

MEMORANDUM

(R-029-2016)

TO: Wendy Southworth, PE
Project Management Coordinator
Division of Highway Design

FROM: Bart Asher, PE, PLS
Geotechnical Branch Manager
Division of Structural Design

BY: J.C. Wilhoite, PE
Geotechnical Branch

DATE: May 4, 2017

SUBJECT: Warren County
KY 884
Station 247+50 to 346+54.77
Item # 03-8852.00
Mars # 8963101D
Project # FD04 114 0884 005-008
Geotechnical Engineering Roadway Report

Location and Description

An abbreviated geotechnical engineering report has been completed for the subject project. Drilling and sampling were performed by Stantec, Inc. The laboratory testing was performed by the Geotechnical Branch. The purpose of this report is to identify potential geotechnical concerns based on the subsurface information obtained, a review of the project plans, the drilling, and prior experience with the project area. This project involves widening and upgrades to KY 884 from Long Road to just south of the Natcher Parkway. This project is adjacent to the project covered under R-028-2016 that continues over the Natcher Parkway. Reduced size geotechnical symbols, notes, and profile sheets are attached. The CADD input, in DGN format, is being e-mailed to the district for incorporation into the roadway plans.

Topography

The project is located in south Kentucky within the Pennyroyal physiographic region. This region consists of karst topography which features cave systems, sinkholes, and underground streams. Two small sinkholes were noted within the project area on Kentucky Geological Survey karst potential maps. These karst features should not affect the construction of the project. However, other, unmapped features may be encountered during construction.

The maximum topographic relief along the proposed centerline is approximately 15.5 feet. The

proposed project will consist of relatively shallow cuts and minor embankment heights due to the low relief of the topography.

Geology

The project is located within the Bowling Green Geologic Quadrangle (#235). The geologic mapping indicates the upper geologic formation at this site is the Ste. Genevieve Limestone Formation. This formation consists of limestone that is susceptible to karst activity as evidenced in the above mentioned topography.

The roadway excavation will produce an insufficient quantity of durable rock for the recommendations below. Rock was not encountered in any profile borings; therefore, rock quantity calculations were not required.

Drilling and Sampling

Drilling operations for this project were performed in January of 2017. Local weather records indicate precipitation events occurred the week prior to and of drilling operations. Therefore, moisture contents of samples shown on the attached profile drawings may be higher than what is encountered during construction depending on the season.

The drilling operations consisted of 33 disturbed profile borings. Sampling depths ranged from 5 to 12 feet with none of the borings encountering refusal on bedrock. Undisturbed sample borings, rock cores, and soundings were not required for this project due to only minor cut and embankment slopes being proposed in the plans.

Laboratory Testing

The soil testing showed the soil types for the project to be equally distributed between low to medium plasticity clays (CL in the Unified Soil Classification System) at 50% and high plasticity clays (CH) at 50% of the soil samples. The soils appear to be residual and are typical given the parent rock formation.

CBR tests were performed on samples obtained from soils from the proposed cuts and/or near the proposed subgrade. Eight CBR tests were performed. The results of the testing ranged from 4.9 to 6.6.

Engineering Analysis

Stability analyses were not required for this project based on the slope heights and configurations. Cut and embankment slopes should be 2H:1V or flatter, and should be constructed according to the current edition of the Standard Specifications for Road and Bridge Construction.

Soil Stabilization

Subgrade problems may occur in areas where the existing pavement will be removed or where the roadway template is in a shallow fill or in a cut condition. Therefore, a two-foot working platform consisting of Kentucky Coarse Aggregate No. 2, 3, or 23 wrapped with Geotextile Fabric may be required for these areas. The thickness of the working platform may need to be greater than two feet in areas as determined by the Engineer on construction and may depend on seasonal fluctuations in the water table. The working platform shall daylight horizontally to the edge of embankment in fills and to the ditchline in cuts, to ensure positive drainage. For quantity estimation purposes only, a 2-foot working platform for 1,000 linear feet of roadway may be assumed.

