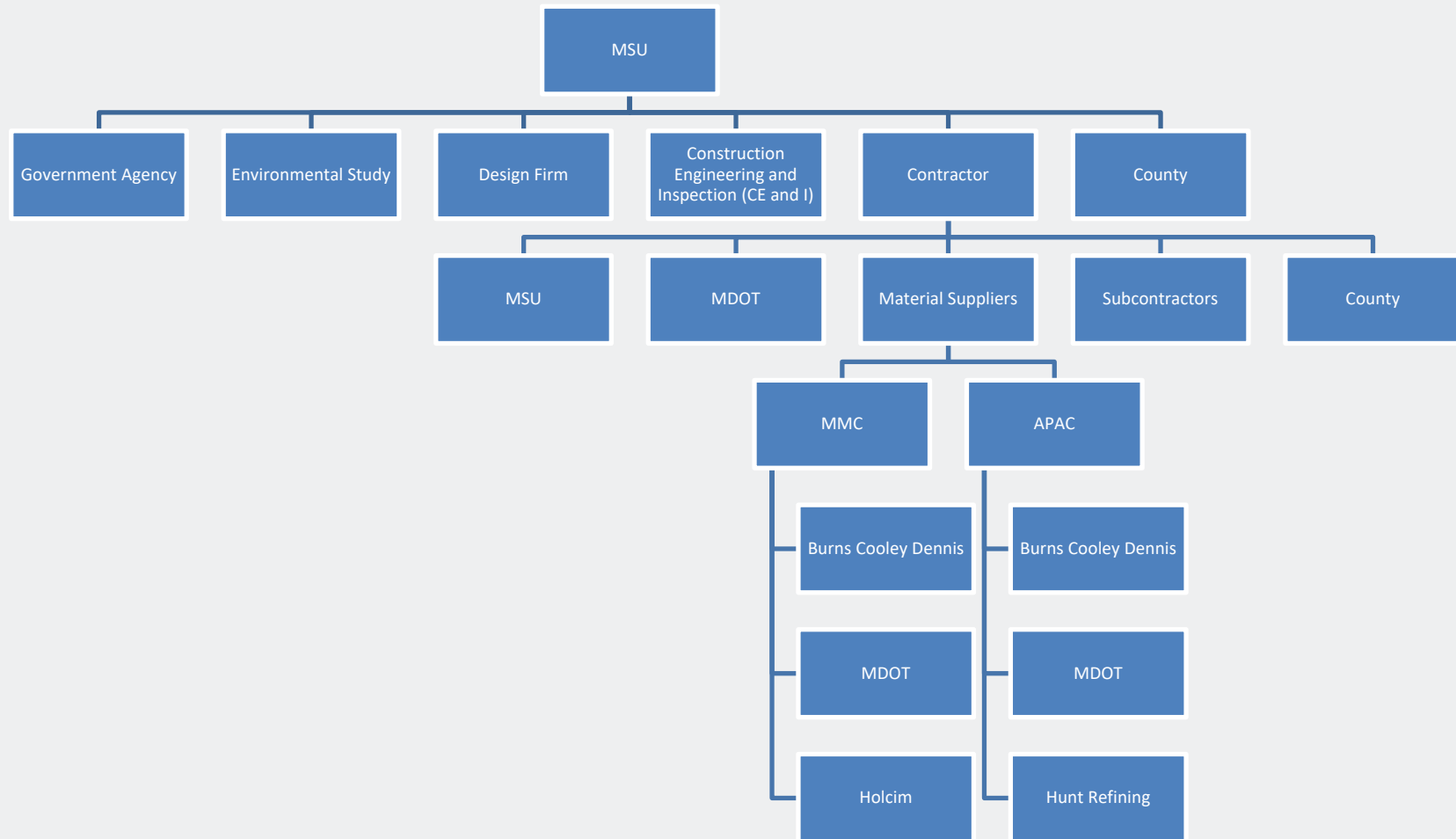
Approximate Timeline

- 2006: Initial Idea
 - Memorandum of Understanding signed in April
- 2007-2010: Environmental study and design
- 2010-2015: Approving drawings and acquiring funds
- Fall 2015: Bid accepted
- Feb. 1st 2016: Notice to proceed issued to Eutaw
- Fall 2017: Estimated completion

Project Management



Project Management



Entities Involved

- MSU
- MDOT
- FHWA
- OSHA
- Neel-Schaffer
- Burns Cooley Dennis, Inc.
- Oktibbeha County
- Eutaw Construction Co., Inc.
- MMC Materials, Inc.
- APAC Mississippi, Inc.
- Hunt Refining Co.
- Holcim US, Inc.
- Corps of Engineers
- Volkert Inc.
- Riverside Traffic Systems
- Traffic Maintenance Service
- Mississippi Paving and Construction, Inc.
- A-1 Sealing, Inc.
- Simmons Erosion Control
- Atwood Fence Co. LLC
- Stewart Environmental Construction, Inc.
- Sunbelt Sealing, Inc.
- Columbus Fence Co. LLC
- Eubank Construction Co., Inc.
- Phillips Contracting Co., Inc.

