| STATE | STATE PROJECT REFERENCE NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|
| N.C. | SF-120239 | 1 | 14 |

PROJECT: 17BP.10.R.139 REFERENCE: SF-120239

# STATE OF NORTH CAROLINA
## DEPARTMENT OF TRANSPORTATION
## DIVISION OF HIGHWAYS
## GEOTECHNICAL ENGINEERING UNIT

# STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *CABARRUS*

SITE DESCRIPTION *BRIDGE NO. 239 ON SR 1006 (MT. PLEASANT RD. S) OVER ADAMS CREEK*

## CONTENTS



PERSONNEL

*J.K. STICKNEY*

*C.L. SMITH*

*B.E. FOSTER*

INVESTIGATED BY *C.R. LAVENDER III*

DRAWN BY *J.E. BEVERLY*

CHECKED BY *K.B. MILLER*

SUBMITTED BY *K.B. MILLER*

DATE *MARCH 2020*

## CAUTION NOTICE

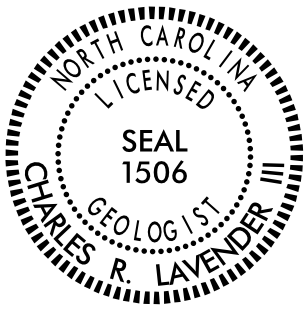
THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:

1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

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SIGNATURE DATE

**DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED**

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# NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
## DIVISION OF HIGHWAYS
## GEOTECHNICAL ENGINEERING UNIT

# SUBSURFACE INVESTIGATION

### SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS
### (PAGE 2 OF 2)

## ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

| | | |
|---|---|---|
| WEATHERED ROCK (WR) |  | NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED. |
| CRYSTALLINE ROCK (CR) |  | FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC. |
| NON-CRYSTALLINE ROCK (NCR) |  | FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC. |
| COASTAL PLAIN SEDIMENTARY ROCK (CP) |  | COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC. |

## WEATHERING

| | |
|---|---|
| FRESH | ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. |
| VERY SLIGHT (V SLI.) | ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE. |
| SLIGHT (SLI.) | ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS. |
| MODERATE (MOD.) | SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK. |
| MODERATELY SEVERE (MOD. SEV.) | ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. *IF TESTED, WOULD YIELD SPT REFUSAL* |
| SEVERE (SEV.) | ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF* |
| VERY SEVERE (V SEV.) | ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF* |
| COMPLETE | ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE. |

## ROCK HARDNESS

| | |
|---|---|
| VERY HARD | CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK. |
| HARD | CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN. |
| MODERATELY HARD | CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS. |
| MEDIUM HARD | CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. |
| SOFT | CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE. |
| VERY SOFT | CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL. |

## FRACTURE SPACING

| TERM | SPACING |
|---|---|
| VERY WIDE | MORE THAN 10 FEET |
| WIDE | 3 TO 10 FEET |
| MODERATELY CLOSE | 1 TO 3 FEET |
| CLOSE | 0.16 TO 1 FOOT |
| VERY CLOSE | LESS THAN 0.16 FEET |

## BEDDING

| TERM | THICKNESS |
|---|---|
| VERY THICKLY BEDDED | 4 FEET |
| THICKLY BEDDED | 1.5 - 4 FEET |
| THINLY BEDDED | 0.16 - 1.5 FEET |
| VERY THINLY BEDDED | 0.03 - 0.16 FEET |
| THICKLY LAMINATED | 0.008 - 0.03 FEET |
| THINLY LAMINATED | < 0.008 FEET |

## INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

| | |
|---|---|
| FRIABLE | RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE. |
| MODERATELY INDURATED | GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. |
| INDURATED | GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER. |
| EXTREMELY INDURATED | SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS. |

## TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: BL-4 @ -BL- STA. 11+03.85
N 599019.628, E 1571470.595
ELEVATION: 526.91 FEET

NOTES:

FIAD - FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

| PROJECT REFERENCE NO. | SHEET NO. |
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| SF–120239 | 2B |

*NORTH CAROLINA DEPARTMENT OF TRANSPORTATION*
*DIVISION OF HIGHWAYS*

# *GEOTECHNICAL ENGINEERING UNIT*

# *SUBSURFACE INVESTIGATION*

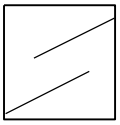
## *SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (PAGE 1 OF 2)*

AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

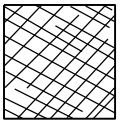
GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)

From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. Note that the table does not apply to structurally controlled failures. Where weak planar structural planes are present in an unfavorable orientation with respect to the excavation face, these will dominate the rock mass behaviour. The shear strength of surfaces in rocks that are prone to deterioration as a result of changes in moisture content will be reduced if water is present. When working with rocks in the fair to very poor categories, a shift to the right may be made for wet conditions. Water pressure is dealt with by effective stress analysis.

