# BUREAU of MATERIALS and RESEARCH

GEOTECHNICAL UNIT
GEOLOGY SECTION

BRIDGE FOUNDATION GEOLOGY REPORT

24-75 K-3325-01

US-24 over Blackjack Creek
Br. No's. 324.53 & 324.54

POTTAWAWATOMIE COUNTY

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By

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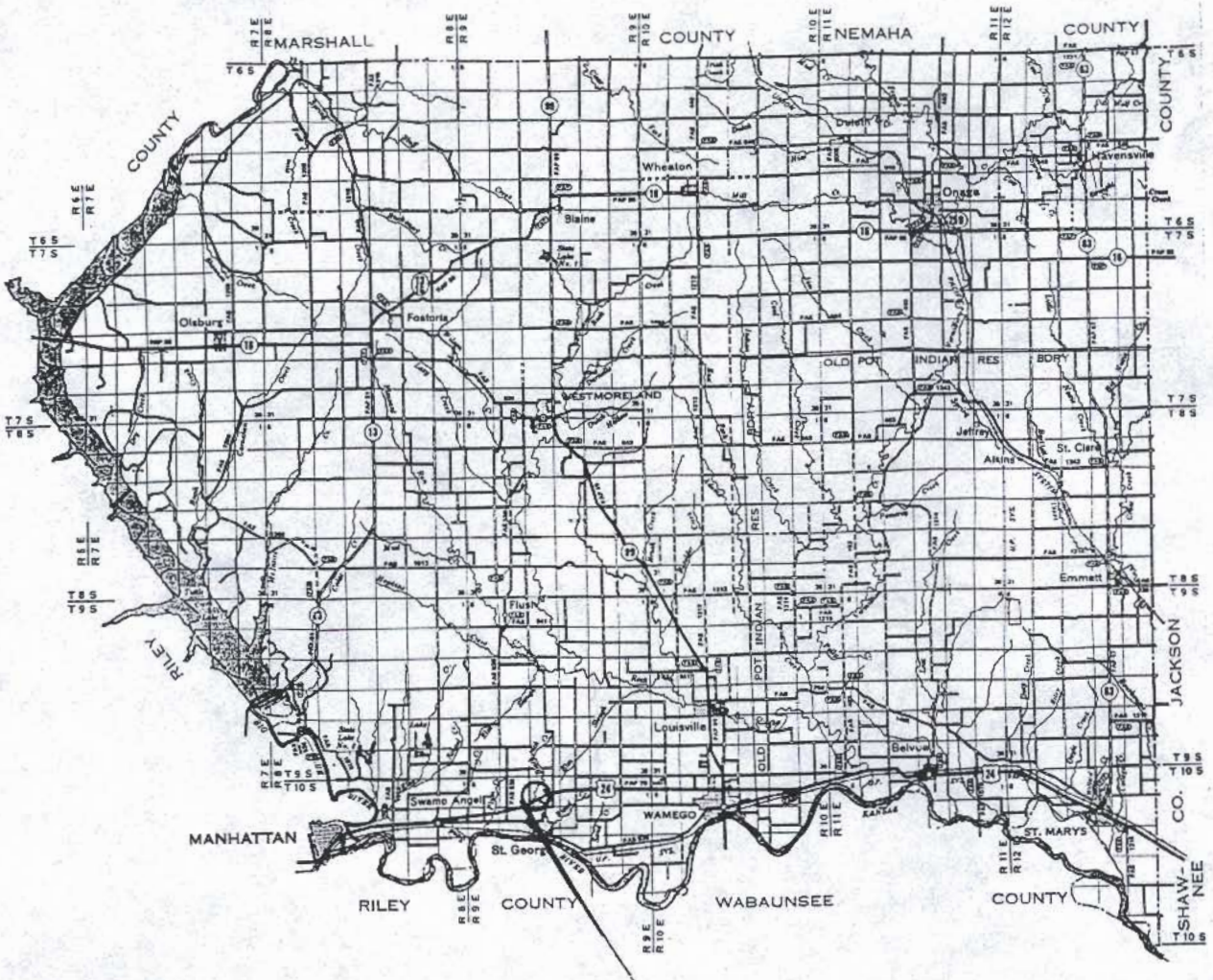
November 1993

# *Kansas Department of Transportation*

## BRIDGE FOUNDATION GEOLOGY REPORT




**24-75 K-3325-01**
**Br. No. 324.54**
**Pottawatomie County**

## INTRODUCTION

This report details the geologic information and foundation recommendations for the proposed construction of US-24 over Blackjack Creek. The original design concept was for the construction of two new structures. Present plans call for the construction of only a new bridge to accommodate W.B. traffic with E.B. traffic using the existing bridge. Since the investigation and report were completed before the concept changed, this report contains recommendations for both the E.B. and W.B. lanes.