Financing and How it Affects Those Involved From the Owner to the Observer

Presenter:
Corbin Coker S.M. ASCE



President MSU ASCE
Student Chapter

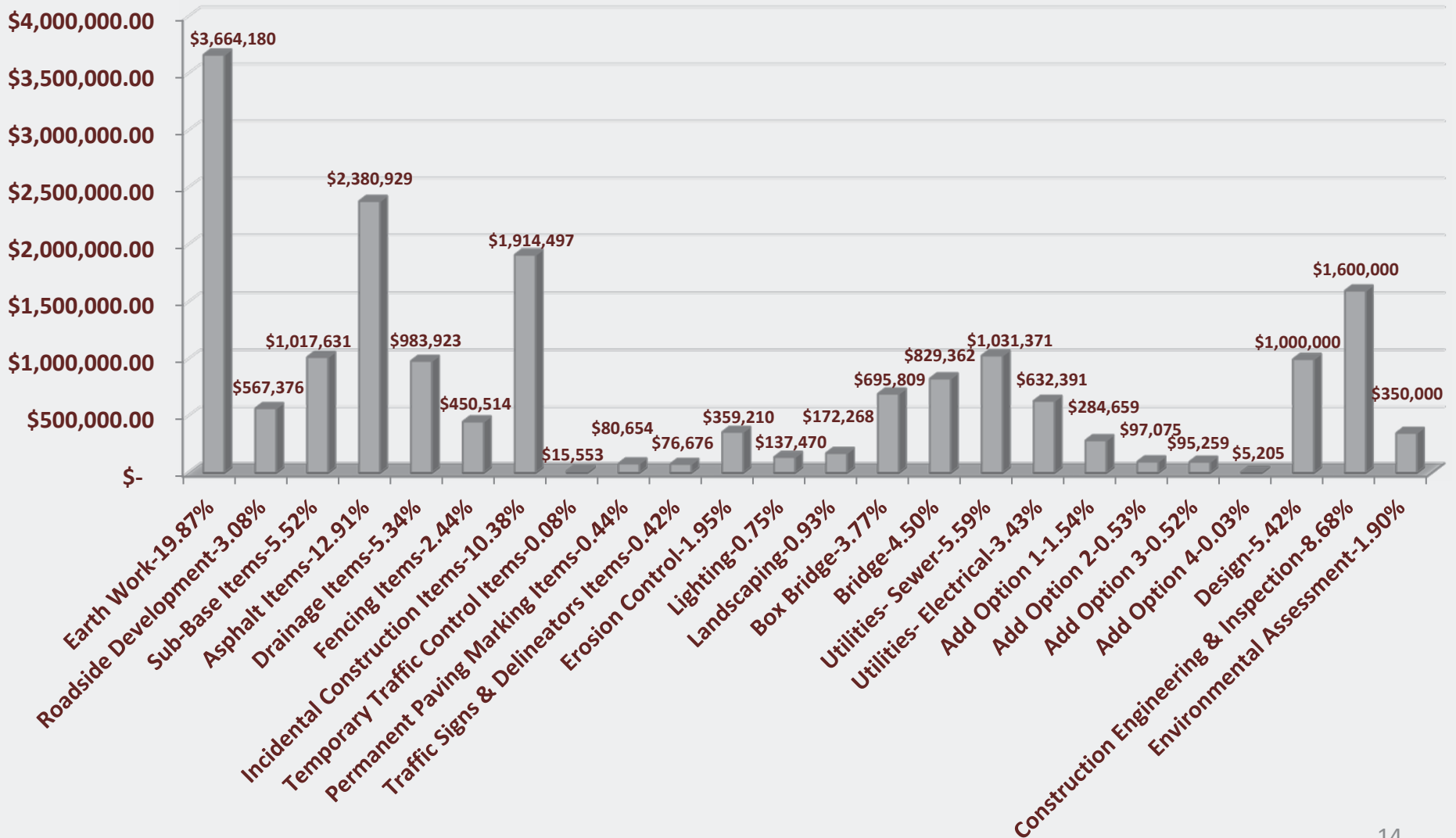


Finances

The Effect it has on Everyone Involved

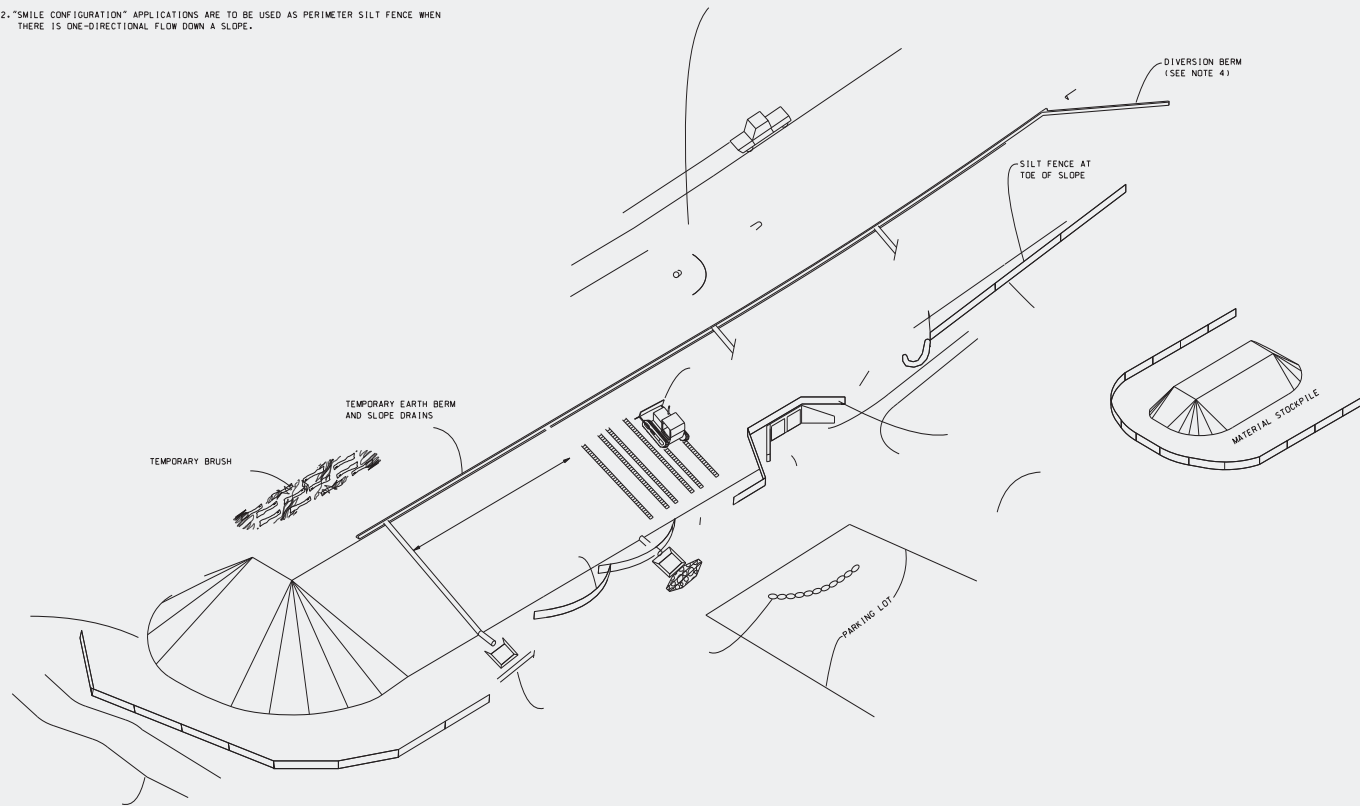
Where the Financing comes from
FHWA/USDOT is one large source

Where the Money goes



Road Site Development-3.08%

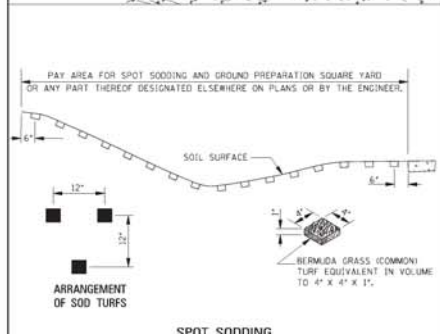
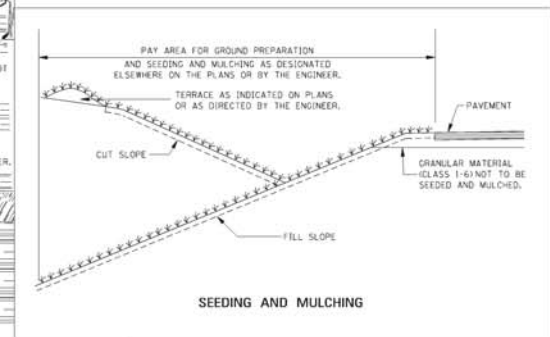
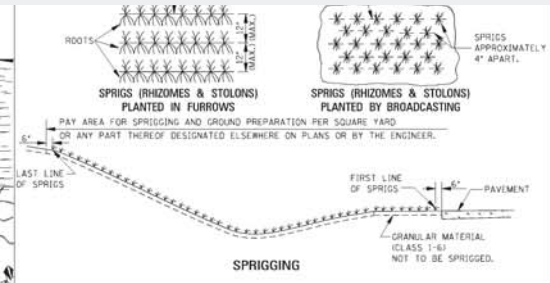
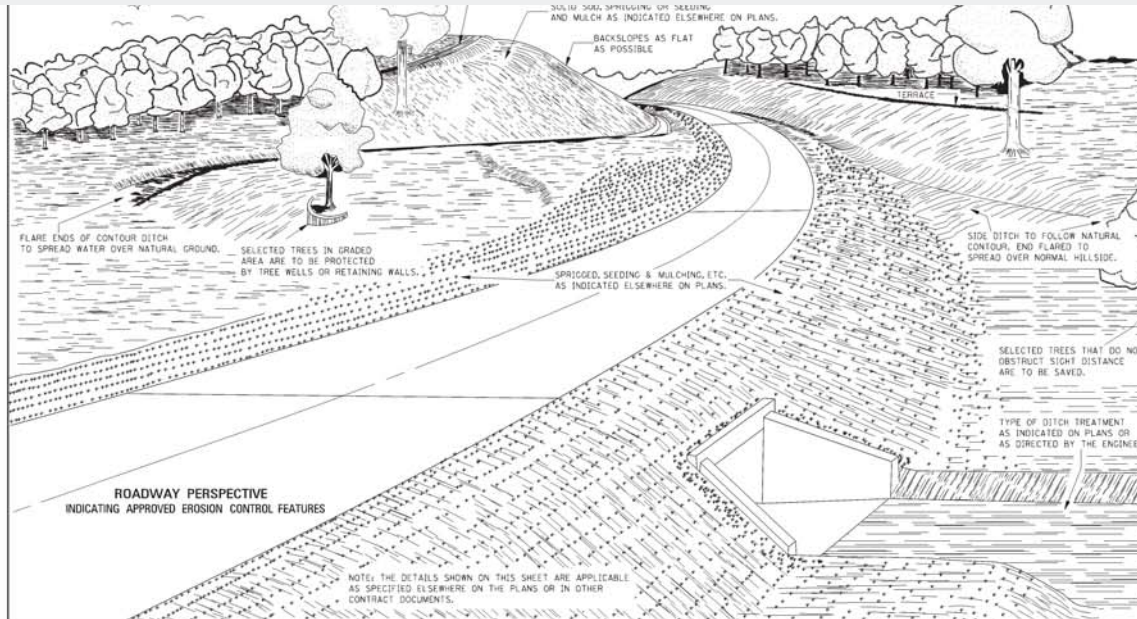
2. "SMILE CONFIGURATION" APPLICATIONS ARE TO BE USED AS PERIMETER SILT FENCE WHEN THERE IS ONE-DIRECTIONAL FLOW DOWN A SLOPE.



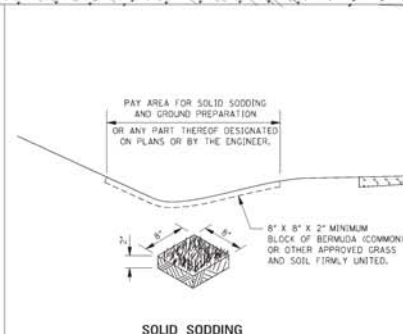
Earth Works and its financial impact-19.87%



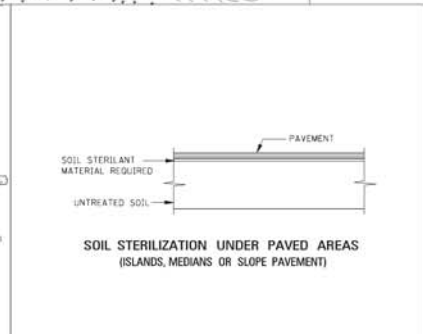
Fencing and Temporary Erosion Control-4.39%



SPOT SODDING



SOLID SODDING



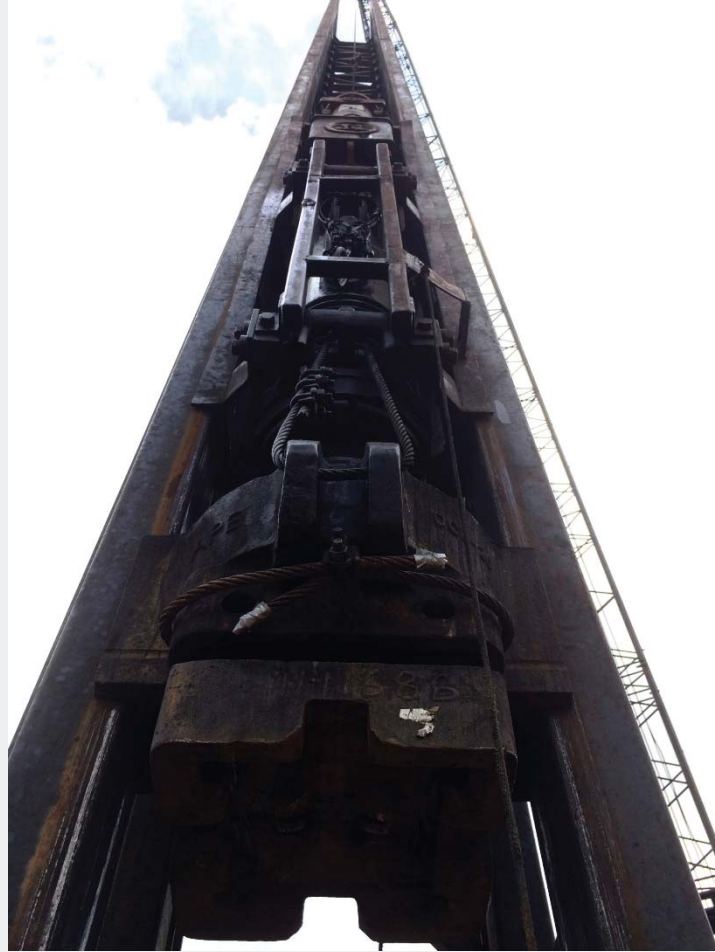
GENERAL NOTE:
1. LONGITUDINAL AND TRANSVERSE MEASUREMENTS FOR THE PAY AREA SHALL BE TAKEN ALONG THE SLOPES.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

EROSION CONTROL

STATE OF MISSISSIPPI
ENGLISH
WORKING NUMBER

Bridge and Culverts-8.27%



Utilities-9.02%

	STATE MISS.	PROJECT NO. TP-0500-00(10)PA
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TYPICAL THRUST BLOCKING IN WATER MAINS
N13

NOTE: ALL THRUST BLOCKS SHALL BE 4000 PSI CONCRETE AGAINST UNDISTURBED EARTH.