As mentioned above, some of the soils are silts and clay soils which are moisture sensitive. The embankment foundation construction may require a working platform where soft and/or saturated soils are encountered. The extent of these problems will depend on time of construction and seasonal water table fluctuations. The recommendations below provide for the use of Kentucky Coarse Aggregate # 2's, 3's or 23's wrapped with Geotextile Fabric for stabilization of any such wet areas encountered during construction. For quantity estimation purposes only, a 2-foot embankment working platform for 1,000 linear feet of roadway may be assumed.

GEOTECHNICAL RECOMMENDATIONS:

- 1.) In accordance with Section 206 of the current Standard Specifications, the moisture content of embankment material shall not vary from the optimum moisture content as determined by the current version of KM 64-511 by more than +2 percent or less than -2 percent. This moisture content requirement shall have equal weight with the density requirement when determining the acceptability of embankment construction. Refer to the Family of Curves for moisture/density correlation.
- 2.) All soils, whether from roadway or borrow, may require manipulation to obtain proper moisture content prior to compaction. Direct payment shall not be permitted for rehandling, hauling, stockpiling, and/or manipulating soils.
- 3.) Excavation of surface ditches and channel changes adjacent to embankment areas shall be performed prior to the placement of the adjacent embankments. The material excavated for the channel changes and surface ditches is suitable for embankment construction if dried to proper moisture content in accordance with Section 206 of the current Standard Specifications for Road and Bridge Construction.
- 4.) The Contractor is responsible for conducting any operations necessary to excavate the cut areas to the required typical section. These operations shall be incidental to Roadway Excavation or Embankment-in-Place and no additional compensation shall be made for this work.
- 5.) Some of the soil horizons and slopes on the project are subject to erosion. Necessary procedures in accordance with Sections 212 and 213 of the current Standard Specifications for Road and Bridge Construction shall be followed on construction.

- 6.) Removal of existing structures and other obstructions shall be completed in accordance with Section 203 of the current Standard Specifications for Road and Bridge Construction.
- 7.) Clearing and grubbing of roadway areas shall be completed in accordance with the requirements of Section 202 of the current Standard Specifications for Road and Bridge Construction before embankment placement.
- 8.) Borrow material, if required for subgrade, shall meet the minimum CBR value of 5.
- 9.) Perforated pipe for subgrade drainage shall be placed in vertical sags and the upgrade end of bridges in accordance with KY Standard Drawing RDP-005 at the following approximate locations and/or where designated by the Engineer.

Mainline

Station 252+03
Station 258+72
Station 277+55
Station 283+44
Station 305+95
Station 312+13
Station 327+30
Station 333+79

- 10.) The existing subgrade may be wet and soft in areas where the roadway template is in a shallow cut or fill, or where existing pavement is being removed. Therefore, a minimum 2-foot working platform may be required in these areas consisting of Kentucky Coarse Aggregate No. 2's, 3's or 23's in accordance with Section 805 of the current Standard Specifications. The working platform shall be wrapped with Geotextile Fabric in accordance with Sections 214 & 843 of the current Standard Specifications. Type IV Fabric shall be used for this application contrary to the standard specifications. The working platform shall extend under the curb and gutter. Where curb and gutter are not used, the working platform shall daylight horizontally to the edge of embankment in fills and to the ditchline in cuts to ensure positive drainage. The actual locations and thickness shall be determined by the Engineer during construction and may depend on seasonal fluctuations in the water table.
- 11.) Where curb and gutter is used, sections of 4-inch perforated drain pipe (approximately 4 feet long) shall be placed transversely in the bottom of the granular material to provide drainage into the drop inlets. Longitudinal edge drains or other preferred methods may be used, in lieu of the transversely placed perforated pipe, to drain the rock layer, as directed by the Engineer.
- 12.) In order to provide a working platform for embankment construction, Kentucky Coarse Aggregate No. 2's, 3's or 23's in accordance with the current edition of Section 805 of the Standard Specifications for Road and Bridge Construction shall be placed over all soft and/or saturated areas that may be detected during construction, as directed by the Engineer. The required thickness is estimated to be 2 foot, but the actual locations and thickness shall be

determined by the Engineer during construction and may depend on seasonal fluctuations in the water table. This material shall be wrapped with Geotextile Fabric in accordance with Sections 214 and 843 of the Standard Specifications for Road and Bridge Construction, current edition. Type IV Fabric shall be used for this application contrary to the standard specifications.