## GEOLOGY AND FOUNDATION MATERIAL

The geology in the area of this bridge consists of thick alluvial deposits overlying the Emporia Limestone on top of the Auburn Shale, both, of the Pennsylvanian System.

The mantle consists of alluvial deposits. The alluvium consists of brown sandy silt with some clay binder, overlying sand and gravel with clay lenses. The alluvial deposits range in thickness from 12.8 to 14.0 meters (42.0 to 45.8 feet).

The Emporia Limestone consists of two limestones with a shale in the middle. Comprising the Emporia Limestone are the Elmont Limestone Member, Harveyville Shale Member and the Reading Limestone Member. The Elmont Ls. Mbr. at this bridge site is approximately 0.4 meters (1.4 feet) thick. The limestone is blue gray, fossiliferous, crystalline and somewhat vertically fractured yet remains dense. The Harveyville Sh. Mbr. at this bridge site is approximately 4.6 meters (15.2 feet) thick. The shale is sandy to silty with sandstone stringers in the upper portion, gray to dark gray in color and clayey. The Reading Ls. Mbr. at this bridge site is approximately 0.4 meters (1.3 feet) thick. The limestone is blue gray, fossiliferous, crystalline and dense. The lower portion of the Reading Ls. Mbr. appears shaly yet dense. The Auburn Shale, at this bridge site, is a complex and variable formation composed of light to dark gray clayey shale with a micaceous sandstone bed containing pyrite bands and or nodules, lower portion contains finegrained sandstone. The Auburn Shale was measured at 3.9+ meters (12.7+ feet) thick.

Casing drives made in this investigation reached refusal on the Elmont Ls. Mbr. contact penetrating 0.1 meters (0.2 feet) of *somewhat fractured limestone at elevation of 994.9 with 100 blows* per tenth.

## FOOTING RECOMMENDATIONS

The foundation recommendations for these bridges are based on core samples, a casing drive, power auger soundings and "As Built" plans. The footings are designed to anticipate pile cutoff rather than necessitating pile splicing due to unforeseen penetration.

Pile Footings

Pile footings are the recommended foundation at all footing locations. H-pile should readily penetrate the alluvium and obtain point bearing in the Elmont Ls. Mbr.

Listed in the table below are the approximate pile tip elevations for the abutment and pier footings at both bridge sites (Br.# 324.53 E.B., Br.# 324.54 W.B.). The following pile tip recommendation are allowing for some cutoff.

| Location | Mantle-Bedrock | Design pile tip Elevation |
|---|---|---|
| **Br.# 324.53 (E.B.)** | | |
| Abutment One Sta. 245+25.75 | 994.9 | 993.9 |
| Pier One Sta. 245+58.76 | 995.2 | 994.2 |
| Pier Two Sta. 246+02.75 | 995.3 | 994.3 |
| Abutment Two Sta. 246+35.75 | 995.5 | 994.5 |

| Location | Mantle-Bedrock | Design pile tip Elevation |
|---|---|---|
| **Br.# 324.54 (W.B.)** | | |
| Abutment One Sta. 245+74.25 | 995.2 | 994.2 |
| Pier One Sta. 246+07.25 | 995.2 | 994.2 |
| Pier Two Sta. 246+51.25 | 995.2 | 994.2 |
| Abutment Two Sta. 246+84.25 | 995.2 | 994.2 |

The following note should be placed on the construction plans.

**PILE BEARING NOTE:**

"If sufficient bearing and penetration into the bedrock are achieved, before the design pile tip elevation is reached, driving pile should cease to avoid damage to the piles."