STRUCTURE



INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities



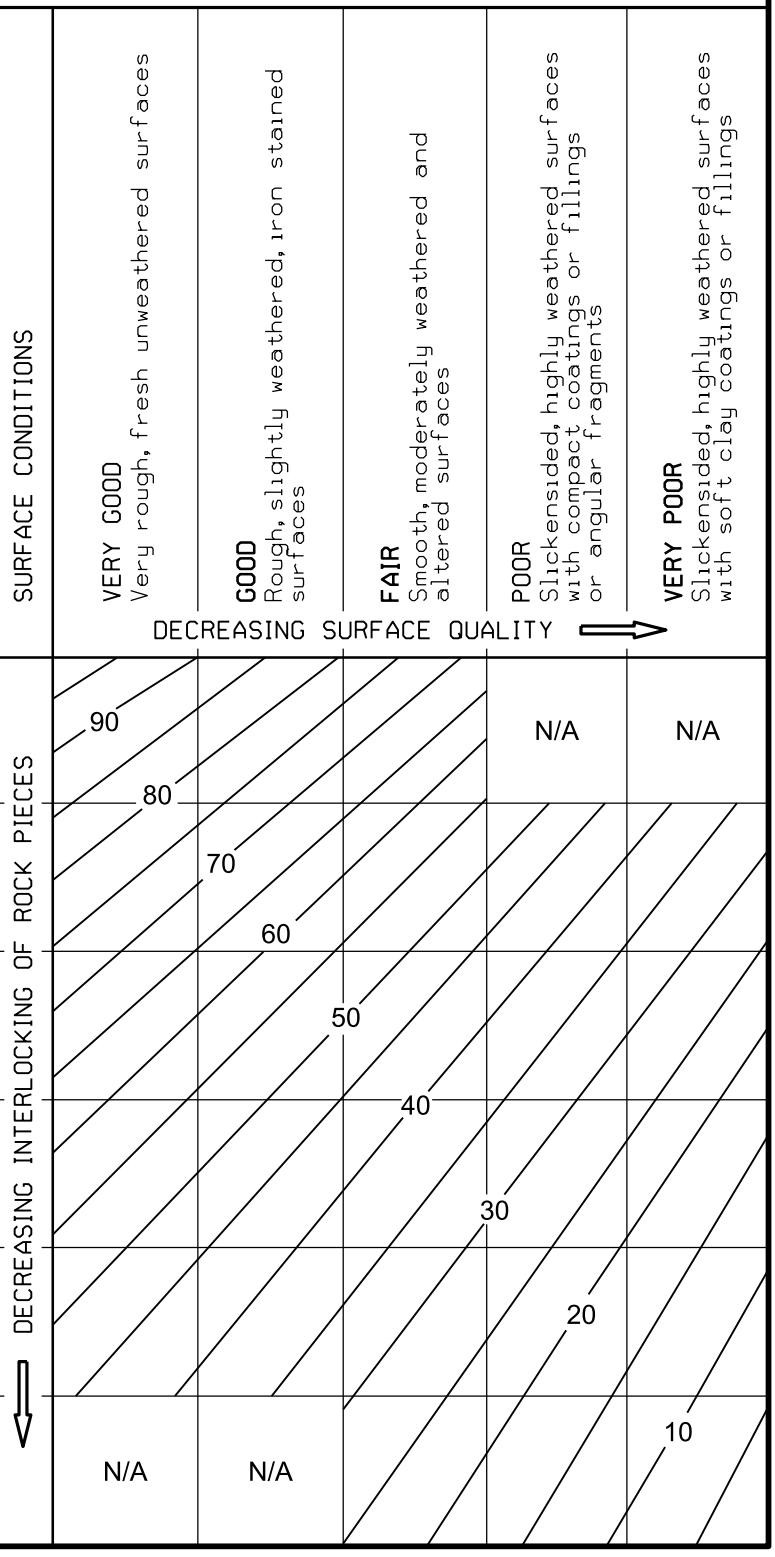
BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets

VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets

BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity

DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces

LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes



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*NORTH CAROLINA DEPARTMENT OF TRANSPORTATION*
*DIVISION OF HIGHWAYS*
# *GEOTECHNICAL ENGINEERING UNIT*