- 13.)** In areas where pavement is not to be overlaid, existing bituminous concrete located at a distance less than three feet below the proposed subgrade elevation within the limits of new roadway embankments, shall be removed entirely. This shall be performed in compliance with Section 206 of the Standard Specifications for Road and Bridge Construction.
- 14.)** As directed by the Engineer, existing bituminous concrete located at a distance greater than three feet below the proposed subgrade elevation within the limits of new roadway embankments, shall be scarified or broken until all cleavage planes are destroyed, or the pavement shall be removed entirely as conditions demand. This shall be performed in compliance with Section 206 of the Standard Specifications for Road and Bridge Construction.
- 15.)** If sinkholes are encountered during construction, please contact the Department's Geotechnical Branch for mitigation procedures.

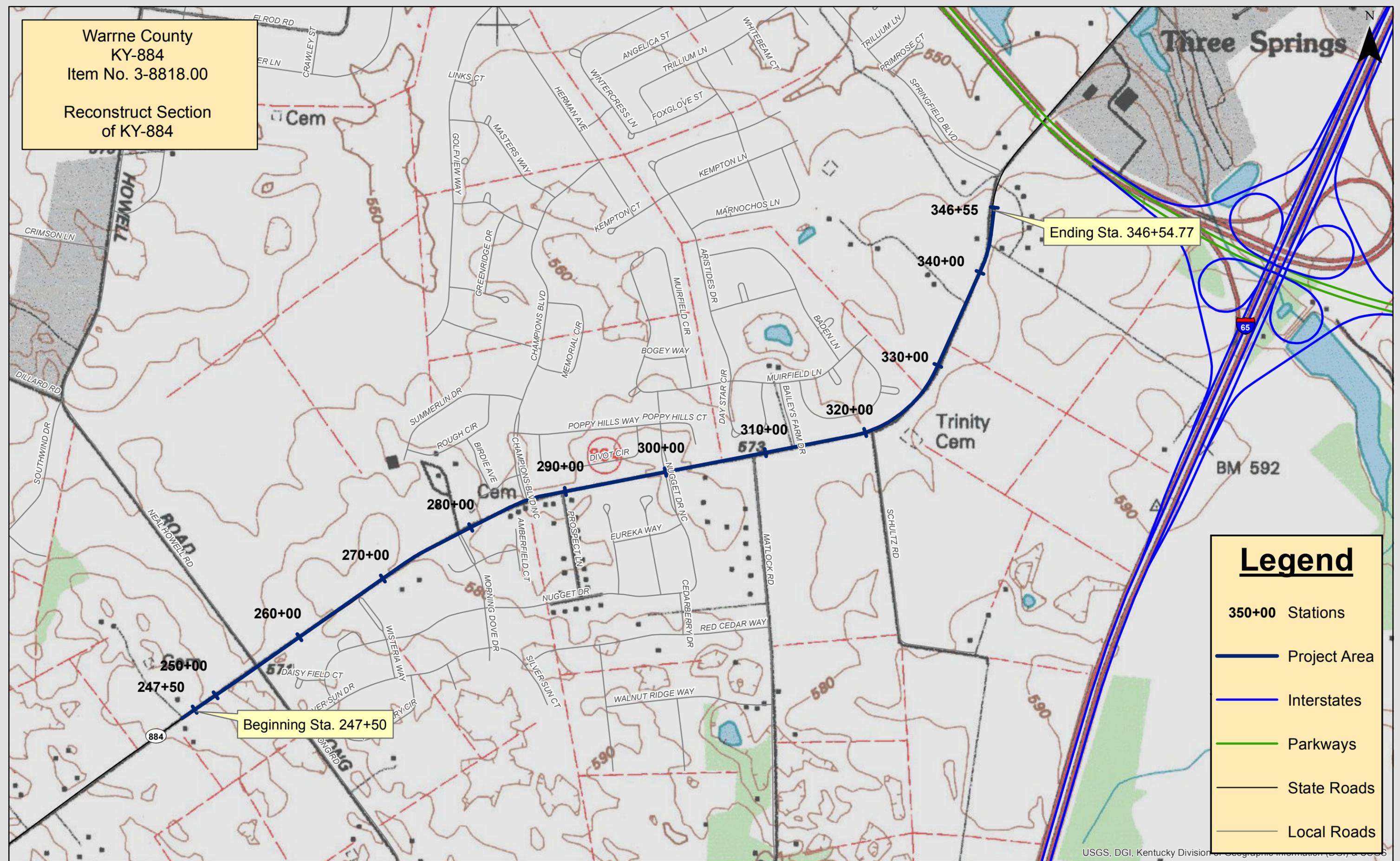
DESIGN RECOMMENDATIONS:

- 1.) The project should be designed for a two foot subgrade with a **CBR Design value of 5**. The average CBR value for the project is 5.6.
- 2.) An average soil shrinkage value of two (2) percent is estimated for this project. This value should be applied to the formula for calculating the Apparent Shrinkage as outlined in the Design Manual.

cc: Division of Design (Plan Processing Section)
TEBM for Pavement Design
Division of Construction
TEBM for Project Delivery & Preservation (District)
TEBM for Project Development (District)
Project Manager (District)

Attachments:

Warne County
 KY-884
 Item No. 3-8818.00
 Reconstruct Section
 of KY-884



Ending Sta. 346+54.77

Beginning Sta. 247+50

Legend

- 350+00 Stations
- Project Area
- Interstates
- Parkways
- State Roads
- Local Roads

0 750 1,500 3,000 Feet

GEOTECHNICAL SYMBOLS

AASHTO Classification of Soils and Soil-Aggregate Mixtures

General Classification	Granular Materials (35% or less passing 0.075 mm)						Silt-Clay Materials (More than 35% passing 0.075 mm)			
	A-1		A-3	A-2			A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6				
Sieve Analysis, Percent Passing										
2.00 mm (No. 10)	50 max	---	---	---	---	---	---	---	---	---
0.425 mm (No. 40)	30 max	50 max	51 min	---	---	---	---	---	---	---
0.075 mm (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min
Characteristics of Fraction Passing 0.425 mm (No. 40)										
Liquid Limit	---	---	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max	N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min

- AI Activity Index
- LI Liquidity Index
- S+C Silt + Clay (% finer than No.200 Sieve)
- Rockline Soundings
- ⊗ Disturbed Sample Boring
- ⊙ Undisturbed Sample Boring
- ⊙ Undisturbed Sample Boring & Rock Core
- Rock Core
- ⊙ Slope inclinometer Installation
- typical applications: ○ ⊗ ⊙ ●
- OW Observation Well
- ➔ Approximate Footing Elevation
- ▼ (Date) Water Elevation

- VS (psf) Field Vane Shear Strength
- Thin-walled Tube Sample
- < Standard Penetration Test Sample
- N Penetration Resistance
- Qu (psf) Unconfined Compressive Strength
- UU (psf) Unconsolidated Undrained Triaxial Strength
- w% Moisture Content
- KY RQD Rock Quality Designation (Kentucky Method)
- STD RQD Rock Quality Designation (Standard Method)
- SDI(JS) Slake Durability Index (Jar Slake Test)
- REC Core Recovery
- ∅ Angle of Internal Friction (Total Stress)
- $\bar{\sigma}$ Angle of Internal Friction (Effective Stress)
- c (psf) Cohesion (Total Stress)
- \bar{c} (psf) Cohesion (Effective Stress)
- γ (pcf) Total Unit Weight
- RDZ Rock Disintegration Zone
- OB Overburden Bench
- IB Intermediate Bench
- R Refusal
- NR Refusal Not Encountered

Unified Soil Classifications

MAJOR DIVISIONS	SYMBOL	NAME
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GM Silty gravels, gravel-sand-silt mixtures.
		GC Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW Well graded sands or gravelly sands, little or no fines.
		SP Poorly graded sands or gravelly sands, little or no fines.
		SM Silty sands, sand-silt mixtures.
		SC Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS LL IS LESS THAN 50	ML Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		ML-CL Silty clay-silty clay with sand and or gravel, sandy silty clay, sandy silty clay with gravel, gravelly silty clay, gravelly silty clay with sand
	SILTS AND CLAYS LL IS GREATER THAN 50	MH Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
CH Inorganic clays of high plasticity, fat clays.		