DRILLED SHAFTS

A drilled shaft design is a viable option foundation for the piers. Reviewing recent flood damage and the scour activity at this bridge site a drilled shaft design could be considered. Although the pier caps were exposed and sustained some damage the piling remained intact. Shafts could be drilled for bearing below the Elmont Ls. Mbr. with the socket in the clayey middle portion of the Harveyville Sh. Mbr. The concrete should be cast against the socket wall to take advantage of the side resistance of the concrete bond. It is imperative that the socket should be free of debris. Both temporary and permanent casing will be required at these piers. Temporary casing should be seated below the Elmont Limestone into the clayey shale at approximately elevation 992.0 to prevent intrusion of overburden and groundwater which occurs in the alluvial deposits.

Drilled shaft footings may be designed with an end bearing of 1.14 MPa (12 tsf).

The Mantle-Bedrock and bottom of socket elevations are listed below at both bridge sites (Br.# 324.53 E.B., Br.# 324.54 W.B.).

| Location | Mantle-Bedrock Elevation | Drilled Socket Elevation |
|---|---|---|
| **Br.#324.53 (E.B.)** | | |
| Pier No. 1 Sta. 245+85.76 | 995.2 | 985.0 * |
| Pier No. 2 Sta. 246+02.75 | 995.3 | 985.0 * |

| Location | Mantle-Bedrock Elevation | Drilled Socket Elevation |
|---|---|---|
| **Br.#324.54 (W.B.)** | | |
| Pier No. 1 Sta. 246+07.25 | 995.2 | 985.0 * |
| Pier No. 2 Sta. 246+51.25 | 995.2 | 985.0 * |

* However, if higher tonnage is required, the bottom of the socket elevation should be lowered to an elevation of 978.4 with a maximum end bearing pressure of 1.9 MPa (20 tsf) on top of the Reading Limestone.

## LATERALLY LOADED PILE

Rock parameters for laterally loaded pile design (3.5 ft. shaft size) are as follows:

**Shale**

QU = 33.273  Dry Unit Wt. = 127.2 pcf  % Moist. = 12.4

q = 66.546
Su = 33.273

NPPY = 3
GAM1 = 0.143 kcf

| YP (I,J) | PP (I,J) |
|---|---|
| 0.0000 | 0.000 |
| 0.0245 | 65.215 k/ft |
| 0.0712 | 116.455 k/ft |

## HYDROLOGY

The groundwater level for this investigation measured in core drill one, near abutment one eastbound (Br.# 324.53) was at elevation 1024.3 (October 1993). The groundwater level measured in power auger one, near abutment two westbound (Br.# 324.54) was at an elevation 1033.0 (October 1993). Any excavations made below the water table will require the use of sheeting and de-watering equipment.

## INVESTIGATION PROCEDURES

Information from one core drill, three power auger soundings and "As Built" plans were made to develop the foundation geology at this bridge location. Logs of the core drill and power auger soundings are included with this report.

## ACKNOWLEDGMENTS

The following individuals participated in the acquisition of field data for this investigation, Bob Bergman (ET Senior), Paul Gudenkauf and Duane Petty (ET's).

CORE HOLE CALCULATION FOR LAB TEST RESULTS GRAPH ON CADD FILES

| T. H. E. | ELEV. | LOG DEPTHS "15" SCALE | | tsf |
|---|---|---|---|---|
| 1036.9 | cd# 1 | cores | Br# 324.53 | |
| | 994.9 | 42 | 33.6 | |
| | 994.55 | 42.35 | 33.88 | 413.6 |
| | 990.7 | 46.2 | 36.96 | |
| | 990.1 | 46.8 | 37.44 | 11.6 |
| | 985.4 | 51.5 | 41.2 | |
| | 985 | 51.9 | 41.52 | 33.3 |
| | 982.25 | 54.65 | 43.72 | |
| | 981.8 | 55.1 | 44.08 | 25.4 |
| | 977.8 | 59.1 | 47.28 | |
| | 977.3 | 59.6 | 47.68 | 904.8 |
| | 975.5 | 61.4 | 49.12 | |
| | 975.1 | 61.8 | 49.44 | 32.4 |
| | 973.1 | 63.8 | 51.04 | |
| | 972.5 | 64.4 | 51.52 | 45.2 |

