



SR 36 One-Way Pair in Jackson From Brownlee Road to Yellow Water Creek and SR 36 Over Yellow Water Creek

Project Number: STP00-0054-01(48), P.I. # 322440

BRST0-054-01(065) P.I. # 333171

Butts County

Value Engineering Study Report

Preliminary Design Stage

April 2009

Designer
GDOT

Value Engineering Consultant





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GA DOT - Engineering Services
One Georgia Center – 5th Floor
Atlanta, Georgia 30308

Re: Project No.STP00-0054-01(048) & BRST0-0054-01(065) Butts, P.I. No.:
322440 & 333171
SR 36 One-Way Pair in Jackson from Brownlee Road to Yellow Water
Creek and SR 36 Over Yellow Water Creek
Value Engineering Study Report

Date:
April 17, 2009

Dear Ms. Myers:

Contact:
Howard Greenfield

Lewis & Zimmerman Associates, Inc. is pleased to submit two hard copies and one electronic copy of the referenced value engineering study report that took place on March 31 – April 3, 2009. The objective of the VE effort was to identify opportunities to reduce costs and enhance the value of the project.

Phone:
301.984.9590 x 20

The VE workshop team developed 21 ideas that will yield significant project cost savings. Of particular interest are alternatives to reduce right-of-way impacts, especially acquisitions, reduce earthwork requirements, and reduce the size of the railroad bridge. The team is also suggesting the addition of a roundabout where new SR 36 will intersect existing SR 36 north of the City to permit greater access to the industrial area of the City from the north and enhance the functionality of the project.

Email:
hgreenfield@lza.com

Our ref:
LZ083345.0000

We thank you for your assistance during the course of the VE team's work. Please do not hesitate to call upon us if you or any of the reviewers have any questions regarding the information presented in this report.

Sincerely yours,

LZA, an ARCADIS company

A handwritten signature in black ink, appearing to read 'Howard B. Greenfield'.

Howard B. Greenfield, PE, CVS
Vice President

Attachment

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EXECUTIVE SUMMARY

INTRODUCTION

This value engineering (VE) study report documents the events and results of the VE study conducted by Lewis & Zimmerman Associates, Inc. for the Georgia Department of Transportation (GDOT). The subject of the study was the SR 36 One-Way Pair in Jackson from Brownlee Road to Yellow Water Creek, STP00-0054-01(048) PI # 322440 and SR 36 over Yellow Water Creek, BRST0-0054-01(065) PI # 333171 project in Butts County, Georgia. The project is being designed by GDOT central office staff in concert with District 3 and was at the Preliminary Stage of Development at the time of the study, March 31 – April 3, 2009.

Comprising the VE team were a highway design engineer, a bridge design engineer, a cost/constructability specialist and a Certified Value Specialist team leader. The team use the following six-phase VE Job Plan to guide its deliberations.

- Information Gathering Phase
- Function Analysis Phase
- Creative Idea Generation Phase
- Evaluation/Judgment of Creative Ideas Phase
- Alternative Development Phase
- Presentation Phase

PROJECT DESCRIPTION

This project seeks to alleviate congestion and improve safety on SR 36 through the City of Jackson. Currently SR 36/South Mulberry Street comes into Jackson from the south, turns east and combines with SR 16 for four blocks before turning back south at East College Street. It continues north across the Norfolk Southern Railroad tracks and then further north across Yellow Water Creek.

The new alignment for SR 36/South Mulberry Street starts at the south side of Jackson just south of Brownlee Road where the two-lane road will expand to four lanes. Brownlee Road and Hancock Street to the south will be realigned to intersect SR 36 at the same location with a new signalized intersection. The four-lane section will expand to a five-lane section with center 14-ft-wide left turn lane and continue north to where Oak Street now meets SR 36/South Mulberry Street where it will split to become a one-way pair. Oak Street will be the southbound part of the pair and Mulberry Street will be the northbound side of the pair.

Each of these streets will have two 11-ft-wide travel lanes and space for parallel parking on both sides of the street in the commercial district. Diagonal parking will be provided at the Courthouse between 3rd and 2nd Streets. Curb and gutter and sidewalks will also be provided on both sides of the street. New signalized intersections at West College Street, 3rd Street, 2nd Street and 1st Street will be installed and the one at West Bypass Street eliminated.

Starting at Slaughter Avenue, Mulberry Street will swing to the northwest on a new alignment and combine with Oak Street. From this point, the combined roads will form a four-lane divided highway with a 20-ft-wide raised concrete median and turn to the northeast on a new alignment. East-west Cindy Street will be extended southeast to intersect with the realigned SR 36 and then continue southeast and then east to intersect an existing subdivision road. Realigned SR 36 will continue northeast with a new bridge over the Norfolk Southern Railroad and adjacent Charlie Shepherd Road. It will then form a signalized intersection with the New Connector Road that will start off in a southeast direction and then turn east to intersect existing SR 36.

At this point, realigned SR 36 will neck down to two lanes and proceed further northeast to merge into existing SR 36 south of Yellow Water Creek. The Yellow Water Creek bridge on existing SR 36 will be replaced with construction starting on SR 36 about 700 ft north of the bridge. The existing SR 36 south of the merge with realigned SR 36 will be cul de saced.

The total estimated costs for the two projects are:

| | |
|-------------|---------------------|
| PI # 322440 | \$29,465,000 |
| PI# 333171 | <u>\$ 3,952,000</u> |
| Total | \$33,417,000 |

Construction is scheduled to begin in October 2012.

CONCERNS AND OBJECTIVES

This project eliminates a zigzag for northbound and southbound traffic through the City of Jackson which currently requires two turning movements and causes congestion where SR 36 combines with SR 16. The new alignment provides a straight route through the City but it places more traffic on Oak and Mulberry Streets. The new alignment to the north of the downtown area cuts through open ground although some high fills are required to span the road over the railroad. The new bridge over Yellow Water Creek requires a detour road. Most of the project's cost is associated with the section north of Slaughter Avenue where the road is on a new alignment and crosses the railroad and the creek.

In developing and constructing the project, GDOT must ensure it receives the optimum value for the funds it expends. To aid in this goal, it has engaged this VE session with the specific objective of identifying alternatives for change that will reduce project costs and/or enhance the functionality of the current concept.

RESULTS OF THE STUDY

The VE team generated 21 alternatives with cost-saving opportunities and one design suggestion that would improve mobility within the project area. All of the alternatives are summarized in the Summary of Potential Cost Savings table which follows and detailed in the Study Results section of the report. Each alternative was developed independently of the others so that some are mutually exclusive or interrelated. Thus the total potential cost savings will have to be evaluated once implementation decisions are made and a revised concept is developed. The narrative below highlights the alternatives with the greatest potential impact to the project's cost and/or functionality.

The Cindy Street connection to realigned SR 36 requires the acquisition of two properties, which is not accounted for in the current right-of-way costs. Also, due to the need for adequate sight distances associated with the road rising up to cross the railroad, and the short distance between the New Connector Road and Cindy Street, a substantial amount of fill is required. Alternative Number (Alt. No.) E-6 suggests that the extension of Cindy Street be eliminated and the connection of the subdivisions east and west of realigned SR 36 be accomplished by extending Valley Road across the new SR 36. In addition, the intersection of the New Connector Road and new SR 36 should be moved north. This combination of changes avoids the property acquisitions at Cindy Street and increases the sight distances from the crest of the hill over the railroad to both intersections allowing steeper grades and less fill to save over \$2.6 million.

Alt. No. ROW-2 presents a partial solution to save costs by suggesting that the subdivision road connection be accomplished by using an extended Valley Road in lieu of an extended Cindy Street to save more than \$1 million. This includes some fill cost savings because the site distance is improved and the vertical profile can be slightly lowered but not as much as in Alt. No. E-6. Additional fill costs can be saved by lowering the roadway profile starting at the north end of the railroad bridge to where the road turns due north as illustrated in Alt. No. E-4.

As designed, the railroad bridge is very expensive due to its size. To reduce its length, mechanically stabilized earth walls can be used in front of stub abutments as shown in Alt. No. B-2. To reduce its width, the 20-ft-wide median can be reduced to 8 ft as shown in Alt. No. B-1. The combination of these changes results in over \$1 million in cost savings.

Sidewalks represent a sizeable cost to the project. The need for sidewalks north of Slaughter Avenue is questionable. Alt. Nos. S-1 and S-3 remove the sidewalks from this part of the project.

From a functionality standpoint, excluding traffic from connecting directly to existing SR 36 from new SR 36 at the north end of the project results in some circuitous routing. Trucks from the north desiring to access the industrial area along existing SR 36 must proceed south on new SR 36 to the New Connector Road, turn east and travel about 1,300 ft to the existing road before turning south again. The same is true for those desiring to access the new middle school. For residents off of existing SR 36 between the New Connector Road and the new cul de sac desiring to go north on SR 36, they must first go south on existing SR 36 to the New Connector Road. Also the new routing of SR 36 puts all through truck traffic through the City of Jackson.

To avoid all this, design suggestion Alt. No. G-2 suggests constructing a roundabout where new SR 36 merges with existing SR 36. The area of the proposed roundabout is relatively flat and is easily viewed from the higher road elevation of the railroad bridge and the bridge over Yellow Water Creek. It may be possible to offset the extra cost of the roundabout by deleting the New Connector Road and traffic signal. Now SR 36 trucks can use the same route they have been using to access the industrial area and trucks on SR 16 can use this route rather than the two-way pair through the City.



SUMMARY OF POTENTIAL COST SAVINGS

| PROJECT: SR 36 / JACKSON FROM SR 16 TO CR 289/STARK ROAD | | PRESENT WORTH OF COST SAVINGS | | | | |
|--|--|-------------------------------|------------------|----------------------|------------------------|----------------------|
| Butts County, Georgia | | ORIGINAL COST | ALTERNATIVE COST | INITIAL COST SAVINGS | RECURRING COST SAVINGS | TOTAL PW LCC SAVINGS |
| ALT. NO. | DESCRIPTION | | | | | |
| RIGHT-OF-WAY | | | | | | |
| ROW-1 | Delete Cindy Street connection and provide access under SR 36 at Thurman Street | \$1,203,388 | \$1,145,696 | \$57,692 | | \$57,692 |
| ROW-2 | Delete Cindy Street connection and provide access at Valley Road | \$1,072,912 | \$0 | \$1,072,912 | | \$1,072,912 |
| ROW-4 | Add a mechanically stabilized earth wall at Station 245+00 to save property on the right side of new SR 36 | \$524,160 | \$149,084 | \$375,076 | | \$375,076 |
| | | | | | | |
| | | | | | | |
| EARTHWORK | | | | | | |
| E-3 | Use 2:1 slopes in lieu of 4:1 slopes between Stations 243+50 and 245+50 | \$21,257 | \$8,450 | \$12,807 | | \$12,807 |
| E-4 | Lower the grade on the north side of the railroad bridge to end of the project | \$693,936 | \$0 | \$693,936 | | \$693,936 |
| E-5 | Move new connector road about 150 ft north | \$128,342 | \$0 | \$128,342 | | \$128,342 |
| E-6 | Connect new SR 36 to Valley Road in lieu of Cindy Street, move new connector road intersection 150 ft north, move new SR 36 curve east and crest new SR 36 at bridge with steep slopes on both sides of bridge | \$2,662,917 | \$0 | \$2,662,917 | | \$2,662,917 |
| E-7 | Use 12-ft-wide shoulders with 2 ft grass strips north of the merge in lieu of 16-ft-wide shoulders | \$197,640 | \$0 | \$197,640 | | \$197,640 |
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STUDY RESULTS

INTRODUCTION

The results are the major feature of this value engineering study since they portray the benefits that can be realized by GDOT and the users. The results will directly affect the project's design and require coordination amongst the GDOT project team to determine the disposition of each alternative.

During the VE workshop, many ideas for potential value enhancement were conceived and evaluated by the team for technical merit, applicability to the project, implementability considering the project's status, and the ability to meet GDOT's project value objectives. Research performed on those ideas considered to have the potential to enhance the value of the project resulted in the development of individual alternatives identifying specific changes to the project as a whole, or individual elements that comprise the project. These may be in the form of VE alternatives (accompanied by cost estimates) or design suggestions (without cost estimates). For each alternative developed, the following information is provided:

- A summary of the original design,
- A description of the proposed change to the project,
- Sketches and design calculations, if appropriate,
- A capital cost comparison and life cycle discounted present worth cost comparison of the alternative and original design (where appropriate),
- An evaluation of the advantages and disadvantages of the alternative, and
- A brief narrative to compare the original design and the proposed change and provide a rationale for implementing the change into the project.

The capital cost comparisons used unit quantities contained in the project cost estimate prepared by the designers, whenever possible. If prices were not available, cost databases from GDOT and team members were consulted. Each design suggestion contains the same information as the VE alternatives, except that no cost information is included. Design suggestions are presented to bring attention to areas of the design that, in the opinion of the VE team, should be changed for reasons other than cost. Examples of these reasons may include improve circulation, reduce maintenance, improve constructability, improve safety, and reduce project risk. In addition, some ideas cannot be quantified in terms of cost with the design information provided; these are also presented as design suggestions and are intended to improve the quality of the project.

Each alternative or design suggestion developed is identified with an alternative number (Alt. No.) that can be tracked through the value engineering process, thus facilitating referencing among the Creative Idea Listing and Evaluation worksheets, the alternatives, and the Summary of VE Alternatives table. The Alt. No. contains one of the following letter prefixes indicating the project element being addressed:

| | | |
|---------------|---|-----|
| Right-of-Way | = | ROW |
| Earthwork | = | E |
| Bridges | = | B |
| Pavement | = | P |
| Sidewalks | = | S |
| Curb & Gutter | = | CG |
| Drainage | = | D |
| General | = | G |

Summaries of the alternatives and design suggestions are provided on the Summary of Potential Cost Savings table. The table is divided into project elements for the reviewer's convenience and is used to divide the results section. The complete documentation of the developed alternatives and design suggestions follows the Summary of Potential Cost Savings tables.

KEY ISSUES

This project eliminates a zigzag for northbound and southbound traffic through the City of Jackson requiring two turning movements and congestion where SR 36 combines with SR 16. The new alignment provides a straight route through the City but it places more traffic on Oak and Mulberry Streets which have three churches and commercial properties, residential properties and governmental facilities bounding the streets. The new alignment to the north of the downtown area cuts through open ground although some high fills are required to span the road over the railroad tracks. The new bridge over Yellow Water Creek requires a detour road. Most of the project's cost is associated with the section north of Slaughter Avenue where the road is on a new alignment and crosses the railroad tracks and the creek.

STUDY OBJECTIVES

In developing and constructing the project, GDOT must ensure it receives the optimum value for the funds it expends. To aid in this goal, it has engaged this VE session with the specific objective of identifying alternatives for change that will reduce project costs and/or enhance the functionality of the current concept.

RESULTS OF THE STUDY

The VE team generated 21 alternatives that could save project costs and one design suggestion that improves the functionality of the entire project. All of the alternatives are detailed this section of the report. The narrative below highlights the team's findings.

The Cindy Street connection to realigned SR 36 requires the acquisition of two properties, which is not accounted for in the current right-of-way costs. Also, because of the need for adequate sight distances associated with the road rising up to cross the railroad, and the short distance between the New Connector Road and Cindy Street, a substantial amount of fill is required. Alt. No. E-6 suggests that the extension of Cindy Street be eliminated and the subdivision connections east and west of

realigned SR 36 be accomplished by extending Valley Road across the new SR 36. In addition, the intersection of the New Connector Road and new SR 36 should be moved north. This combination of changes avoids the property acquisitions at Cindy Street and increases the sight distances from the crest of the hill over the railroad to both intersections allowing steeper grades and less fill to save over \$2.6 million.

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As designed, the railroad bridge is very expensive because of its size. To reduce its length, mechanically stabilized earth walls can be used in front of stub abutments as shown in Alt. No. B-2. To reduce its width, the 20-ft-wide median can be reduced to 8 ft as shown in Alt. No. B-1. The combination of these changes results in over \$1 million in cost savings.

Sidewalks represent a sizeable cost to the project. The need for sidewalks north of Slaughter Avenue is questionable. Alt. Nos. S-1 and S-3 remove the sidewalks from this part of the project.

From a functionality standpoint, excluding traffic from connecting directly to existing SR 36 from new SR 36 at the north end of the project will result in some circuitous routing. Trucks from the north desiring to access the industrial area along existing SR 36 will have to proceed south on new SR 36 to the New Connector Road, turn east and travel about 1,300 ft to the existing road before turning south again. The same is true for those wanting to access the new middle school. For residents off of existing SR 36 between the New Connector Road and the new cul de sac wanting to go north on SR 36, they will first have to go south on existing SR 36 to the New Connector Road. In addition, the new routing of SR 36 will put all through truck traffic through the City of Jackson.

To avoid all this, design suggestion Alt. No. G-2 suggests constructing a roundabout where new SR 36 merges with existing SR 36. The area of the proposed roundabout is relatively flat and is easily viewed from the higher road elevation of the railroad bridge and the bridge over Yellow Water Creek. It may be possible to offset the extra cost of the roundabout by deleting the New Connector Road and traffic signal. Now SR 36 trucks can use the same route they have been using to access the industrial area and trucks on SR 16 can use this route rather than the two-way pair through the City.

EVALUATION OF ALTERNATIVES AND DESIGN SUGGESTIONS

When reviewing the study results, each part of an alternative or design suggestion should be considered on its own merit. There may be a tendency to disregard an alternative because of a concern about one part of it. Each area within an alternative or design suggestion that is acceptable should be considered for use in the final design, even if the entire alternative or design suggestion is not implemented. Variations of these alternatives and design suggestions by GDOT or the design team are encouraged.

All alternatives and design suggestions were developed independently of each other to provide a broad range of options to consider for implementation. Therefore, some are mutually exclusive, so acceptance of one may preclude the acceptance of another. In addition, some of the alternatives may be interrelated, so acceptance of one or more may not yield the total of the cost savings shown for each alternative. Design suggestions could also be interrelated, thus precluding a part of one or more suggestions from being implemented if another design suggestion is also implemented.

All alternatives should be carefully reviewed in order to select the combination of ideas with the greatest beneficial impact on the project. Once this has been accomplished, the total cost savings resulting from the VE study can be calculated based on implementing a revised, all-inclusive design solution.



SUMMARY OF POTENTIAL COST SAVINGS

| PROJECT: SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD <i>Butts County, Georgia</i> | | | | | | |
|--|--|---------------|------------------|-------------------------------|------------------------|----------------------|
| ALT. NO. | DESCRIPTION | ORIGINAL COST | ALTERNATIVE COST | PRESENT WORTH OF COST SAVINGS | | |
| | | | | INITIAL COST SAVINGS | RECURRING COST SAVINGS | TOTAL PW LCC SAVINGS |
| RIGHT-OF-WAY | | | | | | |
| ROW-1 | Delete Cindy Street connection and provide access under SR 36 at Thurman Street | \$1,203,388 | \$1,145,696 | \$57,692 | | \$57,692 |
| ROW-2 | Delete Cindy Street connection and provide access at Valley Road | \$1,072,912 | \$0 | \$1,072,912 | | \$1,072,912 |
| ROW-4 | Add a mechanically stabilized earth wall at Station 245+00 to save property on the right side of new SR 36 | \$524,160 | \$149,084 | \$375,076 | | \$375,076 |
| EARTHWORK | | | | | | |
| E-3 | Use 2:1 slopes in lieu of 4:1 slopes between Stations 243+50 and 245+50 | \$21,257 | \$8,450 | \$12,807 | | \$12,807 |
| E-4 | Lower the grade on the north side of the railroad bridge to end of the project | \$693,936 | \$0 | \$693,936 | | \$693,936 |
| E-5 | Move new connector road about 150 ft north | \$128,342 | \$0 | \$128,342 | | \$128,342 |
| E-6 | Connect new SR 36 to Valley Road in lieu of Cindy Street, move new connector road intersection 150 ft north, move new SR 36 curve east and crest new SR 36 at bridge with steep slopes on both sides of bridge | \$2,662,917 | \$0 | \$2,662,917 | | \$2,662,917 |
| E-7 | Use 12-ft-wide shoulders with 2 ft grass strips north of the merge in lieu of 16-ft-wide shoulders | \$197,640 | \$0 | \$197,640 | | \$197,640 |
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VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

ROW-1

DESCRIPTION: **REMOVE CINDY STREET CONNECTION AND PROVIDE
 ACCESS FROM SUBDIVISIONS UNDER SR 36 AT
 THURMAN STREET**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN:

The original design provides side street access points to SR 36 with the Cindy Street Extension located at Sta. 405+56. This design will displace two home owners.

ALTERNATIVE: (sketch attached)

Eliminate the Cindy Street extensions and provide access by installing a SR 36 underpass. The underpass will use Thurman Street for passage of motorists and will eliminate displacement of existing homeowners. Access to SR 36 will be provided by the access road located on the east side of SR 36 as depicted in the concept layout.

ADVANTAGES:

- Eliminates displacements of homeowners
- Reduces right-of-way acquisitions for street extension

DISADVANTAGES:

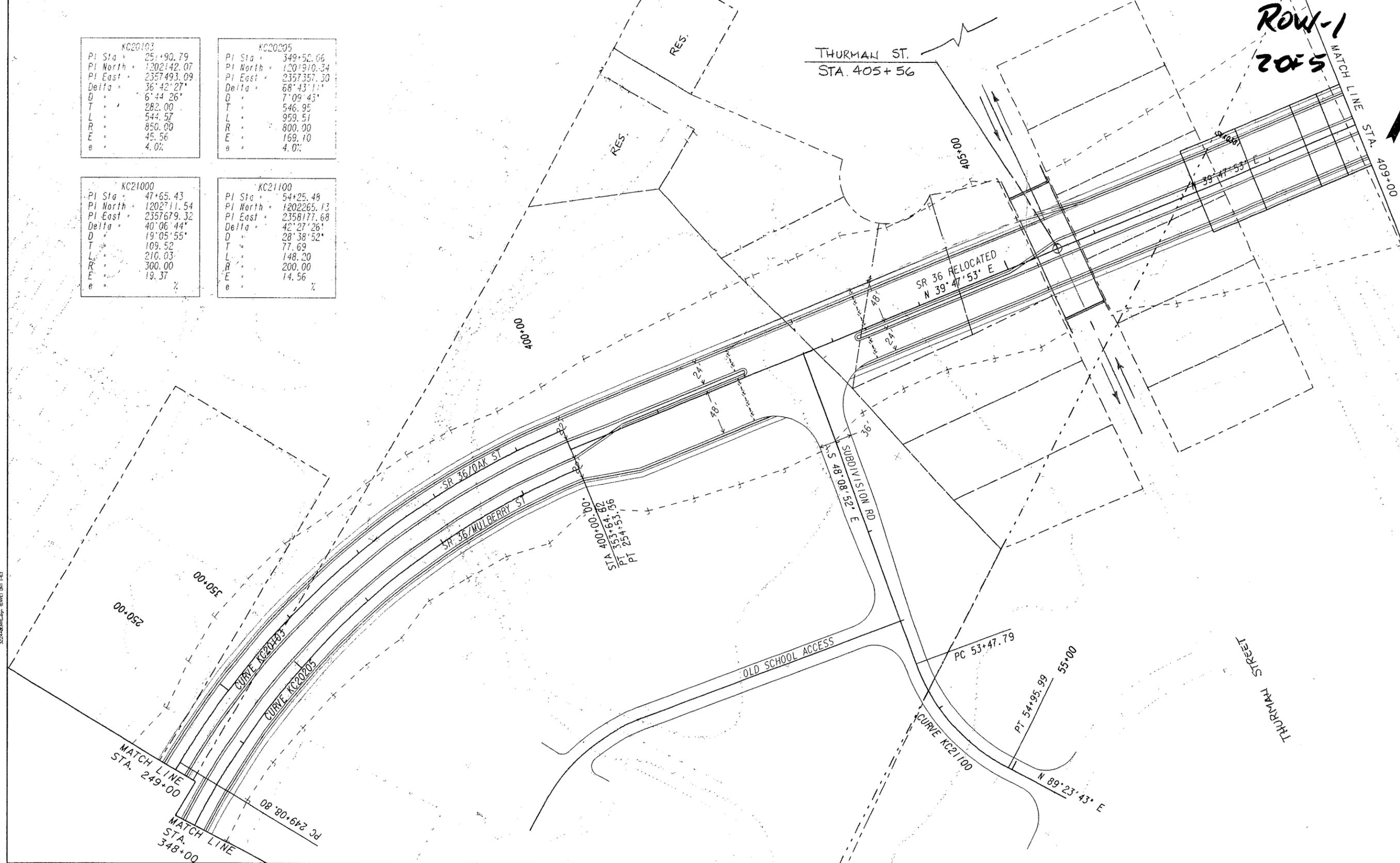
- None apparent

DISCUSSION:

This alternative will eliminate the displacement of two homeowners. It will also provide continuous traffic flow under SR 36 and access to SR 36 on the east side of the new location.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 1,203,388 | — | \$ 1,203,388 |
| ALTERNATIVE | \$ 1,145,696 | — | \$ 1,145,696 |
| SAVINGS (Original minus Alternative) | \$ 57,692 | — | \$ 57,692 |

| | |
|---|--|
| <p>KC20103 PI Sta 251+90.79 PI North 1202142.07 PI East 2357493.09 Delta 36°42'27" D 6'44'26" T 282.00 L 544.57 R 850.00 E 45.56 e 4.0%</p> | <p>KC20205 PI Sta 349+50.06 PI North 1201910.34 PI East 2357357.30 Delta 68°43'11" D 7'09'45" T 546.95 L 959.51 R 800.00 E 169.10 e 4.0%</p> |
| <p>KC21000 PI Sta 47+65.43 PI North 1202711.54 PI East 2357679.32 Delta 40°06'44" D 19'05'55" T 109.52 L 210.03 R 300.00 E 19.37 e %</p> | <p>KC21100 PI Sta 54+25.48 PI North 1202265.13 PI East 2358177.68 Delta 42°27'26" D 28'38'52" T 77.69 L 148.20 R 200.00 E 14.56 e %</p> |

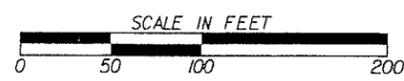


Row-1
20's

| | |
|---|-----|
| PROPERTY AND EXISTING R/W LINE | --- |
| REQUIRED R/W LINE | --- |
| CONSTRUCTION LIMITS | --- |
| EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES | ▨ |
| EASEMENT FOR CONSTR OF SLOPES | ▩ |
| EASEMENT FOR CONSTR OF DRIVES | ▧ |

BEGIN LIMIT OF ACCESS.....BLA
 END LIMIT OF ACCESS.....ELA
 LIMIT OF ACCESS.....LOA
 REQ'D R/W & LIMIT OF ACCESS

GEORGIA
DEPARTMENT
OF
TRANSPORTATION



| REVISION DATES | |
|----------------|--|
| | |
| | |
| | |
| | |

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: ROAD DESIGN
MAINLINE PLAN
SR 36

ASPH: 64.42 #/YD²
GAB

CALCULATIONS



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia
REMOVE CINDY ST. COLLECTION, PROVIDE ACCESS UNDER S.R. 36 @ THURMAN STREET

ALTERNATIVE NO.:

ROW-1

SHEET NO.: 4 of 5

PROPOSED CINDY ST REMOVAL RIGHT-OF-WAY REDUCTION \$20,000 ACRES OR 0.46 & SF
400 LF x 60' (PRESERVED) = 24,000 SF x 0.46 &
= \$11,040.00

2-DISPLACEMENTS @ \$150,000 EA = \$300,000.00 MARK-UP x 3.47 = \$1,041,000.00
(MARK-UP)

TOTAL RIGHT-OF-WAY SAVINGS = \$1,041,000 + \$11,040.00
= \$1,052,040.00

PROPOSED CINDY ST ROADWAY REMOVAL

$\frac{110 \text{ lb. in}}{\text{YD}^2} = \text{ASPH.}$ | $\frac{135 \text{ lbs}}{\text{FT}^3} = \text{GAB}$

400 LF x 24' = 9,600 SF/9 = 1067.00 SY E-TOP

E-TOP 165 lbs/YD² (1067) = 176,000 lbs/2000 = 88.00 TONS (#60) = \$5,808.00

BINDER 220 lbs/YD² (1067) = 234,000 lbs/2000 = 117.00 TONS (#85) = \$9,945.00

BASE 330 lbs/YD² (1067) = 352,110 lbs/2000 = 176.00 TONS (#85) = \$14,960.00
\$30,713.00

EARTHWORK (SIDE STREETS)

35 YD²

400' x 60' / 9 = 2,667.00 SY (35 YD²)
= \$73,333.00

TOTAL COST FOR CONSTRUCTION

93,333.00 + 30,713.00 = \$124,046.00

PROPOSED CELL COSTS

USE H-FILES H12 x 53 / 5' a.c. @ \$57.82 LF

150 lbs/cy - REBAR

L = 150 LF

H = 17 FT

SPALL = 46'

60 EA x 53' = 3,180 LF x \$57.82 LF
= \$183,868.00 H-FILES

REBAR: USE 150 lbs/cy

1057.00 CY x 150 lbs/cy = 158,550 LBS x 1.0316
= \$163,307.00

CL. AA CONC. \$560.41

V₂ = 150 LF x 2.5 FT x 46 FT / 27
= 17,250.00 / 27 = 639 CY

V_{w2} = 161.00 CY

V_{w1} = 150 LF x 2 FT x 14.50 FT / 27
= 161.00 CY

TOTAL CONCRETE = 639 + 161 + 161

= 961 CY (.10) = 96.1 + 961.00

= 1057.00 (560 \$/CY)

= \$591,920.00

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

ROW-2

DESCRIPTION: **DELETE CINDY STREET/SUBDIVISION ROAD AND
 PROVIDE ACCESS WITH THE EXTENSION OF VALLEY
 ROAD AND RELOCATED SUBDIVISION ROAD**

SHEET NO.: 1 of 4

ORIGINAL DESIGN: (sketch attached)

The original design provides access to SR 36 at Cindy Street and relocated Subdivision Road.

ALTERNATIVE: (sketch attached)

Provide access to SR 36 at Valley Road and relocated Subdivision Road to avoid right-of-way displacements.

ADVANTAGES:

- Reduces right-of-way cost
- Avoids two residential displacements
- Slightly less construction cost

DISADVANTAGES:

- None apparent

DISCUSSION:

The current design provides access to SR 36 by extending Cindy Street and displaces two residences. By moving the access to Valley Road, these two homes would be saved. The realignment of the Valley Subdivision Road and Old School Access Road would save approximately 250 ft (in length) of roadway over the current design realignment.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 1,072,912 | — | \$ 1,072,912 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS (Original minus Alternative) | \$ 1,072,912 | — | \$ 1,072,912 |

CALCULATIONS



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

ROW-2

SHEET NO.: 3 of 4

see ROW-1 for RW deduction of
SAVING two displacements AT
Cindy Street.

Total RW SAVINGS including (mkup)

$$\text{Total RW } \$1,041,000 + \$11,040 = \$1,052,040$$

Roadway Area (Pavement saved): Alt design
was 250' Length Less Roadway.

$$\frac{250' \times 11' \times 2}{9 \text{ sf/sy}} = 611 \text{ sy.}$$

use \$28/sy for Pavement section at
3 1/2" of Asphalt & 6" G.A.B.

VALUE ENGINEERING ALTERNATIVE



| | | | |
|--------------|---|------------------|---------------|
| PROJECT: | SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD <i>Butts County, Georgia</i> | ALTERNATIVE NO.: | ROW-4 |
| DESCRIPTION: | ADD A MECHANICALLY STABILIZED EARTH WALL TO THE SOUTH OF SR 36 TO SAVE ACQUISITION OF A PROPOERTY TO THE SOUTH OF FREEMAN ROAD | SHEET NO.: | 1 of 4 |

ORIGINAL DESIGN: (sketch attached)

The new SR 36 will connect to the existing SR 36 at the Freeman Road intersection. To the south of this location on the right side of the road is a house. The fill for the new road will extend significantly into the property where the house is located necessitating the acquisition of the house (not yet considered in the right-of-way acquisition plan).

ALTERNATIVE: (sketch attached)

Construct a mechanically stabilized earth wall adjacent to the roadway to reduce the encroachment on the residential property and avoid the need to acquire the property.