TYPICAL CROSS SECTION
N13

1'-0" MIN.
UNDISTURBED SOIL
CONCRETE THRUST BLOCK
ABSORBED ITEM

1'-0" MIN.
UNDISTURBED SOIL
CONCRETE THRUST BLOCK
ABSORBED ITEM

1'-0" MIN.
UNDISTURBED SOIL
CONCRETE THRUST BLOCK
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CONCRETE THRUST BLOCK
ABSORBED ITEM

1'-0" MIN.
UNDISTURBED SOIL
CONCRETE THRUST BLOCK
ABSORBED ITEM

TYPICAL TRENCH DETAILS FOR WATER PIPES
N13

SC = 18" MIN.
BC = 24" MIN.
BR

INITIAL COMPACTED BACKFILL

BEDDING

BEARING AREA IN SQ. FT.					
NOMINAL PIPE DIAMETER (IN)	DEAD-END OR TEE	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND
6	2.5	3.0	2.0	2.0	2.0
8	4.0	6.0	3.0	3.0	2.0
10	6.0	9.0	5.0	3.5	2.0
12	9.0	11.0	6.0	3.5	2.0
14	12.0	16.0	9.0	5.0	2.5
16	16.0	22.5	12.0	6.0	3.0
18	20.0	28.0	15.0	8.0	4.0
20	24.5	34.0	18.0	10.0	5.0
24	35.0	49.0	27.0	14.0	7.0
30	54.0	76.0	41.0	21.0	10.0
36	77.0	108.0	59.0	30.0	15.0
42	104.0	144.0	79.0	40.0	20.0

NOTE: ABOVE VALUES CALCULATED USING P=100 AND ALLOWANCE SOIL BRG = 1500 PSF. FOR DIFFERENT P, MULTIPLY ABOVE VALUES BY P/100. FOR DIFFERENT SOIL BRG, MULTIPLY ABOVE VALUES BY 1000/S.

VERTICAL BENDS					
NOMINAL PIPE DIAMETER (IN)	DEAD-END OR TEE	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND
6	26.0(1.0)	14.8(5.5)	7.2(6.3)	—	—
8	45.0(1.7)	25.0(9.3)	13.0(5.5)	—	—
10	68.0(2.5)	37.0(14.4)	18.0(7.7)	—	—
12	97.0(3.6)	52.0(19.8)	27.0(12.0)	—	—
14	124.0(4.8)	70.0(26.0)	36.0(16.3)	—	—
16	186.0(7.1)	91.0(33.4)	46.0(21.2)	—	—
18	211.0(8.1)	114.0(42.2)	58.0(27.2)	—	—
20	250.0(9.5)	140.0(51.1)	72.0(33.8)	—	—
24	370.0(13.7)	200.0(74.1)	100.0(45.8)	—	—
30	568.0(21.1)	308.0(114.4)	156.0(69.8)	—	—
36	814.0(30.1)	440.0(161.6)	226.0(99.3)	—	—
42	1100.0(40.7)	592.0(215.2)	304.0(137.2)	—	—

NOTE: ABOVE VALUES REPRESENT THE VOLUME OF BLOCKS INCLUDING SOIL LOAD IN CLEFT (CU YDS). THE VALUES WERE CALCULATED USING A P=1500 PSF AND A S1=1.5. FOR DIFFERENT P, MULTIPLY VALUES BY P/100.

TYPICAL DITCH CROSSING DETAIL
N13

TYPICAL WATER LINE LAYING DETAIL
N13

TYPICAL WATER SERVICE CONNECTION
N13

3" COPPER SERVICE TUBING TYPE K, MEET COPPER WELDING REQUIREMENTS OF FEDERAL SPECIFICATION NO. WMT-799 AND ASTM SPECIFICATION B-88.

BURIED VALVE DETAIL
N13

2" x 2" x 4" CONC. PAD WITH NO. 3 @ 9" O.C.E.A. NOT REQ'D AT CONCRETE PAVEMENT

THREE PIECE VALVE BOX

VALVE BOX TO BEAR ON 2 BLOCKS 8" x 8" x 5" ON TAMPED BACKFILL, NOT ON VALVE BONNET

NO. 3 REBAR

CONCRETE THRUST BLOCK ABSORBED ITEM

EXTEND 1/2" BELOW EDGE OF VALVE EACH WAY

TYPICAL HYDRANT INSTALLATION
ELEVATION

NOTE: GATE VALVES WILL BE REQUIRED ON ALL HYDRANT LEADS

GENERAL NOTE:
1. ALL POTABLE AND NON POTABLE WATER LINE SHALL HAVE A MINIMUM COVER OF 36" EXCEPT WHERE LESS COVER IS INDICATED ON THE DRAWINGS.
2. CARRIER PIPE SHALL BE AS SHOWN ON PLAN VIEW SHEETS AND AS CALLED FOR IN SPECIFICATIONS.

NOTICE TO DRAWING HOLDER

NEEL-SCHAFFER, INC., HEREINAFTER REFERRED TO AS THE ENGINEER HAS PREPARED AND FORWARDED THIS DRAWING TO THE OWNER FOR USE ON THIS PROJECT ONLY. THIS DRAWING SHOULD NOT BE USED ON EXTENSION OF THIS PROJECT OR ON ANY OTHER PROJECT. ANY REUSE OF THIS DRAWING, WITHOUT WRITTEN PERMISSION OF THE ENGINEER, SHALL BE AT THE USER'S SOLE RISK AND THE ENGINEER SHALL BE HELD HARMLESS FROM ALL CLAIMS, DAMAGES, LOSSES AND EXPENSES, INCLUDING ATTORNEY'S FEES ARISING OUT OF OR RESULTING THEREFROM.

REVISIONS			DRAWING INFORMATION	
NO.	DATE	BY	DESCRIPTION	

N-S PROJECT NO.103 08425.000
FILENAME: 08425-DETAILS.DWG
SCALE: N.T.S.
SURVEYED BY:
DSON-COM DATE: 2/2014
DIPHE-ILC DATE: 2/2014
CIND DATE:
GA/OC DATE:

MISSISSIPPI STATE UNIVERSITY

SOUTH ENTRANCE

RELOCATION OF UTILITIES

MISSISSIPPI STATE, MISSISSIPPI

NEEL-SCHAFFER
Solutions you can build upon

UTILITY RELOCATION PLAN

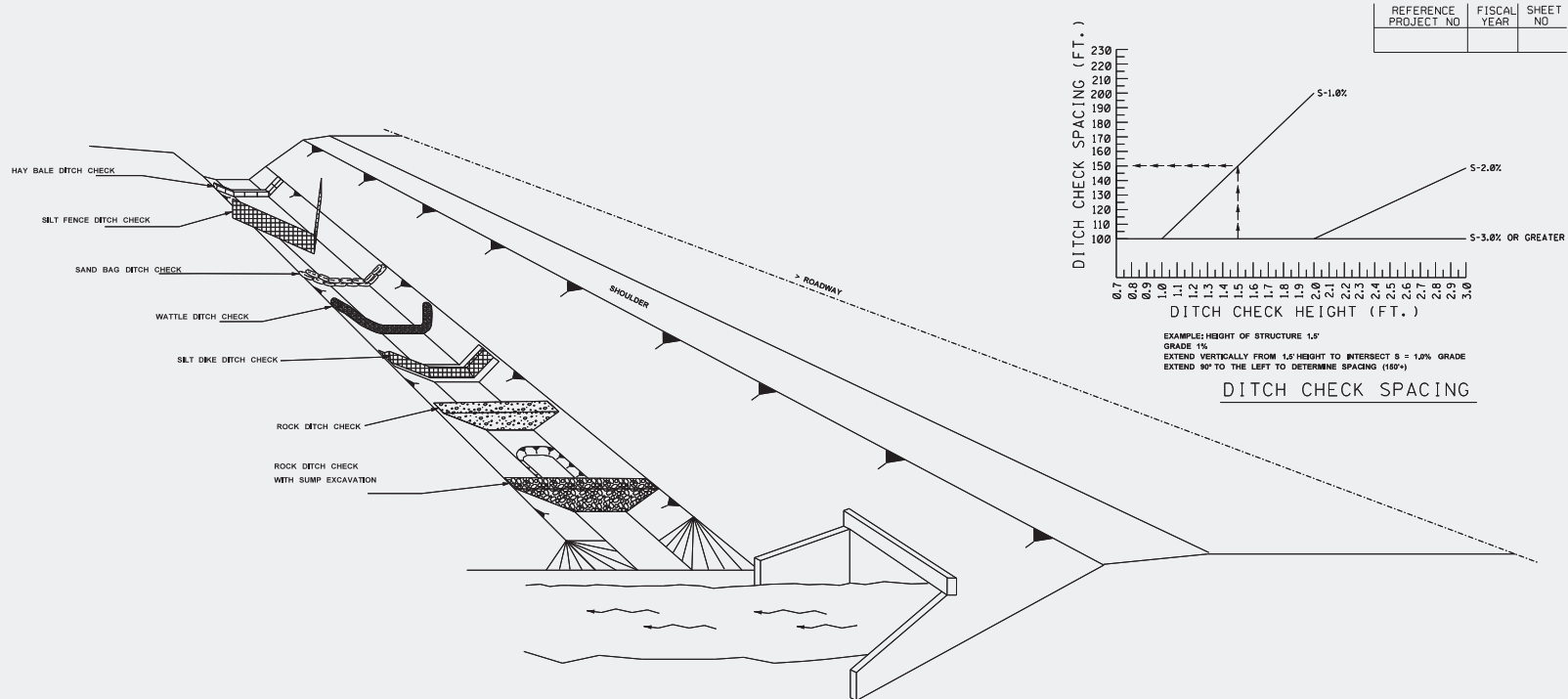
WATER UTILITIES

WORKING NUMBER: U-114	DRAWING NUMBER: 5014
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Drainage-5.34%