# *SUBSURFACE INVESTIGATION*

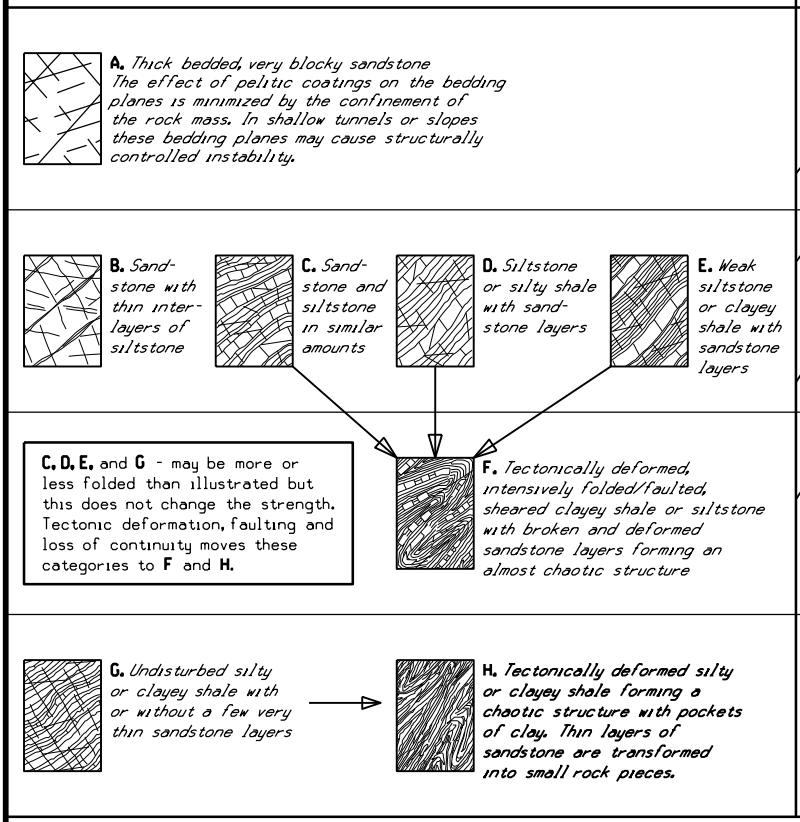
## *SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (PAGE 2 OF 2)*

AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

### GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos. P and Hoek E., 2000)

From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be too precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the Hoek-Brown criterion does not apply to structurally controlled failures. Where unfavourably oriented continuous weak planar discontinuities are present, these will dominate the behaviour of the rock mass. The strength of some rock masses is reduced by the presence of groundwater and this can be allowed for by a slight shift to the right in the columns for fair, poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis.

COMPOSITION AND STRUCTURE




→ Means deformation after tectonic disturbance

DATE: 8-19-16

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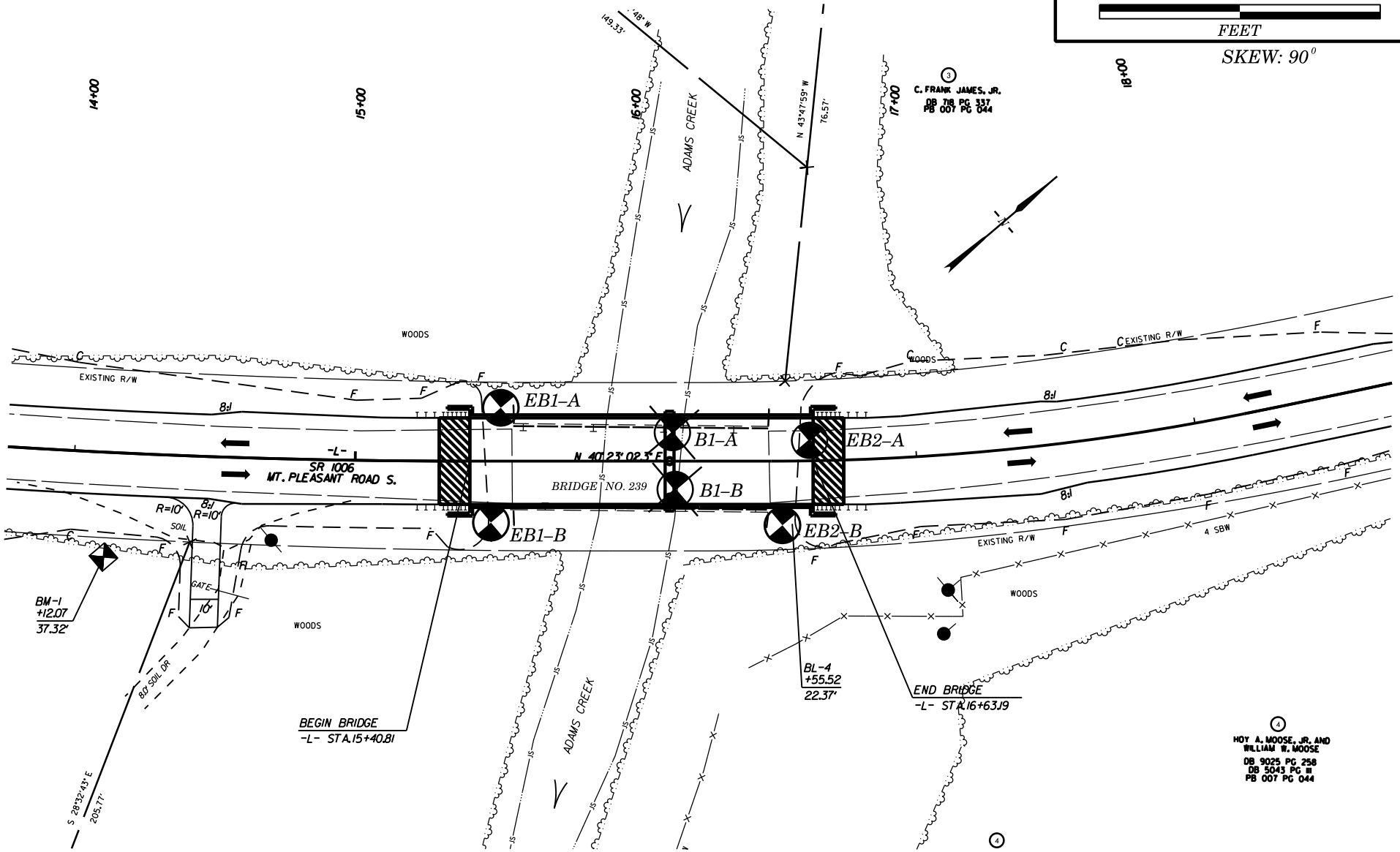
# SITE PLAN

