Illinois Department of Transportation

## Abbreviated Structure Geotechnical Report

| | | | |
|---|---|---|---|
| Original Report Date: 5-14-2014 | Proposed SN: 050-2058 | Route: | FAP 623 (US 6) |
| Revised Date: 03-06-2015 | Existing SN: 050-0108 | Section: | (G) BR |
| Geotechnical Engineer: Michael Short, IDOT District 3 | | County: | LaSalle |
| Structural Engineer: Shuja Kazi, Delta Engineering Group, LLC | | Contract: | 66A58 |

Indicate the proposed structure type, substructure types, and foundation locations (attach plan and elevation drawing): *The proposed structure is a double 12-feet by 12-feet precast concrete box culvert with a 45° left forward skew A copy of the draft TSL is attached.*

Discuss the existing boring data, existing plans foundation information, new subsurface exploration and need for any additional exploration to be provided with SGR Technical Memo (attach all data and subsurface profile plot): *The existing structure is a 3-span bridge with a 44° left forward skew. The substructure consists of steel H-piles at the abutments and spread footings at the column piers. Two soil borings were performed by IDOT on 2012. Copies of the two boring logs are attached.*

Provide the location and maximum height of any new soil fill or magnitude of footing bearing pressure. Estimate the amount and time of the expected settlement. Indicate if further testing, analysis, and/or ground improvement/treatment is necessary: *The proposed culvert location will require a fill approximately 20-feet high to reach the existing grade line. Soil properties below the culvert structure indicate low moisture and the presence of shale. A site visit indicated no signs of settlement at the existing structure. No further settlement analysis is warranted.*

Identify any new cuts or fill slope angles and heights. Estimate the factor of safety against slope failure. Indicate if further testing, analysis or ground improvement/treatment is necessary. *Proposed side slopes at the culvert location are expected to be flatter than existing. Proposed side slope ranges from 1:3 to 1:4. A site visit indicated no signs of slope stability problems at the existing structure. A slope stability analysis indicated that the proposed embankment configuration will have a factor of safety in excess of 1.5.*

Indicate at each substructure, the 100-year and 500-year total scour depths in the Hydraulics report, the non-granular scour depth reduction, the proposed ground surface, and the recommended foundation design scour elevations. *The design scour elevation table is not required for closed bottom box culverts per ABD memo 14.2.*

Determining the seismic soil site class, the seismic performance zone, the 0.2 and 1.0 second design spectral accelerations and indicate if that the soils are liquefiable. *Not applicable to culverts.*

Confirm feasibility of the proposed foundation or wall type and provide design parameters. Attach a pile design table indicating feasible pile types, various nominal required bearings, factored resistances available and corresponding estimated lengths at locations where piles will be used. Provide factored bearing resistance and unit sliding resistance at various elevations and confirm no ground improvement/treatment is necessary where spread footings are proposed. Estimated top of rock elevations as well as preliminary skin friction and end bearing values shall be indicated when drilled shafts are proposed. *Wingwalls are discussed in the attached section labeled "Wingwalls."*

*The soils under the proposed box culvert will not require removal and replacement to support the proposed structure. The only aggregate needed under the precast concrete box culvert is the 6 inches required by Article 540.06 of the Standard Specifications.*

Calculate the estimated water surface elevation and determine the need for cofferdam(s) and seal coat: *The structure can be constructed using conventional methods for water diversion.*

Assess the need for sheeting/soil retention versus using a temporary construction slope and provide recommendation for the most feasible option. *The soil below the culvert consists of shale; therefore Temporary Sheet Piling should not be used. If stage construction is used, the pay item "Temporary Soil Retention" should be used.*

## WINGWALLS

*Horizontal cantilever wingwalls are not recommended due to the high cracking potential caused by unbalanced loads on the wingwalls due to the skew of the culvert.*

*Gabion wingwalls are feasible for both upstream and downstream ends of the culvert. If it is desired to pursue this option, design parameters will be provided via a Geotechnical Design Memorandum.*

*Drilled soldier pile wingwalls may also be feasible. If it is desired to pursue this option, design parameters will be provided via a Geotechnical Design Memorandum.*