Subbase and Asphalt-18.43%



NOTES:

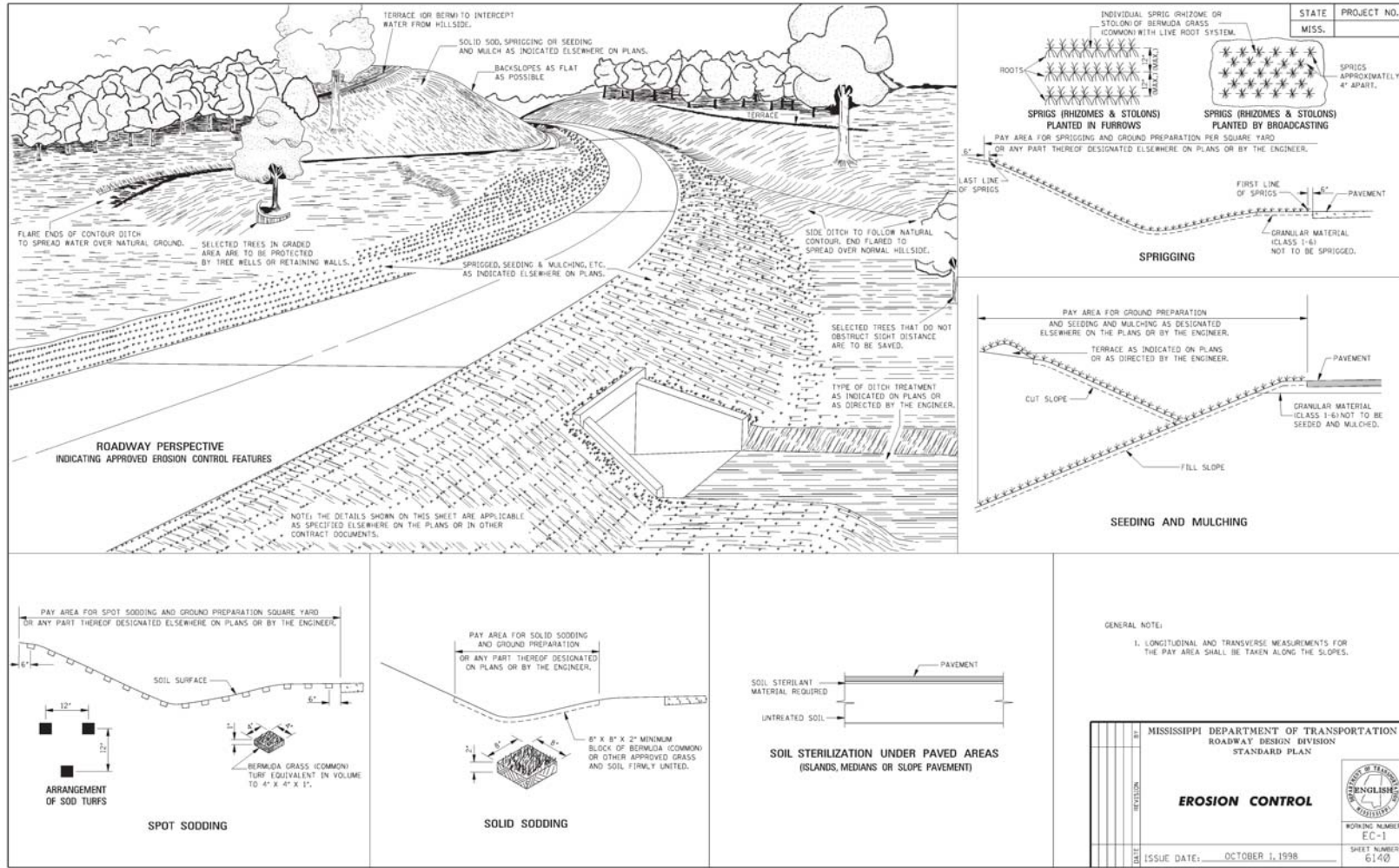
1. THE DITCH CHECK PERSPECTIVE ILLUSTRATES A TOOL BOX OF TEMPORARY PRACTICES THAT MAY BE USED. DITCH CHECKS ARE INSTALLED TO CONTROL RUNOFF VELOCITY AND THUS REDUCE EROSION AND PROVIDE FOR TRAPPING OF SEDIMENTS.
2. SELECTION OF THE APPROPRIATE DITCH CHECK SHOULD BE A FUNCTION OF CONSTRUCTION PHASE, DRAINAGE AREA, DITCH GRADIENT, SOIL TYPE ECONOMY AND SAFETY.
3. DITCH CHECKS CAN BE REMOVED FOR MAINTENANCE AND/OR REPLACEMENT BUT MUST REMAIN IN PLACE UNTIL SLOPE AREAS HAVE BEEN PERMANENTLY STABILIZED. MAINTENANCE INCLUDES REMOVAL OF SEDIMENT BEGINNING WHEN SEDIMENT ACCUMULATION REACHES 1/2 THE CAPACITY OR HEIGHT OF THE STRUCTURE AND NEVER ALLOWING FOR SEDIMENT TO ACCUMULATE MORE THAN 1/2 THE VOLUME OR HEIGHT OF THE DITCH CHECK STRUCTURE.
4. HAY BALES ARE USED TO INTERCEPT LOW VOLUME FLOWS IN LOW TO MODERATE GRADIENT DITCHES.
5. SILT FENCE DITCH CHECKS ARE USED WHERE IT HAS BEEN DETERMINED THAT HAY BALES CHECKS ARE INADEQUATE. SILT FENCE DITCH CHECKS ARE USED TO INTERCEPT LOW VOLUME FLOWS IN LOW TO MODERATE GRADIENT DITCHES.
6. SAND BAG DITCH CHECKS ARE USED FOR VELOCITY REDUCTION AND MINIMAL SEDIMENT TRAPPING IN CONCRETE PAVED DITCHES OR IN DITCHES THAT HAVE ROCKY BOTTOMS.
7. WATTLE DITCH CHECKS ARE USED TO INTERCEPT LOW VOLUME FLOWS IN LOW TO MODERATE GRADIENT DITCHES.
8. SILT DIKES CAN BE USED IN DITCHES WITH CONCENTRATED FLOWS WITHIN THE CLEAR ZONE WHERE RIPRAP CAN NOT BE USED AS CONSTRUCTION PROGRESSES.
9. ROCK DITCH CHECK WITH SUMP EXCAVATION CAN BE PLACED IN DITCHES TO ASSURE ON-SITE SEDIMENT TRAPPING REQUIREMENTS ARE MET. DITCH CHECK WITH SUMP EXCAVATION IS USED WHEN DITCHES RECEIVE DRAINAGE FROM CUT OR FILL SLOPES OR OTHER CRITICAL AREAS WHERE SOIL EROSION IS EXPECTED. DRAINAGE AREA FOR A TEMPORARY SEDIMENT TRAP SHALL NOT EXCEED 3 ACRES. THEY CAN BE USED IN SERIES TO INCREASE ON-SITE SEDIMENT TRAPPING EFFICIENCY.
10. IN GENERAL DITCH CHECKS SHOULD NOT BE PLACED IN LIVE STREAMS.
11. CONFIGURATION AND SPACING MAY BE ADJUSTED IF APPROVED BY THE ENGINEER TO ACCOMMODATE TRAVELWAY SAFETY, WATER FLOW, OR SOIL AND INSTALLATION CHALLENGES.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION	
REVISION	BY

DITCH CHECK STRUCTURES,
TYPICAL APPLICATIONS AND DETAILS

FIGURE NUMBER

Landscaping 0.93%



ADD OPTIONS

- Lime Stabilization-1.54%
- Traffic lighting-0.53%
- Road Side Barriers-0.52%
- Landscape Irrigation system-0.03%

Construction Safety

Presenter:
Chancedy Pulliam



Civil and Environmental Engineering Student
Mississippi State University



Safety & Practices

- Construction Safety
 - PPE
 - People
 - Training
 - Equipment
 - E-MOD
- Construction Practices
 - Eubank pipeline replacement
 - Phillips Bridge Design

Construction Safety

- Each year 20,000 workers are injured in road construction work zones
- Top Injuries throughout the US
 - Contact with equipment
 - Slips/Falls
 - Overexertion
 - Transportation incidents
 - Exposure to harmful substances

Construction Safety

- Fatalities in road construction typically account for 1.5%-3% of all workplace fatalities annually
- 2014 Mississippi only reported 8 fatalities occurring during road construction work and zoning.

Safety Practices

- PPE (Personal Protective Equipment)



Construction Safety

- Three key factors
 - People
 - PPE, Safety meetings, 3 points of contact, and alertness
 - Training
 - OSHA training course, First Aid and CPR Training
 - Environment
 - Animals, Heat Exhaustion, and Prevention Methods