0 50 100

FEET

SKEW: 90°



# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | |
|---|---|---|---|
| **WBS** 17BP.10.R.139 | **TIP** SF-120239 | **COUNTY** CABARRUS | **GEOLOGIST** Stickney, J. K. |
| **SITE DESCRIPTION** BRIDGE NO. 239 ON SR 1006 (MT. PLEASANT RD. S) OVER ADAMS CREEK | | | **GROUND WTR (ft)** |
| **BORING NO.** EB1-A | **STATION** 15+52 | **OFFSET** 19 ft LT | **ALIGNMENT** -L- | **0 HR.** Dry |
| **COLLAR ELEV.** 526.8 ft | **TOTAL DEPTH** 11.2 ft | **NORTHING** 598,967 | **EASTING** 1,571,372 | **24 HR.** FIAD |
| **DRILL RIG/HAMMER EFF./DATE** HFO0072 CME-550X 84% 05/15/2015 | | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Automatic | |
| **DRILLER** Smith, C. L. | **START DATE** 03/02/16 | **COMP. DATE** 03/02/16 | **SURFACE WATER DEPTH** N/A | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 530 | | | | | | | | | | | |
| | | | | | | | | | | 526.8 GROUND SURFACE | 0.0 |
| 525 | | | | | | | | | | **ROADWAY EMBANKMENT** Red and Brown, Sandy Silty Clay | |
| | 522.8 | 4.0 | 3 | 4 | 5 | 9 | | M | | 521.8 | 5.0 |
| 520 | | | | | | | | | | **RESIDUAL** Tan, Orange, and Yellow, Silty Sandy Clay | |
| | 517.8 | 9.0 | 17 | 83/0.3 | | 100/0.8 | | | | 517.8 | 9.0 |
| | | | | | | | | | | **WEATHERED ROCK** (Meta-Argillite) | |
| | | | | | | | | | | 515.6 | 11.2 |
| | | | | | | | | | | Boring Terminated by Auger Refusal at Elevation 515.6 ft on Non-Crystalline Rock (Meta-Argillite) | |

