

ARKANSAS DEPARTMENT OF TRANSPORTATION



SUBSURFACE INVESTIGATION

STATE JOB NO. 110831

FEDERAL AID PROJECT NO. FEDERAL AID PROJECT STPF-0019(61)

HWY. 42 SLIDE REPAIRS (CROSS CO.) (S)

STATE HIGHWAY 42 SECTION 3

IN CROSS COUNTY

The information contained herein was obtained by the Department for design and estimating purposes only. It is being furnished with the express understanding that said information does not constitute a part of the Proposal or Contract and represents only the best knowledge of the Department as to the location, character and depth of the materials encountered. The information is only included and made available so that bidders may have access to subsurface information obtained by the Department and is not intended to be a substitute for personal investigation, interpretation and judgment of the bidder. The bidder should be cognizant of the possibility that conditions affecting the cost and/or quantities of work to be performed may differ from those indicated herein.



April 26, 2024

TO: Mr. Trinity Smith, Engineer of Roadway Design
SUBJECT: Job No. 110831
Hwy. 42 Slide Repairs (Cross Co.) (S)
Hwy. 42, Sec. 3
Cross County

Introduction

Submitted herein are geotechnical recommendations developed for repairing the embankment slide on Highway 42 in Cross County. It is understood that the slide occurred on the south side slope of the roadway embankment and was caused by severe storms and heavy rain that took place on March 31, 2023. The repair limits range from Log Mile 7.85 to Log Mile 12.50 and the repair will be performed utilizing Federal-Aid Emergency Relief funding. The project limits are shown on relevant Project Number Assignment sheets included as Attachment A.

Conceptual Repair Recommendations

Two repair alternatives are considered suitable for repairing the embankment slide at this location. These repair alternatives include:

- Alternative 1: Geogrid Reinforced Embankment
- Alternative 2: Rock Buttress in Conjunction with Geotextile

Geogrid Reinforced Embankment Alternative The geogrid reinforced embankment concept is included as Attachment B. It is recommended the slide zone be completely excavated to form an approximately 1-horizontal to 1-vertical (1H:1V) stable slope and **be benched** in accordance with Subsection 210.09 of the Standard Specifications (2014 Edition). The excavation zone should be backfilled with compacted select fill conforming to the requirements specified in the *Material.(b)* Subsection of the job SP "Geogrid Reinforced Embankment" included in Attachment B. Based on conversations with District 1, suitable select fill borrow is available approximately 15 miles away from the job site.

The select fill should be reinforced with layers of biaxial geogrid placed in nominal 3-foot vertical intervals. The geogrid should have a minimum tensile strength at 2% strain ($T_{2\%}$) of 400 lb/ft and **should be so placed that the stronger axis is orientated in the transverse direction.**

Rock Buttress Alternative The rock buttress concept is included as Attachment C. It is recommended the slide zone be completely excavated to form an approximately 2-horizontal to 1-vertical (2H:1V) stable slope and **be benched** in accordance with Subsection 210.09 of the Standard Specifications (2014 Edition). The excavation zone should be backfilled with Rock Buttress conforming to the requirements specified in Section 630 of the Standard Specifications (2014 Edition).

The rock buttress stones should be underlain with a geotextile fabric complying with the material requirements specified in Subsection 625.02 Type 5.



Transverse Repair Limits

To facilitate designing the repair and estimating quantities, the repair zone for either repair method is estimated to start from the edge of the shoulder (approximately 13 feet from the centerline, to be field verified) and end 50 feet from the centerline (to be field verified). Materials Division is available to assist in evaluating the repair limits at the time of construction.

Estimated Quantities

Geogrid Reinforced Embankment Alternative It should be noted there will be no direct payment made for fulfilling the geogrid and select fill requirements, but compensation should be considered included in the price bid for Geogrid Reinforced Embankment. The following quantities are estimated for the Reinforced Select Fill Alternative:

- 6.7 cubic yards of Section 210 Unclassified Excavation per linear foot of repair
- 6.7 cubic yards of SP Geogrid Reinforced Embankment per linear foot of repair

Rock Buttress Alternative The following quantities are estimated for the Rock Buttress Alternative:

- 5.3 cubic yards of Section 210 Unclassified Excavation per linear foot of repair
- 5.3 cubic yards of Section 630 Rock Buttress per linear foot of repair
- 5.6 square yards of Section 625 Type 5 Geotextile Fabric per linear foot of repair