Construction Safety

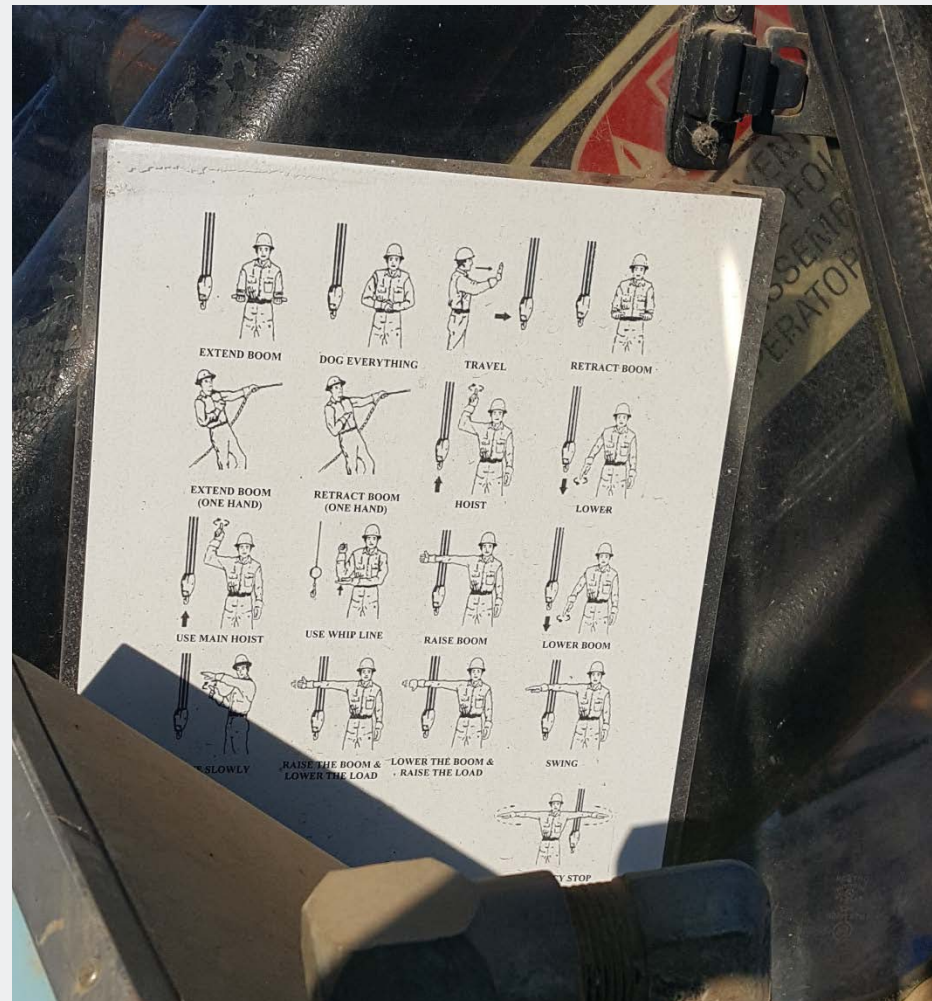


Construction Safety

- Insurance Cost
 - E-MOD (Experience Modification Ranking)
 - E-MOD below 1.0
 - E-MOD's effect on construction contracts
- Equipment Safety
 - Proper Equipment training
 - Equipment maintenance
 - Worker and equipment signals

Construction Safety

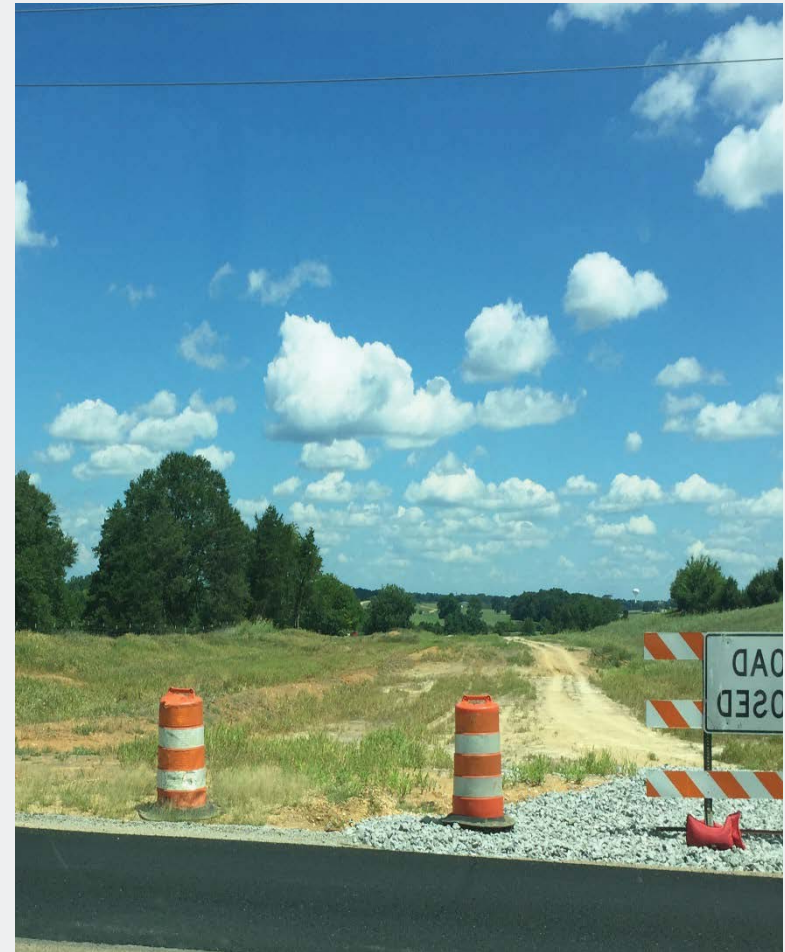
Equipment Signals



Construction Practices



North End



South End

Construction Practices

- Removal of current piping system
- Why PVC?
- Recycling Materials?



Construction Practices

- Just Remove the PIPES?
 - Sewage
 - Bypass Pumps



Construction Practices

- PVC pipe installation process
 - Excavator
 - Grade
 - Numbering
- Rocks instead of soil



Construction Practices



Construction Practices



Construction Practices

- As Future civil engineers how do we plan for the unexpected?



Site Design

Presenter:
Jonathan Buckley



Civil and Environmental Engineering Student
Civil and Environmental Engineering Dept.
Mississippi State University



Master Plan

- Four lane boulevard from Blackjack to Poorhouse road.
- Bike/pedestrian path along the entire route.
- Funding
- Survey of entire proposed project area

Design Issues

- Funding
- South Farm
- Material supplier limitations

Design

- Began approximately 5 years from the initial memorandum of understanding.
- Includes bridges, culverts, asphalt, and alignment.
- After environmental documents are approved, the channel is investigated to determine how the bridge bents will be arranged.

Environmental Document

- Three classes of environmental action
 - CE, example: Overlay or sidewalk.
 - Environmental assessment (FONSI)
 - EIS-(ROD), example: Actions that negatively impact environment that cannot be mitigated.
- The environmental study ensures no negative impacts to:
 - Native American religious sites, burial grounds, or artifacts
 - Noise
 - Endangered Species

ROW Plans

- Preliminary plans are set at 30% design completion.
- Field review is at 60% design completion

Field Review

- Right of ways are defined, appraised, and acquired.
- Right of ways can be sold back to the public with last owner having the first opportunity.
- Utility agreements are approved and utilities relocated.

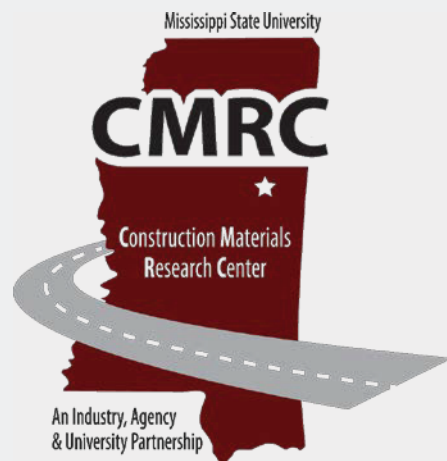
Final Design Phases

- Soil profile
 - performed at 30% design.
- Office review
 - Performed at 100% design.
- Final plans are sent to contractors for bid development.
- Bid letting and awarding.

Earthwork Planning and Procedure

Presenter:

James “Jayme” Williams



Research Assistant for CAVS
Civil Engineering Bachelor's Degree Student
Mississippi State University



Overview

- Borings/Subsurface Exploration
- Construction of Geotechnical Structures

Borings/Subsurface Conditions

- Borings are taken at points of interest
- Information from the borings are used to determine soil profiles for design
- Additional information was required for the bridge's foundation design

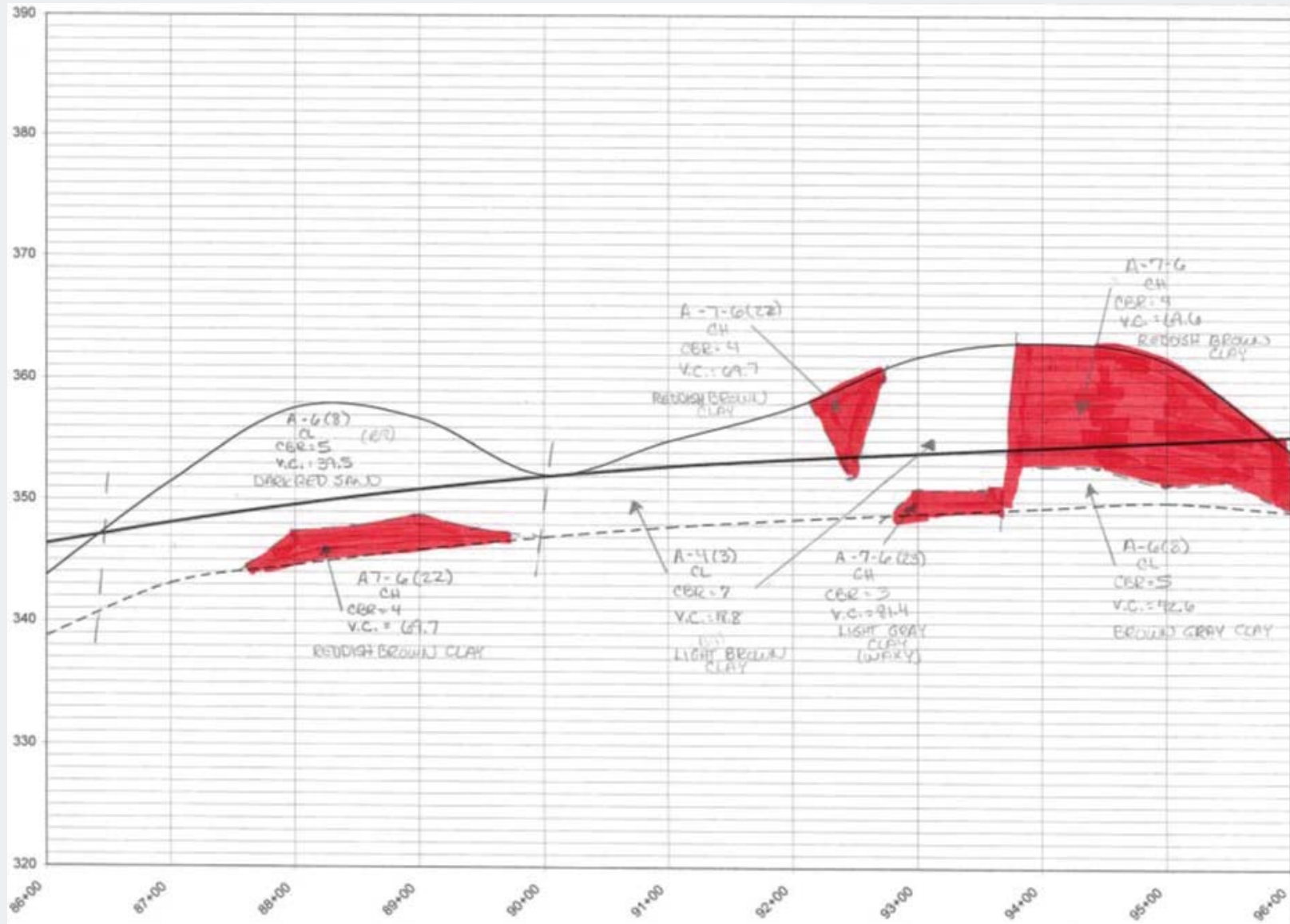
Subsurface Conditions



MSU South Entrance Boring Plan

- Original borings were taken at 100' intervals in cut sections and 200' intervals in fill
 - Indicated high volume change (HVC) soils
- After construction began additional borings were required
 - New plan used 50' intervals and indicated less HVC material