ADVANTAGES:

- Saves costs
- Avoids a displacement

DISADVANTAGES:

- Requires building and maintaining a retaining wall

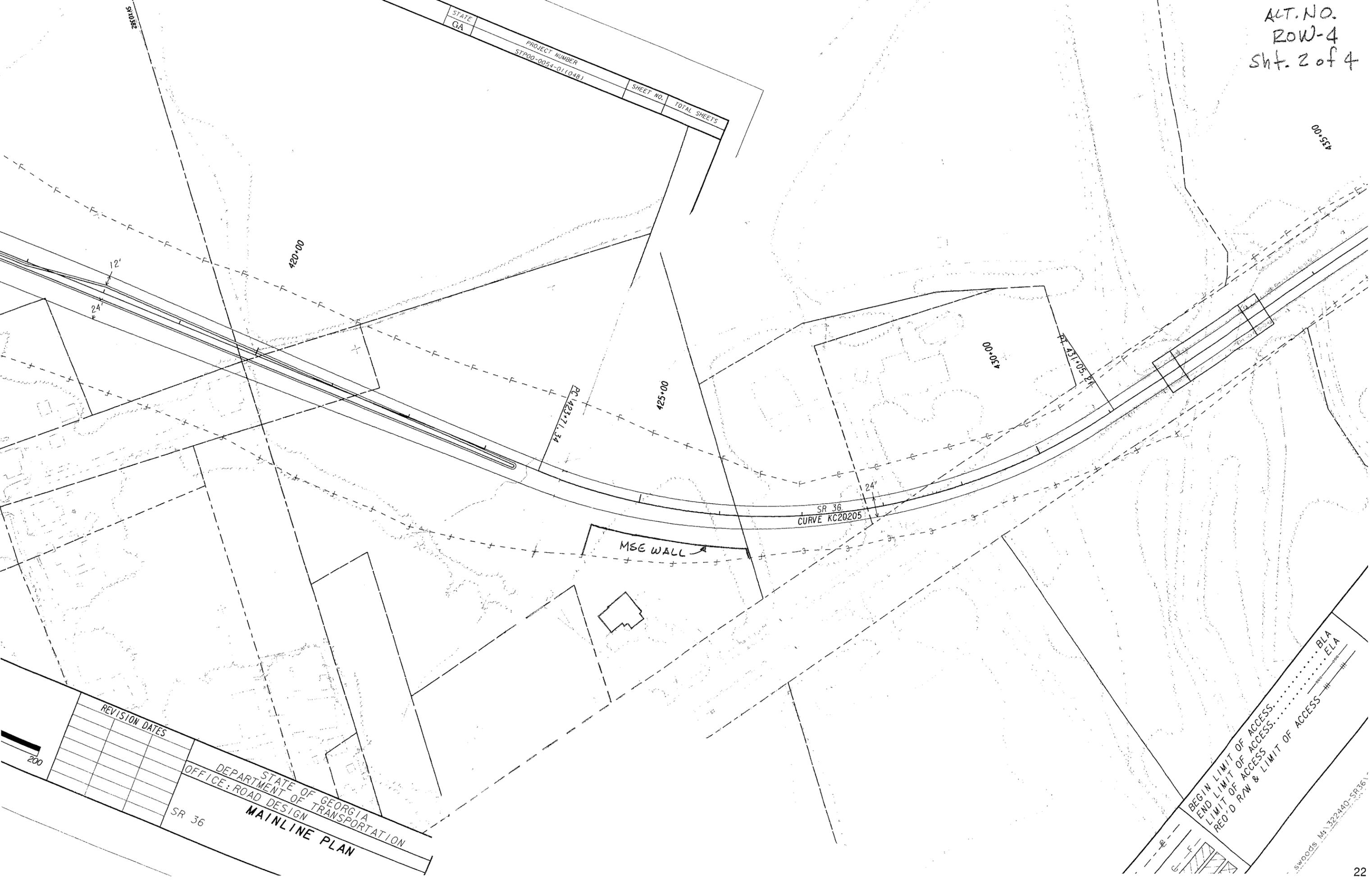
DISCUSSION:

Because of the impact of the embankment fill on this property, it may be necessary to acquire the entire piece of land. The retaining will lessen the impact and avoid the acquisition.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 524,160 | — | \$ 524,160 |
| ALTERNATIVE | \$ 149,084 | — | \$ 149,084 |
| SAVINGS | \$ 375,076 | — | \$ 375,076 |

ACT. NO.
ROW-4
Sht. 2 of 4

| | | | |
|-------------|--------------------------------------|-----------|--------------|
| STATE GA | PROJECT NUMBER STP00-0054-01(048) | SHEET NO. | TOTAL SHEETS |
|-------------|--------------------------------------|-----------|--------------|



STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: ROAD DESIGN
SR 36
MAINLINE PLAN

| REVISION DATES | |
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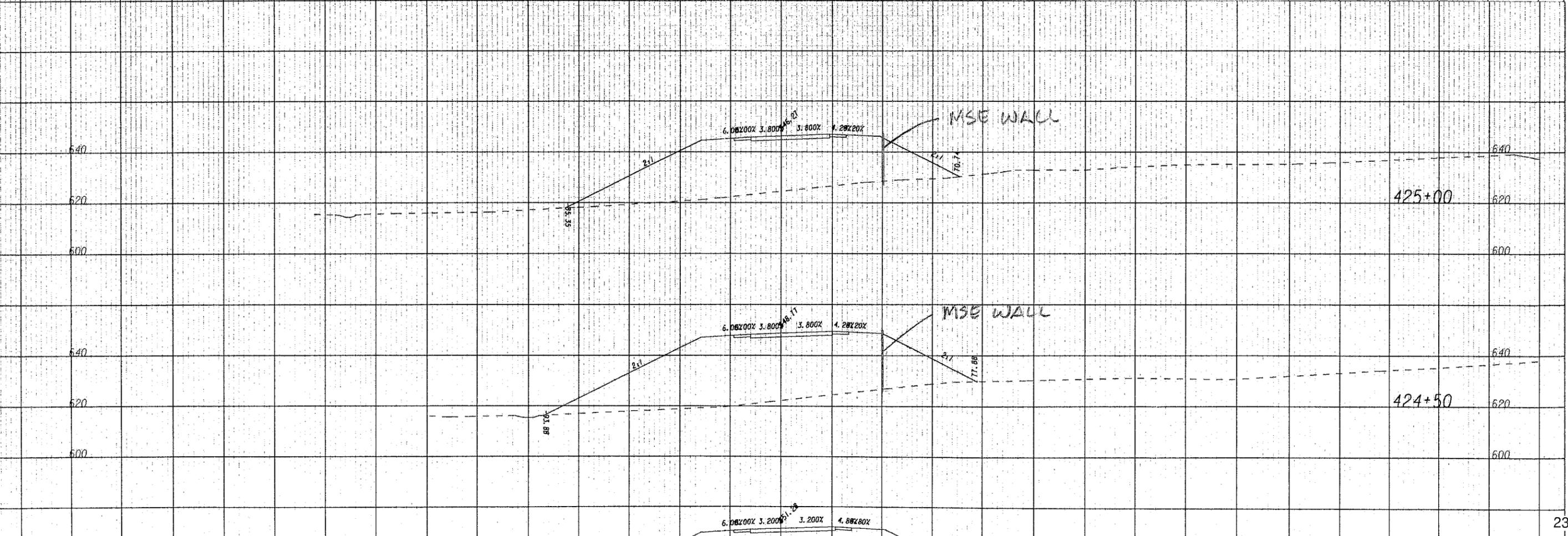
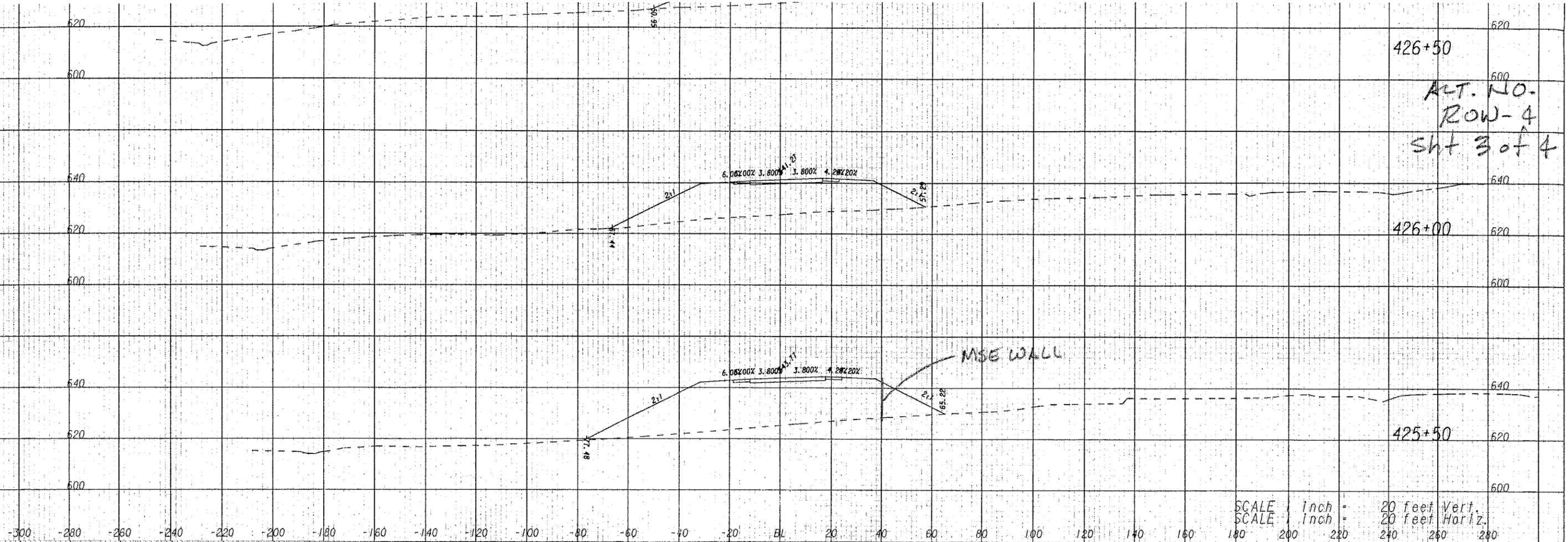
200

BEGIN LIMIT OF ACCESS
END LIMIT OF ACCESS
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS

BLA
ELA

Swoods M-322440-SR36

426+50
ACT. NO.
ROW-4
Sht 3 of 4



VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

E-3

DESCRIPTION: **USE 2:1 SLOPES IN LIEU OF 4:1 SLOPES FROM STA. 243+50 TO STA. 245+50 ON THE RIGHT SIDE OF OAK STREET; USE 2:1 SLOPES IN LIEU OF 4:1 SLOPES FROM STA. 402+50 TO STA. 405+50 ON BOTH SIDES OF NEW SR 36**

SHEET NO.: 1 of 5

ORIGINAL DESIGN: (sketch attached)

The original design proposes 4:1 slopes in several locations.

ALTERNATIVE: (sketch attached)

Use 2: 1 slopes except where a flatter slope may be preferred by adjacent property owners.

ADVANTAGES:

- Reduces construction time
- Reduces earthwork quantities
- Required right-of-way could be reduced north of the merge if desired

DISADVANTAGES:

- 2:1 slopes over 6 ft in height require guardrail
- Harder to maintain slopes

DISCUSSION:

Earthwork is one of the most costly items on this project. Increasing the slopes from 4:1 to 2:1 will reduce the embankment required for the fill slopes by one-half. This will also reduce the amount of construction time. From Sta. 243+50 to Sta. 245+50, Oak Street and Mulberry Street are merging, so it is unlikely that any right-of-way can be saved. From Sta. 402+50 to Sta. 405+50, the fills are not high, so right-of-way would probably not be reduced. Guardrail will be required from Sta. 243+50 to Sta. 245+50 since the fill height exceeds 6 ft.

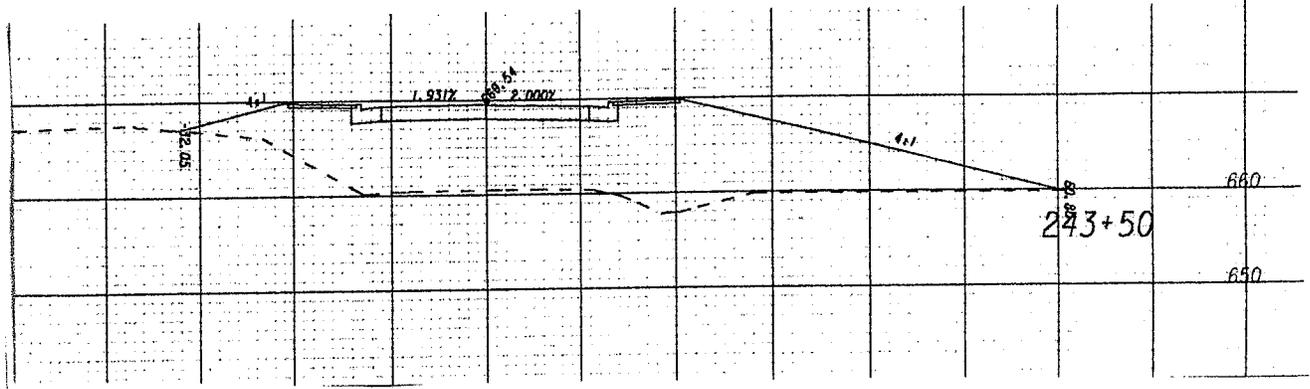
| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 21,257 | — | \$ 21,257 |
| ALTERNATIVE | \$ 8,450 | — | \$ 8,450 |
| SAVINGS | \$ 12,807 | — | \$ 12,807 |

PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

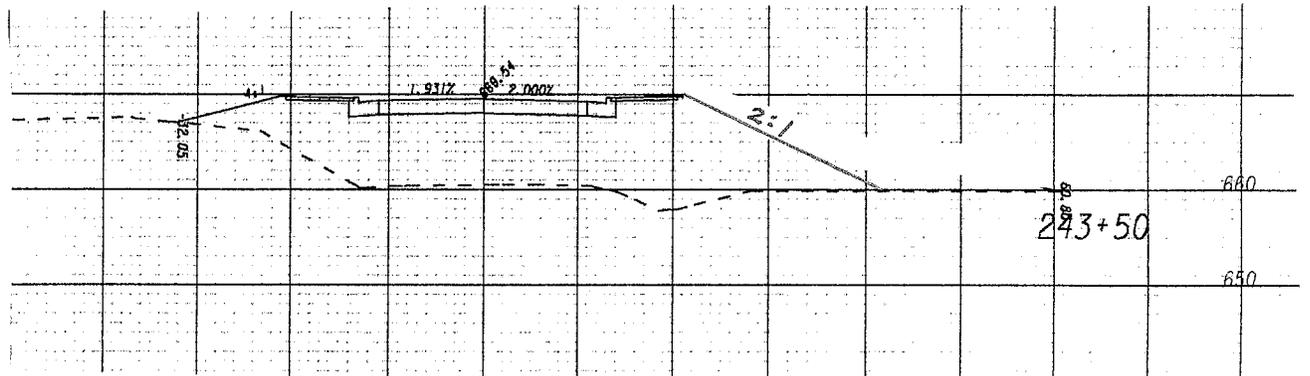
ALTERNATIVE NO.:
E-3

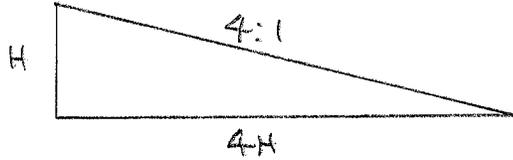
ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: **2 of 5**

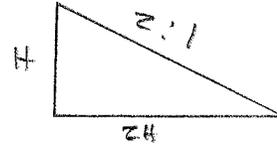


ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH





$$A = .5H(4H) = 2H^2$$



$$A = .5(H)(2H) = H^2$$

$$A = 2H^2 - H^2 = H^2$$

| STATION | FILL HT | AVG | VOL. = H^2L |
|---------|---------|------|---------------|
| 243+50 | 10 | 13 | 4225 |
| 244+00 | 16 | 16.5 | 13613 |
| +50 | 17 | 17 | 14450 |
| 245+00 | 17 | 18 | 16200 |
| +50 | 19 | 16.5 | 6806 |
| 246+00 | 14' | | |

$$\Sigma = 55294 / 27 = 2048 \times 1.2 = 2458 \text{ CY}$$

$$\text{GUARDRAIL } L = 24600 - 24350 = 250 \text{ LF}$$

ADD 1 - TYPE I AND 1 - TYPE 12 ANCHORAGE



SUBJECT: ALTERNATIVE No. E-3

JOB NO: CALCULATIONS

BY: _____ DATE: _____

CHKD: _____ DATE: _____

PAGE

SHEET
4/5

| STATION | LT HT | AVG | VOL | RT HT | AVG | VOL |
|---------|-------|-----|-----------------|-------|-----|-----------------|
| 402+50 | 10 | | | - | | |
| | | 7.5 | 1406 | | | 0 |
| 403+00 | 5 | | | 8 | | |
| | | 5.5 | 1513 | | 6 | 900 |
| +50 | 6 | | | 4 | | |
| | | 5 | 1250 | | 4 | 800 |
| 404+00 | 4 | | | 4 | | |
| | | 4 | 800 | | 4 | 800 |
| +50 | 4 | | | 4 | | |
| | | 4.5 | 506 | | 4.5 | 1013 |
| 405+00 | 5 | | | 5 | | |
| | | | 0 | | 6.5 | 1056 |
| +50 | - | | | 8 | | |
| | | | $\Sigma = 5475$ | | | $\Sigma = 4569$ |

TOTAL = $10044 / 27 = 372 * 1.2 = 446$ CY

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:
E-4

DESCRIPTION: **REVISE SR 36 PROFILE GRADE OVER THE RAILROAD TO
 REDUCE BORROW QUANTITY**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (sketch attached)

The current design has a high fill over the railroad which requires a large borrow earthwork requirement.

ALTERNATIVE: (sketch attached)

Lower the profile grade in the area over the railroad to reduce the borrow quantity requirement.

ADVANTAGES:

- Reduces construction cost
- Reduces construction time

DISADVANTAGES:

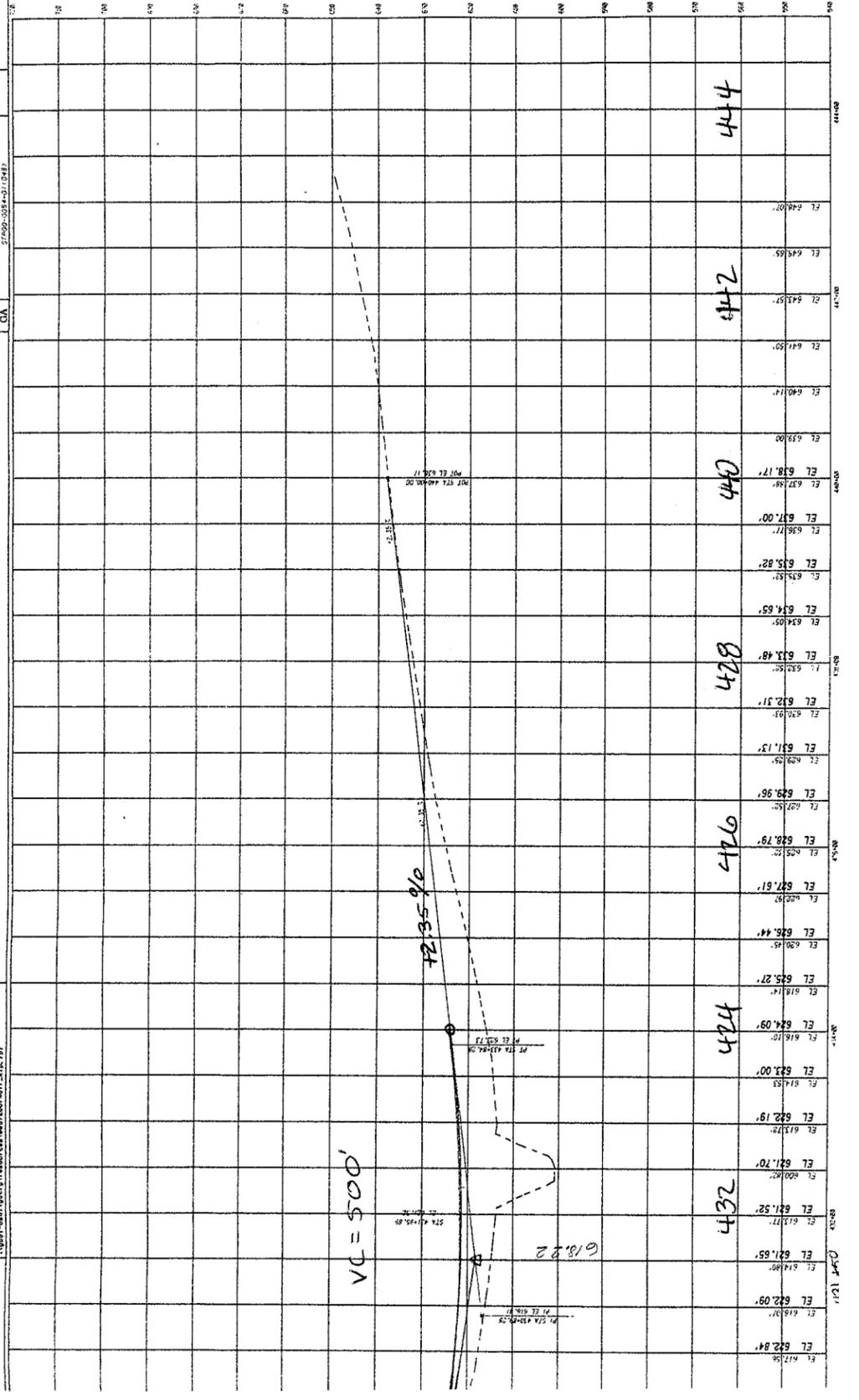
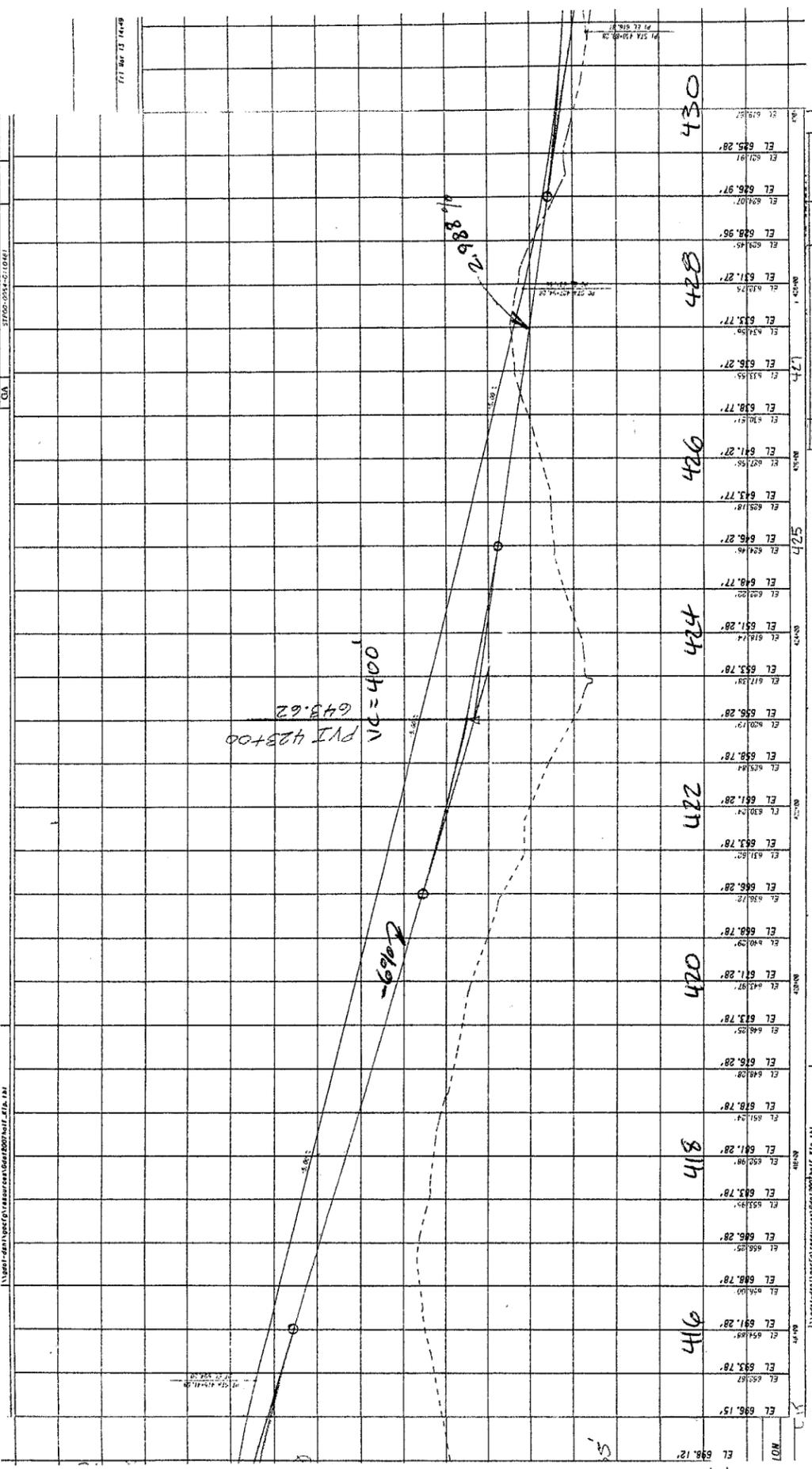
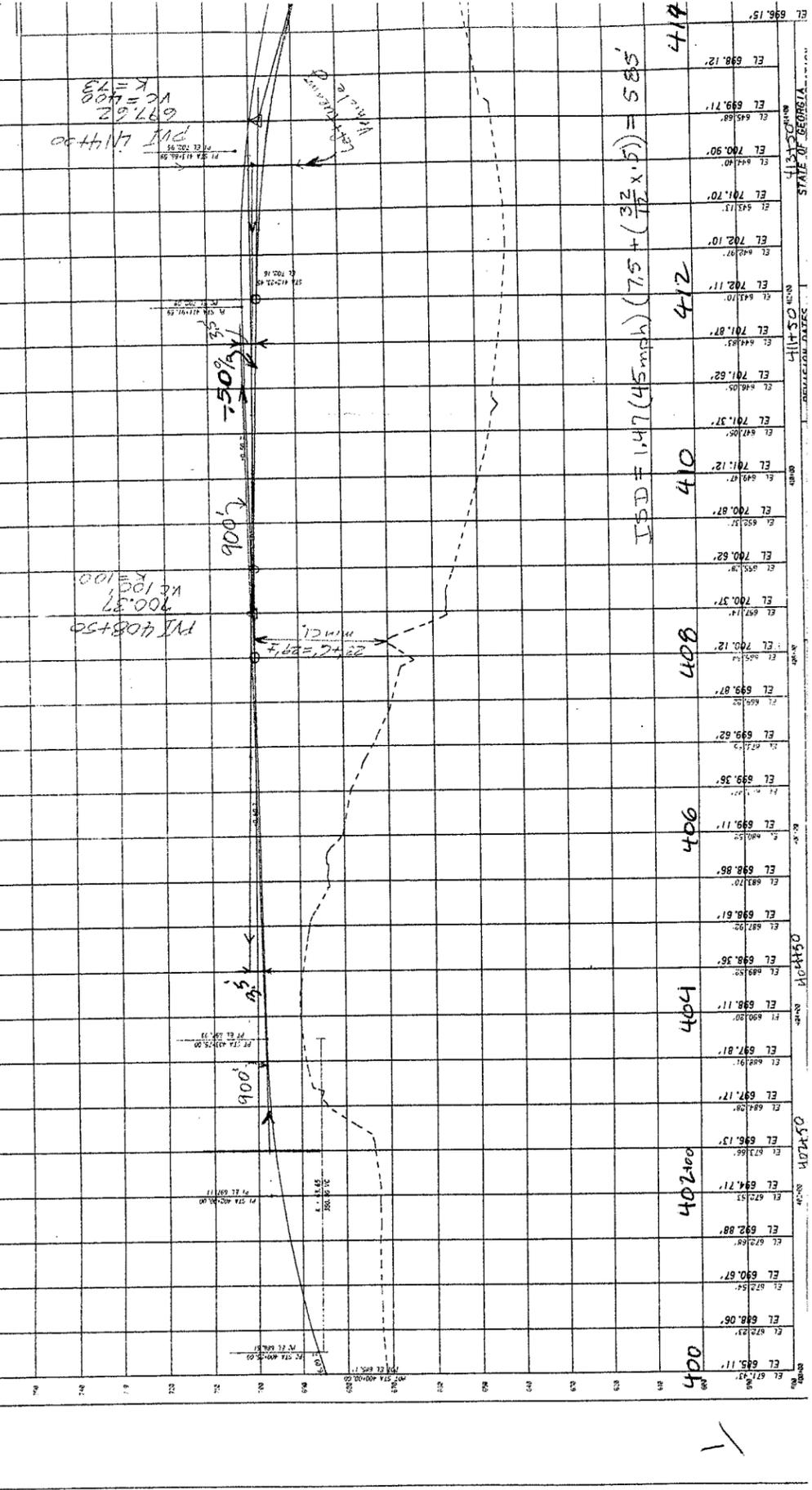
- Steeper grade (6%), but is still in the allowable range

DISCUSSION:

The current design requires 730,000 CY of borrow (fill) material to be hauled in to the project site. Lowering the SR 36 profile grade in the vicinity of the bridge over the railroad would significantly reduce the borrow quantity since this is a high fill (50 ft). It appears that the profile crest could be moved and a slightly steeper grade (6%) could be used to lower the fill area.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|----------------------------------|----------------------------------|
| ORIGINAL DESIGN | \$ 693,936 | — | \$ 693,936 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS | \$ 693,936 | — | \$ 693,936 |

Sketch AH, E4 2/4



CALCULATIONS



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

E.4

SHEET NO.:

3 of 4

$$409+00 \rightarrow 412+00: (300' \times \frac{3'}{2} \times 260') / 27 \text{ cf/cy} = 4,300 \text{ c.y.}$$

$$412+00 \rightarrow 416+00: (400' \times 4.5' \times 280') / 27 = 18,600 \text{ c.y.}$$

$$416+00 \rightarrow 423+00: (700' \times (\frac{5'+12'}{2}) \times 180') / 27 = 39,600 \text{ c.y.}$$

$$423+00 \rightarrow 427+00: (400' \times (\frac{12'+4'}{2}) \times 140') / 27 = 16,500 \text{ c.y.}$$

(Borrow) Total Reduction: 79,000 c.y.

$$79,000 \times 1.2 = 94,800 \text{ c.y.}$$

↗ "Swell" Net Borrow by 20% for
Pay Quantity.

width & height based on X-sections.

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

E-5

DESCRIPTION: **MOVE NEW CONNECTOR ROAD 150 FT NORTH FROM
 CURRENT LOCATION AT STA. 413+46 TO STA. 415+00**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN:

The current design location for the intersection of the New Connector Road with new SR 36 is located at Sta. 413+46.

ALTERNATIVE: (sketch attached)

Move the intersection 150 ft north. This adjustment would aid in lowering the current design profile grade and reduce embankment from the northern portion of the bridge through Sta. 415+00.

ADVANTAGES:

- Reduces borrow requirement
- Shifts the intersection further away from wetland at the current location
- Saves costs and construction time

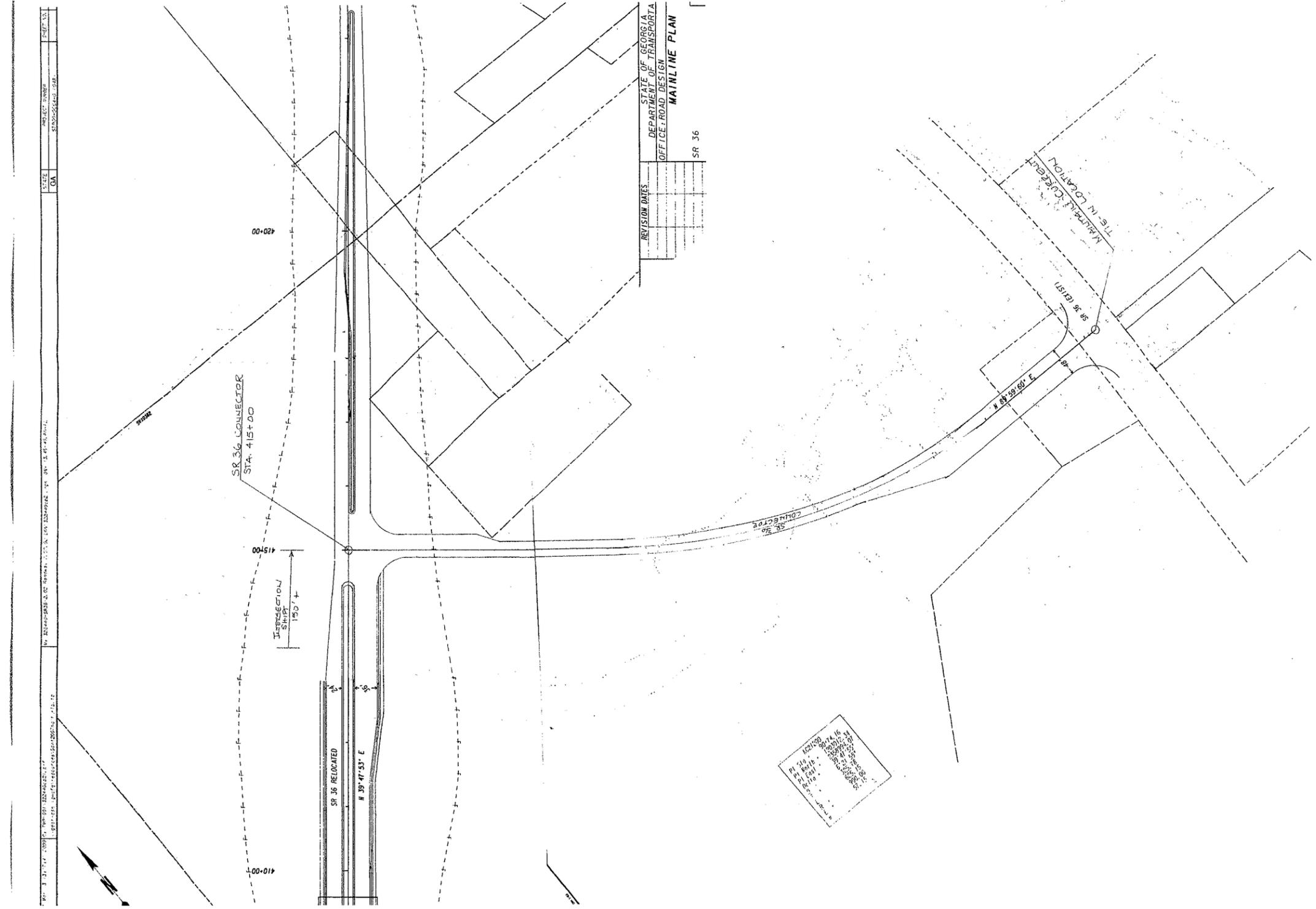
DISADVANTAGES:

- None apparent

DISCUSSION:

Shifting the intersection from Sta. 413+46 to Sta. 415+00 reduces the profile grade and required embankment for mainline SR 36 construction. The profile will be adjusted with the mainline profile grade, thus reducing construction schedule and construction costs.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|----------------------------------|----------------------------------|
| ORIGINAL DESIGN | \$ 128,342 | — | \$ 128,342 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS | \$ 128,342 | — | \$ 128,342 |



PROJECT NUMBER: 2008-0001
 SHEET NUMBER: 2008-0001-001
 DATE: 08/12/08
 DRAWN BY: J. B. BROWN
 CHECKED BY: J. B. BROWN
 APPROVED BY: J. B. BROWN

| REVISION | DATE | DESCRIPTION |
|----------|----------|----------------------|
| 1 | 08/12/08 | ISSUED FOR BIDDING |
| 2 | 08/12/08 | REVISED PER COMMENTS |
| 3 | 08/12/08 | REVISED PER COMMENTS |
| 4 | 08/12/08 | REVISED PER COMMENTS |
| 5 | 08/12/08 | REVISED PER COMMENTS |

PROJECT NUMBER: 2008-0001
 SHEET NUMBER: 2008-0001-001
 DATE: 08/12/08
 DRAWN BY: J. B. BROWN
 CHECKED BY: J. B. BROWN
 APPROVED BY: J. B. BROWN

CALCULATIONS



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

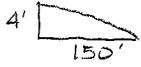
ALTERNATIVE NO.:

E-5

MOVE CONNECTOR 150-FT NORTH FROM CURRENT LOCATION AT STA. 413+46
TO STA. 415+00

SHEET NO.: 3 of 4

S.R. 36 CONNECTOR ROAD SHIFT
ROAD LENGTH 1315 - FT



$$\begin{aligned} A &= \frac{1}{2} b \cdot h \\ &= \frac{1}{2} (150) * 4 \\ &= 14,611.00 \text{ CYDS} \end{aligned}$$

$$14,611 * 1.2 = \underline{\underline{17,533.00 \text{ CYDS}}} \text{ REDUCED}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

E-6

DESCRIPTION: **CONNECT NEW SR 36 TO VALLEY ROAD IN LIEU OF
 CINDY ROAD, MOVE NEW CONNECTOR ROAD 150 FT
 NORTH AND LOWER THE HIGHWAY PROFILES ON EACH
 SIDE OF THE BRIDGE**

SHEET NO.: **1 of 17**

ORIGINAL DESIGN: (sketch attached)

The profile of new SR 36 is set so that sight distance is maintained at the approximate high point at the railroad bridge. Cindy Street is extended east to intersect with new SR 36 and continue further east to connect to a subdivision road. A new connector road is provided on the north side of the railroad bridge to connect new SR 36 with existing SR 36.

ALTERNATIVE: (Sketch attached)

Extend Valley Road east to connect to new SR 36 and then extend it further east to connect to the subdivision road. Move the new connector road on the north side of the railroad bridge 150 ft north. Re-profile the road on both sides of the bridge to reduce the fill heights.

ADVANTAGES:

- Saves borrow cost
- Saves right-of-way costs
- Avoids displacing two residences
- Reduces the amount of trees to be cut down
- Saves construction time

DISADVANTAGES:

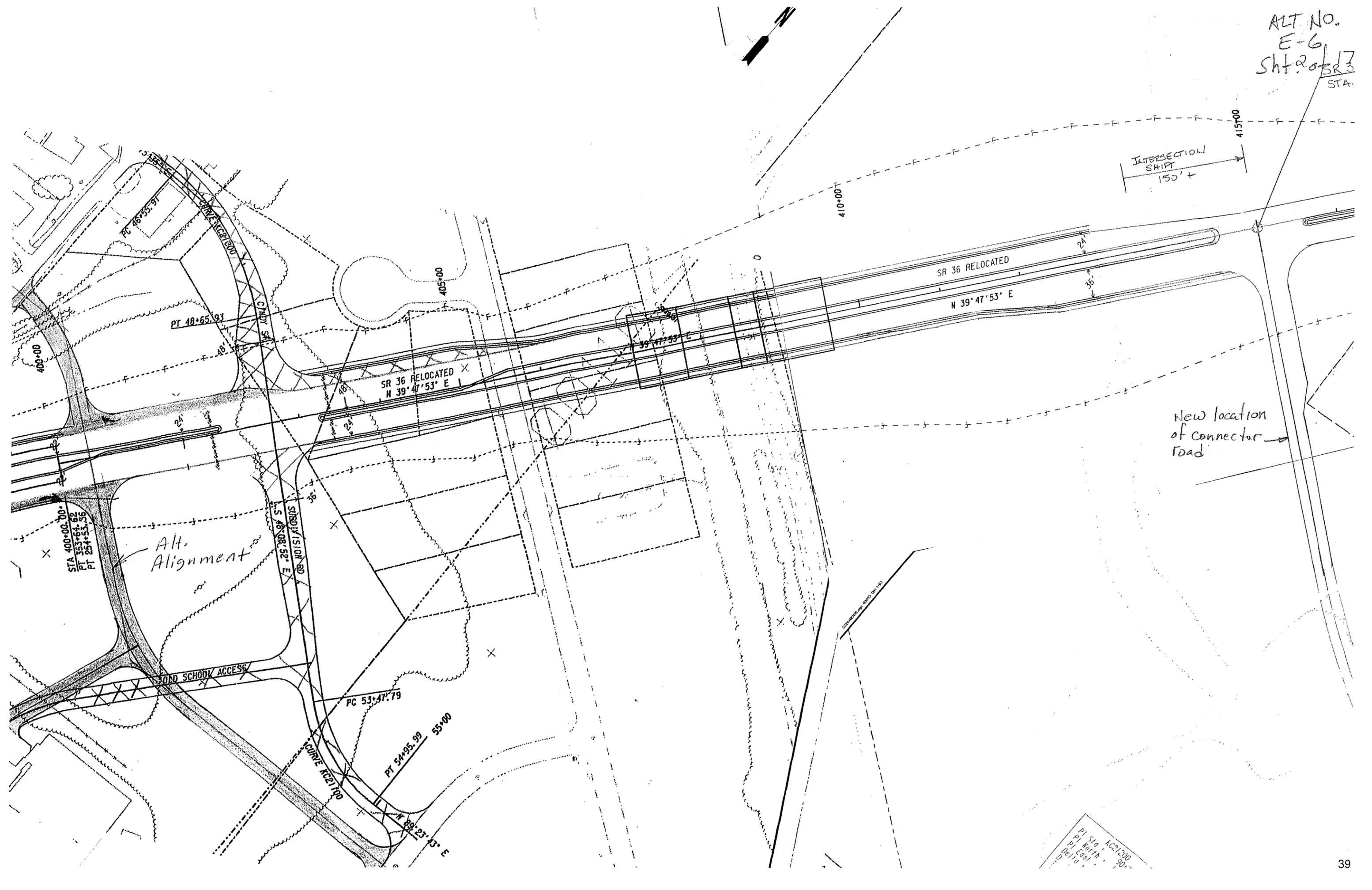
- Brings connector road closer to a property to the north

DISCUSSION:

By using Valley Road as the connector road south of the railroad bridge and moving the new connector road further north, the sight distances are improved. Thus the highway grade can be lowered to save a substantial amount of borrow material. As in Alt. No. ROW-2, using Valley Road in lieu of Cindy Street for the connection to new SR 36 avoids having to acquire two properties.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 2,662,917 | — | \$ 2,662,917 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS | \$ 2,662,917 | — | \$ 2,662,917 |

ALT. NO.
E-6
Sht. 2 of 17
SR3
STA.