Unified Soil Classifications - Continued

MAJOR DIVISIONS	SYMBOL	NAME
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GP-GC Poorly graded gravel with clay (or silty clay), poorly graded gravel with clay and sand (or silty clay & sand)
		GP-GM Poorly graded gravel with silt, poorly graded gravel with silt and sand
		GW-GC Well graded gravel with clay (or silty clay), well graded gravel with clay and sand (or silty clay & sand)
		GW-GM Well graded gravel with silt, well graded gravel with silt and sand
		GC-GM Silty clayey gravel, silty clayey gravel with sand
		SAND AND SANDY SOILS
	SP-SC Poorly graded sand with clay (or silty clay), poorly graded sand with clay and gravel (or silty clay and gravel)	
	SP-SM Poorly graded sand with silt, poorly graded sand with silt and gravel	
	SC-SM Silty clayey sand, silty clayey sand with gravel	
	UNCLASSIFIED MATERIAL	OH Organic (High Plasticity)
OL Organic (Low Plasticity)		

- LIMESTONE
- SANDSTONE
- DURABLE SHALE (SDI ≥ 95)
- NONDURABLE SHALE (SDI < 95)
- GRANULAR EMBANKMENT
- STRUCTURE GRANULAR BACKFILL
- TALUS, MINE WASTE, FILL MATERIAL, BOULDERS, & ETC.
- COAL
- DOLOMITE
- LIMESTONE (ARGILLACEOUS)
- SLOPE PROTECTION

FILE NAME: _____
 USER: _____ DATE PLOTTED: _____
 E-SHEET NAME: _____
 MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
WARREN	3-8852.00	—

GEOTECHNICAL NOTES

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15.) If sinkholes are encountered during construction, please contact the Department's Geotechnical Branch for mitigation procedures.

FILE NAME:

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DESIGNED BY: _____
DATE SUBMITTED: _____

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS
COUNTY OF
WARREN

PROJECT _____
NUMBERS: _____

GEOTECHNICAL NOTES

Detailed data and interpretation of subsurface conditions encountered in individual borings are shown on the soil profile. Soil and rock strata descriptions and indicated boundaries are based on engineering interpretation of available subsurface information obtained at selected locations, and may not necessarily reflect the actual variation in subsurface conditions between borings and samples.

The observed water levels and/or subsurface conditions indicated on the soil profile are as recorded at the time of exploration. These water levels and/or subsurface conditions may vary considerable with time, according to the prevailing climate, rainfall or other factors and are otherwise dependent on the duration of and methods used in the exploration program.

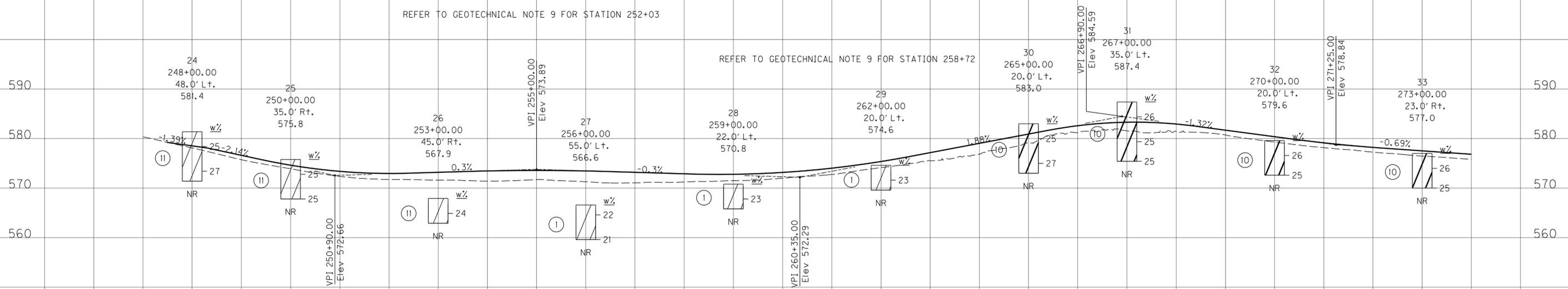
Selected rock cores and all applicable drill logs, are stored at the Division of Structural Design in Frankfort and are available for inspection request. Contact the Division of Structural Design, Geotechnical Branch for availability information and to schedule an inspection.