Attachments

The following attachments are included in this submittal:

- Attachment A – Project Number Assignment
- Attachment B – Geogrid Reinforced Embankment Alternative
- Attachment C – Rock Buttress Alternative


Paul Tinsley
Materials Engineer

PT:yz:mlg:pjt

cc: Division Engineer – Program Management
State Maintenance Engineer
District 1 Engineer
Division Head – Surveys
G. C. File

Attachment A



INTEROFFICE MEMORANDUM

February 5, 2024

TO: Ms. Keli Wylie, Assistant Chief Engineer – Program Delivery

FROM: Erica Adams, Division Engineer – Program Management

SUBJECT: Emergency Slide Repairs
Cross County

Severe storms and tornadoes that occurred on March 31, 2023 caused landslides on Highways 42 and 75 in Cross County. In order to prevent further damage, it has been requested that a project be programmed to repair these locations. The repairs will be performed by contract utilizing Federal-aid Emergency Relief funding.

Upon your concurrence, the following project numbers and names will be assigned for the slide repairs.

Concur: KW

NEW PROJECTS

Job 110831, Hwy. 42 Slide Repairs (Cross Co.) (S)

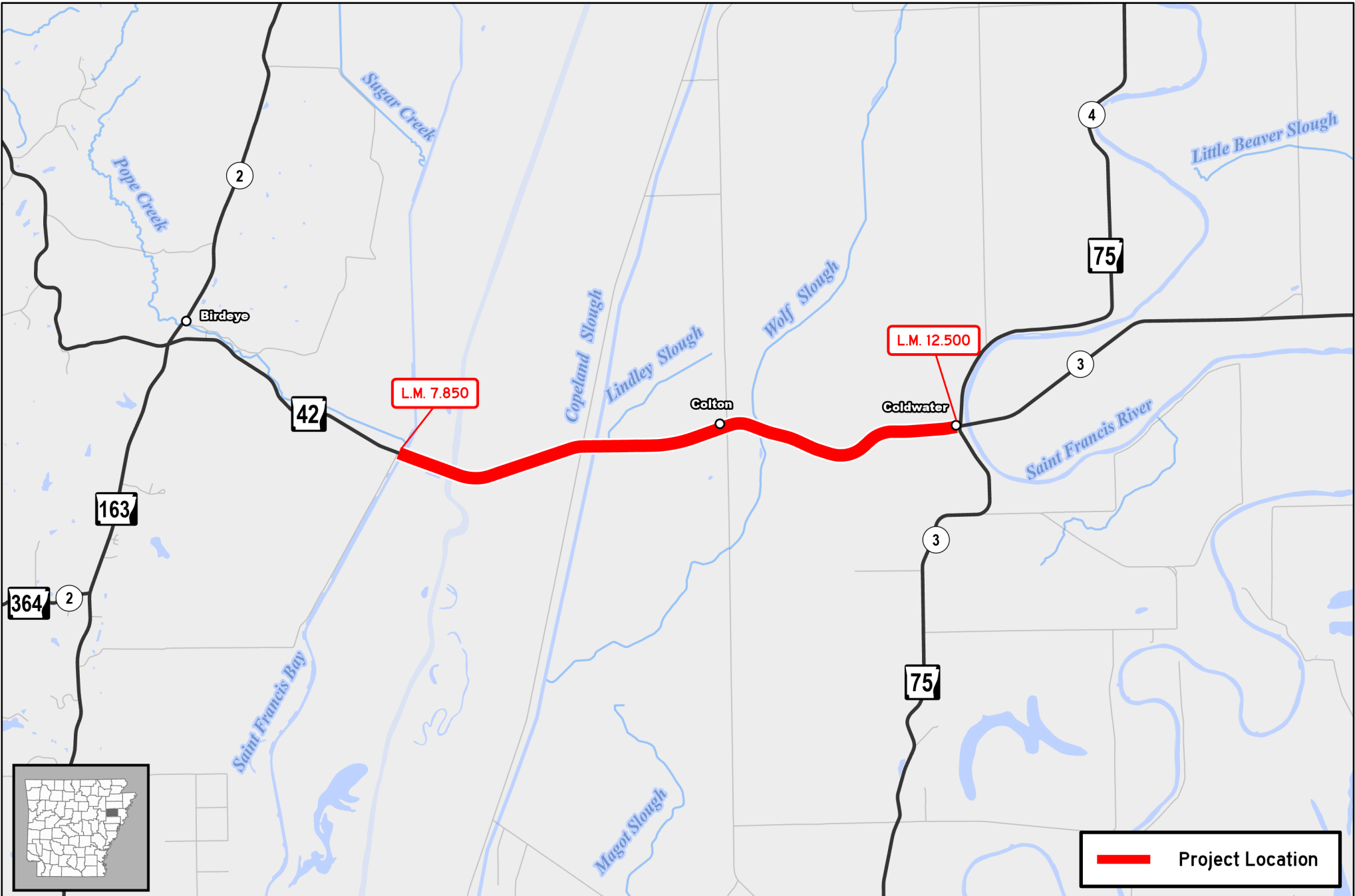
Job 110832, Hwy. 75 Slide Repairs (Cross Co.) (S)