INTERSECTION
SHIFT
150' ±

SR 36 RELOCATED

N 39° 47' 53" E

SR 36 RELOCATED
N 39° 47' 53" E

Alt.
Alignment

New location
of connector
road

STA 400+00.00
PT 353+64.62
PT 254+53.36

DOD SCHOOL ACCESS

SUBDIVISION RD
S 48° 08' 52" E

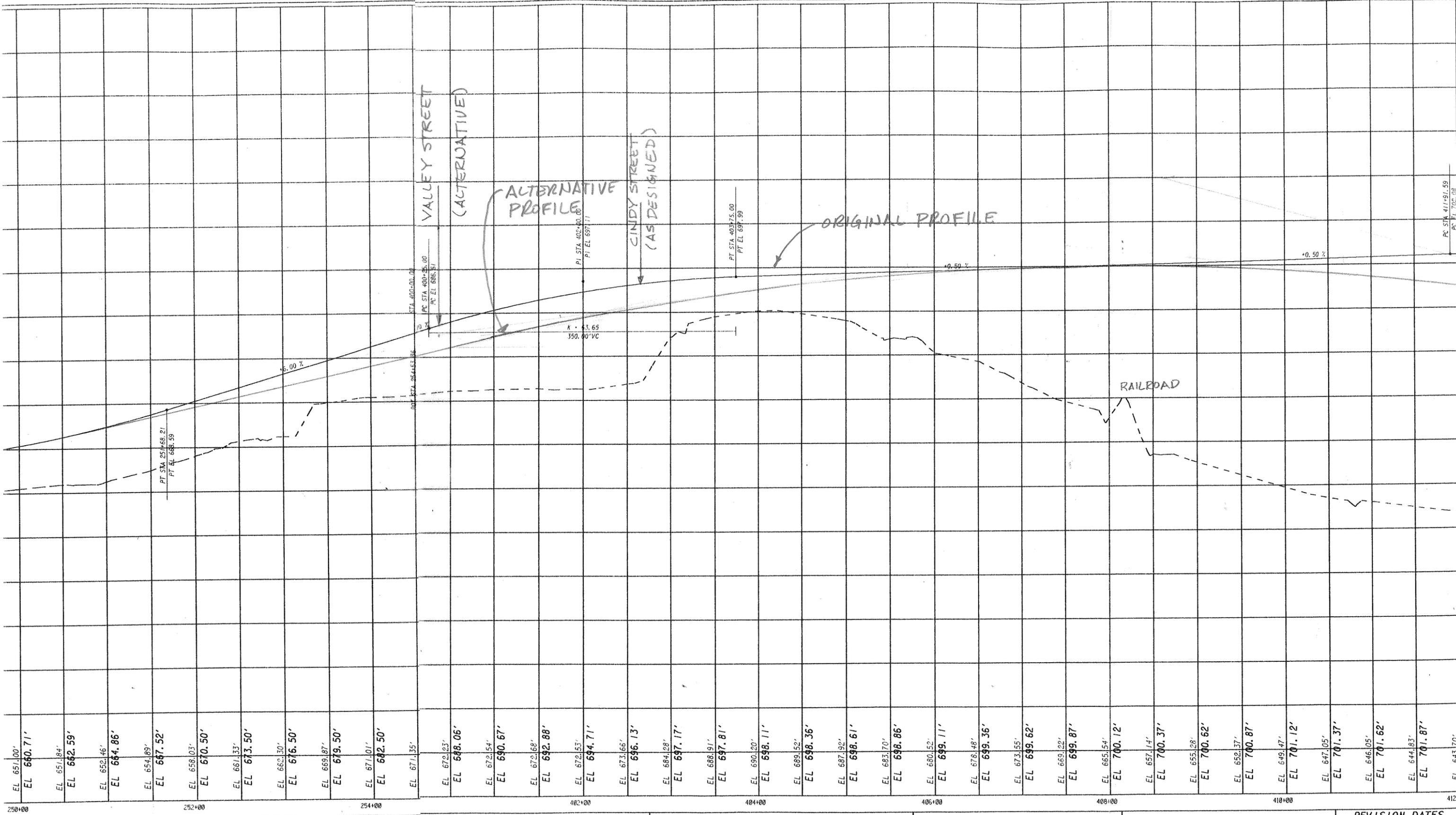
PC 53+47.79

PT 54+95.99 55+00

CURVE R21700

N 89° 23' 13" E

Pl. Sta. AC21200
Pl. North
Del. Eos
Del. 10



1" = 50'

SCALE: HORIZ 1" = 50'

REVISION DATES

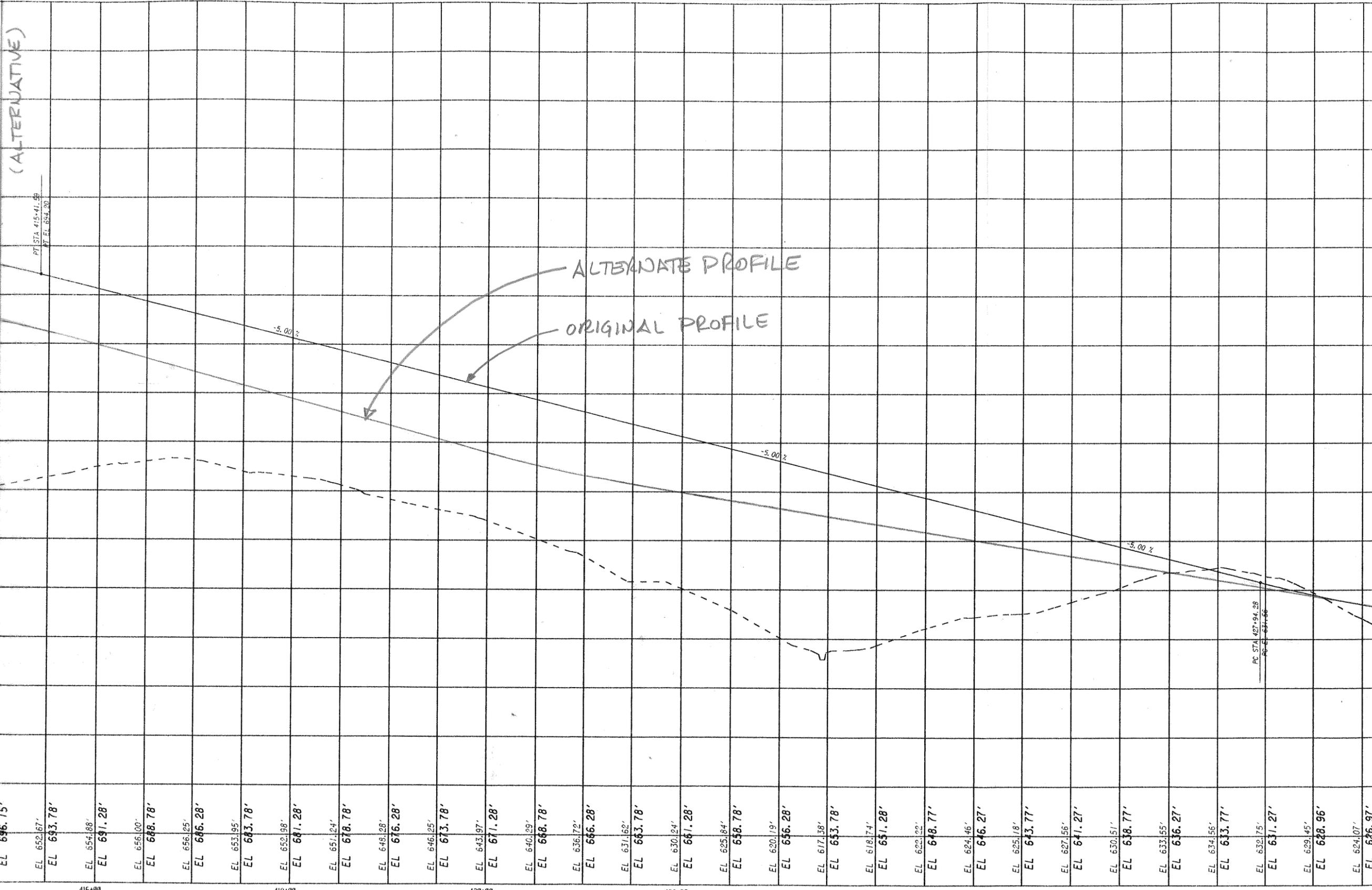
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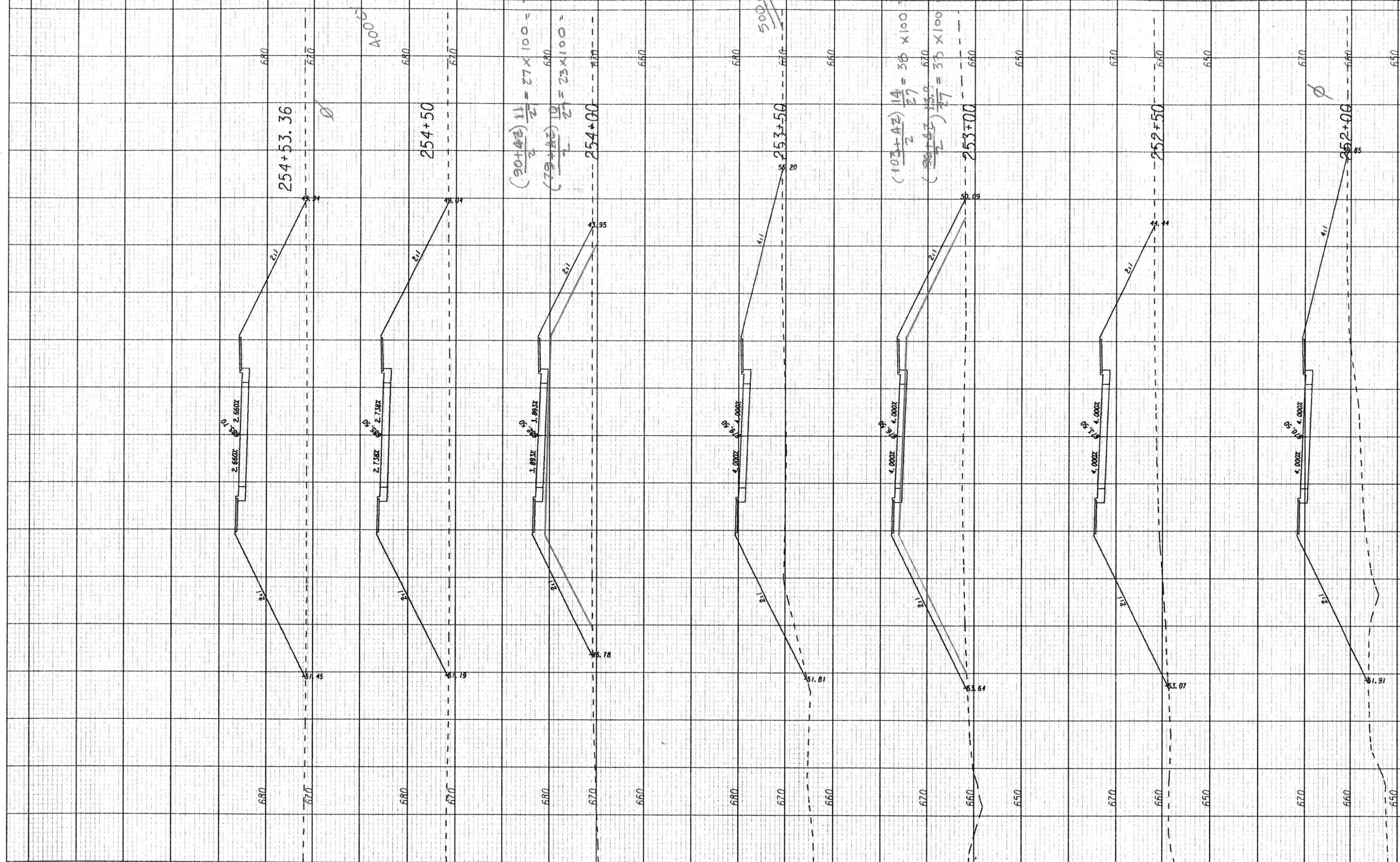
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|-------------|--------------------------------------|----|
| STATE GA | PROJECT NUMBER STP00-0054-01(048) | SH |
|-------------|--------------------------------------|----|

| | |
|-------------------------------------|-------------------------------------|
| NEW CONNECTOR ROAD (AS DESIGNED) | NEW CONNECTOR ROAD (ALTERNATIVE) |
| PI STA 413+66.59 PI EL 702.95 | PT STA 415+41.59 PT EL 694.20 |
| EL 702.10' | EL 696.15' |
| EL 643.13' | EL 652.67' |
| EL 701.70' | EL 693.78' |
| EL 644.40' | EL 654.88' |
| EL 700.90' | EL 691.28' |
| EL 645.68' | EL 656.00' |
| EL 699.71' | EL 688.78' |
| EL 698.12' | EL 656.25' |
| | EL 686.28' |
| | EL 653.95' |
| | EL 683.78' |
| | EL 652.98' |
| | EL 681.28' |
| | EL 651.24' |
| | EL 678.78' |
| | EL 648.28' |
| | EL 676.28' |
| | EL 646.25' |
| | EL 673.78' |
| | EL 643.97' |
| | EL 671.28' |
| | EL 640.29' |
| | EL 668.78' |
| | EL 636.72' |
| | EL 666.28' |
| | EL 637.62' |
| | EL 663.78' |
| | EL 630.24' |
| | EL 661.28' |
| | EL 625.84' |
| | EL 658.78' |
| | EL 620.19' |
| | EL 656.28' |
| | EL 617.38' |
| | EL 653.78' |
| | EL 618.74' |
| | EL 651.28' |
| | EL 622.22' |
| | EL 648.77' |
| | EL 624.46' |
| | EL 646.27' |
| | EL 625.18' |
| | EL 643.77' |
| | EL 627.56' |
| | EL 641.27' |
| | EL 630.51' |
| | EL 638.77' |
| | EL 633.55' |
| | EL 636.27' |
| | EL 634.56' |
| | EL 633.77' |
| | EL 632.75' |
| | EL 631.27' |
| | EL 629.45' |
| | EL 628.96' |
| | EL 624.07' |
| | EL 626.97' |



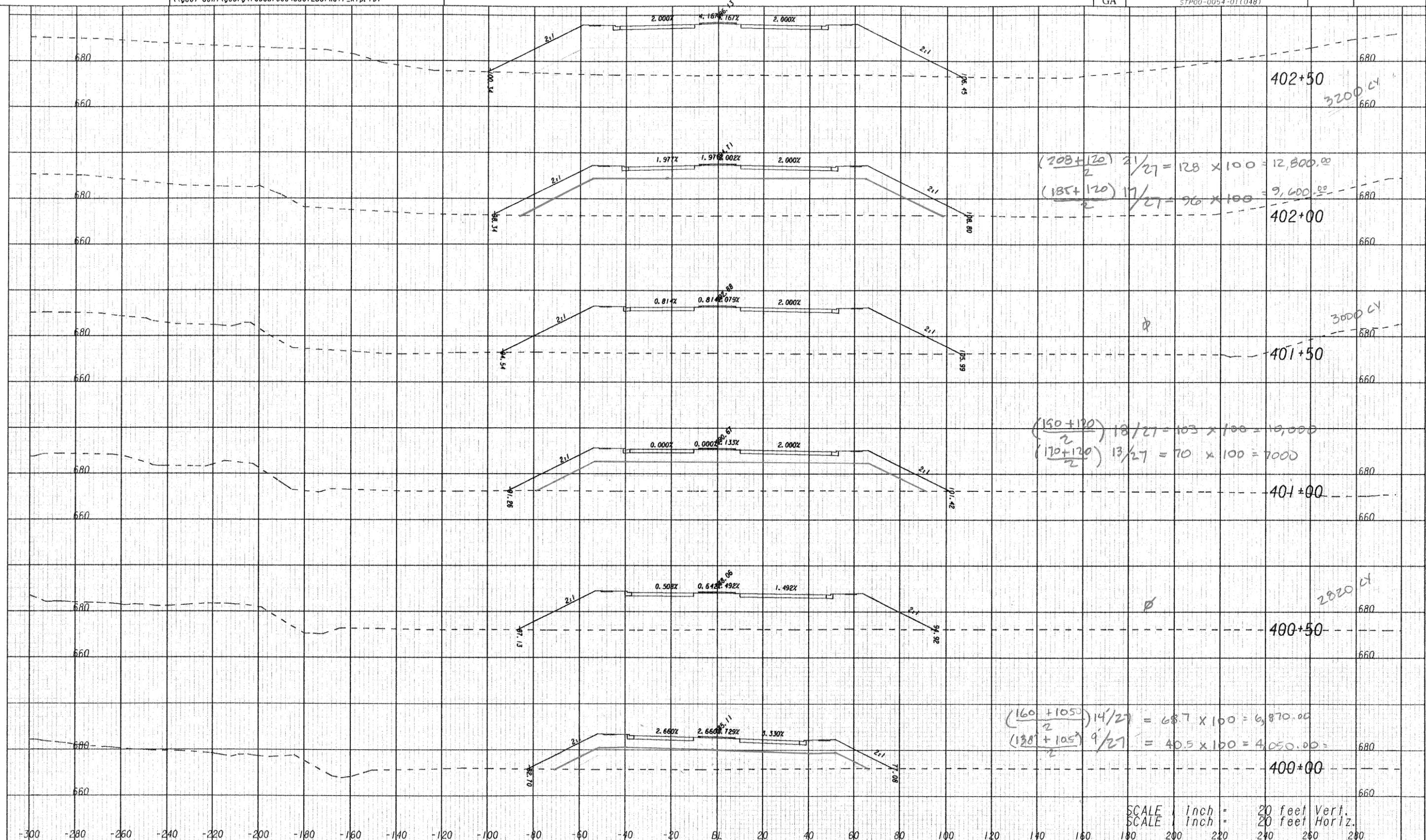


SCALE 1 inch = 10 feet Vert.
SCALE 1 inch = 10 feet Horiz.

322440

| NO. | DATE | DESCRIPTION |
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STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: ROAD DESIGN
CROSS SECTIONS

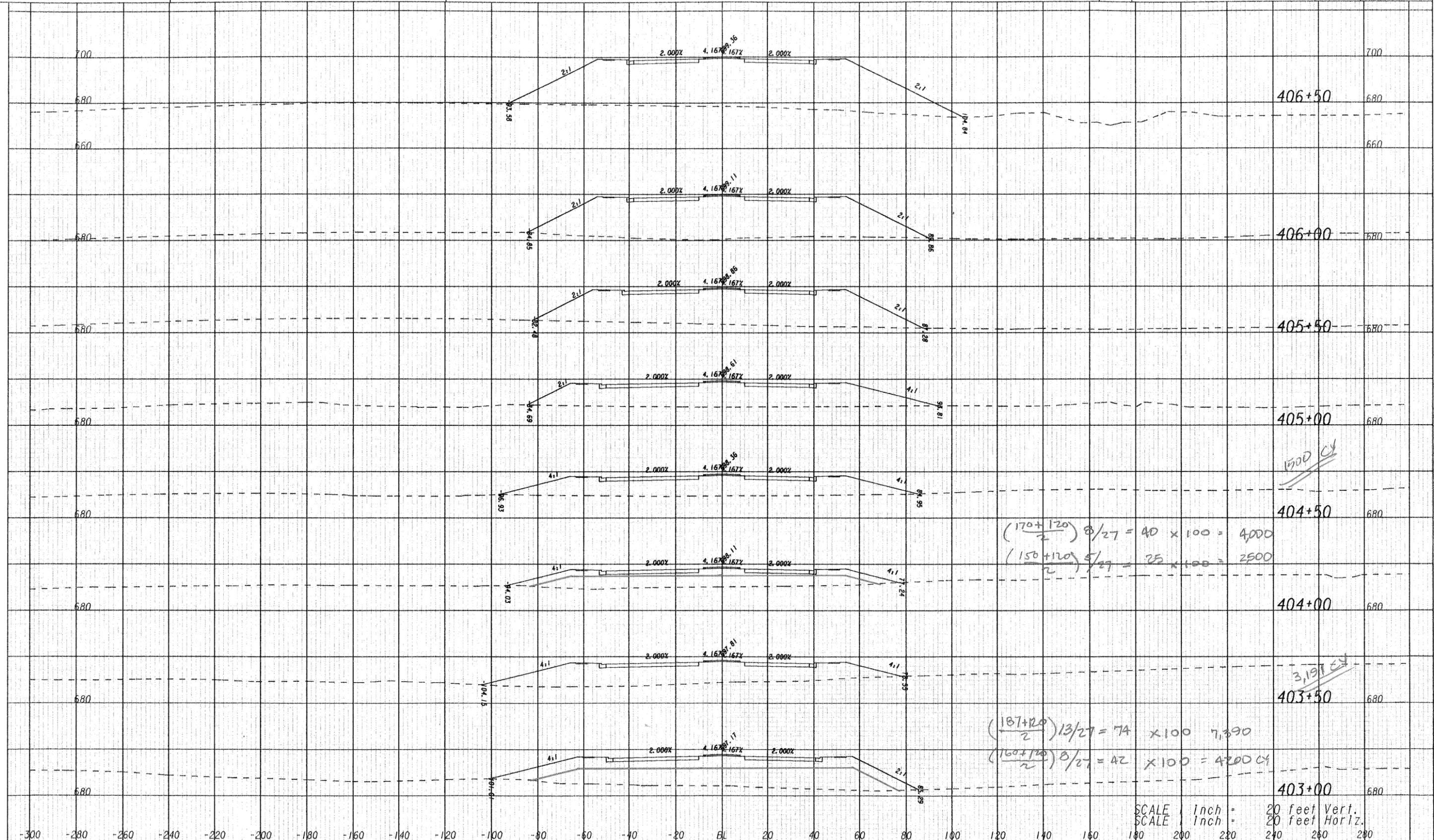


SCALE 1 inch = 20 feet Vert.
 SCALE 1 inch = 20 feet Horiz.

Total Borrow $136,528 \times 1.2 = 143,833.60 (.20) = 32,746.72$
 $+ 32,746.72$
176,580.32 CY

| REVISION DATES |
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STATE OF GEORGIA
 DEPARTMENT OF TRANSPORTATION
 OFFICE: CROSS SECTIONS

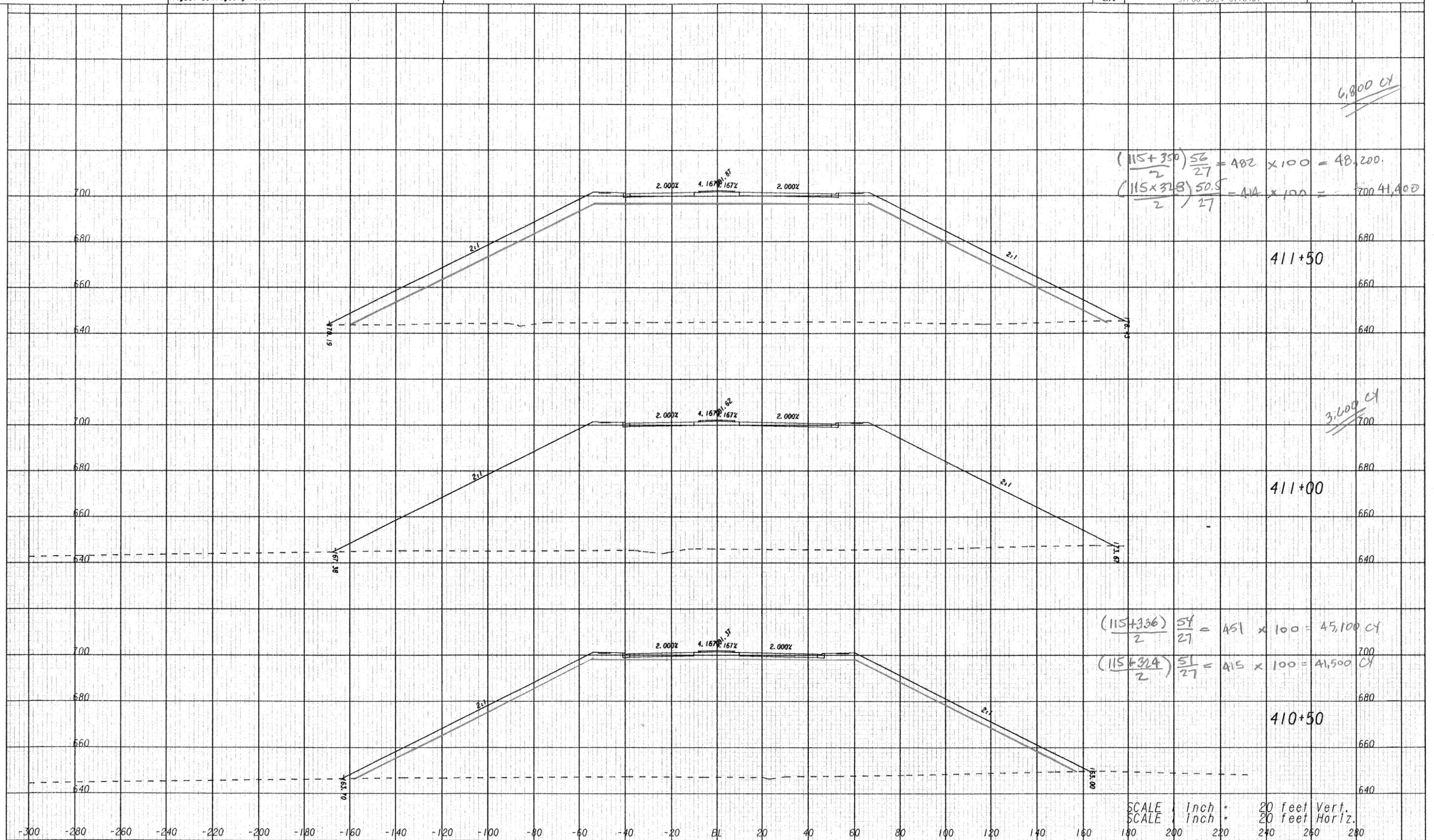


SCALE 1 Inch = 20 feet Vert.
SCALE 1 Inch = 20 feet Horiz.

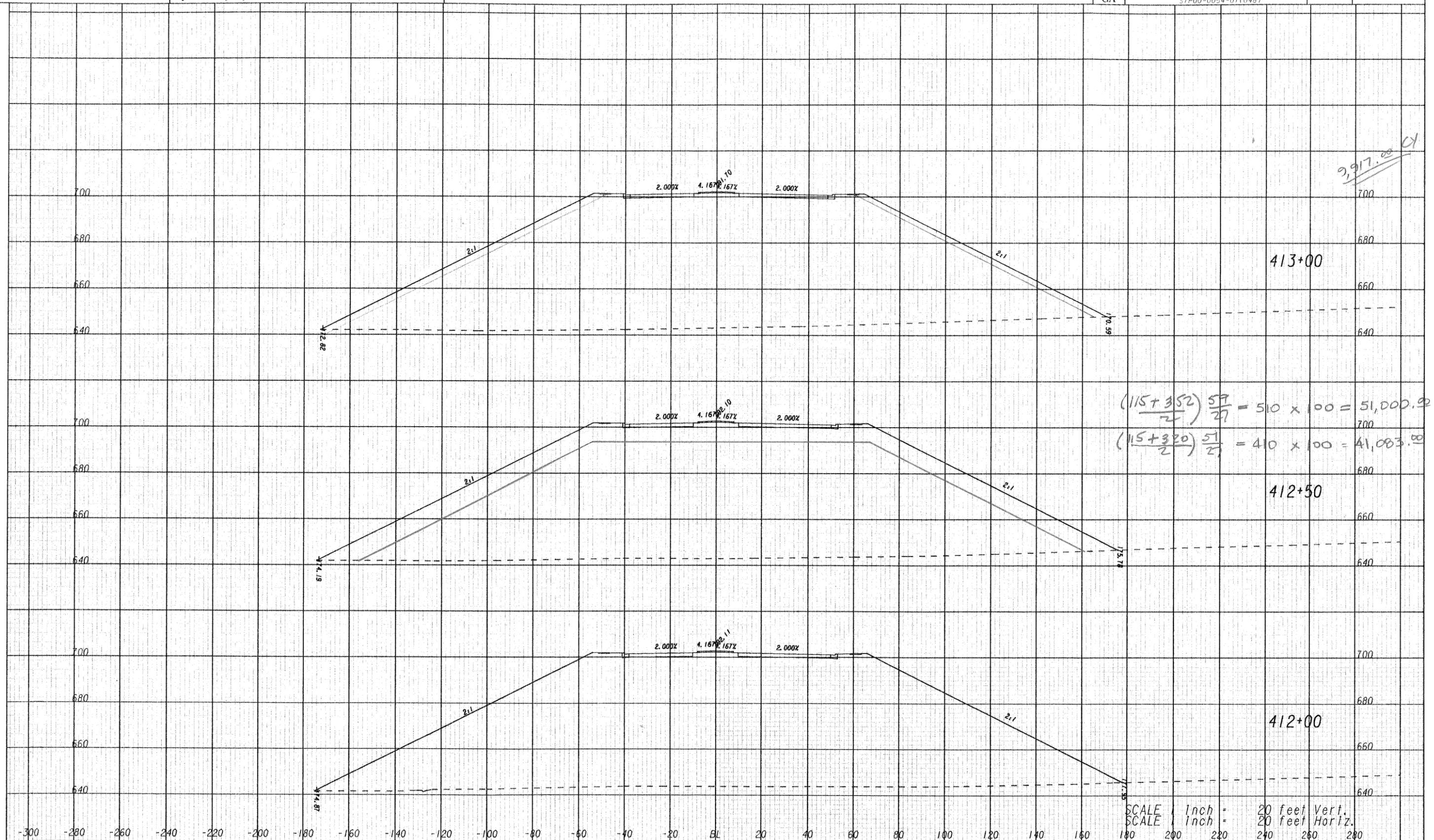
| REVISION DATES | |
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STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE:

CROSS SECTIONS



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| REVISION DATES _____ _____ _____ _____ | STATE OF GEORGIA |
| | DEPARTMENT OF TRANSPORTATION |
| | OFFICE: |
| | CROSS SECTIONS |



$$\left(\frac{115 + 352}{2}\right) \frac{57}{27} = 510 \times 100 = 51,000.00$$

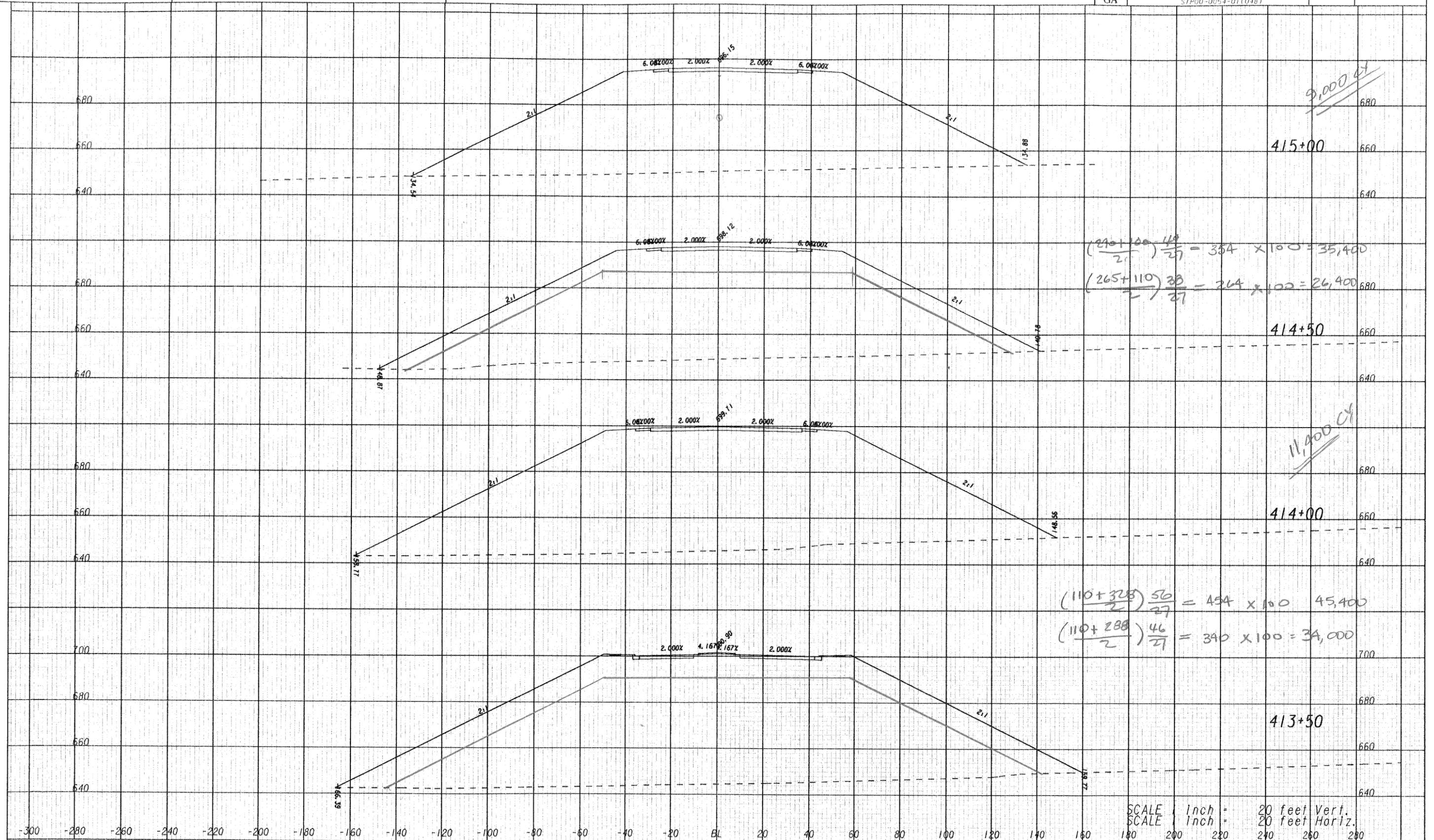
$$\left(\frac{115 + 320}{2}\right) \frac{57}{27} = 410 \times 100 = 41,083.00$$

SCALE 1 inch = 20 feet Vert.
 SCALE 1 inch = 20 feet Horiz.

| REVISION DATES | |
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STATE OF GEORGIA
 DEPARTMENT OF TRANSPORTATION
 OFFICE:
 CROSS SECTIONS

Map Scale 1" = 20'

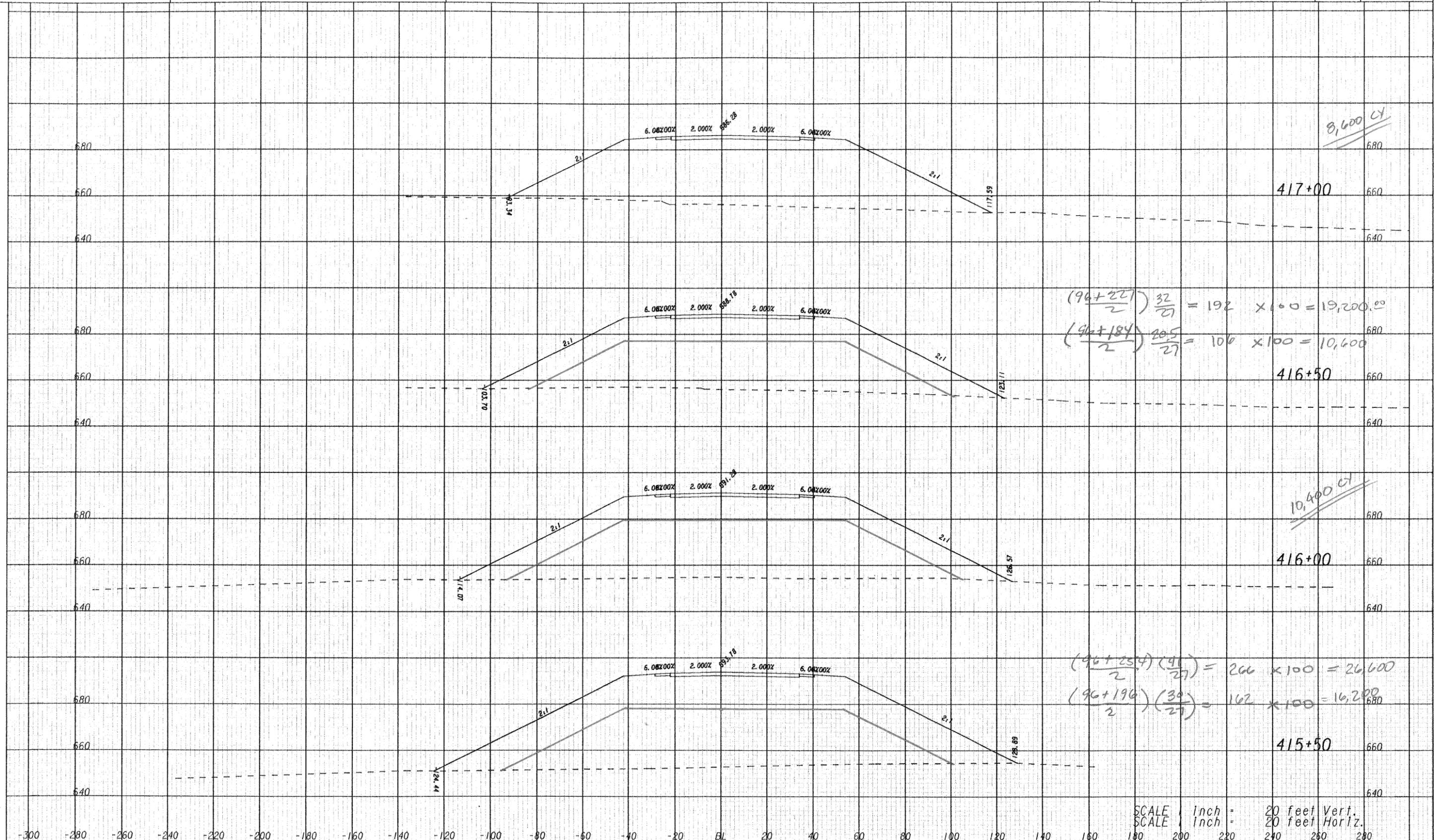


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|----------------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| -300 | -280 | -260 | -240 | -220 | -200 | -180 | -160 | -140 | -120 | -100 | -80 | -60 | -40 | -20 | BL | 20 | 40 | 60 | 80 | 100 | 120 | 140 | 160 | 180 | 200 | 220 | 240 | 260 | 280 |
| REVISION DATES | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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SCALE 1 inch = 20 feet Vert.
SCALE 1 inch = 20 feet Horiz.