NOTICE - Without regard to the materials encountered, all roadway and drainage excavation shall be unclassified and shall be designated as Roadway Excavation. It shall be distinctly understood that any reference to rock, earth or any other materials on the plans or cross-sections whether in numbers, words, letters, or lines, is solely for the Department's information and is not to be taken as an indication of classified excavation or the quantity of either rock, earth or any other material involved.

The bidder must draw his own conclusions as to the conditions to be encountered. The Department does not give any guarantee as to the accuracy of the data and no claim will be considered for additional compensation when the materials encountered are not in accord with the classification shown.

REFER TO GEOTECHNICAL NOTE 9 FOR STATION 252+03

REFER TO GEOTECHNICAL NOTE 9 FOR STATION 258+72



SAMPLE NO.	1	10	11
STATION	259+00	270+00	250+00
OFFSET	22.0' Lt.	20.0' Lt.	35.0' Rt.
DEPTH	0.5-5.0	0.9-7.0	0.5-8.0
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3' + NO. 10)	0	0
	SAND (- NO 10 + NO. 200)	3	9
	SILT (- 0.075 mm + 0.002 mm)	56	30
	CLAY (- 0.002 mm)	41	61
LIQUID LIMIT	39	52	46
PLASTIC LIMIT	22	25	21
PLASTICITY INDEX	17	27	25
ACTIVITY INDEX	0.41	0.44	0.52
SPECIFIC GRAVITY	2.54	2.61	2.83
AASHTO CLASSIFICATION	A-6(18)	A-7-6(27)	A-7-6(25)
UNIFIED CLASSIFICATION	CL	CH	CL
CALIFORNIA BEARING RATIO	7	6	6
MAXIMUM DRY DENSITY (pcf)	104	96	100
OPTIMUM MOISTURE (%)	20	27	22
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS	0	0	0

270+00 271+00 272+00 273+00 274+00

SCALE: 1" = 10' HORIZONTAL
1" = 100' VERTICAL

DESIGNED BY: _____
DATE SUBMITTED: _____

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS
COUNTY OF
WARREN

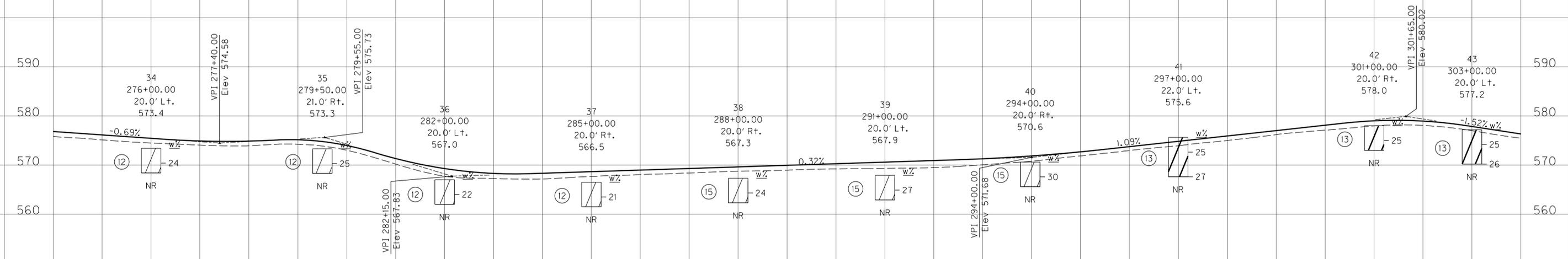
PROJECT _____
NUMBERS: _____

SOIL PROFILE
KY 884
STA. 247+00 to 274+00

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REFER TO GEOTECHNICAL NOTE 9 FOR STATION 277+55