NCDOT BORE SINGLE SF120239_GEO_BH_BRDG0239.GPJ NC_DOT.GDT 3/9/20

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 17BP.10.R.139 | **TIP** SF-120239 | **COUNTY** CABARRUS | **GEOLOGIST** Stickney, J. K. | |
| **SITE DESCRIPTION** BRIDGE NO. 239 ON SR 1006 (MT. PLEASANT RD. S) OVER ADAMS CREEK | | | | **GROUND WTR (ft)** |
| **BORING NO.** EB1-B | **STATION** 15+48 | **OFFSET** 22 ft RT | **ALIGNMENT** -L- | **0 HR.** Dry |
| **COLLAR ELEV.** 527.1 ft | **TOTAL DEPTH** 10.0 ft | **NORTHING** 598,938 | **EASTING** 1,571,401 | **24 HR.** FIAD |
| **DRILL RIG/HAMMER EFF./DATE** HFO0072 CME-550X 84% 05/15/2015 | | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Automatic | |
| **DRILLER** Smith, C. L. | **START DATE** 03/02/16 | **COMP. DATE** 03/02/16 | **SURFACE WATER DEPTH** N/A | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 530 | | | | | | | | | | | |
| | | | | | | | | | | 527.1 GROUND SURFACE | 0.0 |
| 525 | | | | | | | | | | **ROADWAY EMBANKMENT** Red and Brown, Sandy Silty Clay | |
| | 523.2 | 3.9 | 8 | 4 | 4 | 8 | | M | | 522.2 | 4.9 |
| 520 | | | | | | | | | | **RESIDUAL** Tan and Yellow, Silty Sandy Clay | |
| | 518.2 | 8.9 | 52 | 48/0.1 | | 100/0.6 | | | | 518.2 | 8.9 |
| | | | | | | | | | | 517.1 **WEATHERED ROCK** (Meta-Argillite) | 10.0 |
| | | | | | | | | | | Boring Terminated by Auger Refusal at Elevation 517.1 ft on Non-Crystalline Rock (Meta-Argillite) | |

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 17BP.10.R.139 | **TIP** SF-120239 | **COUNTY** CABARRUS | **GEOLOGIST** Stickney, J. K. | |
| **SITE DESCRIPTION** BRIDGE NO. 239 ON SR 1006 (MT. PLEASANT RD. S) OVER ADAMS CREEK | | | | **GROUND WTR (ft)** |
| **BORING NO.** B1-A | **STATION** 16+13 | **OFFSET** 10 ft LT | **ALIGNMENT** -L- | **0 HR.** N/A |
| **COLLAR ELEV.** 514.4 ft | **TOTAL DEPTH** 22.0 ft | **NORTHING** 599,008 | **EASTING** 1,571,418 | **24 HR.** N/A |
| **DRILL RIG/HAMMER EFF./DATE** HFO0070 CME-550X 79% 12/16/2019 | | **DRILL METHOD** NW Casing w/ Core | **HAMMER TYPE** Automatic | |
| **DRILLER** Smith, C. L. | **START DATE** 02/17/20 | **COMP. DATE** 02/17/20 | **SURFACE WATER DEPTH** N/A | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 515 | | | | | | | | | | 514.4 GROUND SURFACE 0.0 |
| | 512.6 | 1.8 | 60/0.0 | | | 60/0.0 | | | | **ALLUVIAL** Brown-Gray Silty Sand With Gravel And Cobbles 1.8 |
| 510 | | | | | | | | | | 511.2 3.2 **NON-CRYSTALLINE ROCK** Moderately Severely Weathered Meta-Argillite |
| 505 | | | | | | | | | | **NON-CRYSTALLINE ROCK** Light To Dark Gray Meta-Argillite REC=97%, RQD=79% GSI=88-90 |
| 500 | | | | | | | | | | |
| 495 | | | | | | | | | | 492.4 22.0 Boring Terminated at Elevation 492.4 ft in Non-Crystalline Rock (Meta-Argillite) |

# GEOTECHNICAL BORING REPORT
# CORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 17BP.10.R.139 | **TIP** SF-120239 | **COUNTY** CABARRUS | **GEOLOGIST** Stickney, J. K. | |
| **SITE DESCRIPTION** BRIDGE NO. 239 ON SR 1006 (MT. PLEASANT RD. S) OVER ADAMS CREEK | | | | **GROUND WTR (ft)** |
| **BORING NO.** B1-A | **STATION** 16+13 | **OFFSET** 10 ft LT | **ALIGNMENT** -L- | **0 HR.** N/A |
| **COLLAR ELEV.** 514.4 ft | **TOTAL DEPTH** 22.0 ft | **NORTHING** 599,008 | **EASTING** 1,571,418 | **24 HR.** N/A |
| **DRILL RIG/HAMMER EFF./DATE** HFO0070 CME-550X 79% 12/16/2019 | | **DRILL METHOD** NW Casing w/ Core | | **HAMMER TYPE** Automatic |
| **DRILLER** Smith, C. L. | **START DATE** 02/17/20 | **COMP. DATE** 02/17/20 | **SURFACE WATER DEPTH** N/A | |
| **CORE SIZE** NX | **TOTAL RUN** 18.8 ft | | | |