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: CROSS SECTIONS

Plot Date: 11/23/09



8,600 cy

$$\left(\frac{96+227}{2}\right) \left(\frac{32}{27}\right) = 192 \times 100 = 19,200.00$$

$$\left(\frac{96+184}{2}\right) \left(\frac{20.5}{27}\right) = 106 \times 100 = 10,600$$

10,400 cy

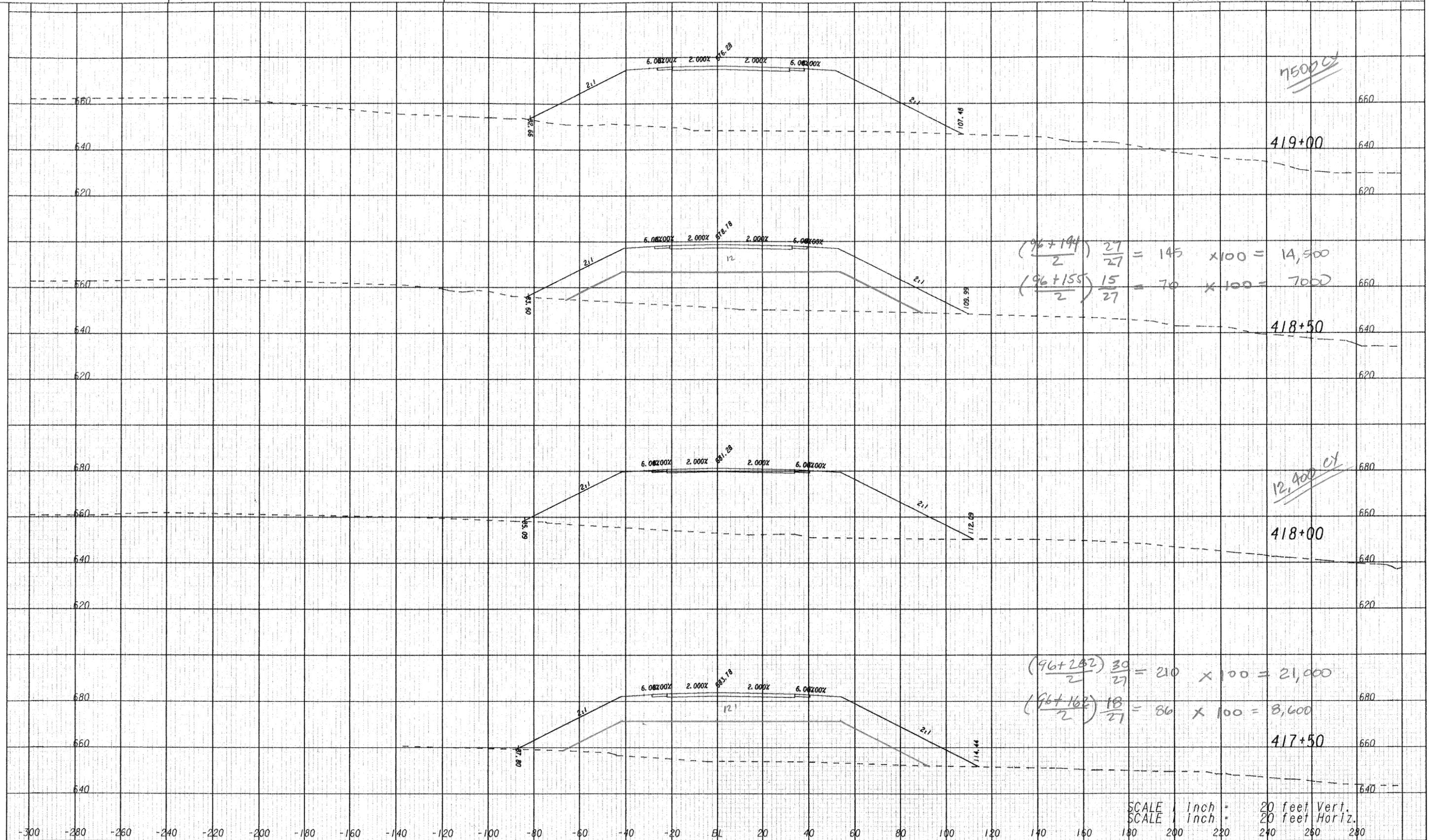
$$\left(\frac{96+254}{2}\right) \left(\frac{41}{27}\right) = 266 \times 100 = 26,600$$

$$\left(\frac{96+196}{2}\right) \left(\frac{30}{27}\right) = 162 \times 100 = 16,200$$

SCALE 1 inch = 20 feet Vert.
SCALE 1 inch = 20 feet Horiz.

| REVISION DATES | |
|----------------|--|
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STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: CROSS SECTIONS



7500 cy

419+00

$$\left(\frac{96+194}{2}\right) \frac{27}{27} = 145 \times 100 = 14,500$$

$$\left(\frac{96+155}{2}\right) \frac{15}{27} = 70 \times 100 = 7,000$$

418+50

12,400 cy

418+00

$$\left(\frac{96+282}{2}\right) \frac{30}{27} = 210 \times 100 = 21,000$$

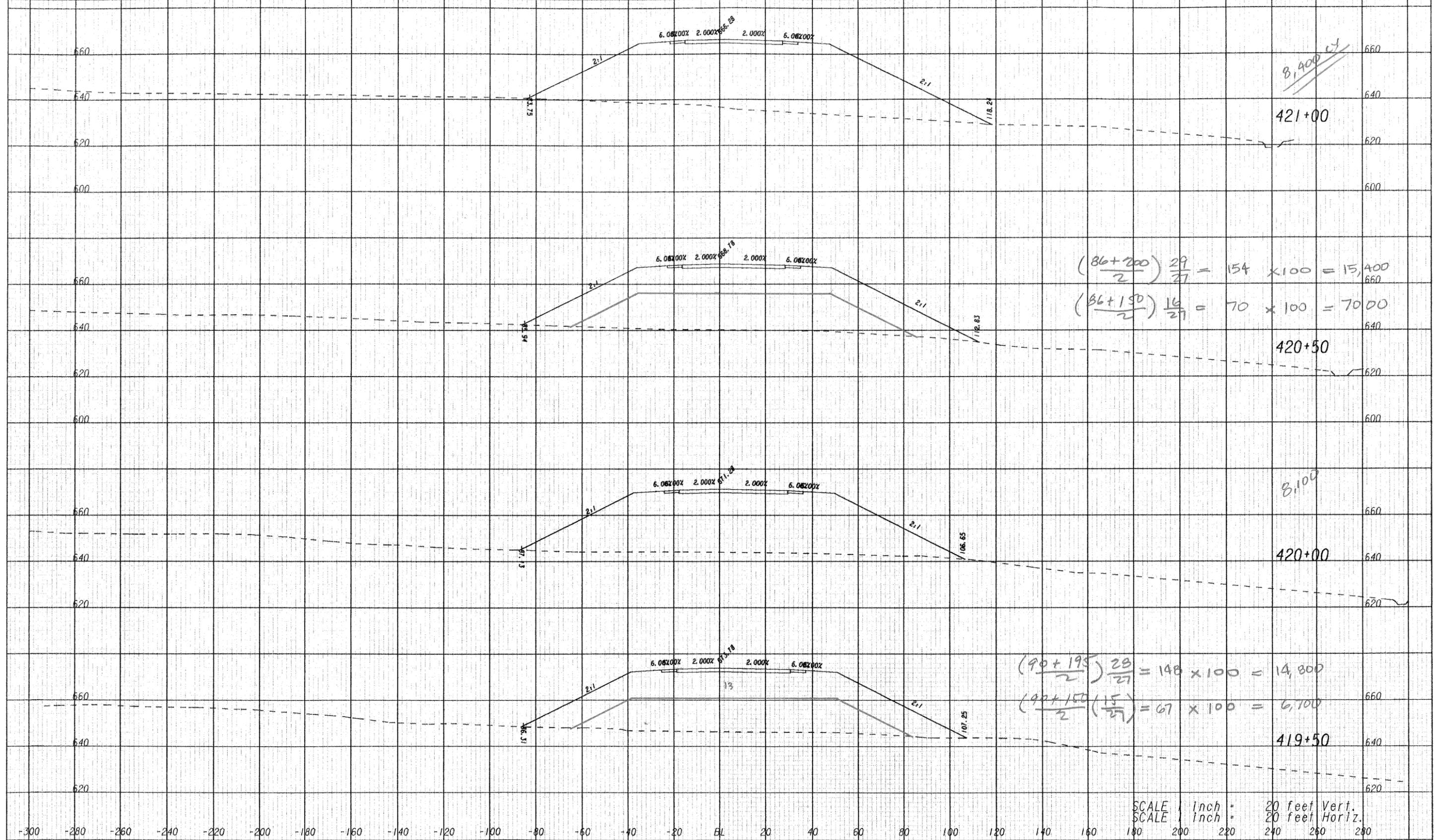
$$\left(\frac{96+162}{2}\right) \frac{18}{27} = 86 \times 100 = 8,600$$

417+50

SCALE 1 inch = 20 feet Vert.
 SCALE 1 inch = 20 feet Horiz.

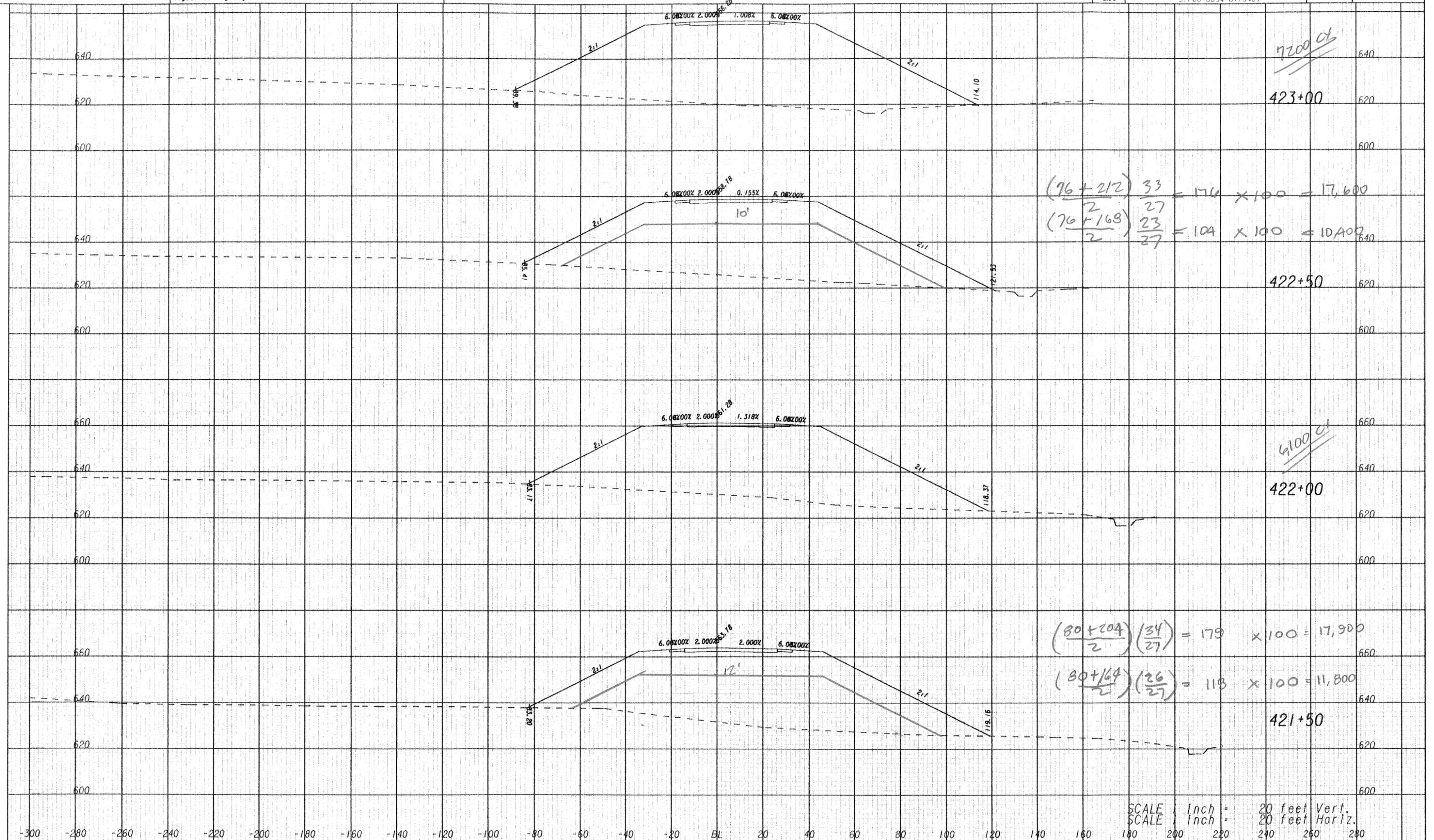
| REVISION DATES | |
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STATE OF GEORGIA
 DEPARTMENT OF TRANSPORTATION
 OFFICE:
 CROSS SECTIONS



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| REVISION DATES | | | STATE OF GEORGIA DEPARTMENT OF TRANSPORTATION OFFICE: CROSS SECTIONS |
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App. 1/2008



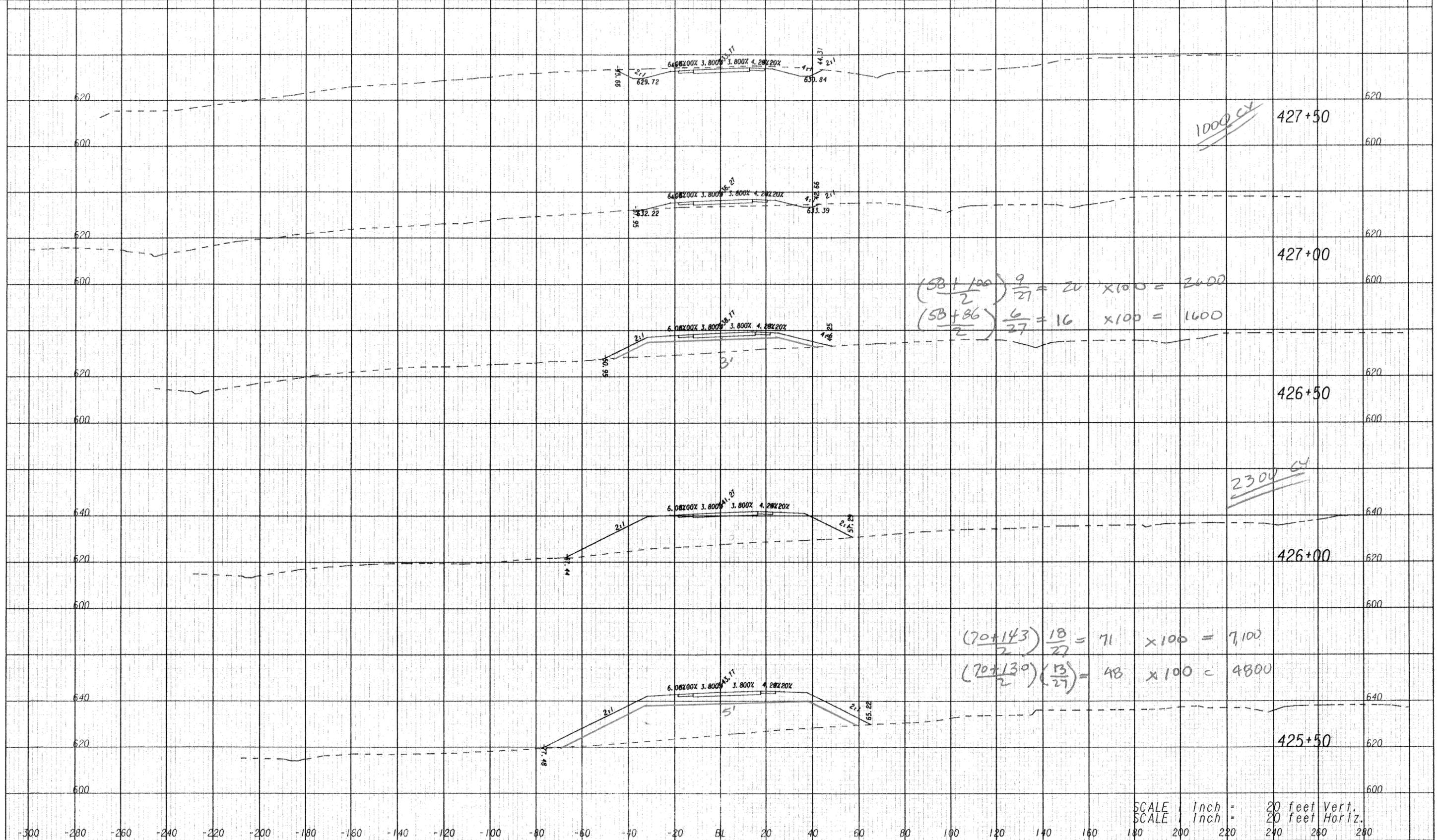
SCALE 1 Inch = 20 feet Vert.
SCALE 1 Inch = 20 feet Horiz.

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE:

CROSS SECTIONS

13/2009



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|----------------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| -300 | -280 | -260 | -240 | -220 | -200 | -180 | -160 | -140 | -120 | -100 | -80 | -60 | -40 | -20 | BL | 20 | 40 | 60 | 80 | 100 | 120 | 140 | 160 | 180 | 200 | 220 | 240 | 260 | 280 |
| REVISION DATES | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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SCALE 1 inch = 20 feet Vert.
SCALE 1 inch = 20 feet Horiz.

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE:
CROSS SECTIONS

VALUE ENGINEERING ALTERNATIVE



| | |
|--|--------------------------------|
| PROJECT: SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD <i>Butts County, Georgia</i> | ALTERNATIVE NO.: E-7 |
| DESCRIPTION: USE 12-FT-WIDE SHOULDERS NORTH OF THE MERGE WITH A 2-FT-WIDE GRASS STRIP IN LIEU OF 16-FT-WIDE SHOULDERS | SHEET NO.: 1 of 4 |

ORIGINAL DESIGN:

The original design between Sta. 400+00 to Sta. 413+50 indicates 16-ft-wide shoulders with 5-ft-wide sidewalks, with a 6 ft offset from the back of the curb.

ALTERNATIVE: (sketch attached)

Use 12-ft-wide shoulders, 2-ft-wide grass strips and 5-ft-wide sidewalks between the above-mentioned stationing.

ADVANTAGES:

- Reduces embankment material in construction
- Reduces the project schedule
- Reduces the right-of-way
- Saves cost

DISADVANTAGES:

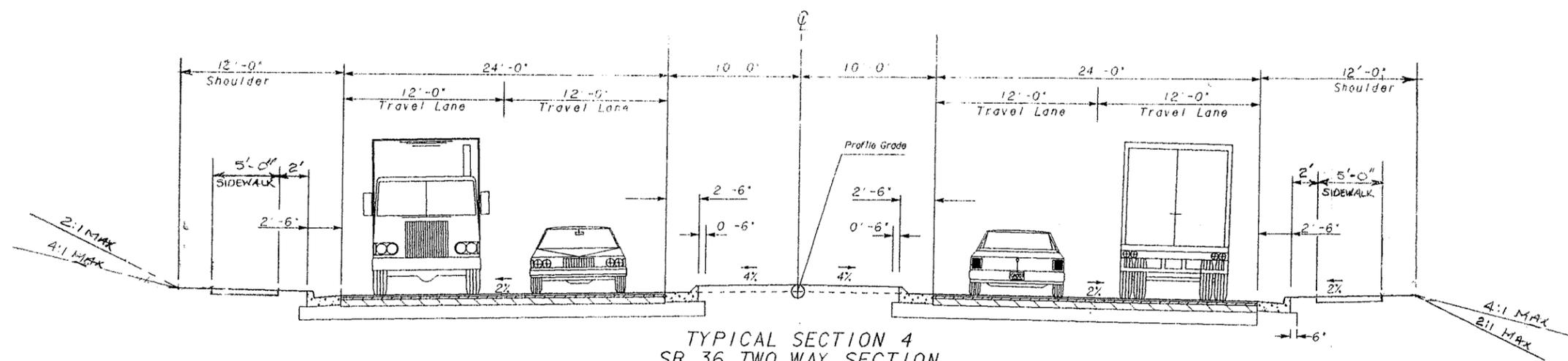
- None apparent

DISCUSSION:

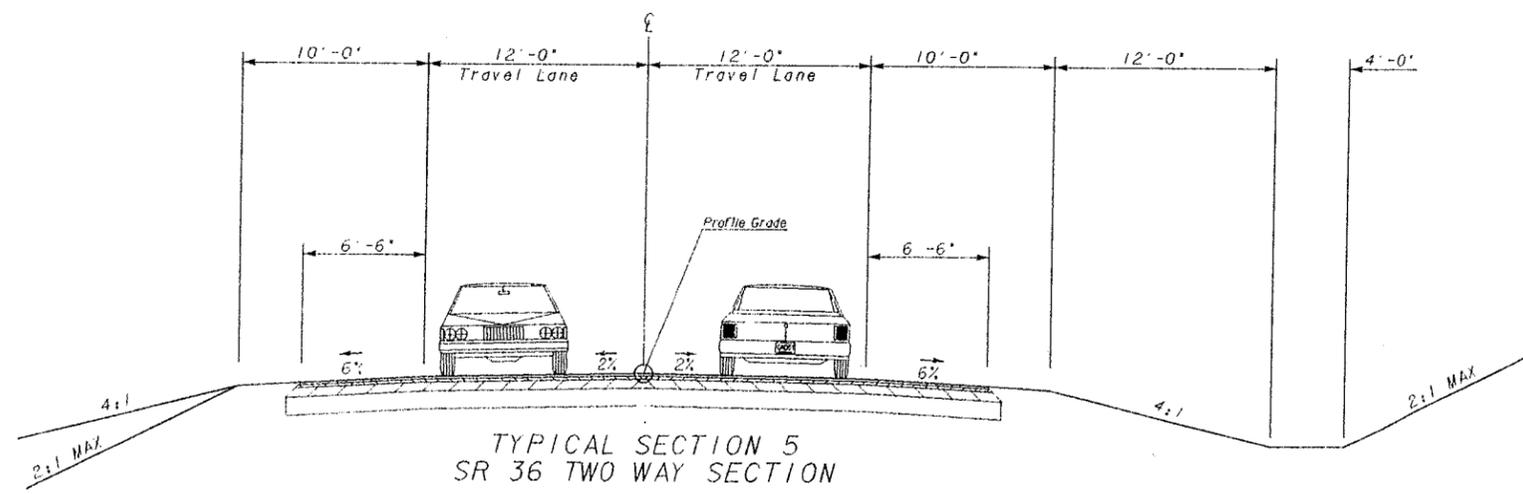
The proposed design will reduce property impacts with regard to the location of construction limits, right-of-way and roadway impacts. Also, since there are no driveways (since access is limited, there will be no driveways), the sidewalk can be closer to the road without having to be constructed around the driveways.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 197,640 | — | \$ 197,640 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS | \$ 197,640 | — | \$ 197,640 |

E-7
2 OF 4



TYPICAL SECTION 4
SR 36 TWO WAY SECTION
STA 400+00.00 TO STA 413+50.00



TYPICAL SECTION 5
SR 36 TWO WAY SECTION
STA 413+50.00 TO STA 440+00.00

| REVISION DATES | | |
|----------------|--|--|
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STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: ROAD DESIGN
TYPICAL SECTIONS

SR 36 WIDENING

DRAWING NO.
5-02

CALCULATIONS



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:
E-7

USE 12-FT SHOULDERS NORTH OF MERGE WITH 2-FT GRASS STRIP I.L.O 16-FT
SHOULDERS, STA. 400+00 TO STA. 413+50

SHEET NO.: 3 of 4

AVG. LENGTH LENGTH OF SLOPE EA SIDE 75 - FT

TYPICAL SECTION FRONT SLOPE REDUCTION DEPTH - 3 - FT

TOTAL LENGTH OF MODIFICATION 1,350 LF

$$V = 1350' \times 75' \times 3' = 303750 \text{ FT}^3 / 27 = 11,250.00 \text{ CY} \times 2$$

$$= \underline{22,500.00 \text{ CYDS}} \times 1.2 = 27000$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:
B-1

DESCRIPTION: **REDUCE THE WIDTH OF THE MEDIAN ON THE BRIDGE**
FROM 20 FT TO 8 FT

SHEET NO.: 1 of 6

ORIGINAL DESIGN: (sketch attached)

There is a 20-ft-wide concrete median across the bridge, 16 ft of which is raised.

ALTERNATIVE: (sketch attached)

Use an 8-ft-wide median, 4 ft of which will be raised.

ADVANTAGES:

- Reduces cost
- Reduces embankment
- Reduces bridge area
- Reduces load on bridge
- Reduces right-of-way

DISADVANTAGES:

- Perceived reduction in safety

DISCUSSION:

From the Cindy Street connection to the SR 36 New Connector Road, there are no left turn lanes required. The median can be reduced in width to reduce the cost of several items. This section has a 45 MPH design speed, so this will be safe, even though there may be a perceived reduction in safety to some drivers.

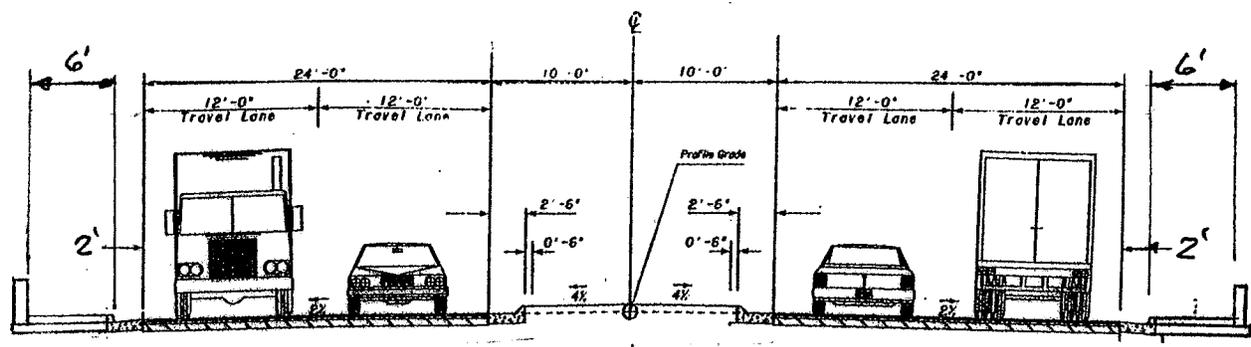
| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 3,055,047 | — | \$ 3,055,047 |
| ALTERNATIVE | \$ 2,501,122 | — | \$ 2,501,122 |
| SAVINGS | \$ 553,925 | — | \$ 553,925 |

PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.: **B-1**

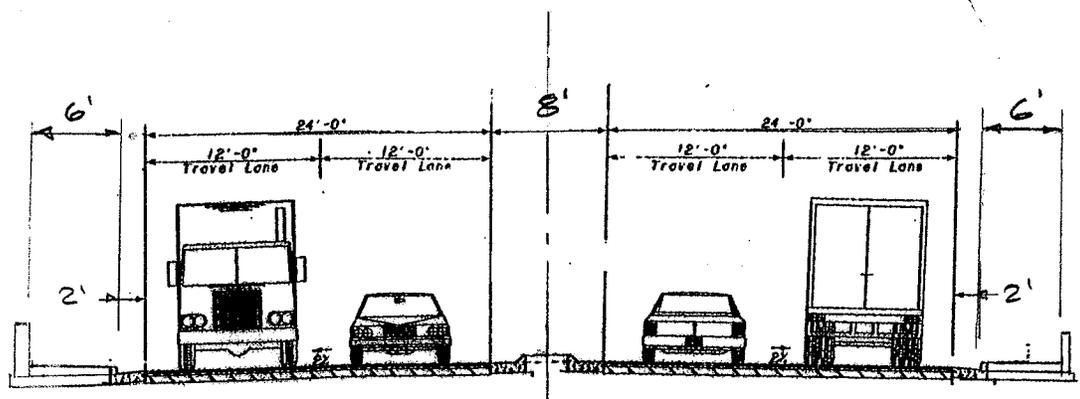
ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: **2 of 6**

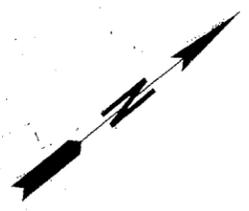


TYPICAL SECTION 4
 SR 36 TWO WAY SECTION

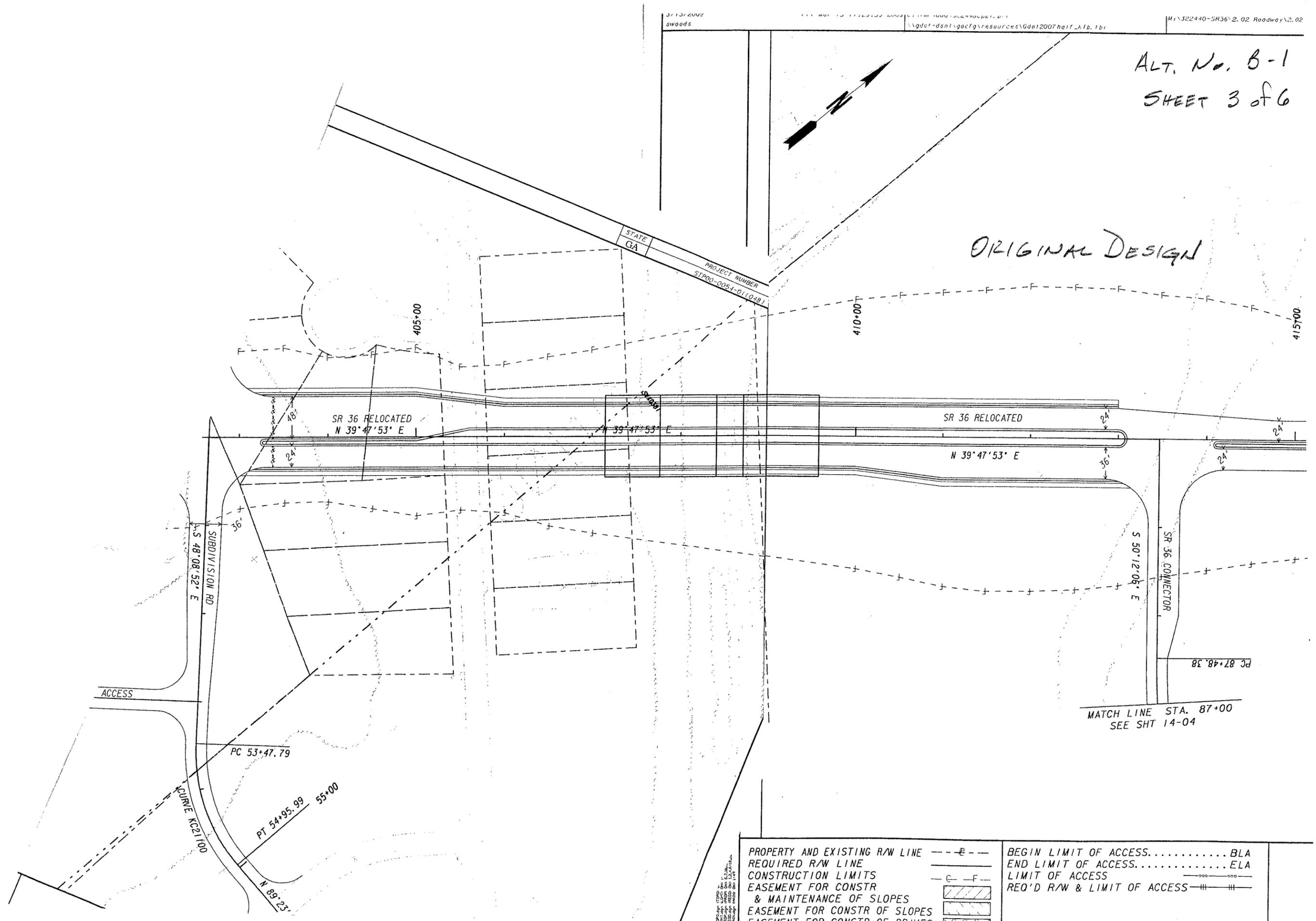
ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH



ALT. No. B-1
SHEET 3 of 6



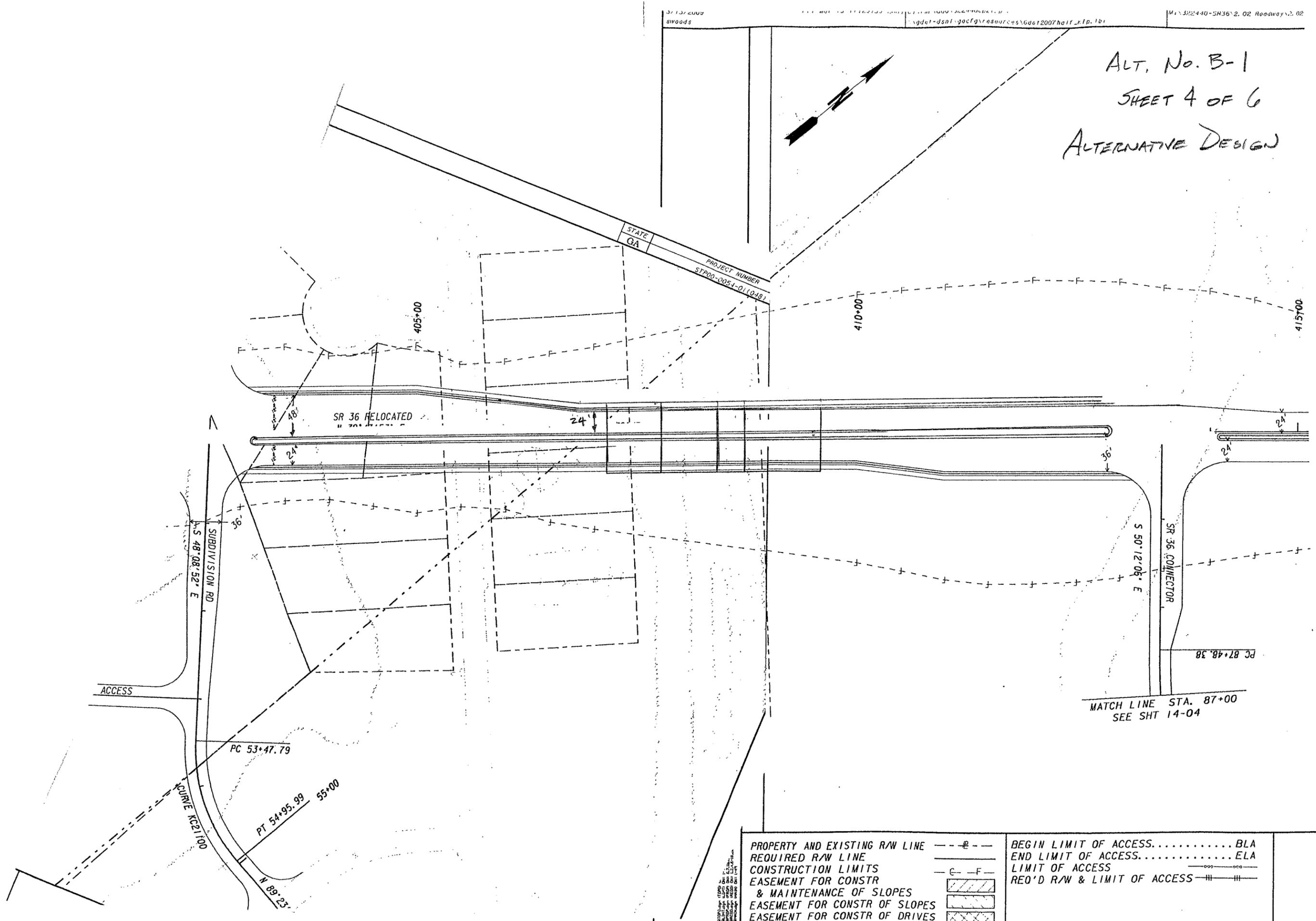
ORIGINAL DESIGN



MATCH LINE STA. 87+00
SEE SHT 14-04

| | | |
|---|-----|-----|
| PROPERTY AND EXISTING R/W LINE | --- | BLA |
| REQUIRED R/W LINE | --- | ELA |
| CONSTRUCTION LIMITS | --- | --- |
| EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES | ▨ | --- |
| EASEMENT FOR CONSTR OF SLOPES | ▩ | --- |
| EASEMENT FOR CONSTR OF DRIVES | ▧ | --- |
| BEGIN LIMIT OF ACCESS..... | --- | BLA |
| END LIMIT OF ACCESS..... | --- | ELA |
| LIMIT OF ACCESS | --- | --- |
| REQ'D R/W & LIMIT OF ACCESS | --- | --- |

ALT. No. B-1
 SHEET 4 OF 6
 ALTERNATIVE DESIGN



MATCH LINE STA. 87+00
 SEE SHT 14-04

| | | | |
|---|-----|-----------------------------|-----|
| PROPERTY AND EXISTING R/W LINE | --- | BEGIN LIMIT OF ACCESS..... | BLA |
| REQUIRED R/W LINE | --- | END LIMIT OF ACCESS..... | ELA |
| CONSTRUCTION LIMITS | --- | LIMIT OF ACCESS | --- |
| EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES | ▨ | REQ'D R/W & LIMIT OF ACCESS | --- |
| EASEMENT FOR CONSTR OF SLOPES | ▩ | | |
| EASEMENT FOR CONSTR OF DRIVES | ▧ | | |



SUBJECT: ALTERNATIVE No. B-1

JOB NO: CALCULATIONS

BY: _____ DATE: _____

CHKD: _____ DATE: _____

REDUCTION IN BRIDGE AREA:

ORIGINAL BRIDGE AREA = 25000 SF

ORIGINAL WIDTH = $2(7.2083 + 2 + 24) + 20 = 86'-5"$

$\therefore L = 290'$

REDUCED WIDTH = $2(7.2083 + 2 + 24) + 8 = 74'-5"$

\therefore AREA = $290(74.4167) = 21580$ SF

BRIDGE MEDIAN CONC REDUCTION $290(.5)(20-8)/27$
 $= 64.4$ CY

BORROW EXCAVATION REDUCTION (FROM 405+00 TO 413+00)

| STA. | FILL HT | Vol = $H \times L \times 12/27$ |
|--------|---------|---------------------------------|
| 405+00 | 10' | 667 X .5 = 333 |
| 406+00 | 20' 15' | |
| 406+85 | 26' 23' | 869 |

BRIDGE

| | | | |
|--------|-----|------|------------------|
| 409+75 | 49' | 50.5 | 561 |
| 410+00 | 52' | 53.5 | 2377 |
| 411+00 | 55' | 57.0 | 2533 |
| 412+00 | 59' | 59.0 | 2622 X .5 = 1311 |
| 413+00 | 59' | | |

TOTAL = 7984 CY X 1.2 = 9581

ROADWAY MEDIAN = $(800 - 290)(12)/9 = 680$ SY

NOTE: USE \$95/SF FOR BRIDGE COST
 PER BRIDGE POLICY MANUAL

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

B-2

DESCRIPTION: **USE MECHANICALLY STABILIZED EARTH WALLS IN LIEU OF END SPANS FOR THE RAILROAD BRIDGE**

SHEET NO.: 1 of 5

ORIGINAL DESIGN: (sketch attached)

The original design calls for spill-through abutments for 2:1 end slopes for the end spans of the bridge over the railroad.

ALTERNATIVE: (sketch attached)

Use mechanically stabilized earth (MSE) walls in lieu of the end spans for the bridge.

ADVANTAGES:

- Reduces bridge cost
- Shorter bridge construction time
- Requires no intermediate bents

DISADVANTAGES:

- Maintenance of bridge/wall interface

DISCUSSION:

Omitting the end spans of the bridge and constructing a single span bridge will result in simpler, quicker, and less costly bridge construction. Also, because there will be no intermediate bents, there will be fewer potential maintenance problems with the bridge. The walls will be built parallel to the railroad, and will taper down to existing ground beginning at the edges of the bridge. Because the railroad has a slight curve to the west of the bridge, there will be a very slight reduction in sight distance, but it is negligible.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 1,141,847 | — | \$ 1,141,847 |
| ALTERNATIVE | \$ 662,133 | — | \$ 662,133 |
| SAVINGS | \$ 479,714 | — | \$ 479,714 |

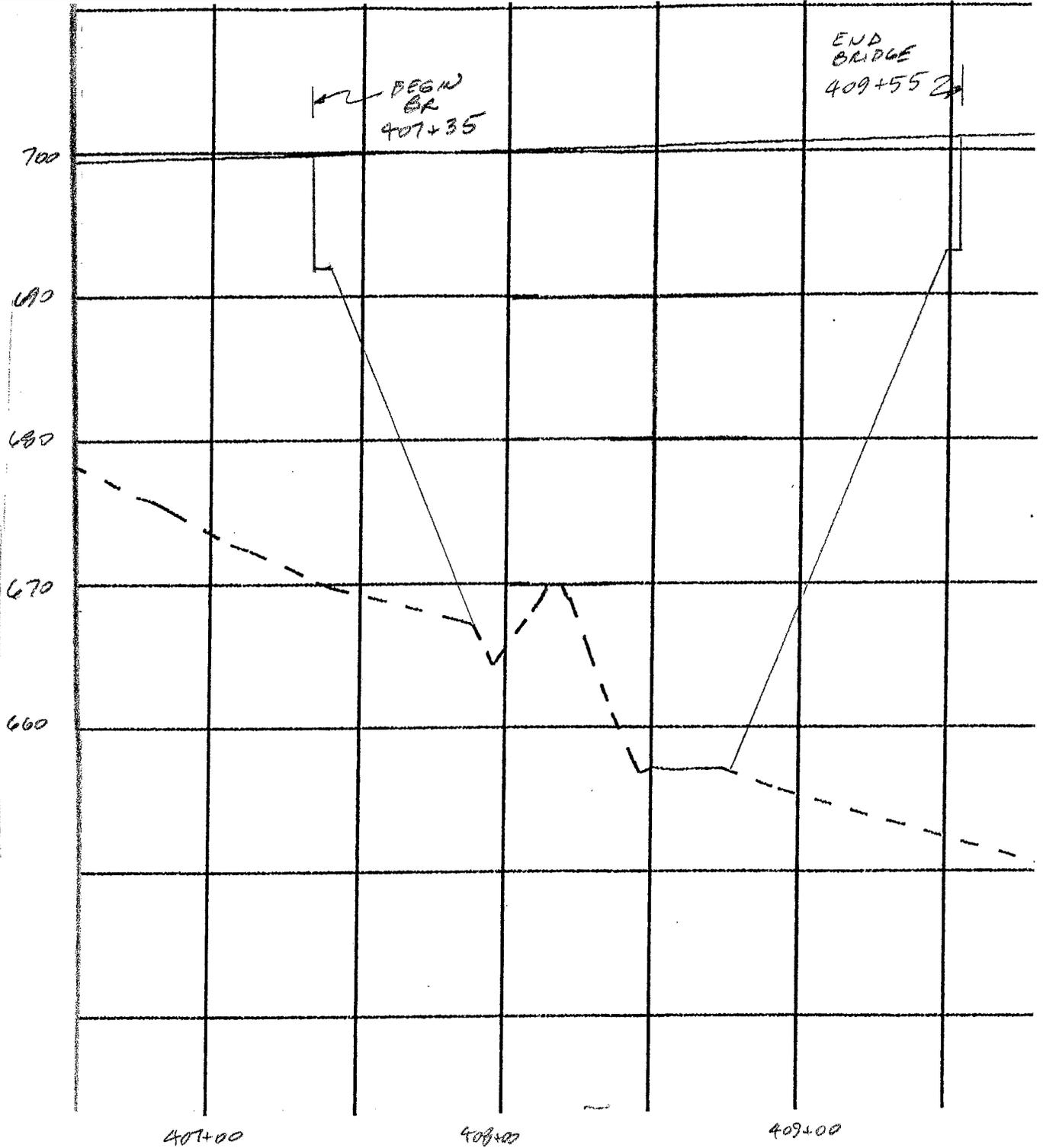
SKETCH

PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:
B-2

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: 2 of 5



SKETCH



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

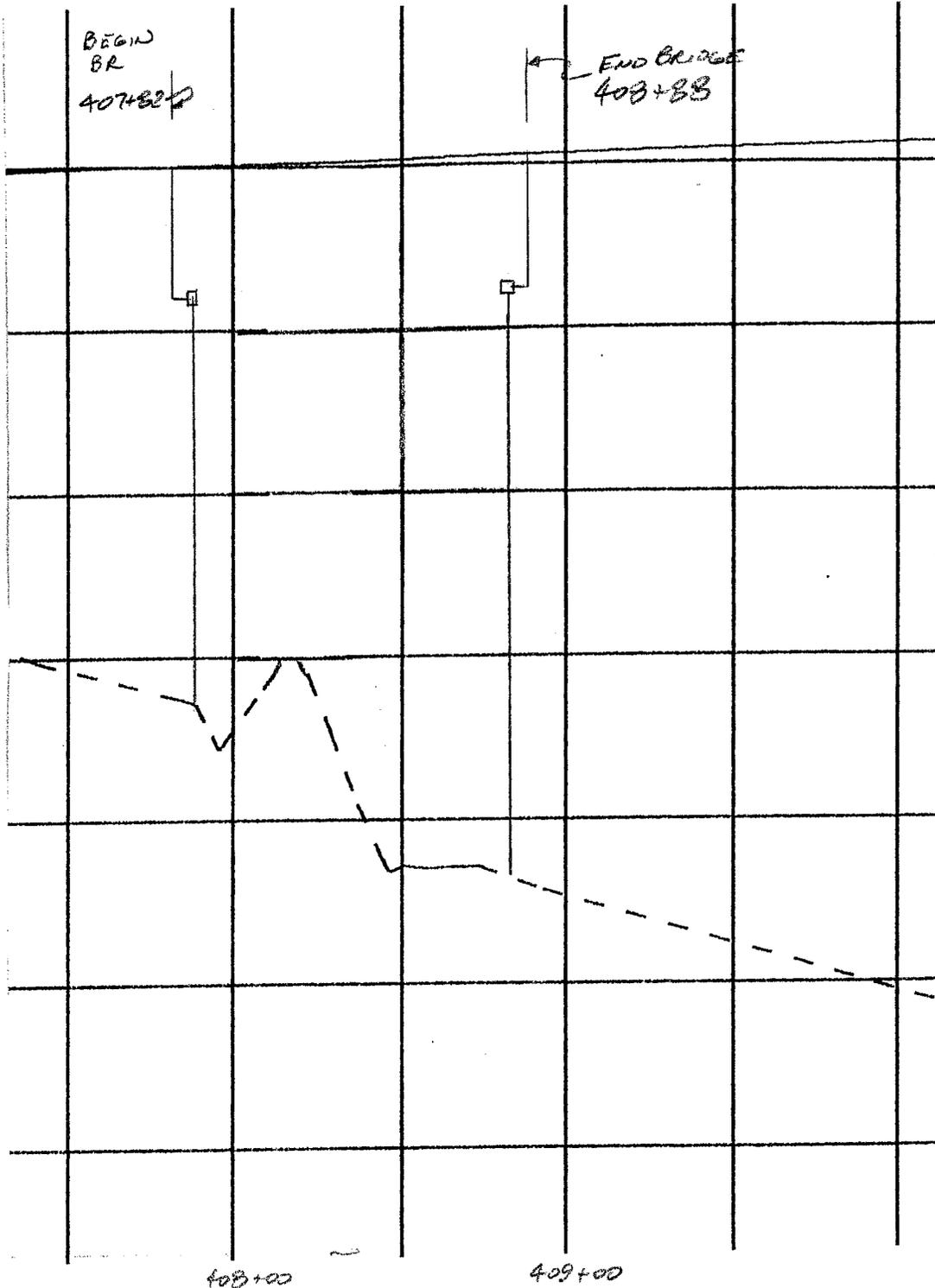
B-2

ORIGINAL DESIGN

ALTERNATIVE DESIGN

BOTH

SHEET NO.: 3 of 5





| | |
|----------|---------------------|
| SUBJECT: | ALTERNATIVE No. B-2 |
| | SHEET OF |
| JOB NO: | CALCULATIONS |

| | |
|-------|-------|
| BY: | DATE: |
| CHKD: | DATE: |

ORIGINAL DESIGN BRIDGE LENGTH = 40955 - 40735
= 220'

WIDTH = 86'-5"

AREA = 19012 SF

ALTERNATIVE DESIGN BRIDGE LENGTH = 40888 - 40782
= 106'

AREA = 9160

Δ = 9952 SF

AT BENT 1, WALK H = 28'

$$L = 86.42 + 2(28)(2) = 198.42 \rightarrow 200'$$

$$AREA = 86.42(28) + 14(113.58) = 4010 SF$$

AT BENT 2, WALK H = 39'

$$L = 86.42 + 2(39)(2) = 242.42 \rightarrow 245'$$

$$AREA = 86.42(39) + 19.5(158.58) = 6463$$

TOTAL WALK AREA = 10473

$$COPING L = 200 + 245 = 445$$

ADDITIONAL MSE BACKFILL:

$$BT 1 \quad L = 26 + 1 - 6 = 21$$

$$BT 2 \quad L = 34 + 1 - 6 = 29'$$

$$VOL. = (21 + 29)(86.83)(8.83)/27 = 1153 CY$$

EMBANKMENT IS APPROXIMATELY EQUAL

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

B-4

DESCRIPTION: **USE ONLY ONE SOUTHBOUND LANE OVER THE RAILROAD BRIDGE**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (sketch attached)

The original design provides two, 12-ft-wide lanes in each direction on new SR 36 from the New Connector Road intersection to the intersection with Cindy Street.

ALTERNATIVE: (sketch attached)

Provide only one 12-ft-wide lane in the southbound direction.

ADVANTAGES:

- Reduces bridge cost
- Reduces bridge construction time

DISADVANTAGES:

- Less room for traffic

DISCUSSION:

Since southbound traffic is metered by the traffic signal at the SR 36/New Connector Road intersection, either traffic from the connector road or traffic from SR 36 will be on the southbound side of the bridge, but not both at the same time. Just south of the bridge, the southbound lane can be expanded to provide two through lanes and a left and right turn lane at the Cindy Street relocation intersection.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 531,810 | — | \$ 531,810 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS | \$ 531,810 | — | \$ 531,810 |

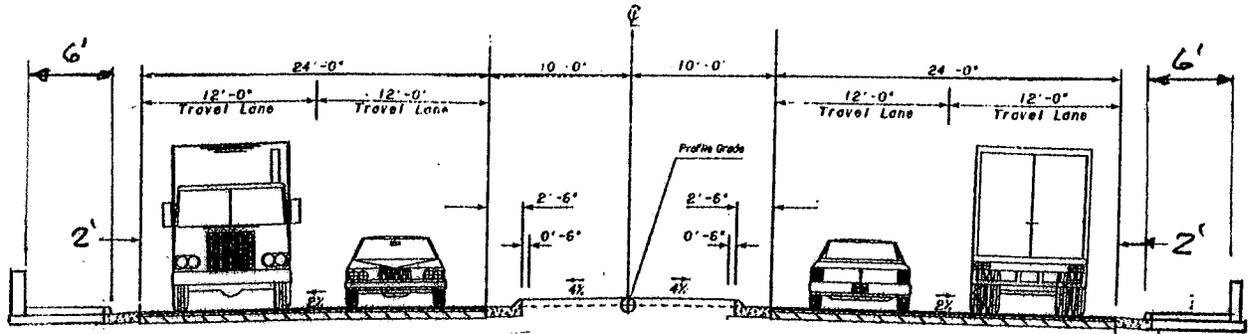
PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

B-4

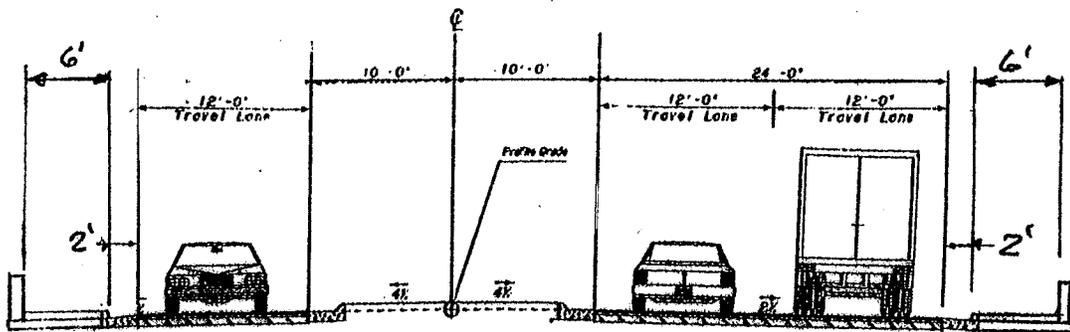
ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: *2 of 5*

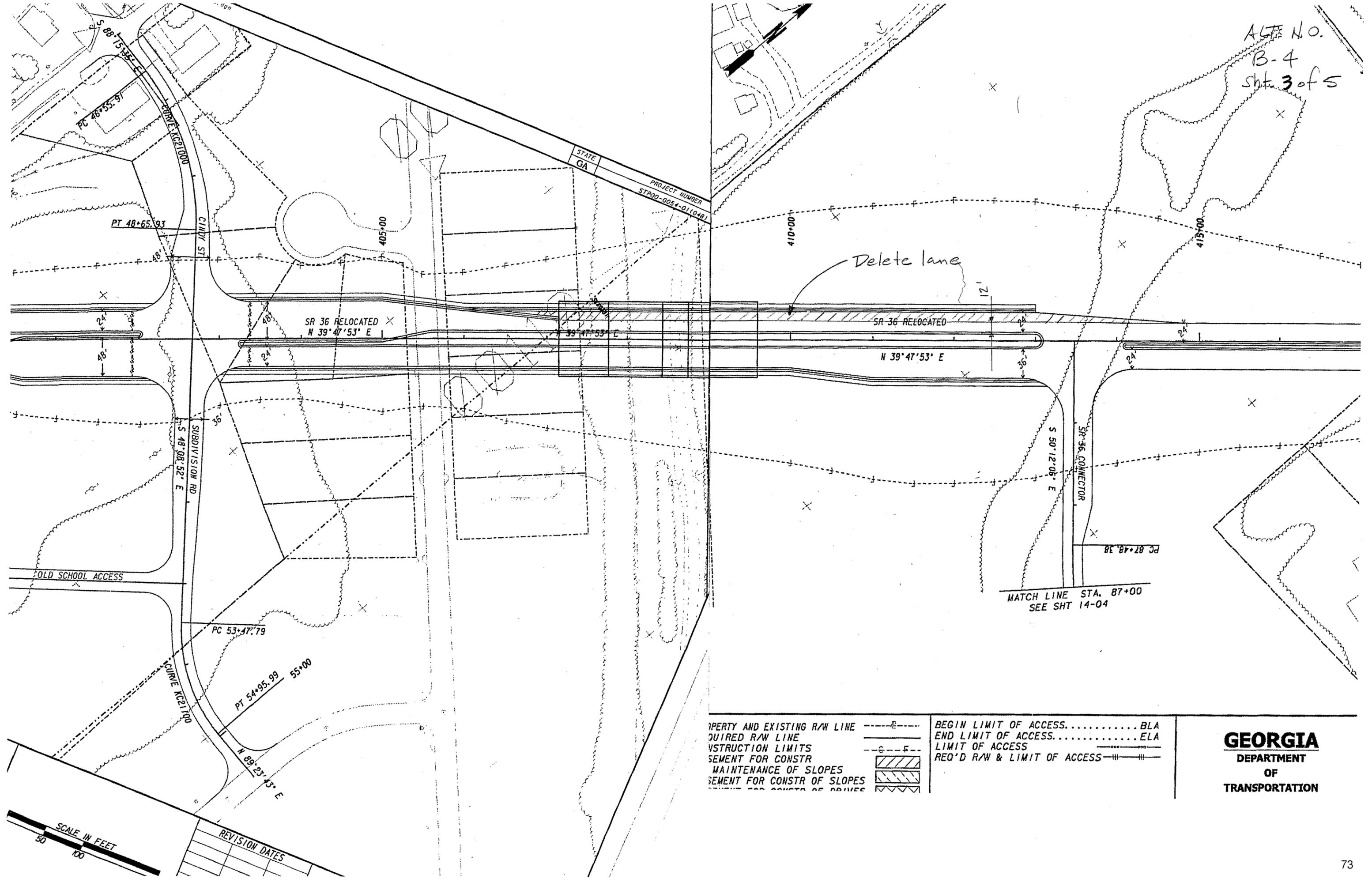


TYPICAL SECTION 4
 SR 36 TWO WAY SECTION

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH



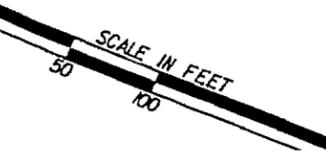
ALTS No.
B-4
Sht. 3 of 5



PROPERTY AND EXISTING R/W LINE
 REQUIRED R/W LINE
 CONSTRUCTION LIMITS
 CEMENT FOR CONSTR
 MAINTENANCE OF SLOPES
 CEMENT FOR CONSTR OF SLOPES
 CEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
 END LIMIT OF ACCESS.....ELA
 LIMIT OF ACCESS
 REQ'D R/W & LIMIT OF ACCESS

GEORGIA
 DEPARTMENT
 OF
 TRANSPORTATION



| NO. | DATE | REVISION |
|-----|------|----------|
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SUBJECT: ALTERNATIVE No. B-4

JOB NO: CALCULATIONS

BY: _____ DATE: _____

CHKD: _____ DATE: _____

PAGE

SHEET
4/5

ORIGINAL BRIDGE AREA = 25,000 SF

WIDTH = 86'-5"

∴ L = 290'

REDUCTION IN AREA = 12(290) = 3480 SF

EMBANKMENT REDUCTION FROM 409+75 TO 413+50

| STATION | Fill Ht | Avg. | Vol = 12HL/27 |
|---------|---------|------|---------------|
| 409+75 | 49' | | |
| | | 50.5 | 561 |
| 410+00 | 52' | | |
| | | 53.5 | 2378 |
| 411+00 | 55' | | |
| | | 57.0 | 2533 |
| 412+00 | 59' | | |
| | | 59.0 | 2622 |
| 413+00 | 59' | | |
| | | 58.0 | 1289 |
| 413+50 | 57' | | |

$\Sigma = 8373 \times 1.2 = 10048 \text{ CY}$

Pavement Reduction

$342 \times 12 = 4104 \text{ sf}$
 $\frac{1}{2} 180 \times 12 = 1080$
 $\frac{1}{2} 100 \times 12 = 600$

 $5,784 \text{ sf} \div 9 = 643 \text{ cy}$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

B-5

DESCRIPTION: **RAISE CHARLIE SHEPHERD ROAD UNDER THE
 RAILROAD BRIDGE AND SHORTEN THE BRIDGE**

SHEET NO.: 1 of 5

ORIGINAL DESIGN: (sketch attached)

Charlie Shepherd Road is approximately 13 ft below the top of rail elevation of the railroad and controls the location of the north end of the bridge.

ALTERNATIVE: (sketch attached)

Raise Charlie Shepherd Road to approximately the railroad elevation and shorten the bridge.

ADVANTAGES:

- Reduces the length and cost of the bridge

DISADVANTAGES:

- Requires additional construction along Charlie Shepherd Road
- Will require a temporary detour to provide access to the sewage treatment plant

DISCUSSION:

The railroad is on a fill through the project area. Charlie Shepherd Road is parallel to the railroad at the original ground elevation. The toe of the bridge slope will be at approximately at the elevation of the road. If the road is raised to approximately the railroad elevation, the toe of the slope will be higher and the bridge can be shorter. In order to raise the grade on the road, there will have to be a temporary location for access to the sewage treatment plant since the road provides the only access.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 330,547 | — | \$ 330,547 |
| ALTERNATIVE | \$ 58,700 | — | \$ 58,700 |
| SAVINGS | \$ 271,847 | — | \$ 271,847 |

PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

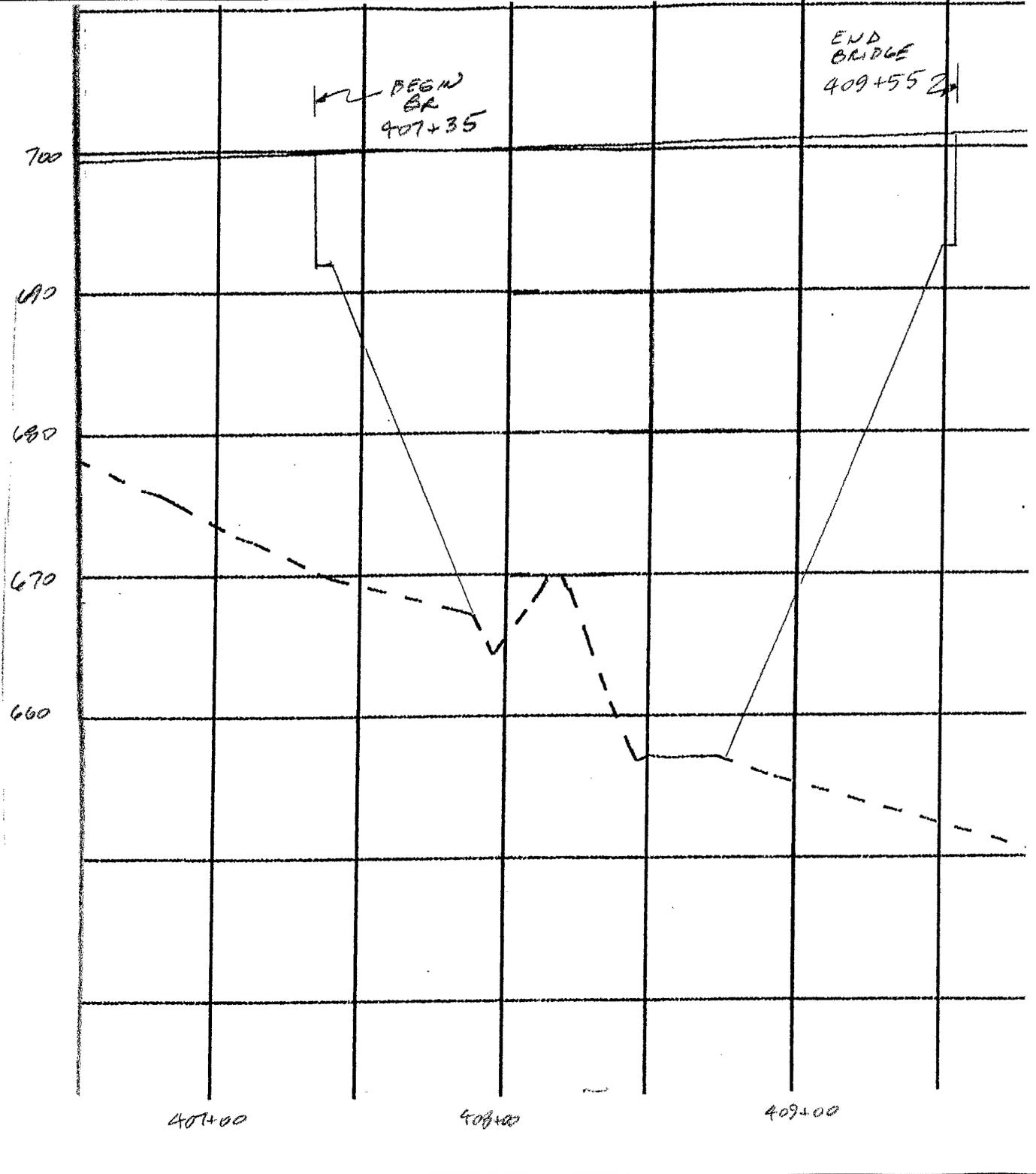
B-5

ORIGINAL DESIGN

ALTERNATIVE DESIGN

BOTH

SHEET NO.: **2 of 5**





| | |
|----------|---------------------|
| SUBJECT: | ALTERNATIVE No. B-5 |
| JOB NO: | CALCULATIONS |

| | |
|-------|-------|
| BY: | DATE: |
| CHKD: | DATE: |

ORIGINAL BRIDGE END STATION IS 409+55

ALTERNATIVE BRIDGE END STATION IS 409+22

BRIDGE WIDTH IS 86'-5"

$$\text{BRIDGE AREA REDUCTION} = 86.42(40955 - 40922) = 2852 \text{ SF}$$

USE 8% GRADE TO RAISE CHARLIE SHEPHERD RD

$$\text{RUN OUT LENGTH} = 13 / 0.08 = 162.5$$

↑ AMOUNT ROAD IS RAISED
↓ FILL WIDTH

$$\text{VOLUME} = \left[\overset{\text{BRIDGE WIDTH ?}}{86}(13)(50) + 13(162.5)(50) \right] / 27 = 5982 \text{ CY} \times 1.2 = 7179 \text{ CY}$$

AGGREGATE SURFACE COURSE: USE 145#/CF

$$\text{VOLUME} = (86 + 2 \times 162.5)(16')(6/12) = 3288 \text{ CF}$$

$$\text{WT} = 3288(145) / 2000 = 238 \text{ TN}$$

VALUE ENGINEERING ALTERNATIVE



| | |
|---|--------------------------------|
| PROJECT: SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD <i>Butts County, Georgia</i> | ALTERNATIVE NO.: P-3 |
| DESCRIPTION: REDUCE PAVED SHOULDER WIDTH FROM 6½ FT TO 4 FT | SHEET NO.: 1 of 4 |

ORIGINAL DESIGN: (sketch attached)

The current design has a 6½ ft paved shoulder on the rural typical section.

ALTERNATIVE: (sketch attached)

Reduce the rural paved shoulder to 4 ft wide.

ADVANTAGES:

- Less construction cost

DISADVANTAGES:

- Narrower paved shoulder for emergencies

DISCUSSION:

Most of this project is being designed for speeds of 35 mph or 45 mph, which is not a high speed facility. Since there will still be a 10 ft graded shoulder, a 4 ft paved shoulder would be adequate for the function of this type of roadway.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 300,852 | — | \$ 300,852 |
| ALTERNATIVE | \$ 185,164 | — | \$ 185,164 |
| SAVINGS (Original minus Alternative) | \$ 115,688 | — | \$ 115,688 |

PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

P-3

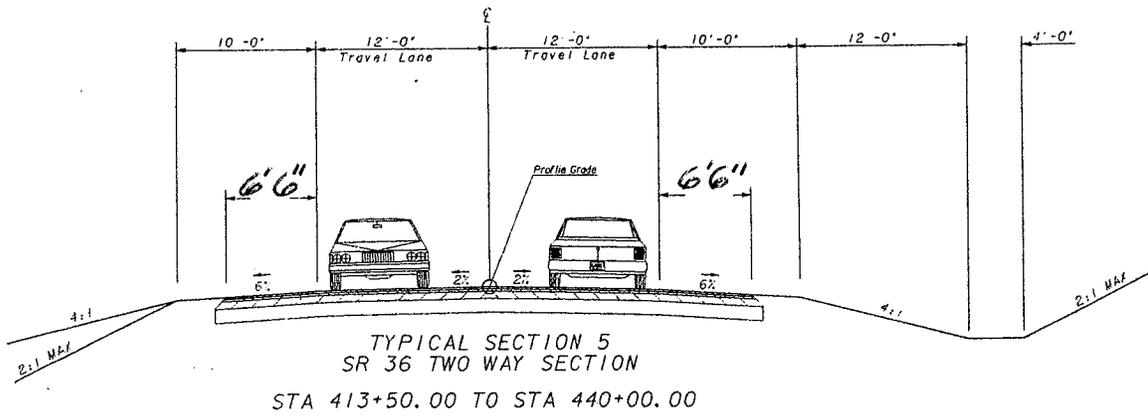
ORIGINAL DESIGN

ALTERNATIVE DESIGN

BOTH

SHEET NO.:

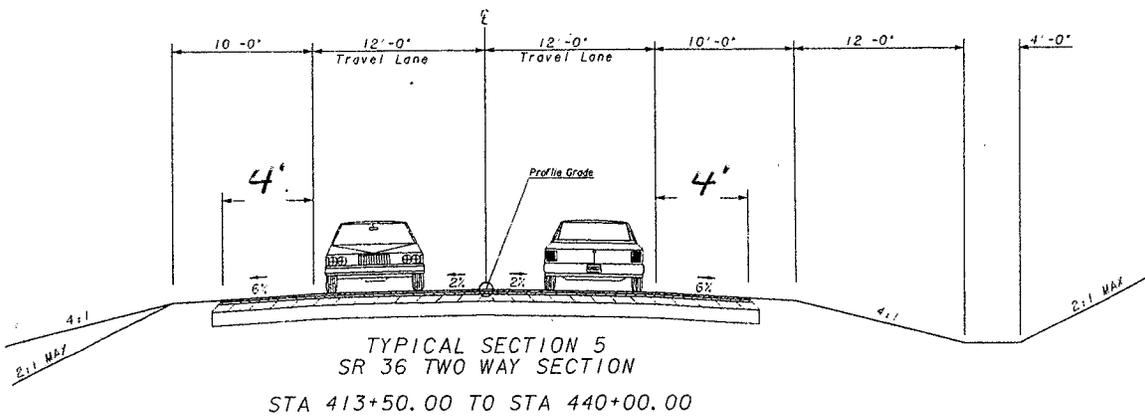
2 of 4



ORIGINAL DESIGN

ALTERNATIVE DESIGN

BOTH



CALCULATIONS



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

P-3

SHEET NO.: 3 of 4

$$6'6'' \text{ Shldrs } \underline{\text{Original Design}} (413+50 \rightarrow 440+00)$$

$$\frac{2 \times 6.5' \times 2,650'}{9 \text{ sf/sy}} = 3,828 \text{ s.y.}$$

Alt. Design: (413+50 → 440+00)

$$\frac{2 \times 4' \times 2,650}{9 \text{ sf/sy}} = 2,356 \text{ s.y.}$$

$$1\frac{1}{2}'' (12.5 \text{ mm Mix}): 1.5'' \times \frac{110 \text{ lb}}{34 \text{ in}} \times \frac{T}{2000 \text{ lb}} \times \$ \frac{85}{T} = \$ 7.02$$

$$2'' (19 \text{ mm Mix}): 2'' \times \frac{110 \text{ lb}}{34 \text{ in}} \times \frac{T}{2000 \text{ lb}} \times \$ \frac{85}{T} = \$ 9.35$$

$$6'' (25 \text{ mm Mix}): 6'' \times \frac{110 \text{ lb}}{34 \text{ in}} \times \frac{T}{2000 \text{ lb}} \times \$ \frac{85}{T} = \$ 28.05$$

$$10'' \text{ GAB} = \underline{\underline{= \$ 20.00}}$$

$$\text{Total Full Depth} = \$ \frac{64.42}{\text{sy}}$$

$$\text{OR use } \frac{\$ 64.42}{\text{sy}} / 9 \text{ sf/sy} = \$ 7.16/\text{sf}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

P-4

DESCRIPTION: **RELOCATE “MERGE” TO THE NORTH BY FLATTENING
 THE HORIZONTAL CURVES**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (sketch attached)

The current design uses reverse curves to merge the northbound SR 36 traffic with the southbound SR 36 traffic.