# KANSAS DEPARTMENT OF TRANSPORTATION

| | | |
|---|---|---|
| 1. ROUTE-COUNTY NO. 24-75 | 7. SOUNDING NO. CD#1 | 12. SHEET 1 OF 2 |
| 2. BRIDGE STA. 245+80.75 | 8. PROJECT NO. K-3325-01 | 13. BRIDGE NO. 324.53 |
| 3. DESCRIPTION U.S.-24 over Blackjack Cr. | | 14. HOLE STA. 245+22.5, RH 14 |
| 4. GEOLOGIST R. Hutchinson | 9. VERTICLE SCALE 1"=10' | 15. DATE Oct. / 1993 |
| 5. DRILLER Bob Bergman | 10. RIG B-61 | 16. ELEVATION TOP OF HOLE 1036.9 |
| 6. GROUND WATER ELEV. 1024.3 | 11. TOTAL DEPTH OF HOLE 72.6 | 17. ELEVATION TOP OF ROCK 994.9 |

| BIT TYPE & NO. | GEOLOGIC NAME | STRATIGRAPHIC COLUMN | DEPTH | ELEVATION | CLASSIFICATION OF MATERIALS DESCRIPTION AND REMARKS | UNCONFINED COMPRESSION | STANDARD PENETRATION OR CASING DRIVE BLOWS | STANDARD PENETRATION OR CASING DRIVE ELEV. |
|---|---|---|---|---|---|---|---|---|
| | | | | | Abut. #1<br>T.H. El. 1036.9 | | | |
| 3½" Diamond Core Bit | Alluvium | | 3.0 | 1033.9 | Sandy Silt with some clay binder, brown | | Pushed 4" Casing | |
| | | | | 1030 | | | | |
| | | | | 1020 | Sand with some clay binder, multi-colored sand, clays brown-green-gray, fine to medium grained, some scattered gravels | | | 1024.0 |
| | | | | 1010 | | | | |
| | | | 40.6 | 1000 | | | | |
| | | | | 996.3 | | | | |
| | | | 42.0 | 994.9 | Sand & Gravel | 413.558 | 100 / 8" | 994.9 |
| | Elmont Ls. Mbr. | | 43.4 | 993.5 | Ls. gray, foss. lower portion silty | | | 994.6 |
| | | | 45.0 | 991.9 | Sh. sndy, blue gray | | | |
| | | | | 990 | Sh. sndy with Ss. lenses, gray | 11.588 | | 990.1 |
| | | | 48.4 | 988.5 | | | | |
| | Harveyville Shale Mbr. | | | | Sh. silty, dark gray, clayey | 33.273 | | 985.0 |
| | | | | | | 25.443 | | 981.8 |
| | | | | 980 | | | | |
| | | | 58.6 | 978.3 | | | | |
| | Reading Ls. Mbr. | | 59.9 | 977.0 | Ls. blue gray, foss., lower shaly | 904.844 | | 977.3 |
| | | | | | | 32.435 | | 975.1 |
| | Auburn Shale | | | | Sh. dark gray, clayey | 45.100 | | 972.5 |
| | | | | 970 | | | | |
| | | | 68.1 | 968.8 | | | | |
| | | | 70.9 | 966.0 | Ss. gray, micaceous, with pyrite | | | |
| | | | 72.6 | 964.3 | Silty Sh. gray, micaceous, sndy & pyrite stringers or bands | | | 964.3 |
| | | | TD | | | | TD | |

DRILLING LOG (con't sheet) | 7. SOUNDING NO. CO#1 | 8. PROJECT NO. K-3325-01 | 12. SHEET 2 OF 2

10. ELEVATION TOP OF HOLE 1036.9 | 6. GROUND WATER ELEV. 1024.3 | 11. TOTAL DEPTH OF HOLE 72' | 17. ELEVATION TOP OF ROCK 994.9