*T type wingwalls are feasible for both upstream and downstream ends of the culvert. For a cast in place wingwall footing with $H_d$ = 16.5 feet, T = 12 inches, $T_f$ = 1.5 feet, and b = 9 feet (see IDOT Culvert Manual for nomenclature), the calculated sliding resistance is 9.2 kip / ft of wall length. This was calculated using a resistance factor of 1.0 (AASHTO 11.5.7-1) and no passive resistance on the footing and assuming the footing is not keyed into the shale. A preliminary calculation determined the unfactored bearing resistance of the shale directly under a footing 9 feet wide and 4 feet below the ground surface is 20 ksf. The bearing resistance factor is 0.55 (AASHTO Table 11.5.7-1)*

## BENCH MARK #1:

Railroad spike in utility pole, sta. 96+49.48, 34.62 ft. left, Elev. 523.37.

## BENCH MARK #2:

Chiseled square on South East Wingwall SN 050-0108 at sta. 94+87.06, 22.21' right, Elev. 525.69.

## EXISTING STRUCTURE:

The existing structure number 050-0108 was originally built in 1959 as F.A. Route 623, section H(I) in LaSalle County over Milliken Creek located 1.7 miles east of Illinois 71. The existing structure is a three span bridge constructed of steel rolled beams and 7 1/2" Reinforced Concrete Deck with clear width of 42'-6" and back to back of abutments 141'-0". The bridge is skewed 44° left forward. The existing structure will be removed and replaced with a Double Barrel 12'-0" wide x 12'-0" high Precast Concrete Box Culvert carrying roadway measuring 40'-0" face to face of guardrail.

The road will be temporarily closed, traffic will be detoured using state route detour during existing structure removal and proposed structure construction.

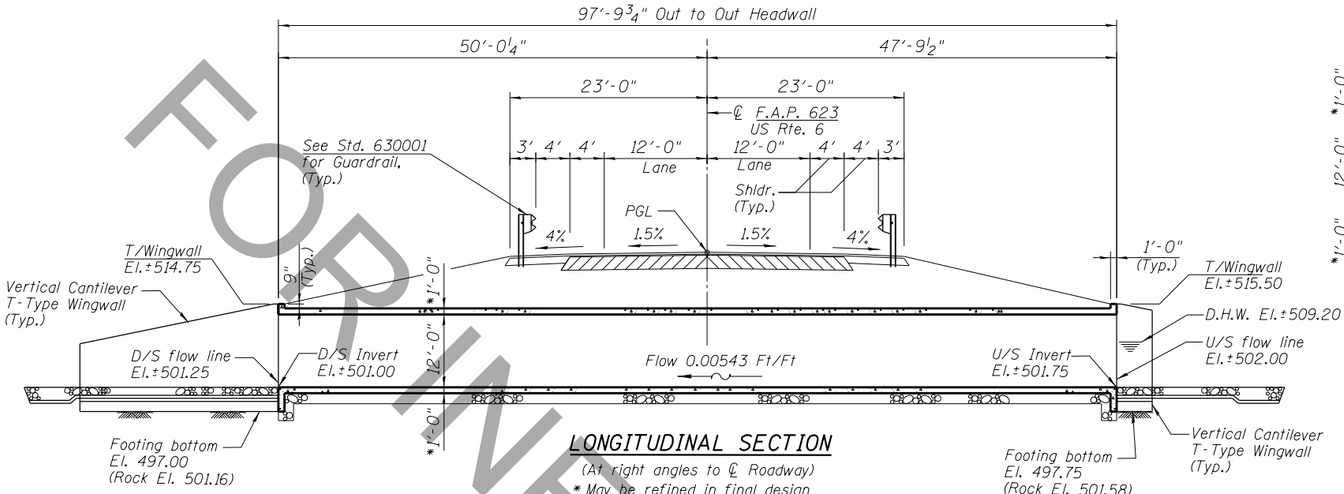
## SALVAGE:

No Salvage

Note:
1. Drainage behind wingwalls to be provided in design phase.