ALTERNATIVE: (sketch attached)

Realign the horizontal alignment to use flatter reverse curves (larger radii) to merge the northbound SR 36 traffic with the southbound SR 36 traffic.

ADVANTAGES:

- Slightly less construction cost
- “Flatter” (larger radii) horizontal reverse curves
- Less super elevation required

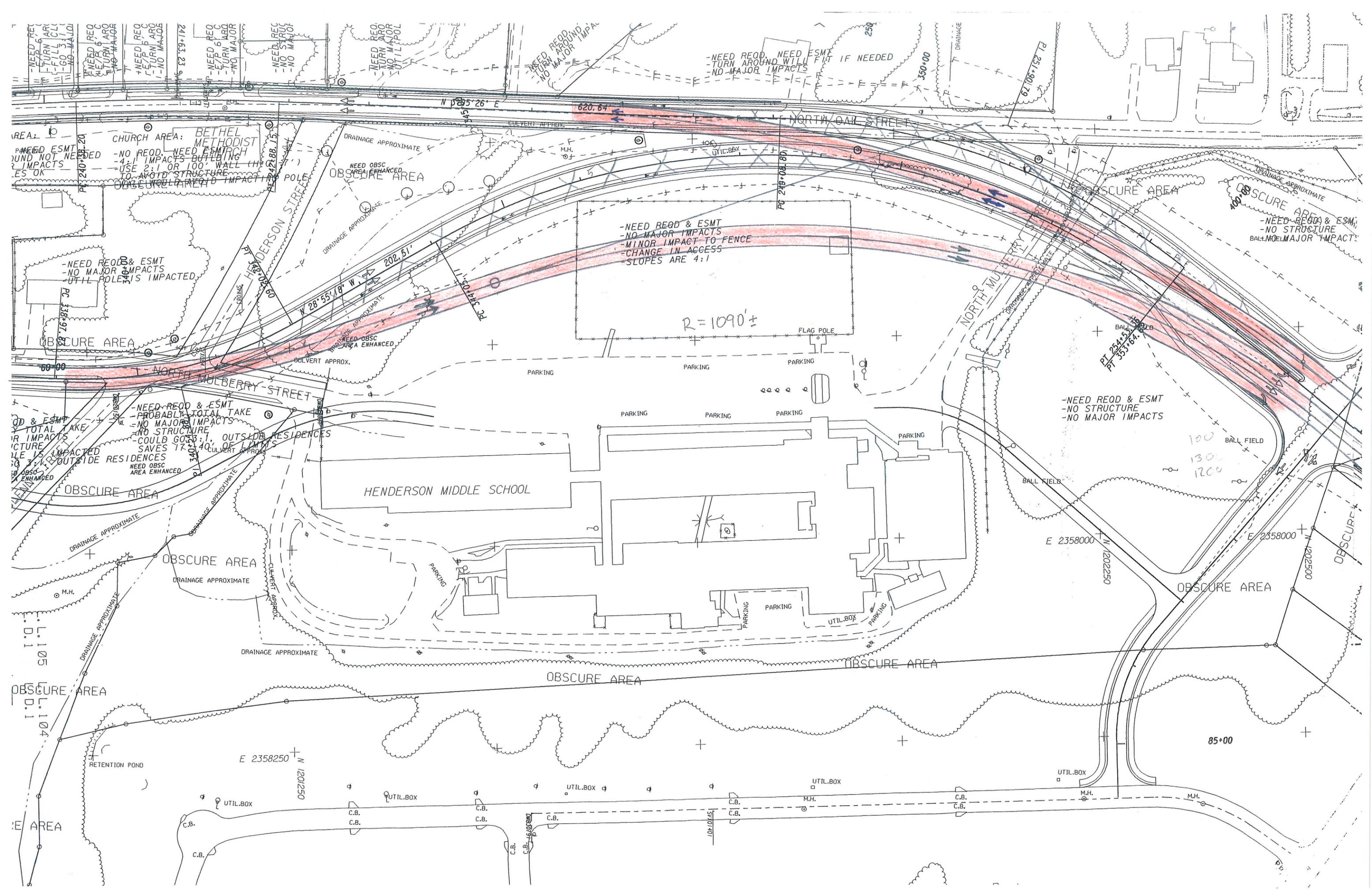
DISADVANTAGES:

- Impacts old playground

DISCUSSION:

The alternate design proposes to flatten the horizontal curves (reverse curves) at the north merge of SR 36. This would require less super elevation and slightly more tangent distance to transition the reverse super elevation. This realignment would have a slightly shorter roadway length of approximately 150 ft.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 58,209 | — | \$ 58,209 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS (Original minus Alternative) | \$ 58,209 | — | \$ 58,209 |



NEED REQ
TURN AROUND
NO MAJOR IMPACTS

CHURCH AREA: BETHEL METHODIST
NEED REQ
TURN AROUND
NO MAJOR IMPACTS

NEED REQ & ESMT
NO MAJOR IMPACTS
UTIL POLES IMPACTED

NEED REQ & ESMT
NO MAJOR IMPACTS
MINOR IMPACT TO FENCE
CHANGE IN ACCESS
SLOPES ARE 4:1

NEED REQ & ESMT
NO STRUCTURE
NO MAJOR IMPACTS

NEED REQ & ESMT
PROBABLY TOTAL TAKE
NO MAJOR IMPACTS
NO STRUCTURE
COULD GO 3:1 OF LIMITS
SAVES 77,140
OUTSIDE RESIDENCES
NEED OBSC
AREA ENHANCED

RETENTION POND
UTIL. BOX
C.B.
M.H.

OBSCURE AREA

Calculations



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

P-4

ORIGINAL DESIGN

ALTERNATIVE DESIGN

BOTH

SHEET NO.:

3 of 4

Short Roadway Length = 150'
(100' NB & 50' SB)

$$\frac{150' \times 24'}{9 \text{ sf/sy}} = 400 \text{ s.y. (Pavement Area)}$$

$$\frac{150' \times 5' \times 2}{9 \text{ sf/sy}} = 168 \text{ s.y. (Sidewalks Save)}$$

$$(150' \times 2') = 300 \text{ L.F. (Curb & Gutter)}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

P-8

DESCRIPTION: **DELETE SR 36 RIGHT-TURN LANE AT HANCOCK STREET AND USE A COMBINED THROUGH AND RIGHT TURN LANE FOR RIGHT TURN MOVEMENT**

SHEET NO.: 1 of 4

ORIGINAL DESIGN:

The current design has a separate right turn/deceleration lane on southbound SR 36 at Hancock Street.

ALTERNATIVE: (sketch attached)

Eliminate the right turn/deceleration lane and use a combination through and right turn lane on southbound SR 36 as the right turn onto Hancock Street.

ADVANTAGES:

- Less construction cost
- Eliminates a merge on SR 36 in a short distance

DISADVANTAGES:

- None apparent

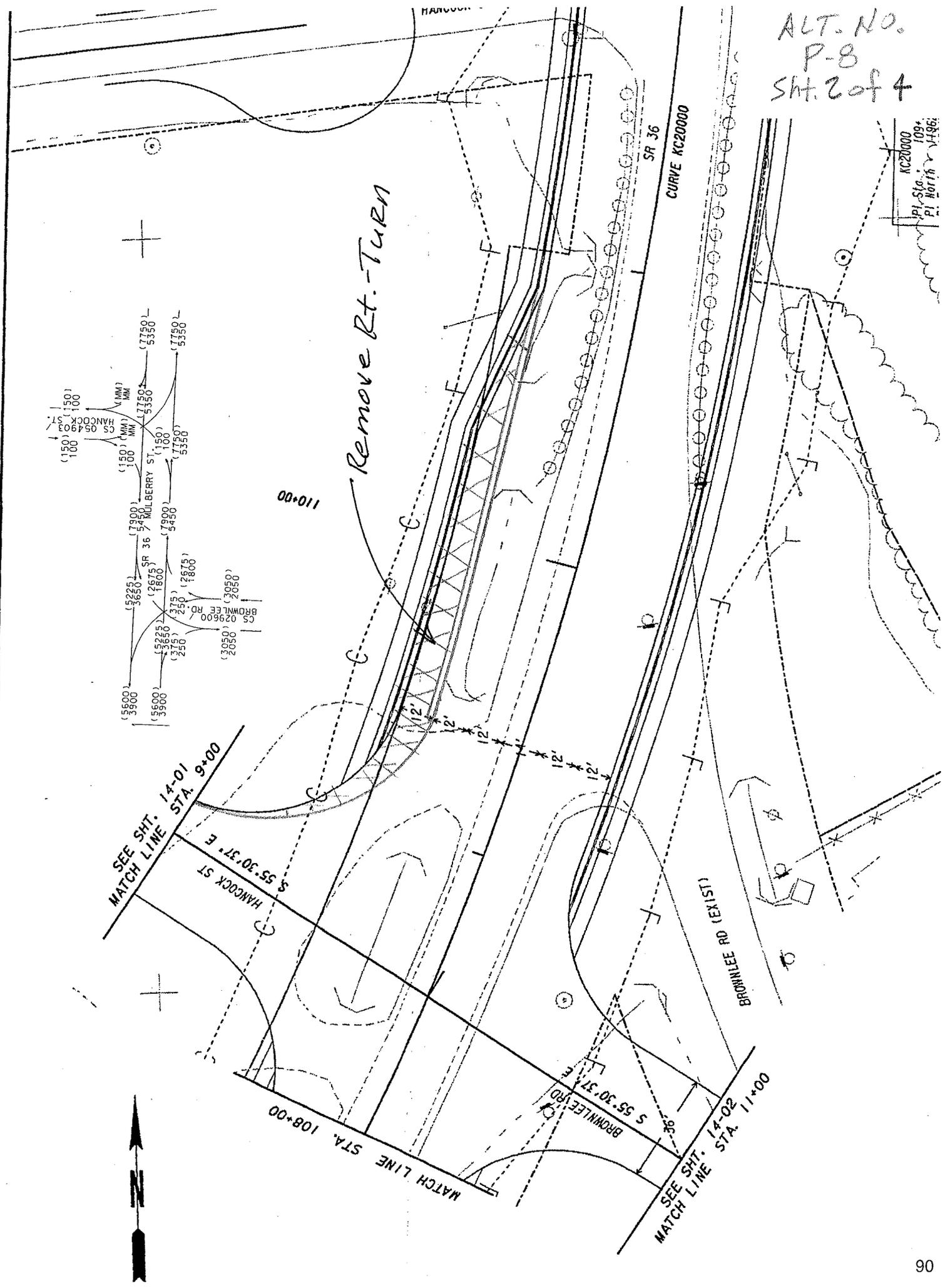
DISCUSSION:

SR 36 drops from two through lanes to one lane after going through the Hancock Street intersection. The alternate design would use a through/right turn lane on SR 36 for the right turn movement thus eliminating the need for a separate deceleration/right turn lane. The through traffic volume on SR 36 is heavy enough that this lane should allow through traffic; however, the right turn numbers are very low (traffic use minor movement).

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 19,678 | — | \$ 19,678 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS (Original minus Alternative) | \$ 19,678 | — | \$ 19,678 |

ALT. NO.
P-8
Sht. 2 of 4

KC20000
PI Sta. 109+
PI North 1496;



CALCULATIONS



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

P-8

SHEET NO.:

3 of 4

Remove Rt. Turn-Lane at Hancock
Pavement Area Saved:

$$\frac{[(100' + \frac{50'}{2}) \times 12'] + (\frac{12'}{2} \times 80')}{9 \text{ sf/sy}} = 220 \text{ sy.}$$

$$\text{R/W AREA} = 1,500 \text{ sf (saved)} = 0.0344 \text{ AC}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

P-9

DESCRIPTION: **USE 11-FT-WIDE LANES FROM THE MERGE TO THE SR 36 NEW CONNECTOR ROAD**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (sketch attached)

The current design proposes 12-ft-wide lanes on SR 36 from the merge (north end) to the end of the project.

ALTERNATIVE: (sketch attached)

Use 11-ft-wide lanes on SR 36 from the merge (north end) to the intersection of SR 36 and the New Connector Road.

ADVANTAGES:

- Less construction cost
- Less borrow required

DISADVANTAGES:

- Narrower lanes

DISCUSSION:

The current design proposes 11-ft-wide lanes through the City of Jackson. The alternate design would extend the 11-ft-wide lanes to the SR 36 connector at Sta. 413+50 to save pavement and borrow costs.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 210,199 | — | \$ 210,199 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS (Original minus Alternative) | \$ 210,199 | — | \$ 210,199 |

PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

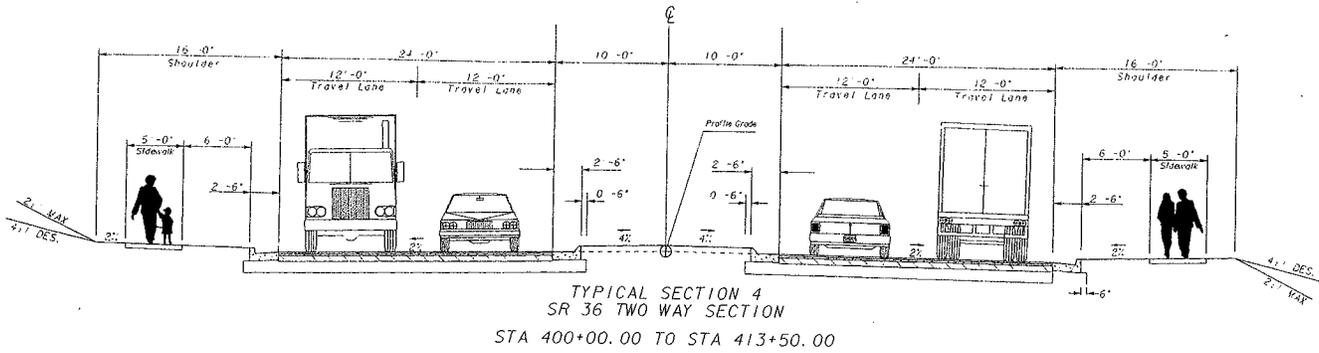
P-9

ORIGINAL DESIGN

ALTERNATIVE DESIGN

BOTH

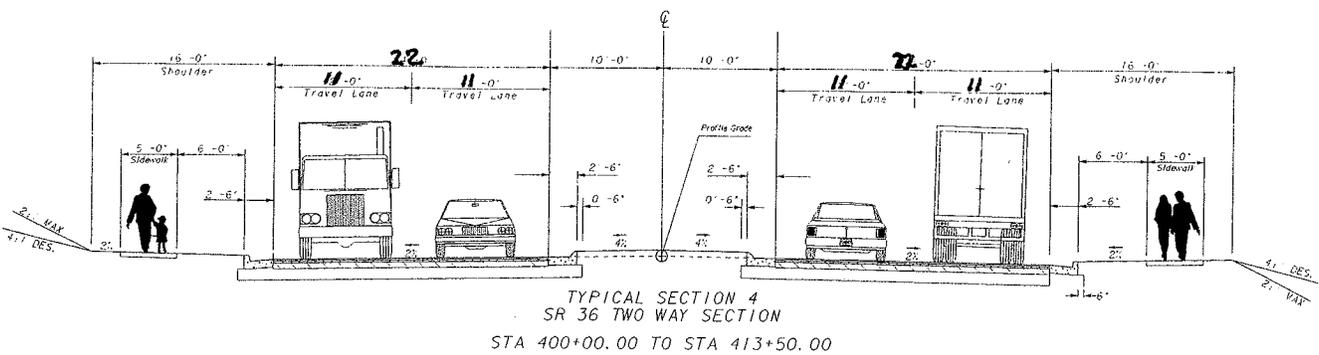
SHEET NO.: 2 of 4



ORIGINAL DESIGN

ALTERNATIVE DESIGN

BOTH



(11' Lanes)

CALCULATIONS



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

P-9

SHEET NO.:

3 of 4

Reduction in Bridge Area Saved:
 $L = 290'$ $4 \text{ Lanes} \times 1' = 4'$

$$290' \times 4' = 1,160 \text{ sf}$$

Reduction in Roadway Pavement Area:

$$1,060' \times 4' = 4,240 \text{ sf}$$

$$\frac{4,240 \text{ sf}}{9 \text{ sf/sy}} = 471 \text{ sy}$$

$$1,350 - 290' = 1,060'$$

(STA 400+00 → 413+50)

Earthwork: (Saved Borrow)

$$\frac{50' \times 425' \times 4'}{27 \text{ cf/cy}} = 3,150 \text{ c.y.}$$

$$\frac{425' \times 4' \times 20'}{27 \text{ cf/cy}} = 1,260 \text{ c.y.}$$

$$\frac{4,410 \text{ c.y. (Borrow Saved)}}{\times 1.2} = 5,292 \text{ c.y.} \leftarrow$$



SUMMARY OF POTENTIAL COST SAVINGS

| PROJECT: SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD | | PRESENT WORTH OF COST SAVINGS | | | | |
|--|---|-------------------------------|------------------|----------------------|------------------------|----------------------|
| Butts County, Georgia | | ORIGINAL COST | ALTERNATIVE COST | INITIAL COST SAVINGS | RECURRING COST SAVINGS | TOTAL PW LCC SAVINGS |
| ALT. NO. | DESCRIPTION | | | | | |
| SIDEWALKS | | | | | | |
| S-1 | Delete the sidewalks north of the merge | \$276,533 | \$0 | \$276,533 | | \$276,533 |
| S-2 | Delete the sidewalks and curb and gutter north of the merge and use rural shoulders | \$339,000 | \$85,116 | \$253,884 | | \$253,884 |
| S-3 | Delete the inside sidewalk from Slaughter Avenue to the merge point except for the strip in front of the church | \$37,271 | \$0 | \$37,271 | | \$37,271 |
| CURB & GUTTER | | | | | | |
| CG-1 | Reduce the width of the curb and gutter section from 30 in to 24 in | \$738,400 | \$701,650 | \$36,750 | | \$36,750 |
| DRAINAGE | | | | | | |
| D-1 | Use HDPE pipe for longitudinal storm drain pipe and side drain pipe in lieu of concrete pipe | \$555,466 | \$375,028 | \$180,438 | | \$180,438 |
| GENERAL | | | | | | |
| G-2 | Construct a roundabout where Freeman Road intersects with the new SR 36 and connect old SR 36 to roundabout | | | | DESIGN SUGGESTION | |
| | | | | | | |
| | | | | | | |
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| | | | | | | |
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VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

S-1

DESCRIPTION: **DELETE THE SIDEWALKS NORTH OF THE MERGE**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (sketch attached)

Sidewalks are provided on both sides of the road from the merge point north to the intersection with the New Connector Road.

ALTERNATIVE: (sketch attached)

Delete the sidewalks. Reduce the bridge width to the travel way plus 8-ft-wide shoulders on each side for a total width of 87 ft 3 in.

ADVANTAGES:

- Saves costs
- Saves construction time
- Reduces width of bridge

DISADVANTAGES:

- None apparent

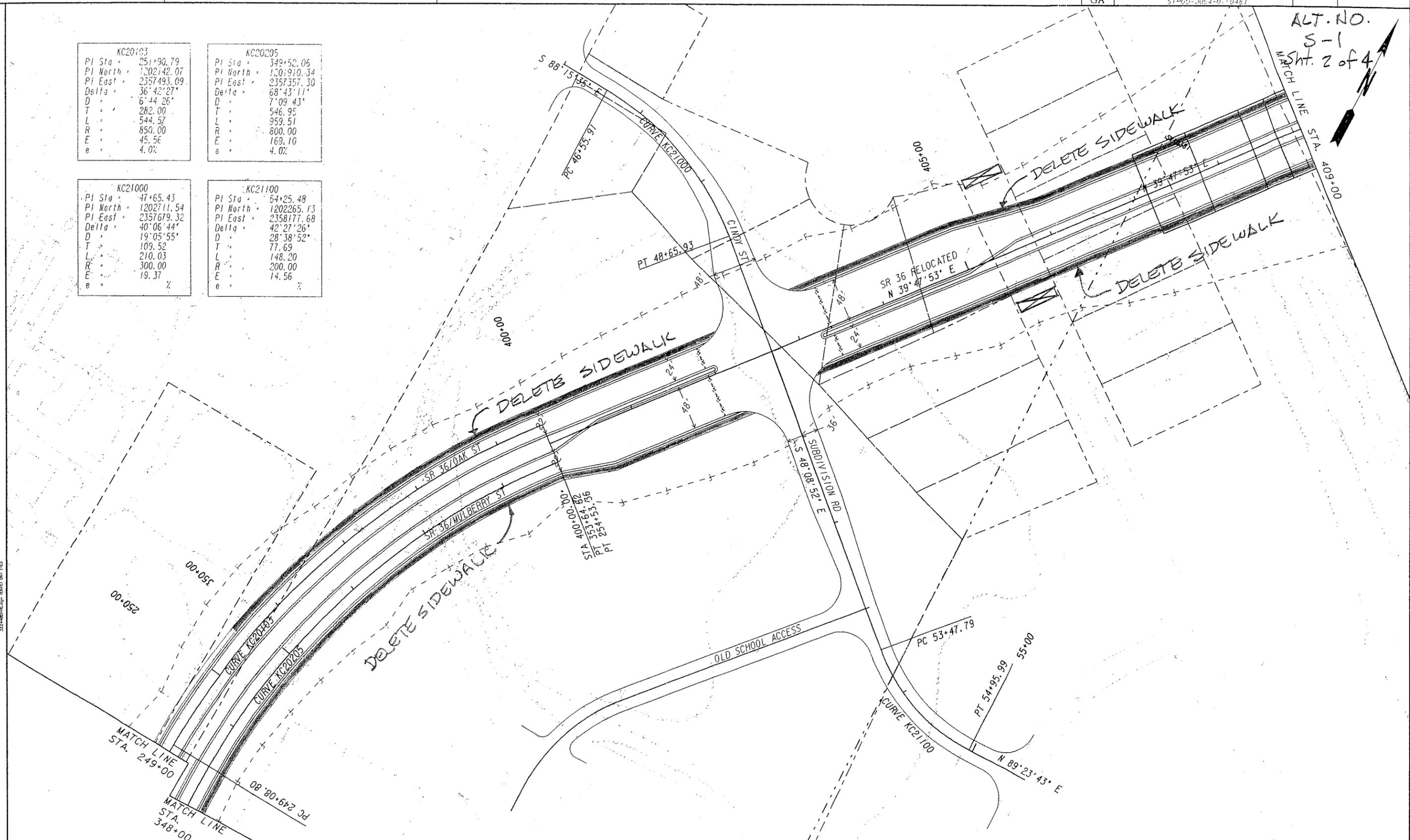
DISCUSSION:

There is no pedestrian access to the sidewalk along this stretch of road. There are no sidewalks on the new connector road or the extension of Cindy Street which will intersect with new SR 36. The land on both sides of SR 36 will probably not be developed because most of this section of new SR 36 is on a high embankment. Thus sidewalks are unnecessary and removing them saves project costs.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 276,533 | — | \$ 276,533 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS | \$ 276,533 | — | \$ 276,533 |

| | | | |
|--|--|---|--|
| KC20103 PI Sta: 251+90.79 PI North: 1202142.07 PI East: 2357493.09 Delta: 36°42'27" D: 6'44.26" T: 282.00 L: 544.57 R: 850.00 E: 45.56 e: 4.0% | | KC20205 PI Sta: 349+52.06 PI North: 1201910.34 PI East: 2357357.30 Delta: 68°43'11" D: 7'09.43" T: 546.95 L: 959.51 R: 800.00 E: 169.10 e: 4.0% | |
| KC21000 PI Sta: 47+65.43 PI North: 1202711.54 PI East: 2357679.32 Delta: 40°06'44" D: 19'05'55" T: 109.52 L: 210.03 R: 300.00 E: 19.37 e: % | | KC21100 PI Sta: 54+25.48 PI North: 1202265.13 PI East: 2358177.68 Delta: 42°27'26" D: 28'38'52" T: 77.69 L: 148.20 R: 200.00 E: 14.56 e: % | |

ALT. NO.
S-1
Sht. 2 of 4



| | |
|---|-----|
| PROPERTY AND EXISTING R/W LINE | --- |
| REQUIRED R/W LINE | --- |
| CONSTRUCTION LIMITS | --- |
| EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES | ▨ |
| EASEMENT FOR CONSTR OF SLOPES | ▩ |
| EASEMENT FOR CONSTR OF DRIVES | ▧ |

BEGIN LIMIT OF ACCESS.....BLA
 END LIMIT OF ACCESS.....ELA
 LIMIT OF ACCESS
 REQ'D R/W & LIMIT OF ACCESS

GEORGIA
DEPARTMENT
OF
TRANSPORTATION

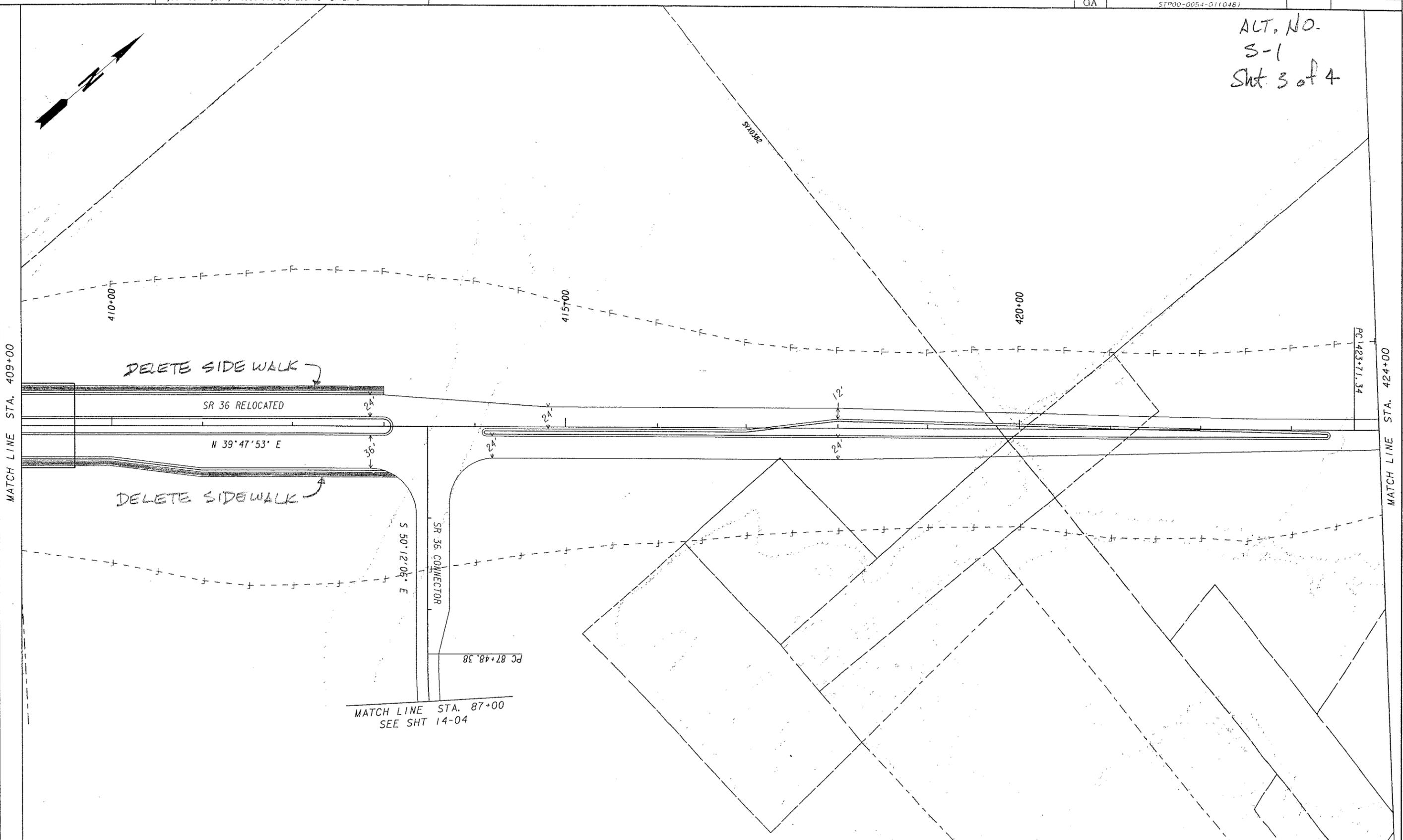


| REVISION DATES |
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STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: ROAD DESIGN
MAINLINE PLAN

SR 36

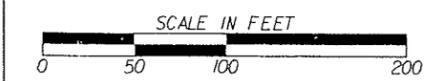
ALT. NO.
S-1
Sht 3 of 4



| | |
|---|-----------------------|
| PROPERTY AND EXISTING R/W LINE | --- |
| REQUIRED R/W LINE | --- |
| CONSTRUCTION LIMITS | --- |
| EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES | [Diagonal Hatching] |
| EASEMENT FOR CONSTR OF SLOPES | [Horizontal Hatching] |
| EASEMENT FOR CONSTR OF DRIVES | [Vertical Hatching] |

| | |
|-------------------------------|-------|
| BEGIN LIMIT OF ACCESS.....BLA | |
| END LIMIT OF ACCESS.....ELA | |
| LIMIT OF ACCESS | --- |
| REQ'D R/W & LIMIT OF ACCESS | == |

GEORGIA
DEPARTMENT
OF
TRANSPORTATION



| REVISION | DATE | DESCRIPTION |
|----------|------|-------------|
| | | |
| | | |
| | | |
| | | |

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: ROAD DESIGN
MAINLINE PLAN
SR 36

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

S-2

DESCRIPTION: **DELETE THE SIDEWALKS AND CURB AND GUTTER
 NORTH OF THE MERGE AND USE RURAL SHOULDERS**

SHEET NO.: 1 of 5

ORIGINAL DESIGN: (sketch attached)

From the merge point to the intersection of SR 36 with the New Connector Road sidewalks and curb and gutter are provided.

ALTERNATIVE: (sketch attached)

Delete the sidewalks from the merge point to Cindy Street and the sidewalks and curb and gutter from Cindy Street to the New Connector Road and use a rural shoulder section.

ADVANTAGES:

- Saves costs
- Saves construction time
- Reduces width of bridge and associated costs
- Deletes piped drainage between the new connector road and Cindy Street

DISADVANTAGES:

- The urban section starts at Cindy Street and not at the new connector road

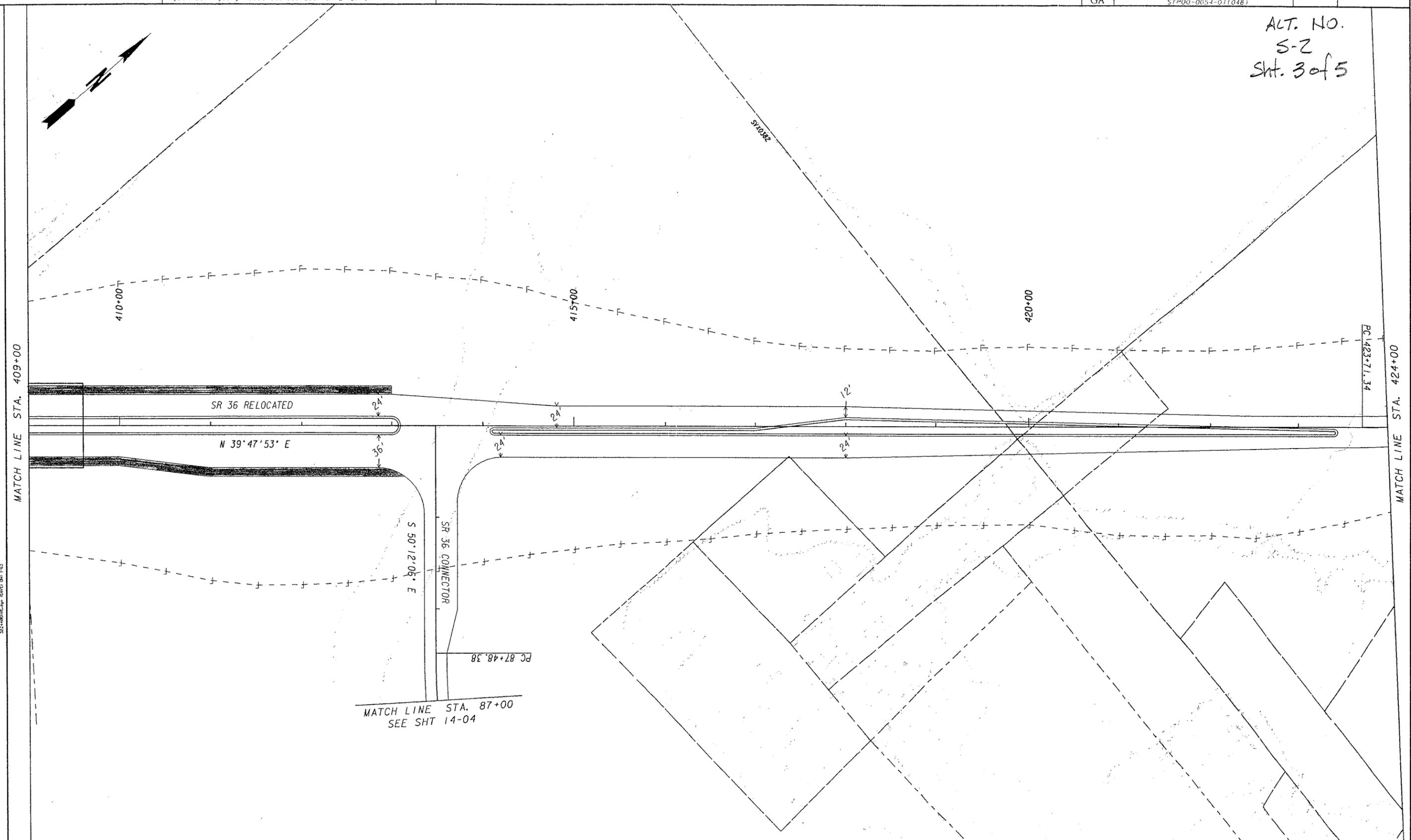
DISCUSSION:

There is no pedestrian access to the sidewalk along this stretch of road. There are no sidewalks on the New Connector Road or the extension of Cindy Street which will intersect with new SR 36. The land on both sides of SR 36 will probably not be developed because most of this section of new SR 36 is on a high embankment. Thus the need for sidewalks is unnecessary and removing them saves project costs.