| ELEV (ft) | RUN ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN REC. (ft) % | RUN RQD (ft) % | SAMP. NO. | STRATA REC. (ft) % | STRATA RQD (ft) % | LOG | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 511.2 | | | | | | | | | | | Begin Coring @ 3.2 ft |
| 510 | 511.2 | 3.2 | 4.8 | | (4.8) 100% | (4.1) 85% | | (18.3) 97% | (14.9) 79% | | 511.2 **NON-CRYSTALLINE ROCK** 3.2<br>Light To Dark Gray, Very Slight To Fresh Weathering, Hard Meta-Argillite,<br>With Close To Moderately Close Fracture Spacing<br>GSI=88-90 |
| | 506.4 | 8.0 | | | | | | | | | |
| 505 | | | 5.0 | | (5.0) 100% | (4.4) 88% | | | | | |
| | 501.4 | 13.0 | | | | | | | | | |
| 500 | | | 5.0 | | (4.5) 90% | (2.5) 50% | | | | | |
| | 496.4 | 18.0 | | | | | | | | | |
| 495 | | | 4.0 | | (4.0) 100% | (3.9) 98% | | | | | |
| | 492.4 | 22.0 | | | | | | | | | 492.4 22.0<br>Boring Terminated at Elevation 492.4 ft in Non-Crystalline Rock<br>(Meta-Argillite) |

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 17BP.10.R.139 | **TIP** SF-120239 | **COUNTY** CABARRUS | **GEOLOGIST** Stickney, J. K. | |
| **SITE DESCRIPTION** BRIDGE NO. 239 ON SR 1006 (MT. PLEASANT RD. S) OVER ADAMS CREEK | | | | **GROUND WTR (ft)** |
| **BORING NO.** B1-B | **STATION** 16+14 | **OFFSET** 10 ft RT | **ALIGNMENT** -L- | **0 HR.** N/A |
| **COLLAR ELEV.** 515.6 ft | **TOTAL DEPTH** 19.9 ft | **NORTHING** 598,996 | **EASTING** 1,571,434 | **24 HR.** N/A |
| **DRILL RIG/HAMMER EFF./DATE** HFO0070 CME-550X 79% 12/16/2019 | | **DRILL METHOD** NW Casing w/ Core | **HAMMER TYPE** Automatic | |
| **DRILLER** Smith, C. L. | **START DATE** 02/17/20 | **COMP. DATE** 02/17/20 | **SURFACE WATER DEPTH** N/A | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 520 | | | | | | | | | | | |
| 515 | | | | | | | | | | 515.6 GROUND SURFACE | 0.0 |
| | 512.7 | 2.9 | 60/0.0 | | | 60/0.0 | | | | 514.6 **ALLUVIAL** Brown-Gray Silty Sand With Gravel And Cobbles | 1.0 |
| 510 | | | | | | | | | | 511.6 **NON-CRYSTALLINE ROCK** Moderately Severely Weathered Meta-Argillite | 4.0 |
| 505 | | | | | | | | | | **NON-CRYSTALLINE ROCK** Light To Dark Gray Meta-Argillite REC=95%, RQD=67% GSI=88-90 | |
| 500 | | | | | | | | | | 495.7 | 19.9 |
| | | | | | | | | | | Boring Terminated at Elevation 495.7 ft in Non-Crystalline Rock (Meta-Argillite) | |

NCDOT BORE SINGLE SF120239_GEO_BH_BRDG0239.GPJ NC_DOT.GDT 3/9/20

# GEOTECHNICAL BORING REPORT
# CORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 17BP.10.R.139 | **TIP** SF-120239 | **COUNTY** CABARRUS | **GEOLOGIST** Stickney, J. K. | |
| **SITE DESCRIPTION** BRIDGE NO. 239 ON SR 1006 (MT. PLEASANT RD. S) OVER ADAMS CREEK | | | | **GROUND WTR (ft)** |
| **BORING NO.** B1-B | **STATION** 16+14 | **OFFSET** 10 ft RT | **ALIGNMENT** -L- | **0 HR.** N/A |
| **COLLAR ELEV.** 515.6 ft | **TOTAL DEPTH** 19.9 ft | **NORTHING** 598,996 | **EASTING** 1,571,434 | **24 HR.** N/A |
| **DRILL RIG/HAMMER EFF./DATE** HFO0070 CME-550X 79% 12/16/2019 | | **DRILL METHOD** NW Casing w/ Core | | **HAMMER TYPE** Automatic |
| **DRILLER** Smith, C. L. | **START DATE** 02/17/20 | **COMP. DATE** 02/17/20 | **SURFACE WATER DEPTH** N/A | |
| **CORE SIZE** NX | **TOTAL RUN** 15.9 ft | | | |