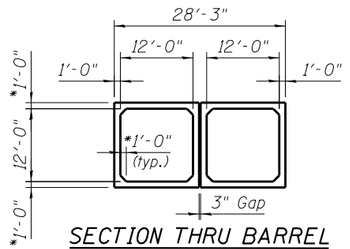
## LEGEND:

- Soil Boring Location



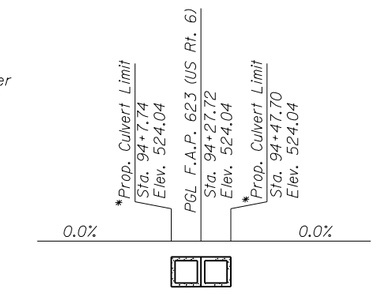

### LONGITUDINAL SECTION

(At right angles to ℄ Roadway)
* May be refined in final design



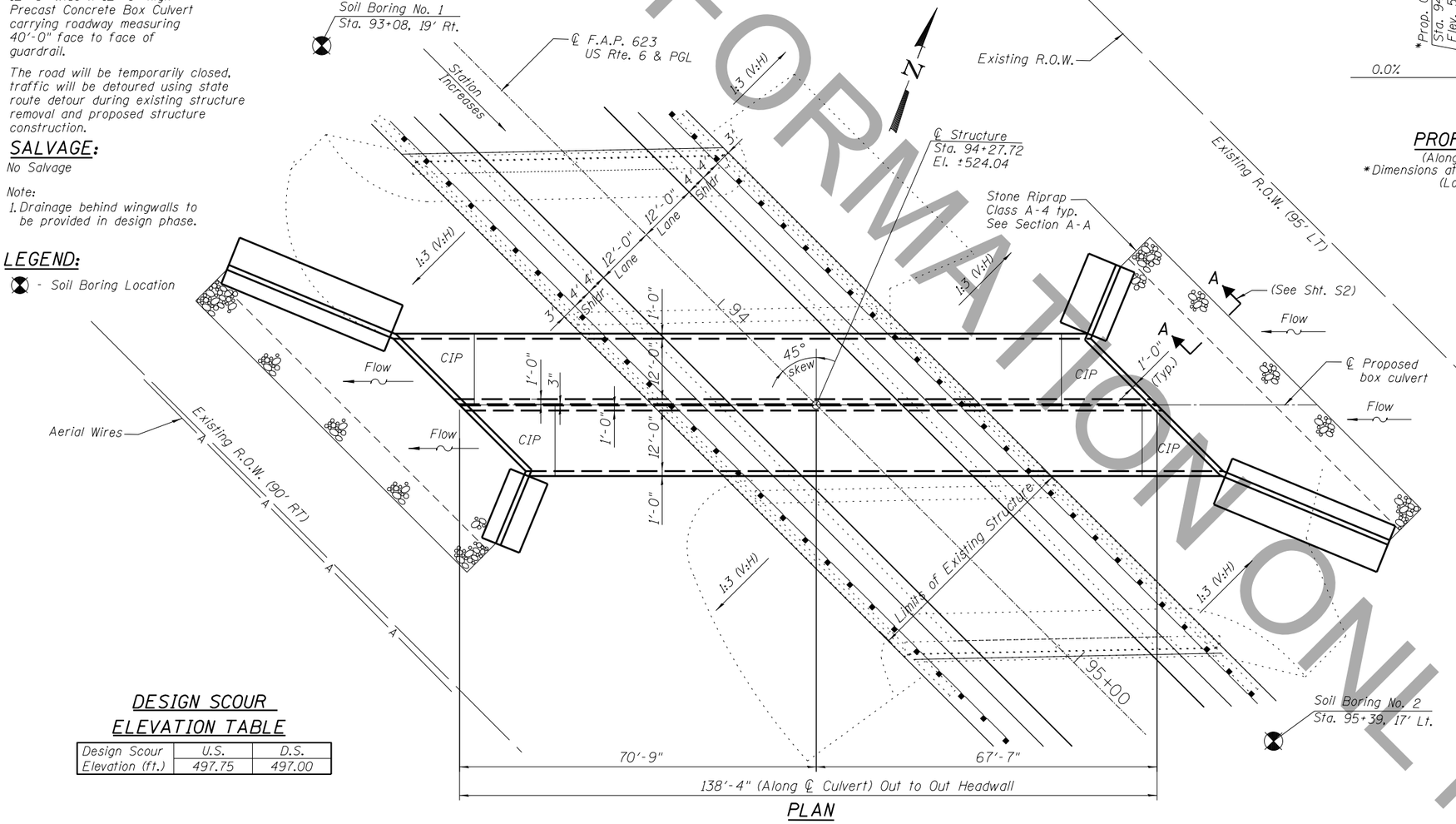

### SECTION THRU BARREL

(At right angles to ℄ Culvert)
* May be refined in final design

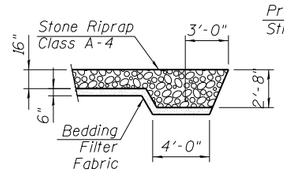



### PROFILE GRADE

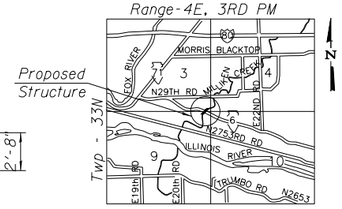
(Along ℄ F.A.P. 623)
*Dimensions at right angle to culvert
(Looking East)




### PLAN




### SECTION A-A




### LOCATION SKETCH

## DESIGN SCOUR ELEVATION TABLE

| Design Scour Elevation (ft.) | U.S. | D.S. |
|---|---|---|
| | 497.75 | 497.00 |

## WATERWAY INFORMATION

Drainage Area = 2.66 sq. mi.
Exist. Low Grade Elev. = 522.68 @ Sta. 86+25
Prop. Low Grade Elev. = 522.68 @ Sta. 86+25

| Flood | Freq. Yr. | Q C.F.S. | Opening Sq. Ft. Exist. | Opening Sq. Ft. Prop. | Nat. H.W.E. | Head - Ft. Exist. | Head - Ft. Prop. | Headwater El. Exist. | Headwater El. Prop. |