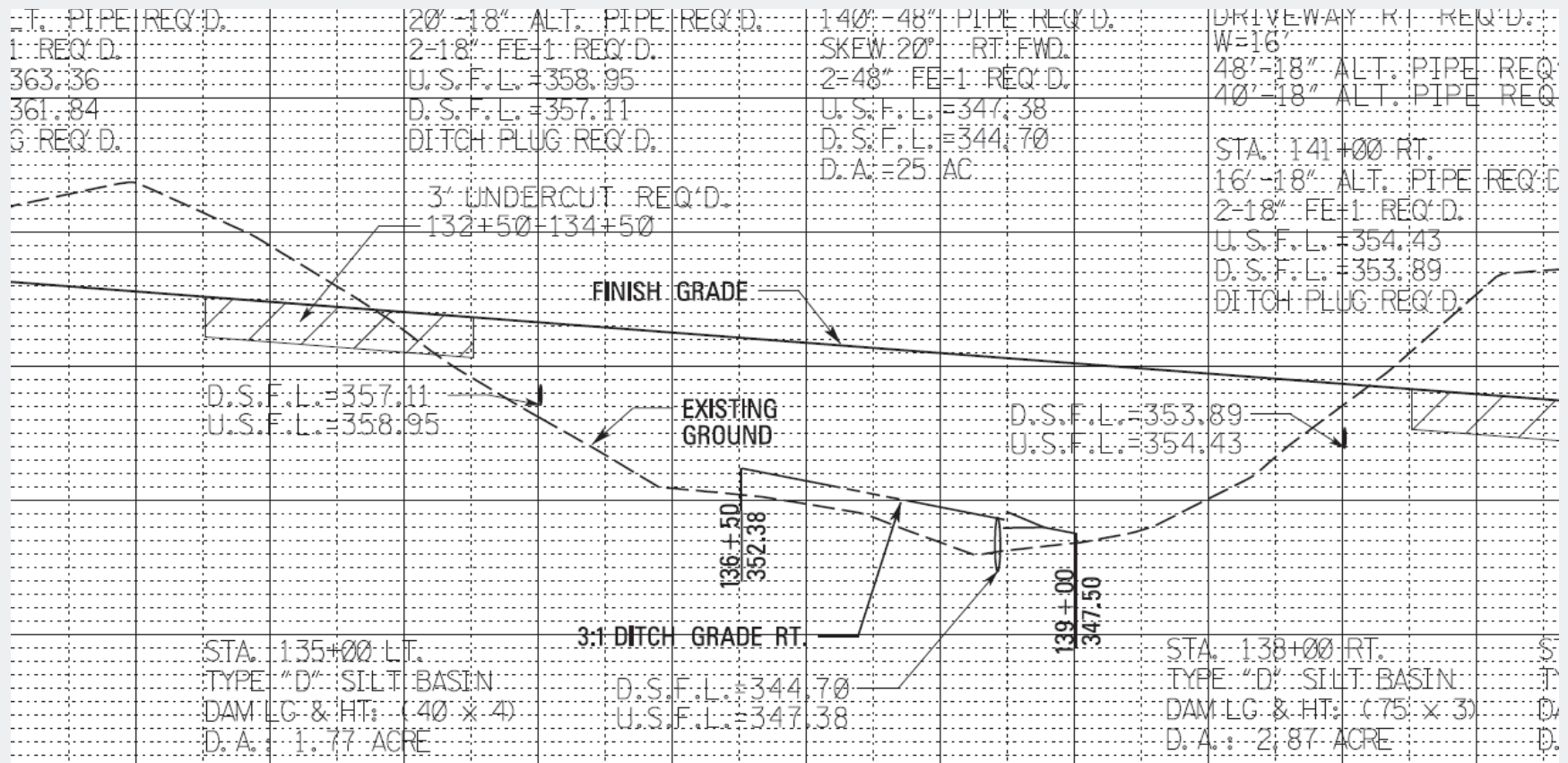
Soil Profile



Test Pile



Finished Grade



Material Supply

- Earthen material can be provided by the site itself or hauled in from a borrow pit.
 - Initial estimates required 17,000 truck loads.
- For this project the contractor was required to deal with county about the damage hauling will cause.

Construction

- Geotechnical structures used in roadways primarily included earthen structures and bridge foundations.
- Construction of the roadbed and embankments is completed using cuts and fills
- Bridge foundation construction typically relies on piles

Cut and Fill



Earthwork Quantities

Pay Item No.	Description	Quantity, yd ³
203-EX017	Borrow Excavation, AH, FME, Class B9	88384
203-EX035	Borrow Excavation, AH, FME, Class B9-6	51975
203-A003	Unclassified Excavation, FM, AH	71984
203-G003	Excess Excavation, FM, AH	141624
203-H003	Surplus Excavation	78301
206-A001	Structure Excavation	4111
206-B001	Select Material for undercuts (Contractor Furnished)	544

Removal of HVC Material, Placement, and Compaction



Erosion & Sediment Control

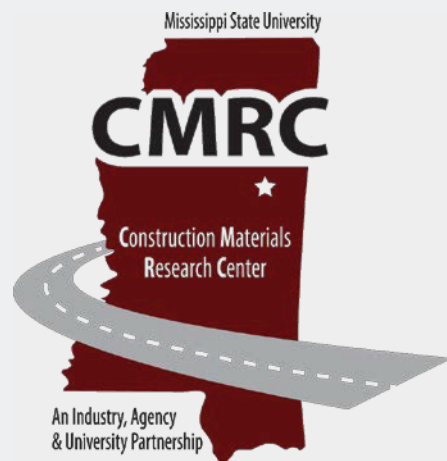
Presenter:

Robert “Drew” Moore

Research Assistant for CMRC

Civil Engineering Master’s Degree Student

Mississippi State University



Erosion & Sediment Control for South Entrance Project

- Roughly \$1 million of overall bid
 - including silt fencing
- Monitored daily by MDOT
- Maintained by EUTAW
- Subcontractor:
 - Simmons Erosion Control, Inc.

Project's Site Erosion and Sediment Plan

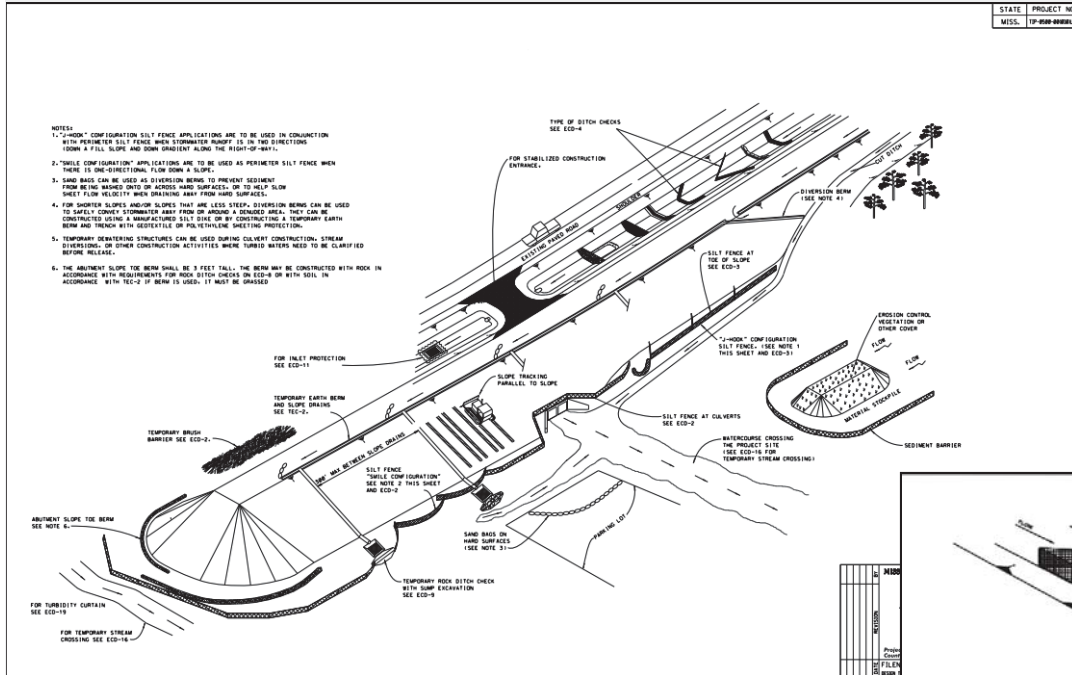


Figure 4: Erosion Control Plans (ECP)