Attachments

DISTRIBUTION



Chief Engineer – Preconstruction
Chief Engineer – Operations
Assistant Chief Engineers
Bridge
Bridge Operations
Construction
Consultant Contracts
Environmental
Fiscal Services
Local Programs
Maintenance
Materials
Planning
Program Management
Right of Way
Roadway

Surveys
System Information and Research
District 1
Job 110831 "C" File
Job 110832 "C" File



Job 110831
Hwy. 42 Slide Repairs (Cross Co.) (S)
 Hwy. 42, Sec. 3
 Cross County

 Project Location

AR DOT
 ARKANSAS DEPARTMENT
 OF TRANSPORTATION

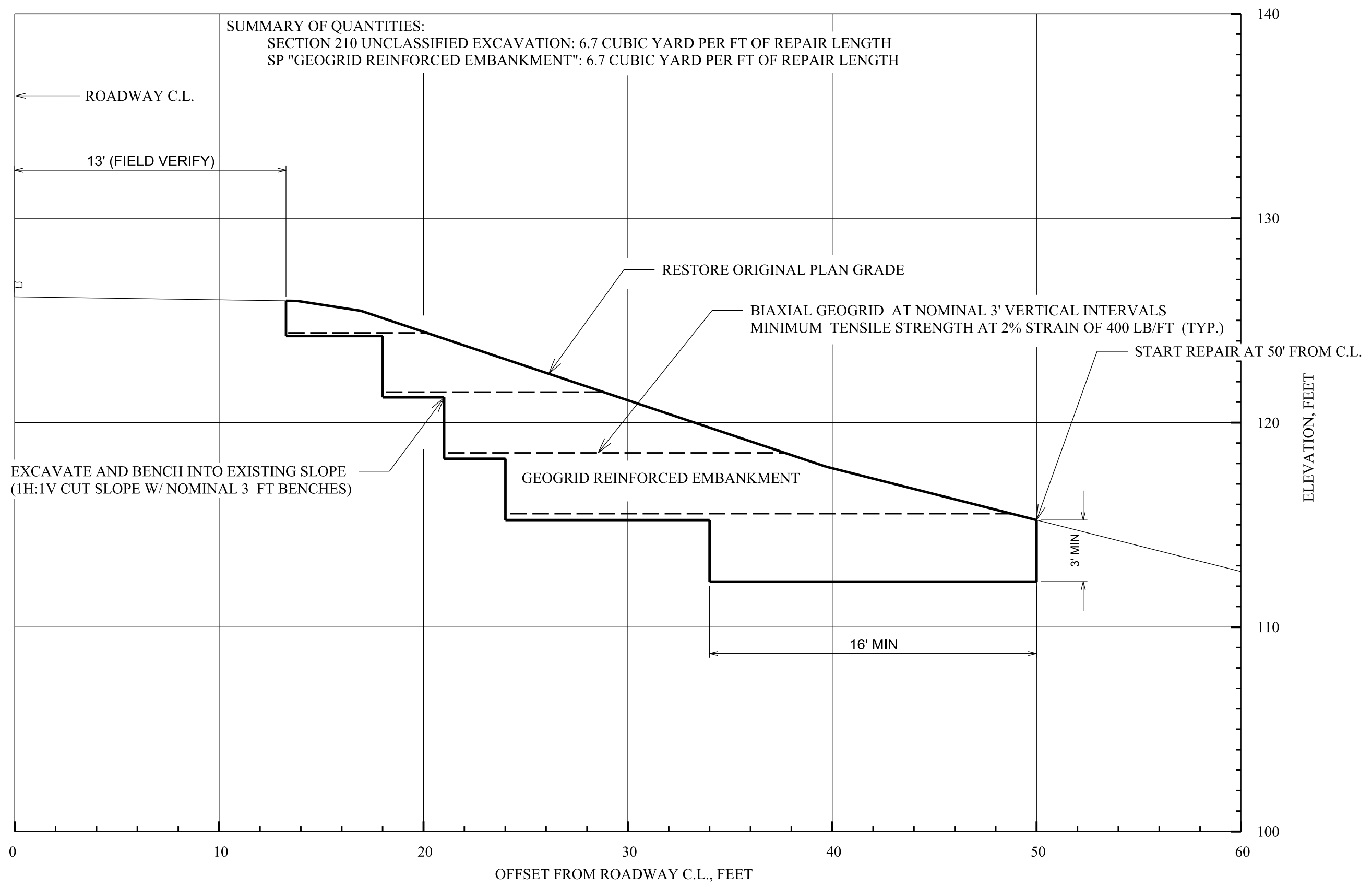


0 0.25 0.5 1
 Mile

Attachment B

NOTE: TYPICAL SECTION IS DEVELOPED USING THE CROSS SECTION AT STA. 30+00. FIELD ADJUST REPAIR SECTIONS.
 SLOPE REPAIR SHOULD BE COMPLETED IN SECTIONS. EACH SECTION SHOULD BE LIMITED TO 50 LINEAR FEET.

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED. RD. DIST. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.		1	2
						JOB NO.	110831	
GEOGRID REINFORCED EMBANKMENT								



ARKANSAS DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION

JOB NO. 110831

GEOGRID REINFORCED EMBANKMENT

Description. This item shall consist of furnishing and installing a geogrid internal reinforcement for embankment construction in accordance with the plans and specifications. The geogrid internal reinforcement shall be placed as described herein and as shown in the plans or as directed by the Engineer.

Material. (a) Geogrid Reinforcement. Geogrid shall be manufactured as a single layer regular network of integrally-connected longitudinal and transverse polymer tensile elements with a geometry that permits significant mechanical interlock with the backfill material. The geogrid structure shall remain dimensionally stable under construction stresses and have high resistance to damage during construction, to ultraviolet degradation, and to all forms of chemical and biological degradation encountered in the soil being reinforced.

The geogrid shall also conform in all respects to the following physical requirements:

Provide a geogrid with either a minimum tensile strength at 2% strain ($T_{2\%}$) or allowable tensile strength (T_{allow}) specified in the plans. If T_{allow} is specified, the following requirements shall be satisfied.

Where: $T_{allow} = T_{ult}/RF$

And $RF = FS_{ID} \times FS_{CR} \times FS_D$

Determine T_{ult} (Ultimate Tensile Strength) according to ASTM D6637 Method B (note that the same test shall be used for definition of the geogrid creep reduction factor) and ASTM D4759.

Determine FS_{ID} , FS_{CR} , and FS_D according to the following:

FS_{ID} Determine the Partial Factor of Safety for Installation Damage from the results of full-scale construction damage tests conducted according to ASTM D5818. If possible, conduct tests using project-specific backfill and construction placement techniques. Use a default value of 3.0 if no installation damage testing has been conducted. The minimum value for FS_{ID} is 1.1.

FS_{CR} Determine the Partial Factor of Safety for Creep Deformation according to ASTM D5262. Collect test data for a minimum duration of 10,000 hours for both standard and elevated temperatures. Extrapolate the test results to a 75-year design life as provided in Appendix B of FHWA Publication No. FHWA-NHI-10-025, "Design and Construction of Mechanically Stabilized Walls and Reinforced Soil Slopes – Volume II". If testing has not been conducted, default values for FS_{CR} are:

<u>Polymer Type</u>	<u>FS_{CR}</u>
Polyester	3.00

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GEOGRID REINFORCED EMBANKMENT

Polypropylene	5.00
Polyethylene	5.00

FS_D The Durability Reduction Factor is dependent on the susceptibility of the geogrid to attack from chemicals, thermal oxidation, hydrolysis, stress cracking, and microorganisms. The minimum reduction factor for the combined effects of chemical and biological degradations is:

<u>Polymer Type</u>	<u>FS_D</u>
Polyester	1.20
Polypropylene	1.25
Polyethylene	1.10

Identify, store and handle geogrids according to ASTM D4873. Limit geogrid exposure to ultraviolet radiation to less than 10 days.