|---|---|---|---|---|---|---|---|---|---|
| | 10 | 357 | 127 | 146 | 508.1 | 0.0 | 0.0 | 508.1 | 508.1 |
| Design | 50 | 543 | 169 | 172 | 509.2 | 0.0 | 0.0 | 509.2 | 509.2 |
| Base | 100 | 618 | 181 | 179 | 509.5 | 0.0 | 0.0 | 509.5 | 509.5 |
| Max. Calc. | 500 | 800 | 206 | 193 | 510.0 | 0.1 | 0.0 | 510.1 | 510.0 |
| Overtopping | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

Existing 10-Year Velocity=3.5 ft/sec.
Proposed 10-Year Velocity=2.9 ft/sec.

## HIGHWAY CLASSIFICATION:

F.A.P. Rte 623-U.S. Rte 6
Functional class: Other principal arterial, Class II truck route.
ADT: 4,800 (2015), 6600 (2035)
ADTT: 5%
DHV: 391 (2015), 537 (2035)
Design speed: 55 mph
Posted speed: 55 mph

## LOADING HL-93

Allow 50 #/sq. ft. for future wearing surface.

## DESIGN SPECIFICATIONS

2014 LRFD Bridge Design Specifications, 7th Edition

## DESIGN STRESSES

### FIELD UNITS

f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)

### PRECAST UNITS

f'c = 5,000 psi
fy = 65,000 psi (Welded wire fabric)
fy = 60,000 psi (Reinforcement)