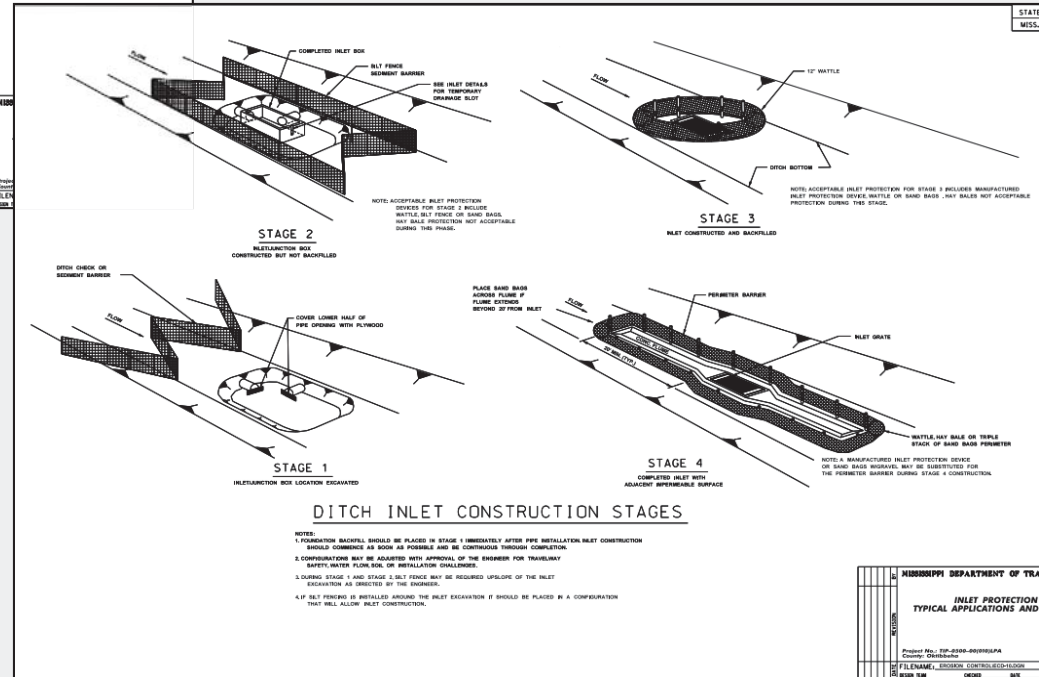


Figure 5: Sediment Control Plans

What is Erosion?

- The removal of land surface (soil and rock) by erosive forces.

What is Sediment?

- Land surfaces that are removed by the erosive forces.

Factors that Influence Erosion

- Climate
 - Precipitation, wind, and frost
- Soil
 - Structure, permeability, and soil gradation
- Topography
 - Steepness, length, and configuration
- Groundcover

Erosion and Sediment Control

Erosion Control

- First line of defense. “If there is no erosion, there can be no sediment.”
- Easy to Install
- Vegetative
- Surface Cover

Sediment Control:

- Subordinate to erosion control practices; second line of defense.
- Structural
- Perimeter Controls

Erosion Control Common Practices

- Preserving vegetation
- Hydroseeding
- Mulching
- Erosion control blankets
- Soil stabilizers
- Soil Tracking
- Other techniques.



Sediment Control Common Practices

- Silt fences
- Wattles
- Rock berms
- Sediment Basins
- Other techniques



Erosion & Sediment Control (MDOT)₍₂₎

Minor/No Deficiencies

- Minor Best Management Practice (BMP) device maintenance

Deficiencies

- Loss of Sediment from the project
- Widespread BMP failure/ maintenance

Major Deficiencies

- Loss in Sediment into Waters of the US and/or wetland

- After the second month of “Deficiencies” a warning letter is sent to contractor.
- A “Major Deficiency” or a 3rd month of “Deficiencies” in a row, the contractor is given 7 days to remediate the project site before construction is halted and reimbursement is withheld.

Impact of Weather on Erosion Control

- Project site does not shut down.
 - MDOT and Contractor inspect the sediment control parameters in use.
- Preventative actions often taken on projects.
 - Soil tracking, emptying of sediment basins, avoid causing damage to existing ground cover.
- Rainy day \neq Day Off

Erosion & Sediment Control Practices On-Site



Erosion & Sediment Control Practices

On-Site Cont.



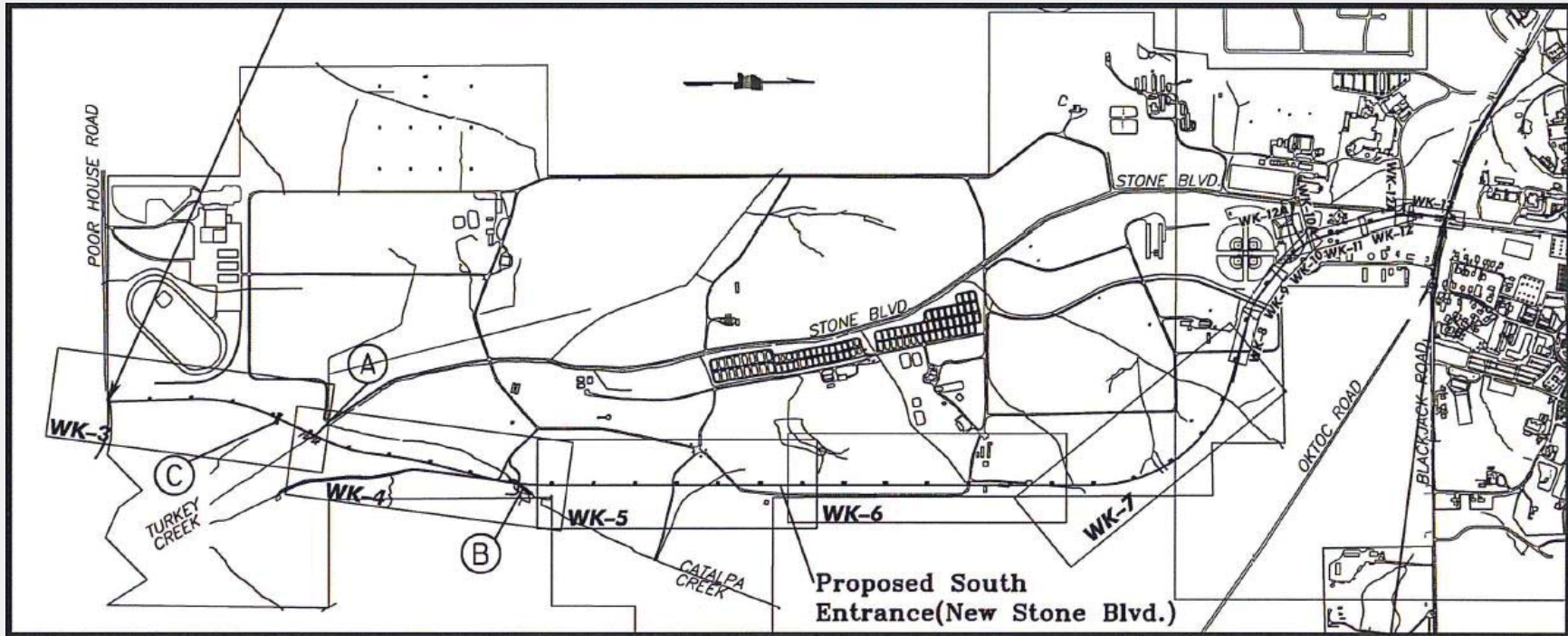
MSU South Entrance Bridge

Presenter:
James Joseph Arthur

Civil and Environmental Engineering Dept.
Mississippi State University



Site Map



Bridge Piles

- 35' and 40' long
- 4 rows
- 51 total
- Battered



Battered Piles



Battered Piles Cont.



Encasing Piles

- Typical Type AA Concrete
 - Maximum W/C
 - 0.45
 - Specified Compressive Strength
 - 4,000 psi
 - Maximum Permitted Slump
 - 3 inches
 - Nominal Air Content
 - 4.5%
 - Maximum Temperature
 - 90° F



MDOT S.P. No. 907-804-16

- Allowed for the use of
 - Fly Ash Type F
 - Structural Fibers
 - High Range Water Reducer
- Increased slump allowable to 8 inches
- Increased maximum allowable temperature to 95° F

Concrete Delivered

- Added water reducer, structural fibers, and ice
- Slump = 7 inches
- Temp = 90.5°F
- Air = 4%
- Unit Weight = 142.2 lb/ft³



Encased Piles



Capped Piles



Bridge Construction (7/28/16)



Future Bridge Construction

- Beam Placement
- Diaphragm Construction
- Bridge Deck Construction

Culvert Construction

Presenter:
Bradley Hansen E.I.



Graduate Research Assistant
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Summary

- 3 box culverts
- 2 box bridge culverts
- Only 2 culverts were observed during construction
 - Box bridge culvert
 - 14' x 8'
 - Double barrel culvert
 - Two 10' x 6' boxes next to each other
 - Both culverts had 3:1 sloped wing walls

Box Bridge Culvert

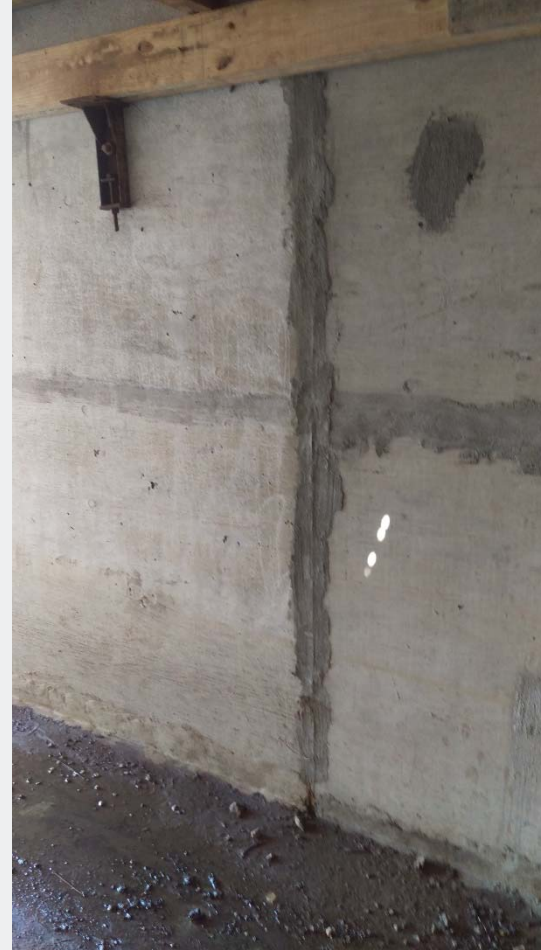


Stilts for the roof



Mortar Patching

- For all the holes or seams in concrete a combination of cement, sand, and water was used. Also called Mortar.