The Contractor shall furnish to the Engineer a production certification stating the geogrid supplied meets the respective criteria set forth in these specifications. The certification shall state the name of the manufacturer, product name, style number, chemical composition of the filaments, ribs, or yarns, and other information to fully describe the material. The manufacturer shall have an onsite GAI-LAP accredited laboratory used for their quality control program. The production lot number must be provided with the supplied material. Quality control test results shall be provided upon request by the Engineer.

(b) Compacted Embankment. With exception of cohesionless sand and silty sand, soils with AASHTO M 145 general classification “Granular Materials” are acceptable for use in embankment construction. Sandy soils classified as “Granular Materials” shall have a minimum plasticity index of 5.

Soils with AASHTO M 145 general classification “Silt-Clay” are acceptable for use in embankment construction if they have a plasticity index of between 8 and 20 and a maximum 65% passing the #200 sieve. Soils not meeting these requirements shall not be utilized for compacted embankment regardless of the source.

Quality control and acceptance sampling and testing shall be performed in accordance with Subsection 210.02 and 210.10 of the Standard Specifications. Tests for plasticity index and gradation shall be performed in accordance with Section 306 of the Standard Specifications, except that the size of the standard lots will be 3000 cubic yards. In addition to the required test, the Engineer may require the Contractor to test any location that, by visual inspection appears different from previously approved material.

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GEOGRID REINFORCED EMBANKMENT

Construction Requirements. The geogrid reinforcement shall be placed to the lines and dimensions shown in the plans or as directed by the Engineer. During clearing and grubbing in the embankment area, all organic and deleterious materials, and soft or loose compressible soils shall be excavated and removed from the fill area. Prior to fill placement, the exposed foundation soils shall be proof rolled to detect any unstable locations, which shall subsequently be compacted or excavated and replaced with compacted fill as directed by the Engineer.

Correct orientation (roll direction) of the geogrid shall be verified by the Engineer. All geogrid shall be placed/unrolled per the manufacturer's recommendations. The Contractor shall provide the Engineer detailed installation recommendations from the manufacturer. All geogrid shall be placed to lay flat, pulled tight and pinned or weighted down to hold its position until the subsequent soil layer can be placed.

The first layer of geogrid shall be placed as specified in the plans, after clearing and grubbing is complete, and the existing embankment side slope face has been benched accordingly. Each subsequent layer of geogrid shall be placed at intervals as shown on the plans.

Geogrid shall be placed in continuous longitudinal strips in the orientation indicated on the plans. Overlaps of geogrid between rolls shall be located at no less than 30 feet from the finished slope face. A minimum of 5 feet is required for overlaps. The number of overlaps shall be limited to one per strip of geogrid. Mechanical bar connections shall be placed per manufacturer's recommendations if required. Adjacent strips of geogrid need not be overlapped.

The embankment fill between layers of geogrid reinforcement shall be prepared in accordance with Section 210, Excavation and Embankment of the Standard Specifications for Highway Construction, Edition of 2014. Reinforcement can be placed directly on the prepared embankment. No special surface treatment will be required. If a sheep's-foot roller is utilized, the imprints are acceptable surfaces for geogrid reinforcement placement.

Tracked construction equipment shall not be operated directly upon the geogrid. A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Turning of tracked vehicles shall be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid.

Rubber-tired equipment may pass over geogrid reinforcement at slow speeds of less than 10 mph. Sudden breaking and sharp turning shall be avoided.

Method of Measurement. All reinforced embankment material including the geogrid reinforcement will be measured by the Cubic Yard in accordance Section 210 Excavation and Embankment of the Standard Specifications for Highway Construction, Edition of 2014 for Compacted Embankment.

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GEOGRID REINFORCED EMBANKMENT

Basis of Payment. Placement and compaction of embankment material and furnishing and installing geogrid reinforcement shall be paid for under the item “Compacted Embankment (Special)”, which price shall be full compensation for all costs involved in furnishing all material; for proof rolling ground surfaces or subgrade; for constructing the embankments in accordance with Section 210 and this Special Provision; for quality control and acceptance sampling and testing; and for all labor, tools, equipment, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	Pay Unit
Geogrid Reinforced Embankment	Cubic Yard

Attachment C

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ROCK BUTTRESS								