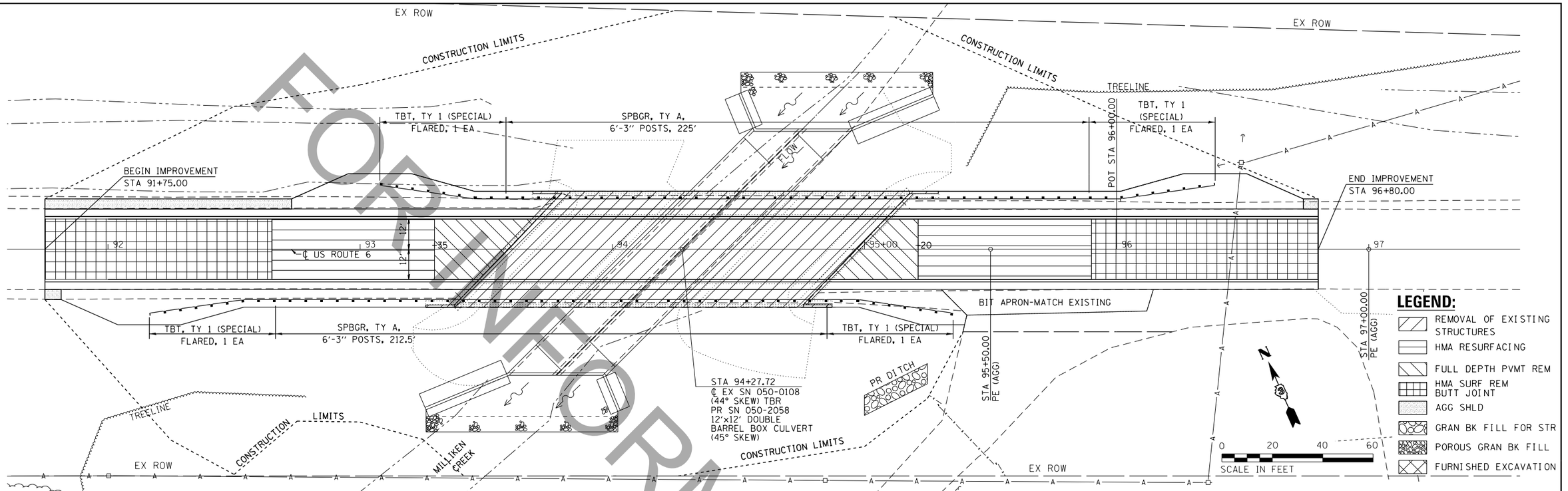
## DESIGN FILL HEIGHT

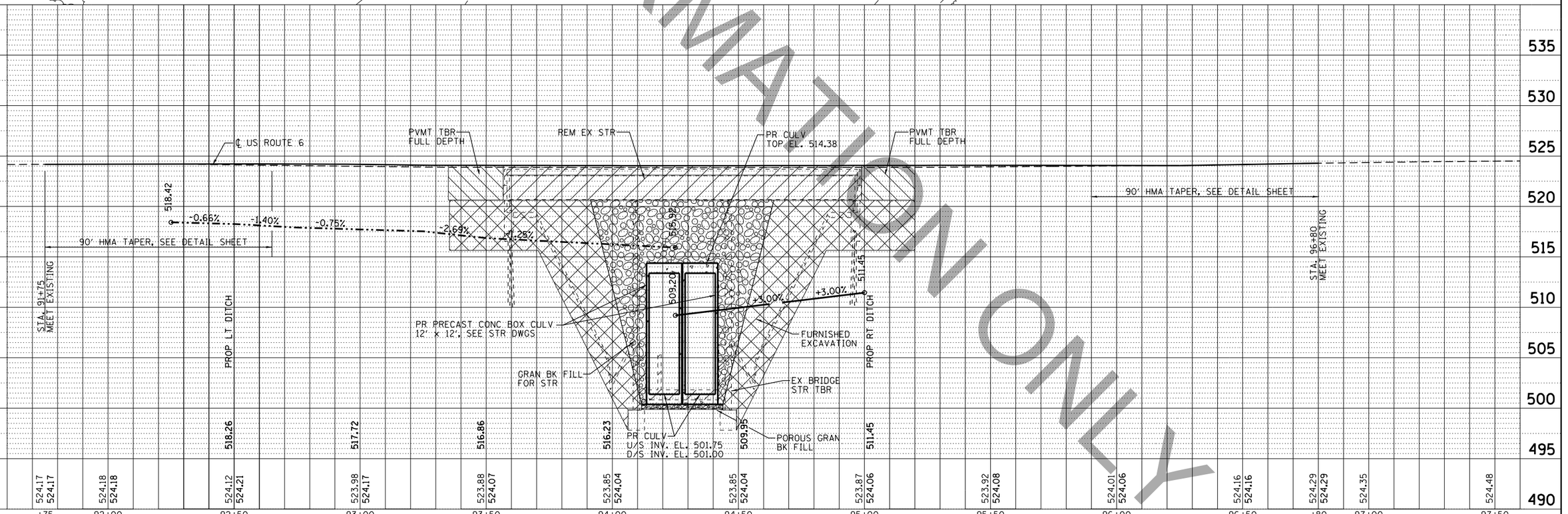
Design Earth Cover=10 ft.