| ELEV (ft) | RUN ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN REC. (ft) % | RUN RQD (ft) % | SAMP. NO. | STRATA REC. (ft) % | STRATA RQD (ft) % | LOG | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 511.6 | | | | | | | | | | | Begin Coring @ 4.0 ft |
| 510 | 511.6 | 4.0 | 0.9 | | (0.9) 100% | (0.9) 100% | | (15.1) 95% | (10.7) 67% | | 511.6 **NON-CRYSTALLINE ROCK** 4.0<br>Light To Dark Gray, Slightly Weathered To Fresh, Hard Meta-Argillite With Close To Wide Fracture Spacing<br>GSI=88-90<br>(from 7.1' - 9.9' Rock Is Moderately Weathered With Very Close Fracture Spacing, GSI=55-60) |
| | 510.7 | 4.9 | 5.0 | | (4.5) 90% | (0.5) 10% | | | | | |
| 505 | 505.7 | 9.9 | 5.0 | | (4.8) 96% | (4.6) 92% | | | | | |
| 500 | 500.7 | 14.9 | 5.0 | | (4.9) 98% | (4.7) 94% | | | | | |
| | 495.7 | 19.9 | | | | | | | | | 495.7 19.9<br>Boring Terminated at Elevation 495.7 ft in Non-Crystalline Rock (Meta-Argillite) |

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | |
|---|---|---|---|
| **WBS** 17BP.10.R.139 | **TIP** SF-120239 | **COUNTY** CABARRUS | **GEOLOGIST** Stickney, J. K. |
| **SITE DESCRIPTION** BRIDGE NO. 239 ON SR 1006 (MT. PLEASANT RD. S) OVER ADAMS CREEK | | | **GROUND WTR (ft)** |
| **BORING NO.** EB2-A | **STATION** 16+62 | **OFFSET** 7 ft LT | **ALIGNMENT** -L- | **0 HR.** N/A |
| **COLLAR ELEV.** 527.4 ft | **TOTAL DEPTH** 15.5 ft | **NORTHING** 599,044 | **EASTING** 1,571,452 | **24 HR.** FIAD |
| **DRILL RIG/HAMMER EFF./DATE** HFO0070 CME-550X 79% 12/16/2019 | | **DRILL METHOD** NW Casing w/ Advancer | **HAMMER TYPE** Automatic |
| **DRILLER** Smith, C. L. | **START DATE** 02/15/20 | **COMP. DATE** 02/15/20 | **SURFACE WATER DEPTH** N/A |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 530 | | | | | | | | | | | |
| | | | | | | | | | | 527.4 GROUND SURFACE | 0.0 |
| 525 | | | | | | | | | | **ROADWAY EMBANKMENT** Red-Brown Sandy Silty Clay | |
| | 523.1 | 4.3 | 2 | 2 | 2 | 4 | | M | | 523.4 | 4.0 |
| 520 | | | | | | | | | | **ALLUVIAL** Tan-Orange Sandy Silty Clay | |
| | 518.1 | 9.3 | 20 | 24 | 51 | 75 | | D | | 520.5 | 6.9 |
| 515 | | | | | | | | | | **RESIDUAL** Tan-Brown Sandy Silty Clay | |
| | 513.1 | 14.3 | 100/0.4 | | | 100/0.4 | | | | 513.1 | 14.3 |
| | | | | | | | | | | 511.9 **WEATHERED ROCK** Gray Severely Weathered Meta-Argillite | 15.5 |
| | | | | | | | | | | Boring Terminated with Casing Advancer Refusal at Elevation 511.9 ft on Non-Crystalline Rock (Meta-Argillite) | |

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | |
|---|---|---|---|
| **WBS** 17BP.10.R.139 | **TIP** SF-120239 | **COUNTY** CABARRUS | **GEOLOGIST** Stickney, J. K. |
| **SITE DESCRIPTION** BRIDGE NO. 239 ON SR 1006 (MT. PLEASANT RD. S) OVER ADAMS CREEK | | | **GROUND WTR (ft)** |
| **BORING NO.** EB2-B | **STATION** 16+52 | **OFFSET** 23 ft RT | **ALIGNMENT** -L- | **0 HR.** Dry |
| **COLLAR ELEV.** 527.1 ft | **TOTAL DEPTH** 12.9 ft | **NORTHING** 599,017 | **EASTING** 1,571,469 | **24 HR.** FIAD |
| **DRILL RIG/HAMMER EFF./DATE** HFO0072 CME-550X 84% 05/15/2015 | | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Automatic | |
| **DRILLER** Smith, C. L. | **START DATE** 03/02/16 | **COMP. DATE** 03/02/16 | **SURFACE WATER DEPTH** N/A | |