| BIT TYPE & NO. | GEOLOGIC NAME | STRATIGRAPHIC COLUMN | DEPTH | ELEVATION | CLASSIFICATION OF MATERIALS DESCRIPTION AND REMARKS | UNCONFINED COMPRESSION | STANDARD PENETRATION OR CASING DRIVE BLOWS | STANDARD PENETRATION OR CASING DRIVE ELEV. |
|---|---|---|---|---|---|---|---|---|
| | | | | | Core #1, 42'-45' (994.9-991.9)<br>Cut: 3' Rec: 1'<br>Core Rec- 38% RQD-12% | | | |
| | | | | | Core #2, 45'-47' (991.9-989.0)<br>Cut: 2' Rec: 2'<br>Core Rec-100% RQD-21% | | | |
| | | | | | Core #3, 47'-52' (989.0-984.4)<br>Cut: 4' Rec: 4'<br>Core Rec-100% RQD-55% | | | |
| | | | | | Core #4, 52'-54' (984.4-982.5)<br>Cut: 1' Rec: 1'<br>Core Rec-100% RQD-0% | | | |
| | | | | | Core #5, 54'-57' (982.5-979.0)<br>Cut: 3' Rec: 3'<br>Core Rec-91% RQD-47% | | | |
| | | | | | Core #6, 57'-61' (979.0-975.9)<br>Cut: 3' Rec: 2'<br>Core Rec-71% RQD-27% | | | |
| | | | | | Core #7, 61'-62' (975.9-974.0)<br>Cut: 1' Rec: 1'<br>Core Rec-100% RQD-58% | | | |
| | | | | | Core #8, 62'-67' (974.0-969.1)<br>Cut: 4' Rec: 4'<br>Core Rec-100% RQD-98% | | | |
| | | | | | Core #9, 67'-72' (969.1-964.3)<br>Cut: 4' Rec: 4'<br>Core Rec-98% RQD-42% | | | |

KANSAS DEPARTMENT OF TRANSPORTATION

**Report of sample of** Geology Cores

**Laboratory No.** 93-4368

**Date Rep'td.** October 27, 1993

**Date Rec'd.** October 25, 1993

**Specification No.** - - **Quantity** - - -

**Source of material** Project

**Sample from** Project

**Submitted by** Alex A. Kotoyantz, Manhattan Regiongal Geologist

**Identification marks** Tags with samples

**Project or POV** 24-75 K-3325-01, Pottawatomie County, District 1

**Type of construction** Bridge Replacement

**TEST RESULTS**

| Sample No. | Station | Dist.ft. CL | Depth ft. | Description | Qu. t.s.f. | Sample p.c.f. by Dry Wt. | Moisture (% of Dry Wt.) |
|---|---|---|---|---|---|---|---|
| T.H.E. 1036.9 | | | | | | | |
| 1 | 245+22.5 | 114' Rt | $42^{0}$-$42^{35}$ | Ls. foss. gray | 413.558 | 159.0 | 3.1 |
| 2 | " | " | $46^{2}$-$46^{8}$ | Sh. Sndy, gray | 11.588 | 128.1 | 12.2 |
| 3 | " | " | $51^{5}$-$51^{9}$ | Sh. gray | 33.273 | 127.2 | 12.4 |
| 4 | " | " | $54^{65}$-$55^{1}$ | Sh. gray, silty | 25.443 | 127.3 | 12.4 |
| 5 | " | " | $59^{1}$-$59^{6}$ | Ls. foss. gray | 904.844 | 165.3 | 1.0 |
| 6 | " | " | $61^{4}$-$61^{8}$ | Sh. gray, clayey | 32.435 | 131.4 | 11.1 |
| 7 | " | " | $63^{8}$-$64^{4}$ | Sh. gray, clayey | 45.190 | 132.5 | 10.2 |

cc: L.S. Ingram
L.A. Rockers ✓
A.A. Kotoyantz
J.J. Brennan
Soil Section
File

Reported by Morris Hunt for

Title James J. Brennan, Soils Engineer

Rev. 3-76

D.O.T. Form No. 623

Power Auger Soundings — Project: 24-75-K-3325-01
Br. # 324.58 (EB) & 324.54 (WB)
US-24 over Blackjack Creek
Pottawatomie County

Note: All stationing is from ℄ of Project.