# GENERAL PLAN
# US ROUTE 6 OVER MILLIKEN CREEK
# F.A.P. ROUTE 623 - SECTION (G)BR
# LASALLE COUNTY
# STATION 94+27.72
# STRUCTURE NO. 050-2058



| | | | | | |
|---|---|---|---|---|---|
| DESIGNED NS | STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION | F.A.P. RTE. | SECTION | COUNTY | TOTAL SHEETS / SHEET NO. |
| CHECKED SSK | | 623 | (G) BR | LASALLE | 2 / 1 |
| DRAWN RM | | | | CONTRACT NO. 66A58 | |
| CHECKED SSK | 10-22-2014 SHEET NO. S1 OF S1 SHEETS | | | ILLINOIS FED. AID PROJECT | |






PLAN: DATE | BY | SURVEYED | PLOTTED | ALIGNMENT CHECKED | RT. OF WAY CHECKED | CADD FILE NAME | NOTE BOOK | NO.

PROFILE: DATE | BY | SURVEYED | PLOTTED | PROFILE CHECKED | BKK. NOTED | STRUCTURE NOTATNS CHKD | NOTE BOOK | NO.

| | | | |
|---|---|---|---|
| FILE NAME = $FILEL$ | USER NAME = $USER$ | DESIGNED - TC | REVISED - |
| | | DRAWN - TC | REVISED - |
| | PLOT SCALE = $SCALE$ | CHECKED - JA | REVISED - |
| | PLOT DATE = $DATE$ | DATE - 10/22/2014 | REVISED - |

**STATE OF ILLINOIS**
**DEPARTMENT OF TRANSPORTATION**

**PLAN AND PROFILE**

SHEET 1 OF 1 SHEETS STA. 127+50.02 TO STA. 139+00.00

| F.A.S. RTE. | SECTION | COUNTY | TOTAL SHEETS | SHEET NO. |
|---|---|---|---|---|
| 315 | 120BR-1 | IROQUOIS | 2 | 2 |
| | | CONTRACT NO. 66C36 | | |
| | | ILLINOIS FED. AID PROJECT | | |

**Illinois Department of Transportation**
Division of Highways
IDOT

# SOIL BORING LOG



Date 7/24/12

**ROUTE** US 6 (FAP 623) **DESCRIPTION** US 6 over Milliken Creek, 1.7 miles East of IL 71 **LOGGED BY** Larry Myers

**SECTION** (G)BR **LOCATION** NE 1/4, **SEC.** 9, **TWP.** 33N, **RNG.** 4E,
**Latitude** , **Longitude**

**COUNTY** LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

**STRUCT. NO.** 050-0108 (Exist.)
**Station** 94+27.72 (Prop.)

**BORING NO.** 1 (S.W. Quad.)
**Station** 93+08
**Offset** 19.0 ft Rt.
**Ground Surface Elev.** 523.66 ft

**Surface Water Elev.** Dry ft
**Stream Bed Elev.** 502.27 ft

**Groundwater Elev.:**
**First Encounter** Dry ft
**Upon Completion** Dry ft
**After** ____ **Hrs.** ____ ft

| DEPTH (ft) | BLOWS (/6") | UCS Qu (tsf) | MOIST (%) | Material |
|---|---|---|---|---|
| | | | | Augered White Shoulder Stone, Brown Sand & Gravel Fill |
| 521.16 | | | | |
| | 7 | | | Very Stiff to Hard Brown, Gray Silty Clay Loam Till Fill & Black Silty Clay Loam Fill & Blue/Green Silty Clay Fill |
| | 5 5 | 3.7 B | 16 | |
| -5 | | | | |
| | 4 | | | |
| | 3 4 | 3.2 B | 27 | |
| 516.16 | | | | |
| | 3 | | | Very Stiff Brown Silty Clay Loam Till Fill |
| | 4 5 | 3.5 B | 15 | |
| -10 | | | | |
| | 5 | | | |
| | 6 7 | 4.0 S | 13 | |
| 511.16 | | | | |
| | 3 | | | Very Stiff Black Silty Clay with Heavy Gravel Pieces - Fill |
| | 6 6 | 3.5 P | 19 | |
| 508.66 -15 | | | | |
| | 2 | | | Very Stiff to Stiff Black Silty Clay Loam |
| | 4 4 | 3.0 P | 26 | |
| | 2 | | | |
| | 2 2 | 1.5 P | 34 | |
| 504.16 | | | | |
| -20 | | | | |