The section of road between Cindy Street and the New Connector Road is all on embankment with no development on both sides. Having curb and gutter is unnecessary and requires the use of piped drainage which also gets eliminated. Starting the urban section of roadway at Cindy Street is also more appropriate because that is where development on either side of the road begins.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 339,000 | — | \$ 339,000 |
| ALTERNATIVE | \$ 85,116 | — | \$ 85,116 |
| SAVINGS | \$ 253,884 | — | \$ 253,884 |

ALT. NO.
S-2
Sht. 3 of 5



PROPERTY AND EXISTING R/W LINE ---#---

REQUIRED R/W LINE ---#---

CONSTRUCTION LIMITS ---#---

EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES [diagonal hatching]

EASEMENT FOR CONSTR OF SLOPES [diagonal hatching]

EASEMENT FOR CONSTR OF DRIVES [diagonal hatching]

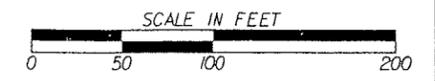
BEGIN LIMIT OF ACCESS.....BLA

END LIMIT OF ACCESS.....ELA

LIMIT OF ACCESS [dashed line]

REQ'D R/W & LIMIT OF ACCESS [thick dashed line]

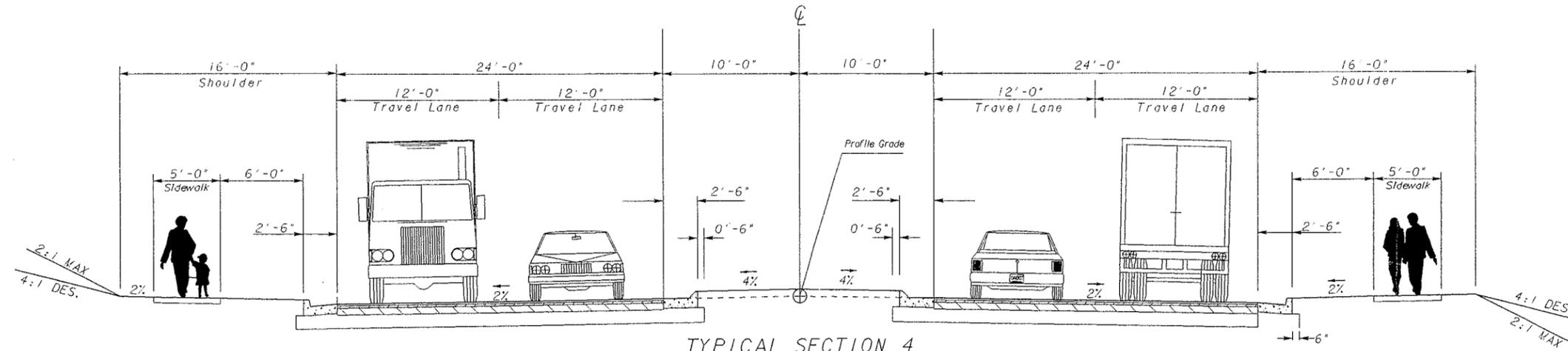
GEORGIA
DEPARTMENT
OF
TRANSPORTATION



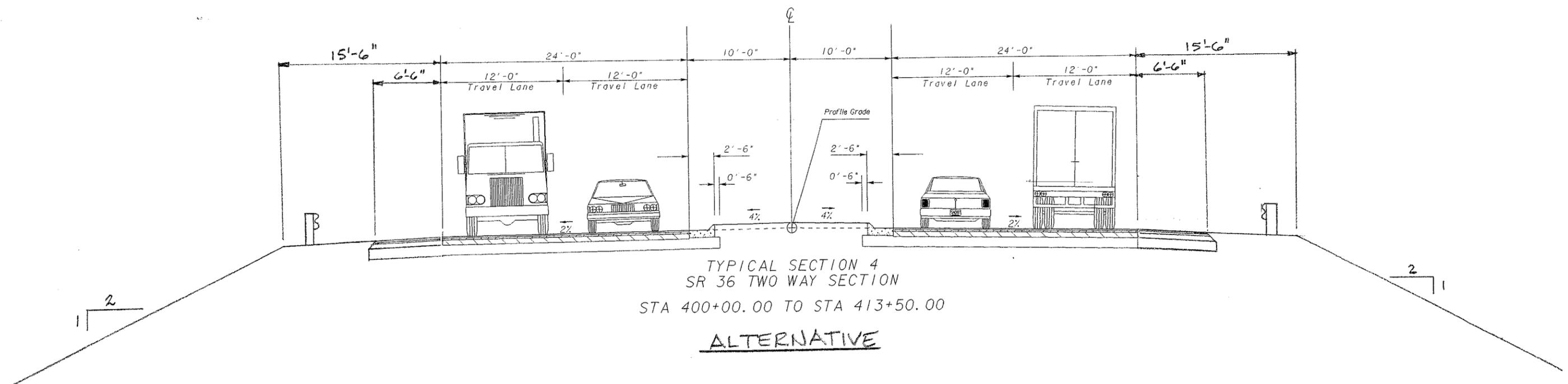
| REVISION DATES | |
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STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: ROAD DESIGN
MAINLINE PLAN
SR 36

DRAWING No.
13-21



TYPICAL SECTION 4
SR 36 TWO WAY SECTION
STA 400+00.00 TO STA 413+50.00
AS DESIGNED



TYPICAL SECTION 4
SR 36 TWO WAY SECTION
STA 400+00.00 TO STA 413+50.00
ALTERNATIVE

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

S-3

DESCRIPTION: **DELETE THE INSIDE SIDEWALKS FROM SLAUGHTER AVENUE TO THE MERGE POINT EXCEPT FOR THE STRIP IN FRONT OF THE CHURCH**

SHEET NO.: 1 of 3

ORIGINAL DESIGN: (sketch attached)

A sidewalk is provided on both sides Oak Street and Mulberry Street from Slaughter Avenue north to the point where the two streets merge.

ALTERNATIVE: (sketch attached)

Delete the sidewalk on the inside area between Oak Street and Mulberry Street except in front of the church on Oak Street.

ADVANTAGES:

- Saves costs
- Saves construction time

DISADVANTAGES:

- None apparent

DISCUSSION:

There is no need for pedestrians to walk in this area. If there is a desire to walk along either street, the sidewalks on the west side of Oak Street or the east side of Mulberry Street can be used. Access is provided to the church from the south. Implementing this alternative saves costs.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 37,271 | — | \$ 37,271 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS | \$ 37,271 | — | \$ 37,271 |

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:
CG-1

DESCRIPTION: **REDUCE THE WIDTH OF THE CURB AND GUTTER SECTION FROM 30 IN TO 24 IN**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (sketch attached)

The curb and gutter sections are 30 in wide with 24-in-wide gutter pans.

ALTERNATIVE: (sketch attached)

Reduce the gutter pan width to 18 in.

ADVANTAGES:

- Saves costs
- Increases width of raised median

DISADVANTAGES:

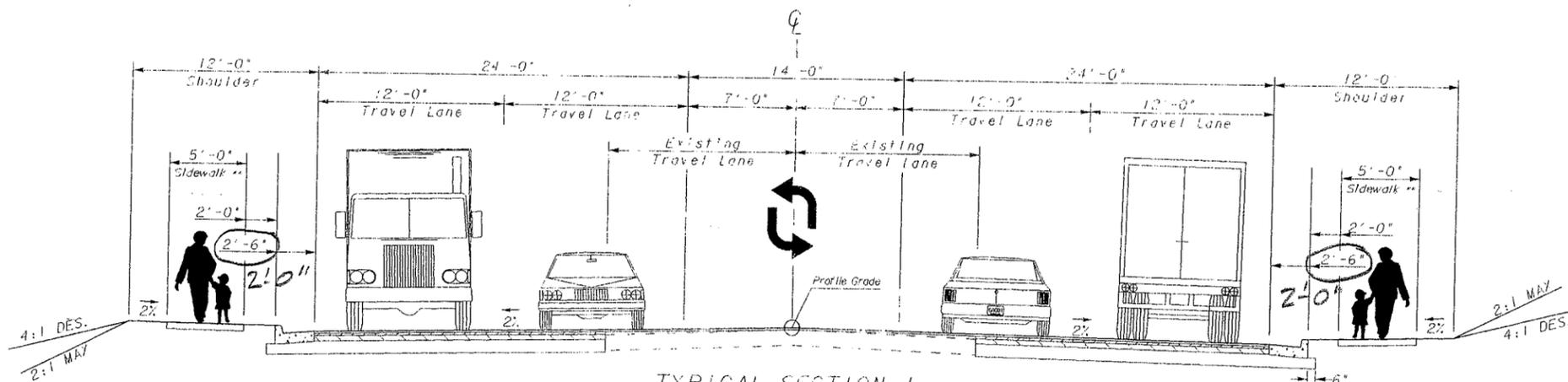
- None apparent

DISCUSSION:

This gutter pan size is used extensively by other jurisdictions and saves costs.

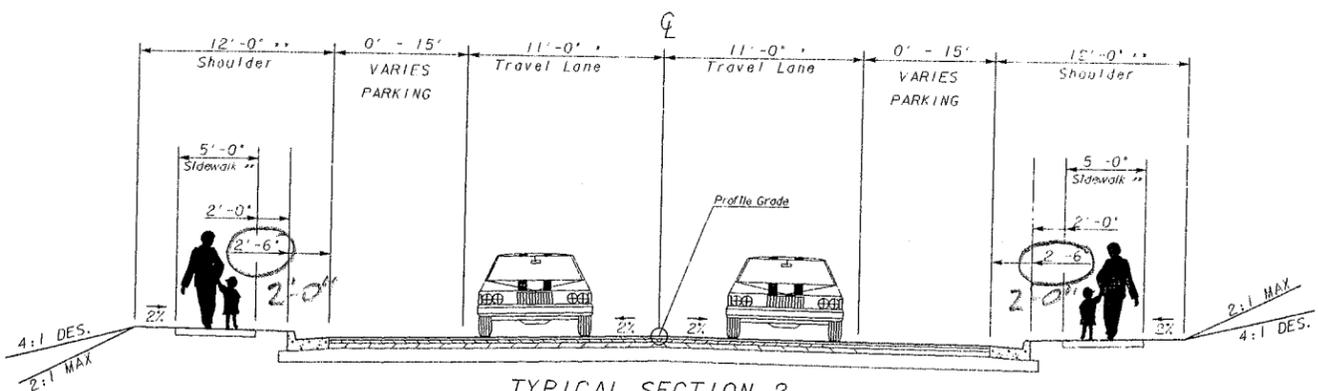
| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 738,400 | — | \$ 738,400 |
| ALTERNATIVE | \$ 701,650 | — | \$ 701,650 |
| SAVINGS | \$ 36,750 | — | \$ 36,750 |

ALT. NO.
CG-1
Sht. 2 of 4

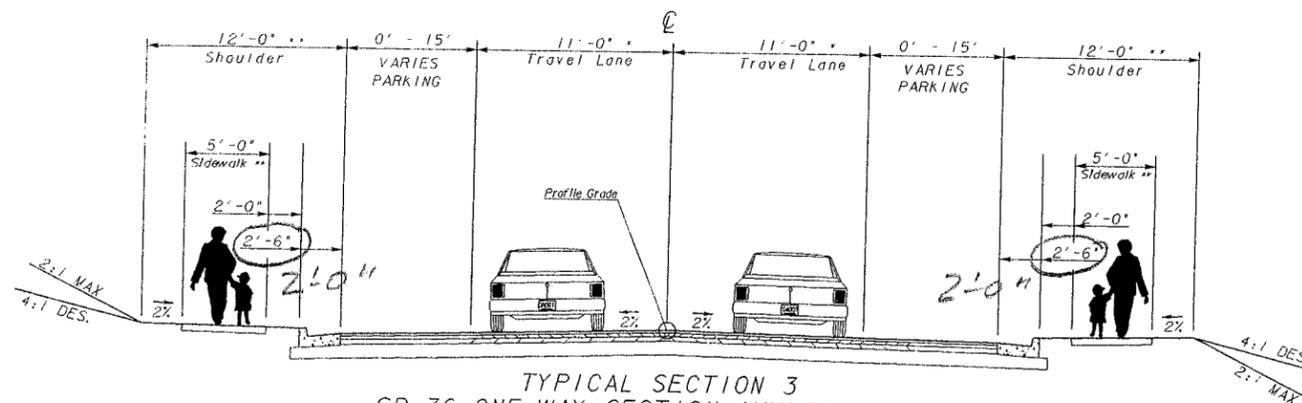


TYPICAL SECTION 1
SR 36 TWO WAY SECTION

STA 103+57 TO STA 115+92.02 (OAK ST) -
STA 103+51 TO STA 116+90.21 (MULBERRY ST)



TYPICAL SECTION 2
SR 36 ONE WAY SECTION (OAK ST)
STA 200+00.00 TO STA 254+53.36



TYPICAL SECTION 3
SR 36 ONE WAY SECTION (MULBERRY ST)
STA 300+00.00 TO STA 353+64.62

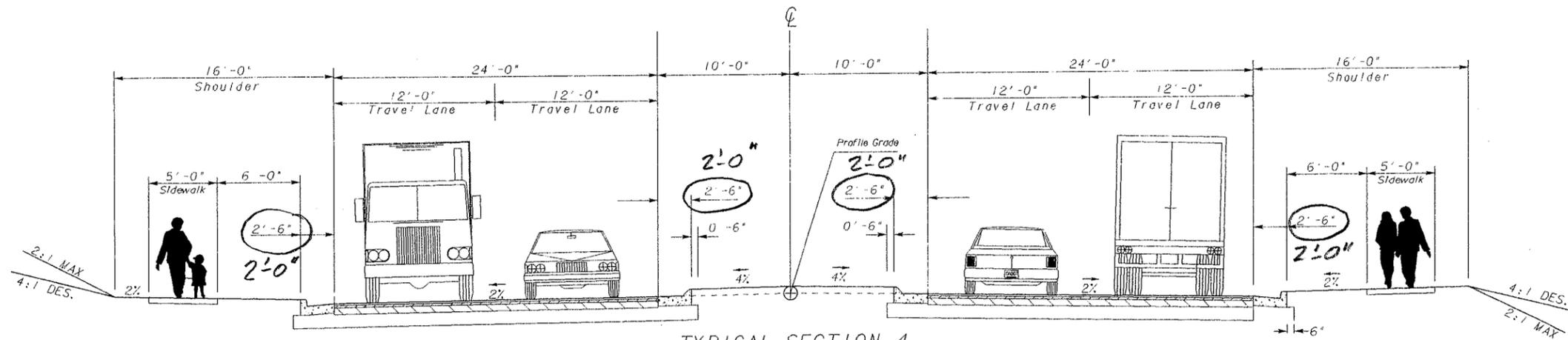
NOTES:

- * 11' LANES APPLY FROM COLLEGE STREET TO OAK/MULBERRY MERGE
- * 12' LANES APPLY FROM OAK/MULBERRY SPLIT TO COLLEGE STREET
- ** 10' SHOULDER APPLIES NORTH OF 1ST STREET
- ** SIDEWALK LOCATION VARIES TO REDUCE IMPACTS. SEE PLANS FOR LOCATION

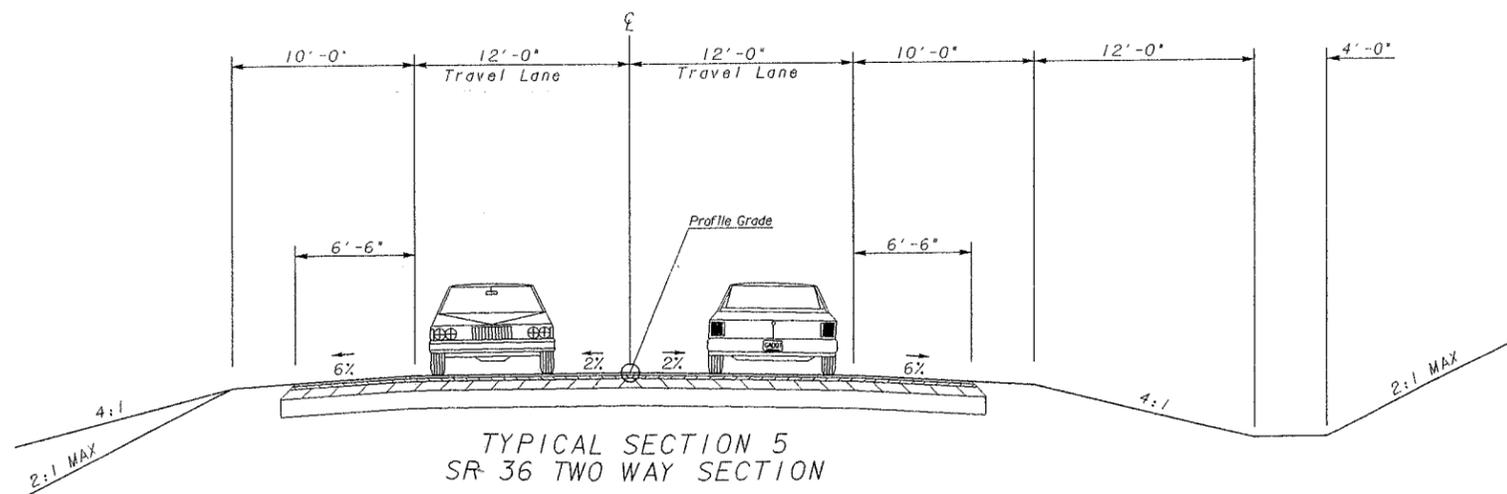
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STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: ROAD DESIGN
TYPICAL SECTIONS

ALT. NO.
CG-1
Sht. 3 of 4



TYPICAL SECTION 4
SR 36 TWO WAY SECTION
STA 400+00.00 TO STA 413+50.00



TYPICAL SECTION 5
SR 36 TWO WAY SECTION
STA 413+50.00 TO STA 440+00.00

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STATE OF GEORGIA
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OFFICE: ROAD DESIGN
TYPICAL SECTIONS

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD**
Butts County, Georgia

ALTERNATIVE NO.:

D-1

DESCRIPTION: **USE HDPE PIPE FOR LONGITUDINAL STORM DRAIN PIPE
 AND SIDE DRAIN PIPE**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN:

The current design uses concrete storm drain pipe for all circular storm drain pipes on slopes less than 10%.

ALTERNATIVE:

Use HDPE pipe for the urban longitudinal system and side drain pipes under driveways and side roads.

ADVANTAGES:

- Saves construction cost
- Saves construction time due to short installation time
- Uses an approved material

DISADVANTAGES:

- None apparent

DISCUSSION:

HDPE pipe is less expensive and much easier to install since it is lighter and comes in 20 ft lengths. This alternate recommends its usage for the longitudinal system and side drains; however, it has the strength to be used for the cross drains also.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 555,466 | — | \$ 555,466 |
| ALTERNATIVE | \$ 375,028 | — | \$ 375,028 |
| SAVINGS | \$ 180,438 | — | \$ 180,438 |

CALCULATIONS



PROJECT: SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD

ALTERNATIVE NO.:

Butts County, Georgia

Use HDPE pipe for longitudinal Storm Drain Pipe and side drain pipe

SHEET NO.: 2 of 3

Quantity of Storm Drain pipe that could be HDPE pipe:

3,500 LF of 18" storm drain pipe (H1-10)

3,500 LF of 24" storm drain pipe (H1-10)

1,000 LF of 36" storm drain pipe (H1-10)

900 LF of 18" side drain pipe (H1-10)

Prices for HDPE pipe:

$$18" \text{ HDPE} = \$26.00/\text{LF} = \left(\$8 + \left(\frac{\$1/\text{LF}}{\text{in-Dia}} \times 18" \right) \right)$$

Installation

$$24" \text{ HDPE} = \$38/\text{LF} = \left(\$14 + \left(\frac{\$1}{\text{LF-Dia}} \times 24" \right) \right)$$

$$36" \text{ HDPE} = \$60 = \left(\$24 + \left(\frac{\$1}{\text{LF-Dia}} \times 36" \right) \right)$$

$$\text{HDPE } 18" \text{ side DR. pipe} = \$26/\text{LF}$$

VALUE ENGINEERING ALTERNATIVE



| | |
|---|--------------------------------|
| PROJECT: SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD <i>Butts County, Georgia</i> | ALTERNATIVE NO.: G-2 |
| DESCRIPTION: CONSTRUCT A ROUNDABOUT WHERE FREEMAN ROAD INTERSECTS WITH THE NEW SR 36 AND CONNECT OLD SR 36 TO THE ROUNDABOUT | SHEET NO.: 1 of 4 |

ORIGINAL DESIGN: (sketch attached)

SR 36 is to be realigned at the intersection with Freeman Road to head southwest and then connect with Oak Street before diverging into a one-way pair with Mulberry Street. Existing SR 36 to the south of the intersection is to be cul de saced. The driveway from two properties to the west of existing SR 36 will connect to new SR 36 on the other side of the intersection.

ALTERNATIVE: (sketch attached)

Build a roundabout at the intersection of Freeman Road and new SR 36. Connect the part of existing SR 36 south of the roundabout and the driveway to the roundabout. Use a 100 ft inside diameter and 140 ft outside diameter for the roundabout resulting in a 16-ft-wide travel lane with 2-ft-wide gutter pans on each side.

ADVANTAGES:

- Allows vehicles desiring to access the industrial area from the north a direct route
- Reduces traffic at the New Connector Road intersection with new SR 36
- Provides better access to the school from the north
- Provides more direct access to the north for the residents off of existing SR 36

DISADVANTAGES:

- Adds some minor costs for the roundabout

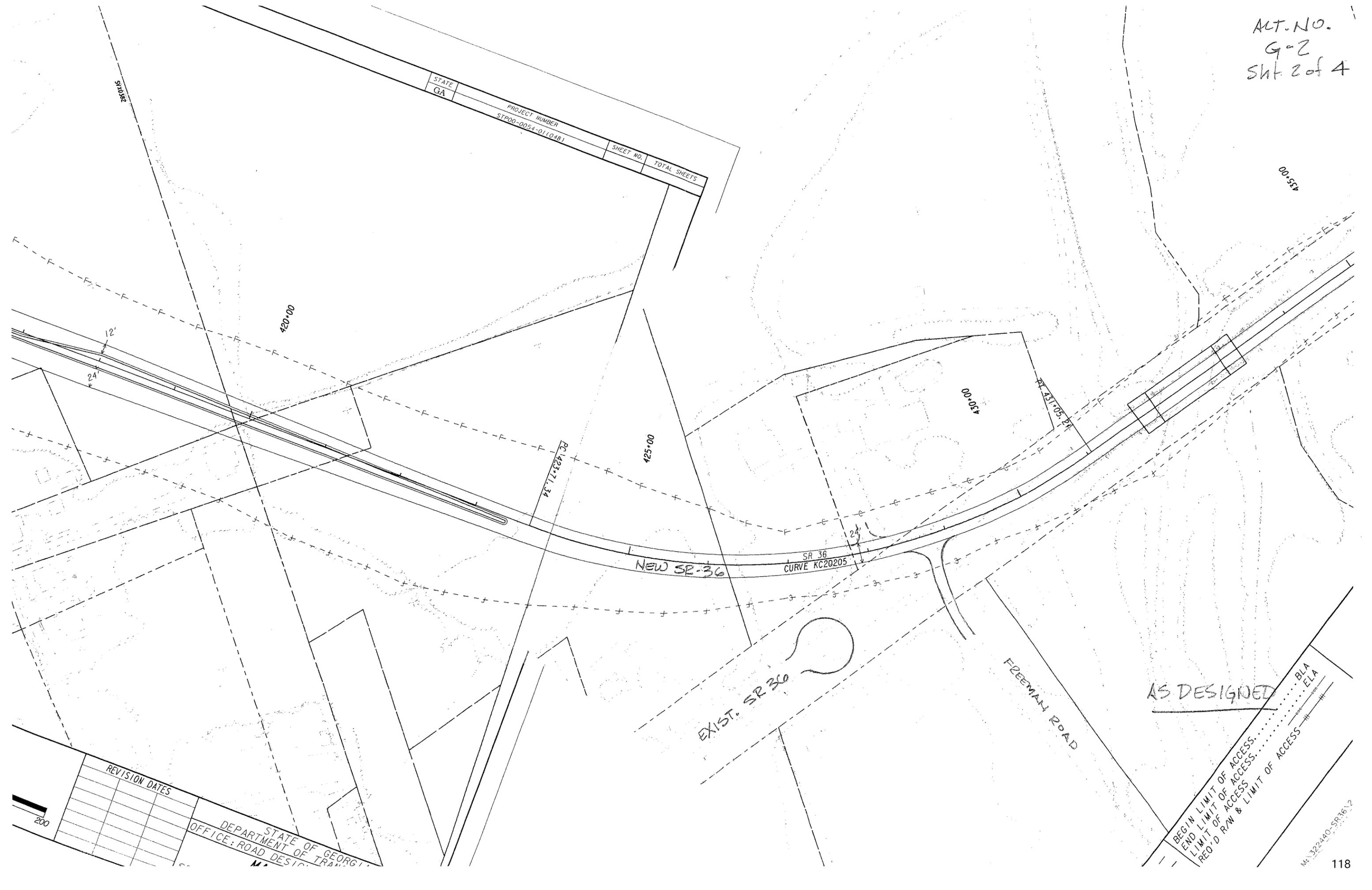
DISCUSSION:

The location of the roundabout is in an area where the land is very flat making it an ideal location. The roundabout serves a transition from a rural highway to a developed area. By connecting existing SR 36 south of the Freeman Road intersection to the roundabout, access to all areas south is greatly enhanced. By constructing the roundabout, it may be possible to eliminate the New Connector Road saving significant costs as well as eliminating a traffic signal.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | | | |
| ALTERNATIVE | DESIGN SUGGESTION | | |
| SAVINGS | | | |

ALT. NO.
G-2
Sht 2 of 4

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| STATE GA | PROJECT NUMBER STP00-0054-01(048) | SHEET NO. | TOTAL SHEETS |
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DEPARTMENT OF TRANSPORTATION
OFFICE OF ROAD DESIGN

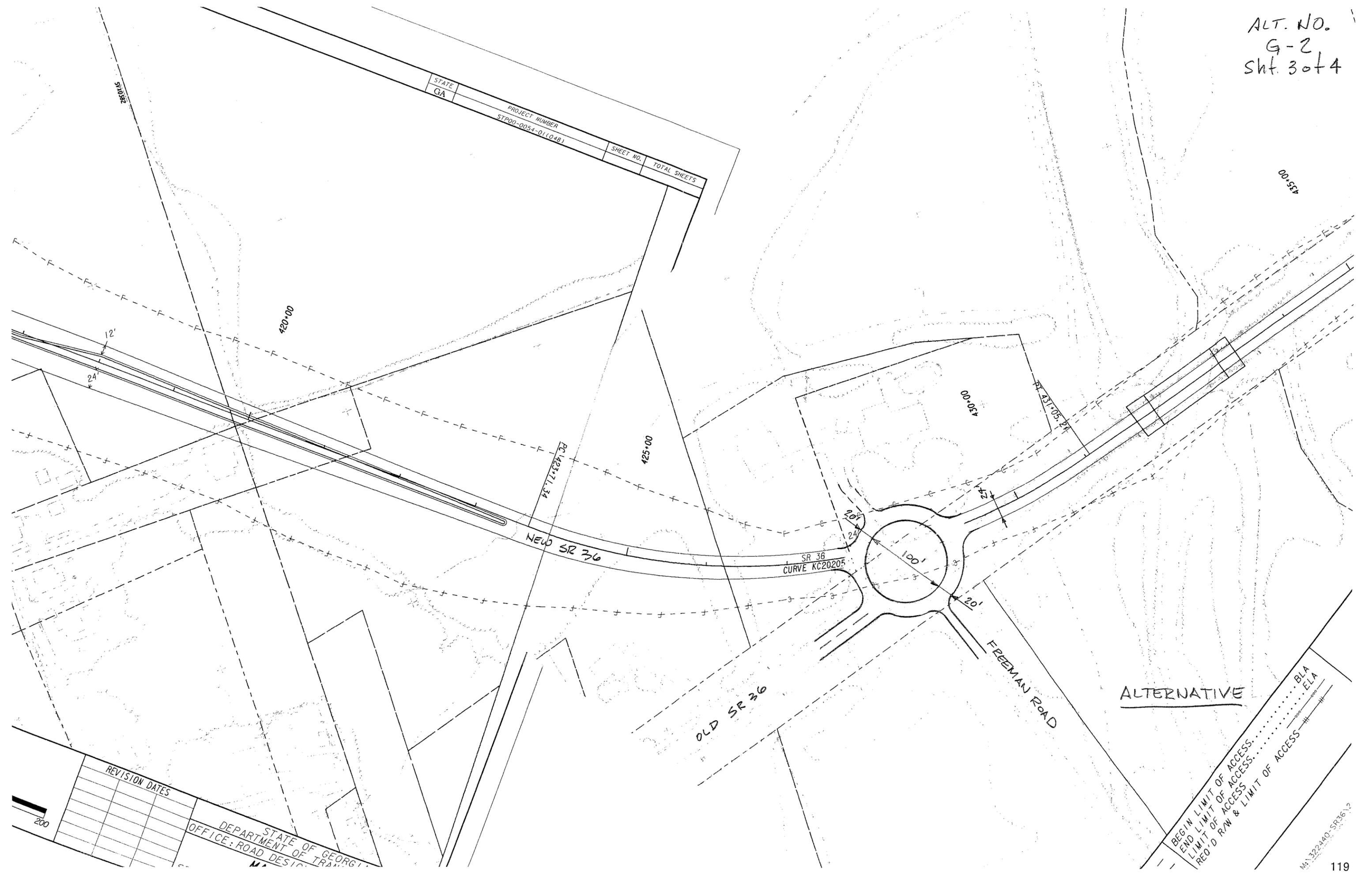
AS DESIGNED

--- BEGIN LIMIT OF ACCESS
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 - - - ELA

M-32240-SR3612

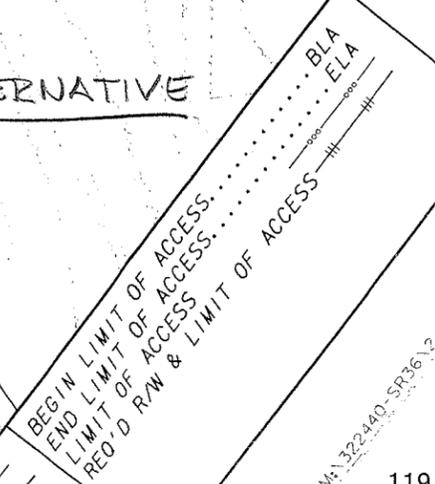
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| STATE GA | PROJECT NUMBER STP00-0054-01(048) | SHEET NO. | TOTAL SHEETS |
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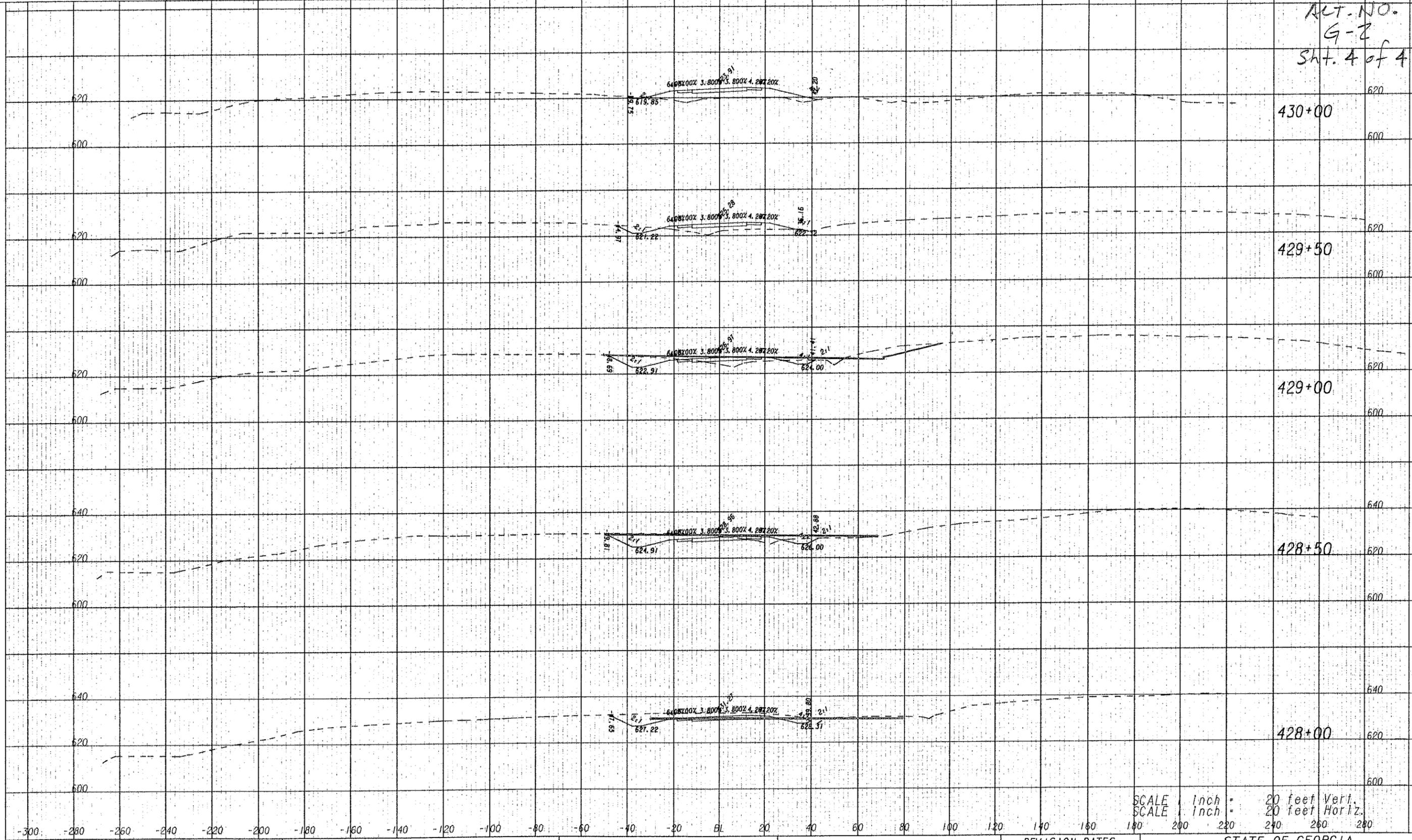


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STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: ROAD DESIGN



ALT. NO.
 G-2
 Sht. 4 of 4



SCALE 1 inch = 20 feet Vert.
 SCALE 1 inch = 20 feet Horiz.

| REVISION DATES | |
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STATE OF GEORGIA
 DEPARTMENT OF TRANSPORTATION
 OFFICE:
 CROSS SECTIONS

SR 36

DRAWING No.
 23-14

PROJECT DESCRIPTION

The subject of the study was the SR 36 One-Way Pair in Jackson from Brownlee Road to Yellow Water Creek, STP00-0054-01(048) PI # 322440 and SR 36 over Yellow Water Creek, BRST0-0054-01(065) PI # 333171 project in Butts County, Georgia. The project is being design by GDOT central office staff in concert with District 3.

Existing Conditions

SR 36 from SR 16 north is a two-lane rural minor arterial with 8% truck traffic. It has 12-ft-wide lanes near the SR 16 intersection which narrows to 10-ft-wide lanes in the middle of the project area and widens back to 12-ft-wide lanes near the intersection with Stark Road. The southern portion of SR 36 near SR 16 has curb, gutter and sidewalks while the northern portion near Stark Road does not. There is no median and the posted speed limit is 35 mph. Additionally, this portion of SR 36 contains a number of historic resources and is located within the Jackson Historical District.

This section of roadway has a crash rate higher than the statewide average for this classification of roadway for the years 2005 and 2006.

This section of SR 36 is located along a bicycle route identified by the McIntosh Trail Regional Development Center in the Regional Bicycle and Pedestrian Pathway Plan of April 2005. Existing pedestrian facilities such as sidewalks are also located within this section of SR 36.

The SR 36 bridge over Yellow Water Creek was constructed in 1949 and has a sufficiency rating of 47.59.

Need and Purpose

The amount of traffic along SR 36 in the City of Jackson results in a Level of Service (LOS) D, which indicates a need to address capacity issues. Traffic is expected to increase by 91% and LOS is expected to decline to F between 2007 and 2034 which will further increase the need for added capacity. Thus the purpose of the project is to address additional capacity needs in the downtown area of Jackson, to improve safety, and to address bicycle and pedestrian facilities proposed for the corridor.

The sufficiency rating of the SR 36 bridge over Yellow Water Creek meets the criteria for replacement.

PROJECT DESCRIPTION

The project widens SR 36 through the City of Jackson from two to four lanes and partially relocates SR 36 by creating a one-way pair. The one-way pair will use existing north/south two-way streets named Mulberry Street and Oak Street which form the east and west sides on the town square, respectively. This project will build a new bridge over Norfolk Southern Railroad tracks on a new alignment, located north of the one-way pair terminus. This project also replaces the SR 36 bridge over Yellow Water Creek located at the north end of the project.

Currently SR 36/South Mulberry Street comes into Jackson from the south, turns east and combines with SR 16 for four blocks before turning back south at East College Street. The current alignment continues north across the Norfolk Southern Railroad tracks and then further north across Yellow Water Creek.