REFER TO GEOTECHNICAL NOTE 9 FOR STATION 283+44



SAMPLE NO.		12	13	15
STATION		279+50	301+00	291+00
OFFSET		21.0' Rt.	20.0' Rt.	20.0' Lt.
DEPTH		0.3-5.0	0.5-5.0	0.5-5.0
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3' + NO. 10)	0	0	0
	SAND (- NO 10 + NO. 200)	5	8	4
	SILT (- 0.075 mm + 0.002 mm)	55	52	53
	CLAY (- 0.002 mm)	40	40	43
LIQUID LIMIT		44	50	39
PLASTIC LIMIT		22	19	21
PLASTICITY INDEX		22	31	18
ACTIVITY INDEX		0.55	0.78	0.42
SPECIFIC GRAVITY		2.53	2.53	2.53
AASHTO CLASSIFICATION		A-7-6(23)	A-7-6(30)	A-6(18)
UNIFIED CLASSIFICATION		CL	CH	CL
CALIFORNIA BEARING RATIO		5	6	-
MAXIMUM DRY DENSITY (pcf)		99	97	-
OPTIMUM MOISTURE (%)		23	22	-
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		0	0	0

SCALE: 1" = 10' HORIZONTAL
1" = 100' VERTICAL

299+00 300+00 301+00 302+00 303+00 304+00

274+00 275+00 276+00 277+00 278+00 279+00 280+00 281+00 282+00 283+00 284+00 285+00 286+00 287+00 288+00 289+00 290+00 291+00 292+00 293+00 294+00 295+00 296+00 297+00 298+00

SOIL PROFILE
KY 884
STA. 274+00 to 304+00

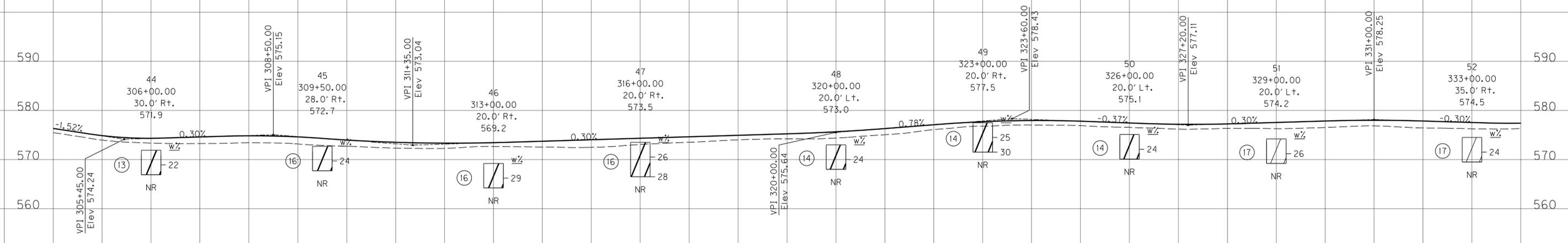
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REFER TO GEOTECHNICAL NOTE 9 FOR STATION 327+30