Formwork for the Wing Wall



1 Cubic Yard Bucket



- The 1 cubic yard bucket is filled up and then swung over to the formwork by a track hoe.
- Eutaw workers directed the bucket over the formwork and then pushed down the lever to release the concrete into the form.

Pouring of Wing Wall



Vibrating of Concrete



Finishing of wing wall



- The finishing occurred after the placement and vibration of the concrete.
- The finishing and curing must be done correctly or the concrete could become deficient.

Drainage Issues



Finished Side

- One completed side with wing walls
- After the box bridge culvert is completed:
 - Removal of Dirt Road
 - Redirection of stream to original direction through box bridge culvert



Completed Box Culvert



Double Barrel Culvert



- Construction techniques are the same as the box bridge culvert
- Only real difference in culverts is wall thickness and size
- Designed on 100 year storm
- Also large enough to allow cattle to walk through

Challenge of Double Barrel Wall

- The steel for the walls is packed together tightly
- The tightness of the steel matrix makes stiffer concrete harder to place and vibrate



Completed Double Barrel



Concrete Quality Control & Quality Assurance

**Presenter:
Bradley Hansen E.I.**



*Graduate Research Assistant
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QC VS. QA

- QC is completed by contractor
 - Burns Cooley Dennis, Inc.
- QA is completed by MDOT
- By MDOT's Standards need 3 QA tests for every 10 QC tests
 - Most states only require 1 QA for every 10 QC

Sampling (MDOT)_(4,5)

- Contractor specifies amount of yardage for each mixture for the day
- Then the frequency of sampling is based off of Table 4 Section 804 from the MDOT Red Book
- The sampling is done randomly
- The Location of sampling is also random

**TABLE 4
CONTRACTOR'S MINIMUM REQUIREMENTS FOR QUALITY CONTROL**

Portland Cement Concrete		
Control Requirement	Frequency	AASHTO/ASTM Designation
A. PLANT AND TRUCKS		
1. Mixer Blades	Monthly	
2. Scales	Daily	
a. Tared	Every 6 months	
b. Calibrate	Weekly	
c. Check Calibration		
3. Gauges & Meters - Plant & Truck		
a. Calibrate	Every 6 months	
b. Check Calibration	Weekly	
4. Admixture Dispenser		
a. Calibrate	Every 6 months	
b. Check Operation & Calibration	Daily	
B. AGGREGATES		
1. Sampling		T 2
2. Fine Aggregate		
a. Gradation / FM	250 yd ³ Concrete	T 27
b. Moisture	Check Meter Against Test Results Weekly	T 255
c. Specific Gravity / Absorption	2500 yd ³ Concrete	T 84
3. Coarse Aggregates		
a. Gradation / FM	250 yd ³ Concrete	T 27
b. Moisture	Minimum of once daily or more as needed to control production	T 255
c. Specific Gravity / Absorption	2500 yd ³ Concrete	T 85
C. PLASTIC CONCRETE		
1. Sampling		T 141
2. Air Content	First load then one per 50 yd ³	T 152 or T 196
3. Slump	First load then one per 50 yd ³	T 119
4. Compressive Strength	One set (two cylinders) for 0-100 yd ³ inclusive and one set for each additional 100 yd ³ or fraction thereof for each class concrete delivered and placed on a calendar day from a single supplier. A test shall be the average of two cylinders.	T 22, T 23, T 231
5. Yield	Each 400 yd ³	T 121
6. Temperature	With each sample	C 1064

Quality Control Sampling



QC/QA tests

Table 1

AASHTO: T 2	Sampling Aggregates
AASHTO: T 19	Bulk Density ("Unit Weight") and Voids in Aggregates
AASHTO: T 22	Compressive Strength of Cylindrical Concrete Specimens
AASHTO: T 23	Making and Curing Concrete Test Specimens in the Field
AASHTO: T 27	Sieve Analysis of Fine and Coarse Aggregates
AASHTO: T 84	Specific Gravity and Absorption of Fine Aggregate
AASHTO: T 85	Specific Gravity and Absorption of Coarse Aggregate
AASHTO: T 119	Slump of Hydraulic Cement Concrete
AASHTO: T 121	Mass per Cubic Meter (Cubic Foot), Yield, and Air Content (Gravimetric) of Concrete
AASHTO: T 126	Making and Curing Concrete Test Specimens in the Laboratory
AASHTO: T 141	Sampling Freshly Mixed Concrete
AASHTO: T 152	Air Content of Freshly Mixed Concrete by Pressure Method *
AASHTO: T 196	Air Content of Freshly Mixed Concrete by the Volumetric Method *
AASHTO: T 231	Capping Cylindrical Concrete Specimens
AASHTO: T 248	Reducing Field Samples of Aggregate to Testing Size
AASHTO: T 255	Total Evaporable Moisture Content of Aggregate by Drying
ASTM: C 1064	Temperature of Freshly Mixed Portland Cement Concrete

QC/QA Equipment



Possible additions to QC/QA

- Paste cylinder compressive strength and setting time
- Potential monitoring throughout placement and early hours after placement
- Long term durability tests

Asphalt Production and Quality Control

**Presenter:
Westin Graves**



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Overview

- Performance Grading System
- Hunt Refining
- APAC Mississippi
- Quality Control



What is Asphalt?

- Comes mostly from fractional distillation
- Comes from the bottom of the barrel of crude oil
- Two main types of Crude oil
 - Sweet crude (Less than 2% Sulfur)
 - Sour crude (Greater than 2% Sulfur)
- Asphalt binder is the most expensive single part of the mix

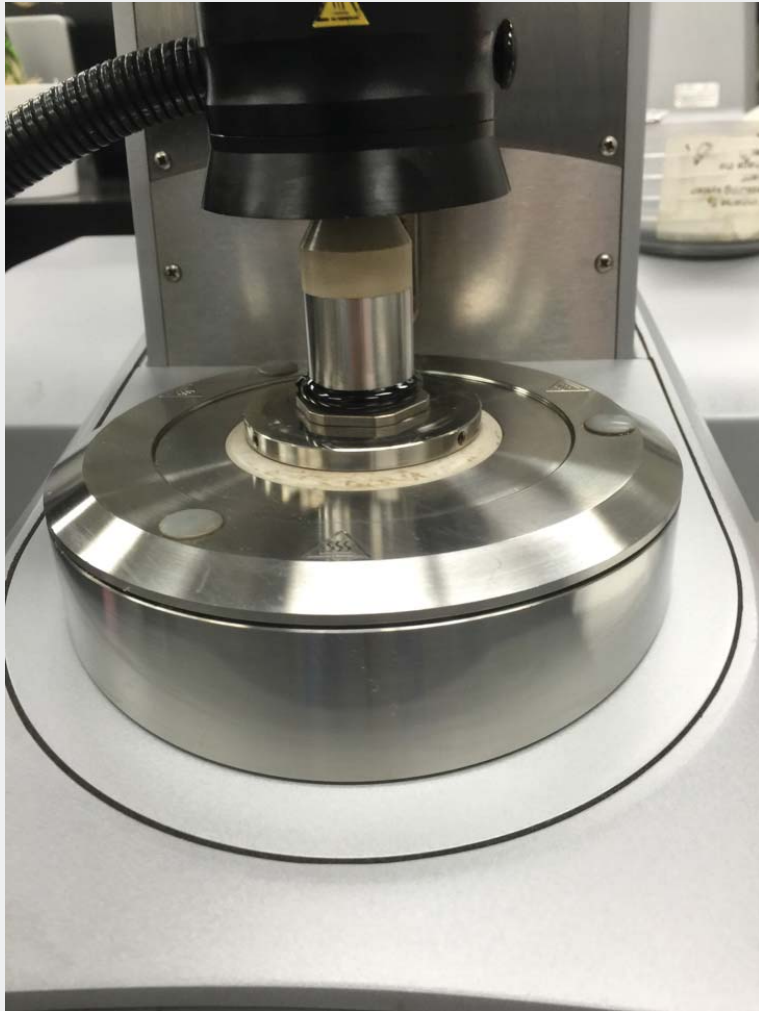
Asphalt Grading

- Beginning in the 1970s, asphalts were specified as viscosity grades
 - Not directly related to its performance throughout the anticipated life
 - Examples are: AC-20 and AC-30
- Performance Grading System (PG)
 - A new asphalt specification for selecting binder for pavement performance
 - Rutting, fatigue cracking, and thermal cracking
 - Standard notation: PG XX-YY or PG 67-22 for example

Determining PG grades

- Rotational Viscometer
 - Test that ensures that the asphalt can be pumped off the truck
- Dynamic Shear Rheometer (DSR)
 - Determines the measurement of the deformation resistance of asphalt binders
 - Used to grade the maximum temperature of asphalt binders
- Bending Beam Rheometer (BBR)
 - Test method that provides a means for measuring the flexural creep stiffness
 - Determines the pass or fail value for the minimum temperature

Asphalt Binder Testing: DSR and BBR



Where is the Asphalt Coming from?

Hunt Refining Co.

- Supplying the asphalt binder for project site
 - PG 67-22
 - Asphalt contents 5.36% (9.5mm mix) and 3.80% (19mm mix)

APAC Mississippi, Inc.

- Producing the asphalt mix to the South Entrance Project
- Two lifts
 - ST 9.5mm and ST 19mm
- Aggregates being used
 - ¾" and ½" Crushed Gravel
 - #67 and #89 Limestone
 - Coarse Sand
 - Reclaimed Asphalt Pavement (RAP)
 - Hydrated Lime

MSU South Entrance Project

- 3.4 million dollars of roughly 18.2 million overall
- Planned placing August 2016
- About 3.5 miles long
- 28,000 tons of asphalt

Pay Factors and Quality Control

- Asphalt Content
 - Troxler Asphalt Content Gauge
- Density
 - Bulk Specific Gravity (AASHTO T166)
 - Nuclear Gauge
- Gradation
 - MT-31
 - Aggregate Wash
 - Sieve Test

Quality Control Testing



Conclusion

- Objectives Learned:
 - Size and scale of transportation construction
 - Competition aspects
 - Communication and people skills

References

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Questions?