The new alignment for SR 36/South Mulberry Street starts at the south side of Jackson just south of Brownlee Road where the two-lane road will expand to four lanes. Brownlee Road and Hancock Street to the south will be realigned to intersect SR 36 at the same location with a new signalized intersection. The four-lane section will expand to a five-lane section with center 14-ft-wide left turn lane and continue north to where Oak Street now meets SR 36/South Mulberry Street where it will split to become a one-way pair. Oak Street will be the southbound part of the pair and Mulberry Street will be the northbound side of the pair.

Each of these streets will have two 11-ft-wide travel lanes and space for parallel parking on both sides of the street in the commercial district. Diagonal parking will be provided at the Courthouse between 3rd and 2nd Streets. Curb and gutter and 5-ft-wide concrete sidewalks with a 2-ft-wide mow strip will also be provided on both sides of the street. New signalized intersections at West College Street, 3rd Street, 2nd Street and 1st Street will be installed and the one at West Bypass Street eliminated.

Starting at Slaughter Avenue, Mulberry Street will swing to the northwest on a new alignment and combine with Oak Street. From this point, the combined roads will form a four-lane divided highway with a 20-ft-wide raised concrete median and turn to the northeast on a new alignment. The cross section will include 12-ft-wide shoulders with 6-ft-wide grass strips and 5-ft-wide concrete sidewalks.

East-west Cindy Street will be extended southeast to intersect with the realigned SR 36, and then continue southeast and then east to intersect an existing subdivision road. Realigned SR 36 will continue northeast with a new bridge over the Norfolk Southern Railroad and adjacent Charlie Shepherd Road. It will then form a signalized intersection with the New Connector Road that will start off in a southeast direction and then turn east to intersect existing SR 36.

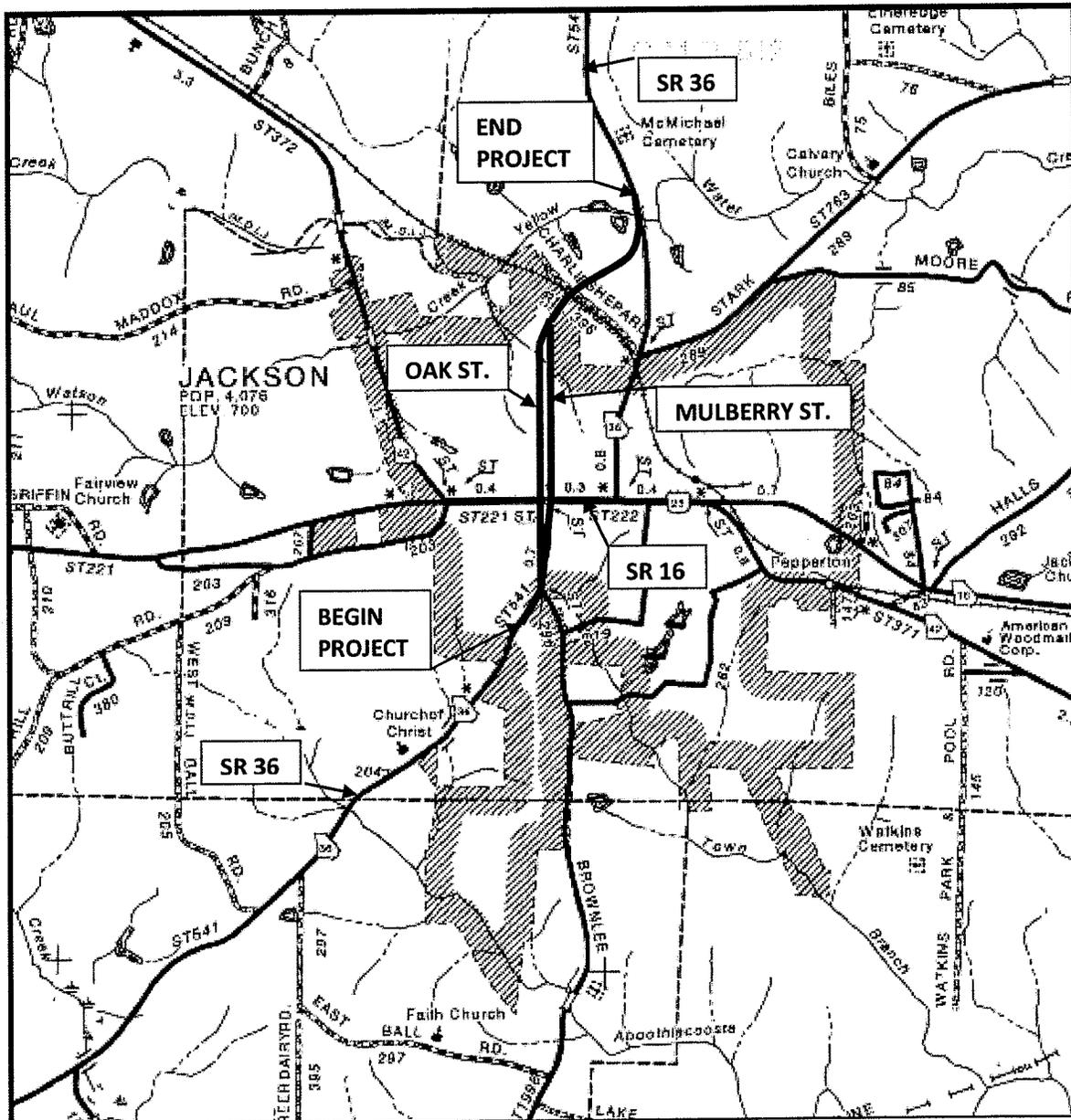
At this point, realigned SR 36 will neck down to two lanes and proceed further northeast to merge into existing SR 36 south of Yellow Water Creek. The roadway will have a rural cross section with two 12-ft-wide lanes. The rural cross section will also include 10-ft-wide shoulders on each side, 6.5 ft of which is paved. The Yellow Water Creek bridge on existing SR 36 will be replaced with construction starting on SR 36 about 0.15 mile north of the bridge. The existing SR 36 south of the merge with realigned SR 36 will be cul de saced.

The total length of the project is about 2.03 miles. The total estimated costs for the two projects are:

| | |
|-------------|---------------------|
| PI # 322440 | \$29,465,000 |
| PI# 333171 | <u>\$ 3,952,000</u> |
| Total | \$33,417,000 |

Construction is scheduled to begin in October 2012.

Selected project drawings follow.



PROJECT LOCATION MAP

STP00-0054-01(048), PI 322440
SR 36 One-Way Pair in Jackson from Brownlee Rd to Yellow Water Creek
BRST0-0054-01(065) PI 333171
SR 36 Over Yellow Water Creek

VALUE ANALYSIS AND CONCLUSIONS

GENERAL

This section describes the value analysis (VA) procedure used during the VE study on the SR 36 One-Way Pair in Jackson from Brownlee Road to Yellow Water Creek and SR 36 Over Yellow Water Creek, Project Numbers: STP00-0054-01(048) & BRST0-0054-01(065) P.I. Numbers: 322440 & 333171 in Butts County facilitated by Lewis & Zimmerman Associates, for the GDOT. The workshop was performed March 31 – April 3, 2009, in GDOT's Central Office in Atlanta, Georgia. The GDOT project team provided information for the VE team to use as the basis of the study.

A systematic approach was used in the VE study, which is divided into three parts: (1) Preparation Effort, (2) Workshop Effort, and (3) Post-Workshop Effort. A task flow diagram outlining each of the procedures included in the VE study is attached for reference.

Following this description of the VA procedure, separate narratives and supporting documentation identify the following:

- VE workshop participants
- Economic data
- Cost model
- Function analysis
- Creative ideas and evaluations

PREPARATION EFFORT

Preparation for the workshop consisted of scheduling workshop participants and tasks and gathering necessary project documents for team members to review before attending the workshop. These documents, listed below, were used as the basis for generating VE alternatives and for determining the cost implications of the selected VE alternatives:

- Department of Transportation, State of Georgia, Office of Road Design Project Concept Report Project Number: STP00-0054-01(048) & BRST0-0054-01(065), County: Butts, P.I. Numbers: 322440 & 333171, dated 9-18-08
- Estimate Report for file "PI# 322440 17 Mar 09 VE Est.," prepared by GDOT
- Estimate Report for file "PI 333171," dated 12/17/2008, prepared by GDOT
- Preliminary Right of Way Cost Estimate, dated April 1, 2008, prepared by GDOT
- Half Size Preliminary Construction Plans SR 36 One-Way Pair in Jackson from Brownlee Road to Yellow Water Creek and SR 36 Over Yellow Water Creek, Project Numbers: STP00-0054-01(048) & BRST0-0054-01(065) P.I. Numbers: 322440 & 333171, dated 3/13/2009, prepared by GDOT

Value Engineering Study Task Flow Diagram



Preparation Effort

Coordination Project

- Verify Schedule
- Suggest Format for Designer Presentation
- Outline Project Responsibilities
- Outline Needed Background Data
- Define *Project Value Objectives*
- Identify Project Constraints

Prepare for Workshop

- Collect Project Data
- Distribute Data to Team Members
- Team Members Become Familiar with Project

Construct Cost Models

- Construct Cost Models
- Construct Graphic Function Analysis
- Outline High Cost Areas

LCC Model

- Roadway
- Bridges
- MOT
- Energy
- User Impact

Workshop Effort

Information Phase

- Introduction by VETL
- Project Description and Presentation by Designer
- Outline Owner Requirements
- Review Project Data
- Visit Project Site (Alt.)

Function Identification and Analysis Phase

- Analyze Project Costs and Energy Usage
- Perform Function Analysis and FAST Diagram
- Identify High Cost and Energy Areas
- Calculate Cost/Worth Ratios
- Identify Paradigms

List Ideas Generated During Function Analysis

Speculation Phase

- Introduction by VETL
- Creative Idea Listing:
 - Quantity of Ideas
 - Association of Ideas
- Brainstorm
- Do Creative Thinking
 - Group Thinking
 - Individual Thinking
- Use Checklist for Ideas

Evaluation Phase

- Eliminate Impractical Ideas
- Rank Ideas with Advantages/ Disadvantages
- Evaluate Alternatives (Include Non-Economic considerations: Safety, Reliability, Environment, Aesthetics, O&M, etc.)
- Select Best Ideas for Implementation

Development Phase

- Develop Proposed Alternatives
- Prepare Alternative Design Sketches
- Estimate Costs
- Perform Life Cycle Comparison
 - Initial Cost
 - Redesign Cost
 - O&M Cost
 - LCC Cost

Presentation Phase

- Summarize Findings
- Present VE Ideas to Owner/ User/Designer
- Oral Presentation

Post-Workshop Effort

VE Study Report

- Develop Implementation VE Report
- Designer Prepares Responses to VE Report
- Owner Evaluates Recommendations

Implementation Phase

- Participate in Implementation Meeting with Owner/User/ Designer/ VE Team, as needed
- Prepare Final VE Report

Final Acceptance

- Redesign by Designer

- Concept Layout SR 36 One-Way Pair in Jackson from Brownlee Road to Yellow Water Creek and SR 36 Over Yellow Water Creek, prepared by GDOT

Information relating to the project's purpose and need, owner concerns, project stakeholder concerns, design criteria, project constraints, funding sources and availability, regulatory agency approval requirements, and the project's schedule and costs is very important as it provides the VE team with insight about how the project has progressed to its current state.

Project cost information provided by the designers is used by the VE team as the basis for a comparative analysis with similar projects. To prepare for this exercise, the VE team leader used the cost estimate prepared by GDOT to develop a cost model for the project. The model was used to distribute the total project cost among the various elements or functions of the project. The VE team used this model to identify the high-cost elements or functions that drive the project and the elements or functions providing little or no value so that the team could focus on reducing or eliminating their impact.

VALUE ENGINEERING WORKSHOP EFFORT

The VE workshop was a 3-1/2-day effort beginning with an orientation/kickoff meeting on Tuesday, March 31, 2009, and concluding with the final VE Presentation on Friday, April 3, 2009. During the workshop, the VE Job Plan was followed in compliance with Federal Highway Administration guidelines for conducting a VE study. The Job Plan guided the search for alternatives to mitigate or eliminate high-cost drivers, secondary functions providing little or no value, and potential project risks. Alternatives to specifically address the owner's project concerns and enhance value by improving operations, reducing maintenance requirements, enhancing constructability, and providing missing functions were also considered. The Job Plan includes six phases:

- Information Phase
- Function Analysis Phase
- Creative/Speculation Phase
- Evaluation Phase
- Development Phase
- Presentation Phase

Information Phase

At the beginning of the study, the decisions that have influenced the project's design and proposed construction methods have to be reviewed and understood. For this reason, the workshop began with a presentation of the project by GDOT to the team. The presentation highlighted the information provided in the documentation reviewed by the VE team before the workshop and expanded on it to include a history of the project's development and any underlying influences that caused the design to develop to its current state. During this presentation, VE team members were given the opportunity to ask questions and obtain clarification about the information provided.

Function Analysis Phase

Having gained some information on the project, the VE team proceeded to define the functions provided by the project, identifying the costs to provide these functions, and determining whether the value provided by the functions has been optimized. Function analysis is a means of evaluating a project to see if the expenditures actually perform the requirements of the project or if there are disproportionate amounts of money spent on support functions. Elements performing support functions add cost to the project but have a relatively low worth to the basic function.

Function is defined as the intended use of a physical or process element. The team attempted to identify functions in the simplest manner using measurable noun/verb word combinations. To accomplish this, the team first looked at the project in its entirety and randomly listed its functions, which were recorded on Random Function Analysis Worksheets (provided in the Function Identification and Analysis section). Then the individual function(s) of the major components of the project depicted on the cost model were identified.

After identifying the functions, the team classified the functions according to the following:

| <u>Abbreviation</u> | <u>Type of Function</u> | <u>Definition</u> |
|---------------------|-------------------------|--|
| HO | Higher Order | The primary reason the project is being considered or project goal. |
| B | Basic | A function the must occur for the project to meet its higher order functions. |
| S | Secondary | A function that occurs because of the concept or process selected and may or may not be necessary. |
| R/S | Required Secondary | A secondary function that may not be necessary to perform the basic function but must be included to satisfy other requirements or the project cannot proceed. |
| G | Goal | Secondary goal of the project. |
| O | Objective | Criteria to be met. |
| LO | Lower Order | A function that serves as a project input. |

Higher order and basic functions provide value, while secondary functions tend to reduce value. The goal of the next job phase is to reduce the impact of secondary functions and thereby enhance project value.

To further clarify the impact of the various functions, the team assigned costs to provide the functions or group of functions indicated by a specific project element using the cost estimate and cost model(s). Where possible, they seek to find the lowest cost, or worth, to perform the function. This is accomplished using published data from other sources or team knowledge obtained from working on other similar projects to establish cost goals and then comparing them to the current costs. By identifying the cost and worth of a function or group of functions, cost/worth ratios were calculated. Cost/worth ratios greater than one indicated that less than optimum value was being provided. Those project functions or elements with high cost/worth ratios became prime targets for value improvement.

As well as looking at areas with high cost/worth ratios, the team used the cost model(s) previously prepared to seek out the areas where most of the project funds are being applied. Because of the absolute

magnitude of these high-cost elements or functions, they also became initial targets for value enhancement.

Overall, these exercises stimulated the VE team members to focus on apparently low value areas and initially channel their creative idea development in these places.

Creative/Speculation Phase

This VE study phase involved the creation and listing of ideas. Starting with the functions or project elements with high cost/worth ratios, a high absolute cost compared to other elements in the project, and secondary functions providing little or no value and using the classic brainstorming technique, the VE team began to generate as many ideas as possible to provide the necessary functions at a lower total life cycle cost, or to improve the quality of the project. Ideas for improving operation and maintenance, reducing project risk, and simplifying constructability were also encouraged. At this stage of the process, the VE team was looking for a large quantity of ideas and free association of ideas. A Creative Idea Listing worksheet was generated and organized by the function or project element being addressed.

The GDOT project team may wish to review these creative lists since they may contain ideas that were not pursued by the VE team but can be further evaluated for potential use in the design.

Evaluation Phase

Since the goal of the Creative/Speculation Phase was to conceive as many ideas as possible without regard for technical merit or applicability to the project goals, the Evaluation Phase focused on identifying those ideas that do respond to the project value objectives and are worthy of additional research and development before being presented to the owner. The selection process consisted of the VE team evaluating the ideas originated during the Creative/Speculation Phase based on GDOT's value objectives identified through conversations. Based on the team's understanding of the owner's value objectives, each idea was compared with the present design concept, and the advantages and disadvantages of each idea were discussed.

How well an idea met the design criteria was also reviewed. Based on the results of these reviews, the VE team rated the idea by consensus using a scale of 1 to 5, with 5 or 4 indicating an idea with the greatest potential to be technically sound and provide cost savings or improvements in other areas of the project, 3 indicating an idea that provides marginal value but could be used if the project was having budget problems, 2 indicating an idea with a major technical flaw, and 1 indicating an idea that does not respond to project requirements. Generally, ideas rated 4 and 5 are pursued in the next phase and presented to the owner during the Presentation Phase.

The team also used the designation "DS" to indicate a design suggestion, which is an idea that may not have specific quantifiable cost savings but may reduce project risk, improve constructability, help to minimize claims, enhance operability, ease maintenance, reduce schedule time, or enhance project value in other ways. Design suggestions could also increase a project's cost but provide value in areas not currently addressed. These are also developed in the next phase of the VA process.

Development Phase

In this phase, each highly rated idea was expanded into a workable solution designated as a VE alternative. The development consisted of describing the current design and the alternative solution, preparing a life cycle cost comparison where applicable, describing the advantages and disadvantages of the proposed alternative solution, and writing a brief narrative to compare the original design to the proposed change and provide a rationale for implementing the idea into the design. Sketches and design calculations, where appropriate, were also prepared in this part of the study. The VE alternatives are included in the Study Results section of this report.

Design suggestions include the same information as the alternatives except that no cost analysis is performed. They also are included in the Study Results section.

Presentation Phase

The goals of the last phase of the workshop were to summarize the results of the study, to prepare draft Summary of Potential Cost Savings worksheets to hand out at the presentation, and to present the key VE alternatives and design suggestions to the GDOT project team. The presentation was held on Friday, April 3, 2009, at GDOT's Central Office in Atlanta, GA. The purpose of the meeting was to provide the attendees with an overview of the suggestions for value enhancement resulting from the VE study and afford them the opportunity to ask questions to clarify specific aspects of the alternatives presented. Procedures for implementing the results of the study were discussed, and arrangements were made for the reviewers of the VE report to contact the VE team in order to obtain further clarifications, if necessary. Draft copies of the Summary of Potential Cost Savings worksheets were given to GDOT and design team to facilitate a timely review and speedy implementation of the selected ideas.

POST-WORKSHOP EFFORT

The post-workshop portion of the VE study consisted of the preparation of this VE Study Report. Personnel from GDOT will analyze each alternative and prepare a short response, recommending incorporation of the alternative into the project, offering modifications before implementation, or presenting reasons for rejection. LZA is available at your convenience as you review the alternatives. Please do not hesitate to call on us for clarification or further information as you consider an implementation approach.

Upon completing their reviews, the GDOT project team will meet and, by consensus, select VE alternatives and design suggestions to incorporate into the project.

VALUE ENGINEERING WORKSHOP PARTICIPANTS

The VE team was organized to provide specific expertise in the unique project elements involved with the SR 36 One-Way Pair in Jackson from Brownlee Road to Yellow Water Creek and SR 36 Over Yellow Water Creek project. The multidisciplinary team comprised professionals with highway and bridge planning, design and construction experience and a working knowledge of VE procedures. The following lists the VE team members:

| <u>Participant</u> | <u>Specialization</u> | <u>Affiliation</u> |
|---------------------------|------------------------------|------------------------------|
| John P. Tiernan, PE | Bridge Engineering | ARCADIS US, Inc. |
| Harley Griffin | Cost/Constructability | Delon Hampton & Associates |
| Joseph Leoni, PE | Highway Engineer | ARCADIS US, Inc. |
| Howard B. Greenfield, PE | VE Team Leader | Lewis & Zimmerman Associates |

DESIGNER'S PRESENTATION

An overview of the project was presented on Tuesday, March 31, 2009, by representatives from GDOT. The purpose of this meeting, in addition to being an integral part of the Information Phase of the VE study, was to bring the VE team "up to speed" regarding the overall project specifics. Additionally, the meeting afforded the owner and design team the opportunity to highlight in greater detail those areas of the project requiring additional or special attention. An attendance list for the meeting is attached.

VALUE ENGINEERING TEAM'S FORMAL PRESENTATION

A formal presentation was conducted by the VE team on Friday, April 3, 2009, at GDOT's Central Office, in Atlanta, GA to review VE alternatives with the owner and representatives from the design team. Copies of the Draft Summary of Potential Cost Savings worksheet were provided to the attendees. An attendance list for the meeting is attached.

VE STUDY SIGN-IN SHEET

Project No.: STP00-0054-01(048) BRSTO-0054-01(065) County: Butts PI No.: 322440/333171 Date: March 31 - April 3, 2009

4-3-09

| NAME | EMPLOYEE ID NO. | DOT OFFICE OR COMPANY | PHONE NUMBER | EMAIL ADDRESS |
|----------------------|---------------------|-----------------------------|------------------|-----------------------------|
| Lisa L. Myers | 00244168 | Engineering Services | 404-631-1770 | lmyers@dot.ga.gov |
| James K. Magnus | 00208161 | Construction | 404-631-1971 | jmagnus@dot.ga.gov |
| Ken Werho | 00256268 | Traffic Operations | 404-635-8144 | kwerho@dot.ga.gov |
| Douglas Fadool | 00928931 | Engineering Services | 404-631-1764 | dfadool@dot.ga.gov |
| Ron Wishon | 00208180 | Engineering Services | 404-631-1753 | rwishon@dot.ga.gov |
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| John P. Tierman | | ARCADIS | 770-431-8666 | John.Tierman@arcadis-us.com |
| Howard Greenfield | | Lewis & Zimmerman | 301-984-9590 x26 | hgreenfield@lza.com |
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| Jim Simpson | 00255896 | " " | 404-631-1605 | jsimpson@dot.ga.gov |
| SAM WOODS | 00874211 | " " | 404-631-1628 | Swoods@DOT-GA.GOV |
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| Nabil Raad | 00721514 | Traffic OP. | 404-635-8126 | nraad@dot.ga.gov |
| Brent Story | 00285686 | Road Design | 404-631-1600 | bstory@dot.ga.gov |
| HARLEY GRIFFIN | | DeLou Hampton & Assoc | 404-524-8030 | hgf.fhin@delonhampton.com |
| Bobby Dollar | 00841961 | OEL | 404-669-6883 | rdollar@dot.ga.gov |
| Video Conf. with D-3 | | | | |
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ECONOMIC DATA

The comparisons of life cycle costs between the VE alternatives and the current design solutions were performed on the basis of discounted present worth. To accomplish this, the VE team developed economic criteria to use in its calculations based on information gathered from GDOT and the design team. The following parameters were used when calculating discounted present worth:

| | |
|-------------------------------|---------------|
| Year of Analysis: | 2009 |
| Construction Start Date: | November 2012 |
| Construction Completion Date: | 2015 |
| Planning Period (n): | 20 |

When computing capital costs, direct material, labor and equipment costs are marked up using a 22% for Engineering and Construction Administration, construction contingency and fuel adjustment.

COST MODEL

The VE team prepared the attached cost model for the project prior to the workshop. The cost model is arranged in the Pareto Charting/Cost Histogram format to aid in identifying high cost areas. As can be expected, judgments at this stage of the study are based on experience and intuition rather than facts, which are not uncovered until well along in the analysis of function. As a result of these qualified hypotheses, there appears to be a potential for initial savings in the following areas:

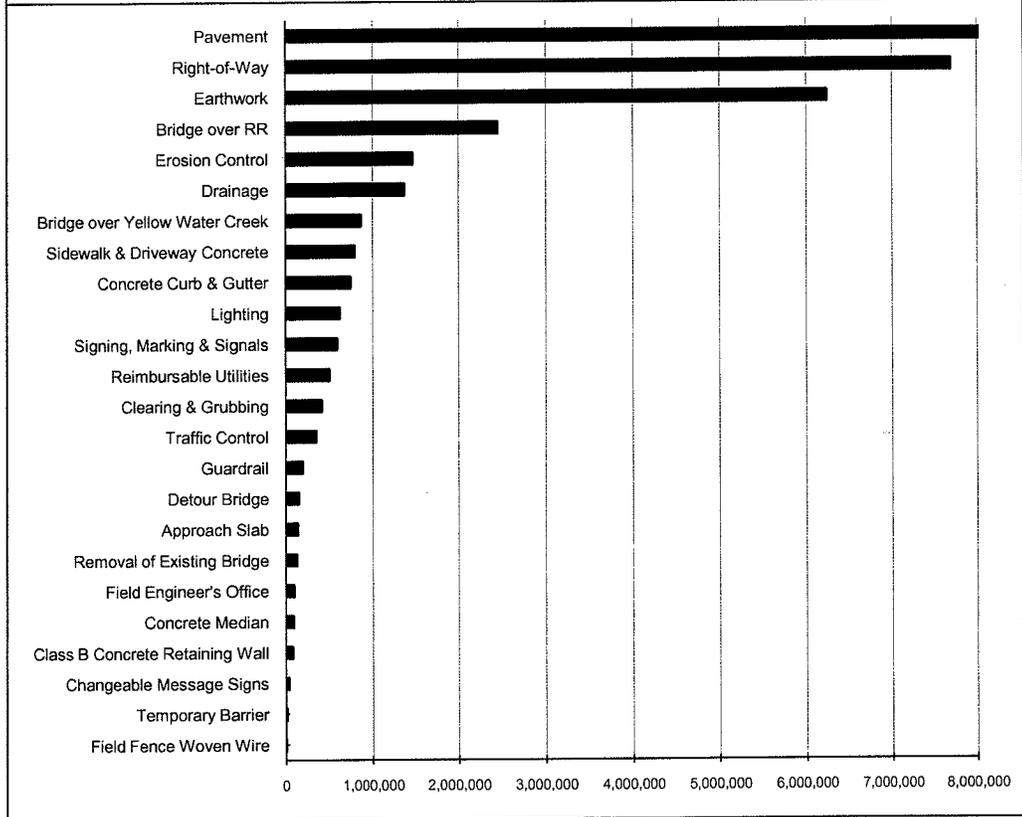
- Earthwork
- Right-of-Way
- Bridges

COST HISTOGRAM



PROJECT: SR 36 ONE-WAY PAIR IN JACKSON FROM BROWNLEE ROAD TO YELLOW WATER CREEK

| PROJECT ELEMENT | COST | PERCENT | CUM. PERCENT |
|---------------------------------|----------------------|----------------|--------------|
| Pavement | 8,334,723 | 25.02% | 25.02% |
| Right-of-Way | 7,700,400 | 23.12% | 48.14% |
| Earthwork | 6,240,116 | 18.73% | 66.88% |
| Bridge over RR | 2,448,545 | 7.35% | 74.23% |
| Erosion Control | 1,470,351 | 4.41% | 78.64% |
| Drainage | 1,369,988 | 4.11% | 82.76% |
| Bridge over Yellow Water Creek | 861,888 | 2.59% | 85.34% |
| Sidewalk & Driveway Concrete | 790,918 | 2.37% | 87.72% |
| Concrete Curb & Gutter | 740,986 | 2.22% | 89.94% |
| Lighting | 612,136 | 1.84% | 91.78% |
| Signing, Marking & Signals | 584,223 | 1.75% | 93.54% |
| Reimbursable Utilities | 494,600 | 1.48% | 95.02% |
| Clearing & Grubbing | 410,131 | 1.23% | 96.25% |
| Traffic Control | 342,796 | 1.03% | 97.28% |
| Guardrail | 190,805 | 0.57% | 97.85% |
| Detour Bridge | 146,913 | 0.44% | 98.29% |
| Approach Slab | 134,601 | 0.40% | 98.70% |
| Removal of Existing Bridge | 122,427 | 0.37% | 99.07% |
| Field Engineer's Office | 91,820 | 0.28% | 99.34% |
| Concrete Median | 87,211 | 0.26% | 99.60% |
| Class B Concrete Retaining Wall | 74,913 | 0.22% | 99.83% |
| Changeable Message Signs | 34,657 | 0.10% | 99.93% |
| Temporary Barrier | 16,130 | 0.05% | 99.98% |
| Field Fence Woven Wire | 6,207 | 0.02% | 100.00% |
| TOTAL | \$ 33,307,486 | 100.00% | |



FUNCTION ANALYSIS

A function analysis of the project was prepared to (1) understand the project purpose and need, (2) define the requirements for each project element, (3) ensure a complete and thorough understanding by the VE team of the basic function(s) needed to attain the given project purpose and need, (4) identify other public goals, and (5) identify secondary functions that should be addressed by the VE team. The Random Function Analysis worksheet completed by the team for the project in its entirety and the various elements follow. Key functions of the project are:

- Save Cost
- Improve Functionality (LOS) (Capacity)
- Enhance Safety
- Reduce Right-of-Way

RANDOM FUNCTION ANALYSIS



| PROJECT: SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD <i>Butts County, Georgia</i> | | SHEET NO.: 1 of 2 | | |
|---|---------------|--------------------------|-------------|---|
| DESCRIPTION | FUNCTION | | | |
| | VERB | NOUN | KIND | |
| Total Project Purpose and Need | Increase | Capacity | B | |
| | Increase | Access | B | |
| | Enhance | Safety | HO | |
| | Improve | Level of Service | HO | |
| | Separate | Railroad | B | |
| | Replace | Deficient Bridge | B | |
| | Promote | Downtown Development | HO | |
| | Promote | Northside Development | HO | |
| | | | | |
| Pavement | \$8.3M/\$7.5M | Increase | Capacity | B |
| | | Support | Loads | B |
| | | Enhance | Rideability | B |
| | | Create | Space | S |
| | | | | |
| Right-of-Way | \$7.7M/\$6.7M | | | |
| | | | | |
| Earthwork | \$6.4M/\$5.9M | Raise | Elevation | S |
| | | | | |
| Railroad Bridge | \$2.5M/\$2M | Separate | Railroad | B |
| | | | | |
| Erosion Control | \$1.5M | Prevent | Erosion | S |
| | | | | |
| Drainage | \$1.4M/\$1M | Remove | Stormwater | B |
| | | Convey | Stormwater | B |

| | | | | |
|----------------------|-----------------|-------|-------------------------|-------------------|
| Function defined as: | Action Verb | Kind: | B = Basic | HO = Higher Order |
| | Measurable Noun | | S = Secondary | LO = Lower Order |
| | | | RS = Required Secondary | G = Goal |

CREATIVE IDEA LISTING AND EVALUATION OF IDEAS

During the Creative/Speculation Phase, numerous ideas were generated for the project using conventional brainstorming techniques. These ideas were recorded and are shown with their corresponding ranking on the attached Creative Idea Listing Worksheets. For the convenience of tracking an idea through the VA process, the ideas were grouped into the following project elements and numbered according to the order in which they were conceived. The following letter prefixes were used to identify the project elements.

| PROJECT ELEMENTS | PREFIX |
|------------------|--------|
| Pavement | P |
| Right-of-Way | ROW |
| Earthwork | E |
| Bridges | B |
| Drainage | D |
| Sidewalks | S |
| Curb & Gutter | CG |
| General | G |

Creative Idea Evaluation

The ideas were then ranked on a qualitative scale of 1 to 5 on how well the VE team believed the idea met the project purpose and need criteria. To assist the team in evaluating the creative ideas, the advantages and disadvantages of each new idea compared to the existing design solution were discussed based on the owner's value objectives for the project. The following are the top value objectives for this project:

- Saves costs
- Improves functionality
- Improves safety
- Reduces right-of-way impacts and acquisitions

After discussing each idea, the team evaluated the ideas by consensus. This produced 20 ideas rated 4 or 5 to research and develop into formal VE alternatives to be included in the Study Results section of the report. Highly rated ideas that were not developed further may have been combined with another related idea or discarded as a result of additional research indicating the concept as not being cost effective or technically feasible. The reader is encouraged to review the Creative Idea Listing and Evaluation worksheet since it may suggest additional ideas that can be applied to the design.

CREATIVE IDEA LISTING



| | | | |
|----------|---|------------|--------|
| PROJECT: | SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD <i>Butts County, Georgia</i> | SHEET NO.: | 1 of 2 |
|----------|---|------------|--------|

| NO. | IDEA DESCRIPTION | RATING |
|---------------------------|---|--------|
| GENERAL (G) | | |
| G-1 | Delete median opening at new connector road and use road under the railroad bridge to access southbound SR 36 | 2 |
| G-2 | Add in a roundabout where Freeman Road intersects SR 36 and connect old SR 36 to the roundabout | 4 |
| DRAINAGE (D) | | |
| D-1 | Use HDPE pipe for longitudinal storm draining pipe | 4 |
| BRIDGES (B) | | |
| B-1 | Reduce width of median on bridge to 6 ft | 4 |
| B-2 | Use walls in lieu of end spans for railroad bridge | 4 |
| B-3 | Use conspan for Yellow Water Creek Bridge | 4 |
| B-4 | Use only one southbound lane over the bridge | 4 |
| B-5 | Raise the road under the bridge and shorten the bridge | 4 |
| RIGHT-OF-WAY (ROW) | | |
| ROW-1 | Delete Cindy Street connection and provide access under SR 36 at Thurman Street | 5 |
| ROW-2 | Delete Cindy Street connection and provide access at Valley Road | 4 |
| ROW-3 | Use confined earth section on both sides of the bridge | 4 |
| ROW-4 | Add a mechanically stabilized earth wall at Sta. 425+00 to save property on the right side of SR 36 | 4 |
| PAVEMENT (P) | | |
| P-1 | Relocate the connector road to the north end of the project | 3 |
| P-2 | Use 11-ft-wide lanes throughout the project | 2 |
| P-3 | Reduce the paved shoulder width from 6½ ft to 4 ft | 4 |
| P-4 | Relocate the combined (merged) section to the east | 4 |
| P-5 | Relocate the north entrance to Old School to right-in/right-out on the existing driveway alignment | 2 |

Rating: 1→2 = Not to be developed 3→4 = Varying degrees of development potential 5 = Most likely to be developed
 DS = Design suggestion ABD = Already being done

CREATIVE IDEA LISTING



| | | | |
|----------|---|------------|--------|
| PROJECT: | SR 36/JACKSON FROM SR 16 TO CR 289/STARK ROAD <i>Butts County, Georgia</i> | SHEET NO.: | 2 of 2 |
|----------|---|------------|--------|

| NO. | IDEA DESCRIPTION | RATING |
|------|--|--------|
| | PAVEMENT (P) (continued) | |
| P-6 | Add a right turn from the north end of existing SR 36 that is to be cul-de-saced to new SR 36 | 2 |
| P-7 | Delete the right-turn pockets at Cindy Street | 2 |
| P-8 | Delete the right-turn pocket on southbound SR 36 at Hancock Street | 4 |
| P-9 | Use 11-ft-wide lanes from the merge to the connector | 4 |
| | | 5 |
| | SIDEWALKS (S) | |
| S-1 | Delete sidewalks north of the merge | 5 |
| S-2 | Delete sidewalks and curb and gutter north of the merge | 5 |
| S-3 | Delete the inside sidewalk from Slaughter Avenue to the merge; bring sidewalk past the church | 5 |
| | | |
| | CURB AND GUTTER (CG) | |
| CG-1 | Use 24-in-wide curb and gutter in lieu of 30-in-wide curb and gutter | 4 |
| | | |
| | EARTHWORK (E) | |
| E-1 | Reduce the median width from 20 ft to 6 ft | |
| E-2 | Lower the profile at Sta. 243+00 about 5 ft | 4 |
| E-3 | Use 2:1 slope in lieu of 4:1 slope at Sta. 243+50 to Sta. 245+50 | 4 |
| E-4 | Raise the grade on the south side of the railroad bridge and lower the grade on the north side of the railroad bridge | 4 |
| E-5 | Move the connector about 150 ft north | 4 |
| E-6 | Connect SR 36 to Valley Road in lieu of Cindy Street, move the new connector road intersection 150 ft north and crest SR 36 at the bridge with steep slopes on both sides, and move SR 36 curve east | 4 |
| E-7 | Use 12-ft-wide shoulders north of the merge with a 2 ft grass strip in lieu of 16-ft-wide shoulders | 4 |
| | | |
| | | |

| |
|--|
| Rating: 1→2 = Not to be developed 3→4 = Varying degrees of development potential 5 = Most likely to be developed DS = Design suggestion ABD = Already being done |
|--|