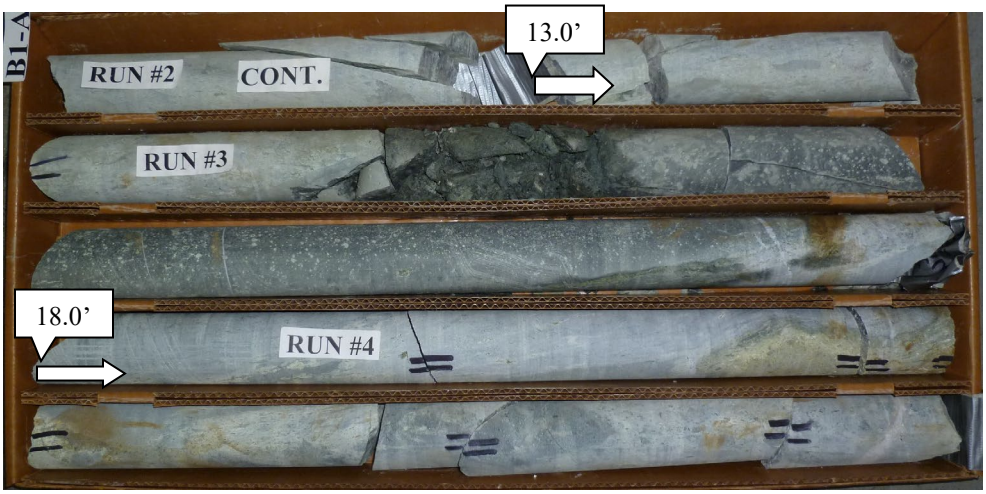
| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 530 | | | | | | | | | | | |
| | | | | | | | | | | 527.1 GROUND SURFACE | 0.0 |
| 525 | | | | | | | | | | **ROADWAY EMBANKMENT** Red and Brown, Sandy Silty Clay | |
| | 523.2 | 3.9 | 4 | 3 | 2 | 5 | | M | | 522.2 | 4.9 |
| 520 | | | | | | | | | | **RESIDUAL** Tan and Yellow, Silty Sandy Clay | |
| | 518.2 | 8.9 | 2 | 2 | 20 | 22 | | D | | 516.7 | 10.4 |
| 515 | | | | | | | | | | **WEATHERED ROCK** (Meta-Argillite) | |
| | | | | | | | | | | 514.2 | 12.9 |
| | | | | | | | | | | Boring Terminated by Auger Refusal at Elevation 514.2 ft on Non-Crystalline Rock (Meta-Argillite) | |

# CORE PHOTOGRAPHS:
# Bridge No. 239 on SR 1006 (Mt. Pleasant Rd. S) over Adams Creek
# B1-A: -L- Station 16+13, 10 ft LT

**Begin core at 3.2’**


0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0

SCALE IN FEET



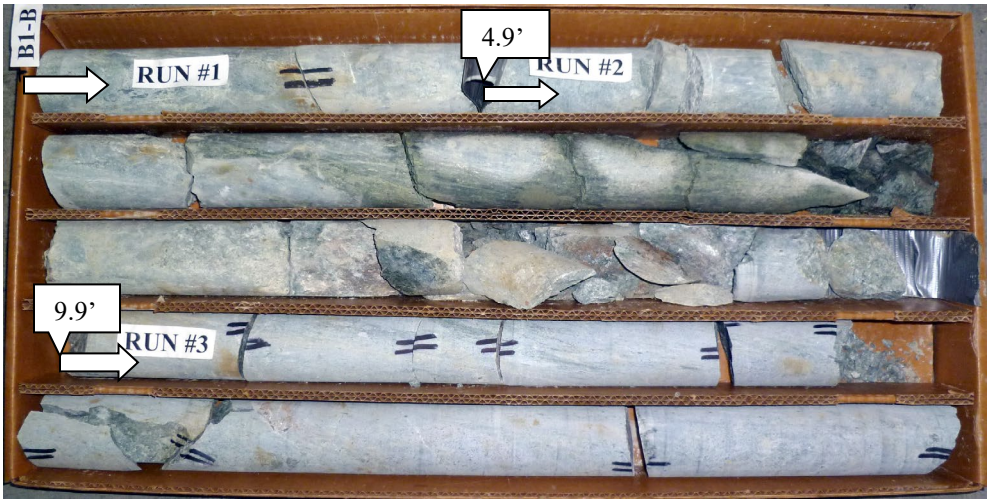

0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0

SCALE IN FEET

**End core at 22.0’**

# CORE PHOTOGRAPHS:
## Bridge No. 239 on SR 1006 (Mt. Pleasant Rd. S) over Adams Creek
## B1-B: -L- Station 16+14, 10 ft RT

**Begin core at 4.0’**




0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0

SCALE IN FEET


0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0

SCALE IN FEET

**End core at 19.9’**

# Bridge No. 239 on SR 1006 (Mt. Pleasant Rd. South) over Adams Creek

## SITE PHOTO


**Photo:** View looking EB1 toward EB2, Creek flows Lt to Rt