| | | | |
|---|---|---|---|
| Abut # 2 (WB) PA #1 | 1038.4 | 0° - 1° | Sndy Silt, brown, moist |
| Sta. 247+20, Lt. 26 | 1037.4 | 1° - 2⅙ | Snd., fine grained |
| 10-22-93 | 1035.8 | 2⅙ - 3⅜ | Concrete (ditch liner) |
| W.L. - 5¼ | 1035.1 | 3⅜ - 5⅝ | Silt, very sndy |
| closed | 1032.9 | 5⅝ - 8⅝ | Sndy Silt, saturated |
| | 1029.9 | 8⅝ - 12⅝ | Snd, fine grained, some clay lenses, scattered gravels, sat. |
| | 1025.9 | 12⅝ - 21° | Snd, gray, fine grained, some clay binder |
| | 1017.4 | 21° - 34¼ | Snd, green cast, fine grained |
| | 1004.0 | 34¼ - 40⅞ | Snd with gravel stringers |
| | 997.7 | 40⅞ - 40⅞ | Gravel stringer |
| | 997.5 | 40⅞ - 42½ | Snd with some gravel |
| | 995.8 | 42½ - 43⅜ | Gravel, med. - large |
| | 995.2 | 43⅜ - 43⅜ | Ls. very hard, no return |
| | 995.1 | 43⅜ | SIS |
| | | | |
| Abut # 1 (WB) PA # 2 | 1038.9 | 0° - 3⅜ | Sndy Silt, brown, slightly moist |
| Sta. 245+84, Lt. 60 | 1035.6 | 3⅜ - 4⅞ | Snd with some clay binder |
| 10-22-93 | 1034.7 | 4⅞ - 7° | Snd, clean, fine grained |
| closed | 1031.9 | 7° - 10° | Snd, saturated, gray brown, with some clay binder |
| | 1028.9 | 10° - 25° | Snd, some clay binder and scatt. gravels, gray brown |
| | 1013.9 | 25° - 43⅞ | Snd, with gravel layers, heavy gravel near bottom, green cast |
| | 995.2 | 43⅞ - 44⅜ | Ls. hard, gray, very little return |
| | 994.6 | 44⅜ | SIS |

Power Auger Soundings (Cont) Project: 24-75-K-3325-01

Br. # 324.53 (EB) & 324.54 (WB)

US-24 over Blackjack Creek

Pottawatomie County

| | | | | |
|---|---|---|---|---|
| Abut # 2 (EB) PA # 3 | | 1041.5 | 0° - 3' | Silty clay, sndy with Ls rubble (fill) |
| Sta. 246+87, Rt. 103 | | 1038.2 | 3' - 7° | Snd with some clay binder |
| 10-22-93 | | 1034.5 | 7° - 8° | Snd with clay binder, saturated |
| W.L. - 12' | | 1033.5 | 8° - 19° | Snd, clean with clay lenses |
| Closed | | 1022.5 | 19° - 32° | Snd, gray with some clay binder & scatt. gravels |
| | | 1009.5 | 32° - 45' | Snd, green cast with scatt. gravels |
| | | 996.4 | 45' - 45' 8" | Gravel & sand |
| | | 995.7 | 45' 8" - 46° | Ls. hard, no return |
| | | 995.5 | 46° | S/S |

Survey Notes

Project: 24-75-K-3325-01

BM # 324.53 (EB) & 324.54 (WB)

US-24 over Blackjack Creek

Pottawatomie County

| | BS | HI | FS | Elev. | |
|---|---|---|---|---|---|
| BM #36 | | | | 1049.86 | "□" Cut W. Cor. SW Brg. Abut. Sta. 245+77, Rt 60 |
| $T_1$ | 2.83 | 1052.69 | | | |
| CO #1 | | | 15.78 | 1036.91 | Sta. 245+22.5, Rt. 114 |
| Close | | | 2.83 | 1049.86 | closed BM #36 |
| $T_2$ | 4.48 | 1054.34 | | | Notes |
| PA #1 | | | 15.90 | 1038.44 | Sta. 247+20, Lt. 26 |
| close | | | 4.48 | 1049.86 | closed BM #36 |
| $T_3$ | 2.60 | 1052.46 | | | Notes |
| PA #3 | | | 10.93 | 1041.53 | Sta. 246+87, Rt. 103 |
| PA #2 | | | 13.61 | 1038.85 | sta. 245+84, Lt. 60 |
| close | | | 2.60 | 1049.86 | closed BM #36 |