| DEPTH (ft) | BLOWS (/6") | UCS Qu (tsf) | MOIST (%) | Material |
|---|---|---|---|---|
| | 5 | | | Hard Gray & Brown Clay & Reworked Shale *(continued)* |
| | 7 9 | >4.5 P | 24 | |
| 501.16 | | | | |
| | 10 | | | Dense Dark Gray Clay Shale |
| | 23 58 | >4.5 P | 29 | |
| 499.16 | | | | |
| -25 | | | | |
| 498.24 | 100/5" | | 11 | Very Dense & Brittle Black Clay Shale - with Higher Organics - Coalish - Low Grade Coal |
| | | | | End of Boring |
| -30 | | | | |
| -35 | | | | |
| -40 | | | | |

**The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)**
**The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)**

**BBS, form 137 (Rev. 8-99)**

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Date 7/24/12

**ROUTE** US 6 (FAP 623) **DESCRIPTION** US 6 over Milliken Creek, 1.7 miles East of IL 71 **LOGGED BY** Larry Myers

**SECTION** (G)BR **LOCATION** NE 1/4, **SEC.** 9, **TWP.** 33N, **RNG.** 4E,
**Latitude** , **Longitude**

**COUNTY** LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

**STRUCT. NO.** 050-0108 (Exist.)
**Station** 94+27.72 (Prop.)

**BORING NO.** 2 (N.E. Quad.)
**Station** 95+39
**Offset** 17.0 ft Lt.
**Ground Surface Elev.** 523.58 ft

**Surface Water Elev.** Dry ft
**Stream Bed Elev.** 501.77 ft

**Groundwater Elev.:**
**First Encounter** Dry ft
**Upon Completion** Dry ft
**After** ____ **Hrs.** ____ ft

| Description | DEPTH (ft) | BLOWS (/6") | UCS Qu (tsf) | MOIST (%) |
|---|---|---|---|---|
| Augered Shoulder Stone & White Sand/Gravel Fill | | | | |
| | 521.08 | | | |
| Very Stiff Buff Silty Loam/Silty Clay Loam Till Fill | | 4 | | |
| | | 4 | 2.5 | 14 |
| | | 4 | P | |
| | 519.08 | | | |
| Very Loose Loamy Sand & Gravel Fill | -5 | 1 | | |
| | | 1 | | 18 |
| | | 1 | | |
| | 516.58 | | | |
| Very Stiff Light Brown Silty Loam/Silty Clay Loam Till Fill with Loamy Gravel Layers - Fill | | 3 | | |
| | | 4 | 3.5 | 11 |
| | | 5 | P | |
| | -10 | 6 | | |
| | | 6 | 3.0 | 10 |
| | | 5 | P | |
| | 511.58 | | | |
| Very Stiff Dark Brown Silty Clay Loam Fill | | 3 | | |
| | | 4 | 3.3 | 24 |
| | | 5 | S | |
| | -15 | 2 | | |
| | | 2 | 2.1 | 20 |
| | | 3 | S | |
| | 506.58 | | | |
| Stiff to Very Stiff Brown Silty Clay Loam with Heavy Gravel | | 2 | | |
| | | 2 | 2.4 | 18 |
| | | 3 | S | |
| | -20 | | | |

| Description | DEPTH (ft) | BLOWS (/6") | UCS Qu (tsf) | MOIST (%) |
|---|---|---|---|---|
| Stiff to Very Stiff Brown Silty Clay Loam with Heavy Gravel *(continued)* | | 2 | | |
| | | 5 | 2.6 | 18 |
| | | 4 | S | |
| | 501.58 | | | |
| Very Dense & Brittle Black Clay Shale with Higher Organics - Coalish - Low Grade Coal | 500.41 | 75 | | |
| | | 100/2" | | 12 |
| End of Boring | | | | |
| | -25 | | | |
| | -30 | | | |
| | -35 | | | |
| | -40 | | | |

**The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)**
**The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)**

**BBS, form 137 (Rev. 8-99)**