REFER TO GEOTECHNICAL NOTE 9 FOR STATION 333+79

REFER TO GEOTECHNICAL NOTE 9 FOR STATION 312+13

REFER TO GEOTECHNICAL NOTE 9 FOR STATION 305+95



SAMPLE NO.	15	14	16	17
STATION	291+00	323+00	313+00	333+00
OFFSET	20.0' Lt.	20.0' Rt.	20.0' Rt.	35.0' Rt.
DEPTH	0.5-5.0	0.5-6.0	0.9-5.0	0.5-5.0
COMPOSITION OF TOTAL SAMPLE				
GRAVEL (- 3' + NO. 10)	0	0	0	0
SAND (- NO 10 + NO. 200)	4	4	5	4
SILT (- 0.075 mm + 0.002 mm)	53	45	49	57
CLAY (- 0.002 mm)	43	51	46	40
LIQUID LIMIT	39	50	50	43
PLASTIC LIMIT	21	24	23	22
PLASTICITY INDEX	18	26	27	21
ACTIVITY INDEX	0.42	0.51	0.58	0.53
SPECIFIC GRAVITY	2.53	2.53	2.53	2.53
AASHTO CLASSIFICATION	A-6(18)	A-7-6(28)	A-7-6(29)	A-7-6(22)
UNIFIED CLASSIFICATION	CL	CH	CH	CL
CALIFORNIA BEARING RATIO	-	6	5	-
MAXIMUM DRY DENSITY (pcf)	-	98	96	-
OPTIMUM MOISTURE (%)	-	23	24	-
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS	0	0	0	0

SCALE: 1" = 10' HORIZONTAL
1" = 100' VERTICAL

329+00 330+00 331+00 332+00 333+00 334+00

304+00 305+00 306+00 307+00 308+00 309+00 310+00 311+00 312+00 313+00 314+00 315+00 316+00 317+00 318+00 319+00 320+00 321+00 322+00 323+00 324+00 325+00 326+00 327+00 328+00

SOIL PROFILE
KY 884
STA. 304+00 ± 334+00

FILE NAME:
USER: DATE PLOTTED:
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MicroStation v8.11.7.443

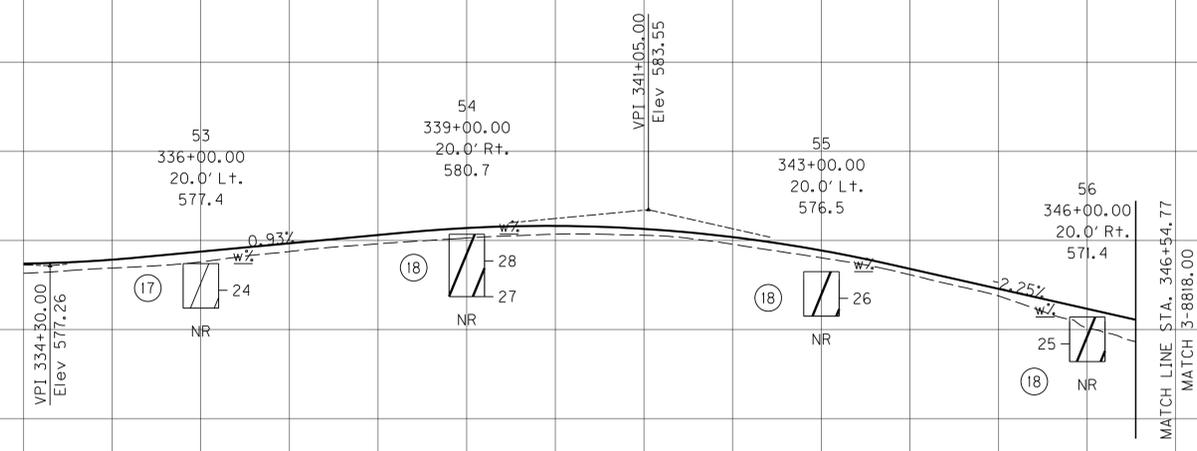
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USER: DATE PLOTTED:

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590
580
570
560



590
580
570
560

SAMPLE NO.	17	18
STATION	333+00	343+00
OFFSET	35.0' Rt.	20.0' Lt.
DEPTH	0.5-5.0	0.9-5.0
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3' + NO. 10)	0
	SAND (- NO 10 + NO. 200)	4
	SILT (- 0.075 mm + 0.002 mm)	57
	CLAY (- 0.002 mm)	40
LIQUID LIMIT	43	50
PLASTIC LIMIT	22	23
PLASTICITY INDEX	21	27
ACTIVITY INDEX	0.53	0.54
SPECIFIC GRAVITY	2.53	2.58
AASHTO CLASSIFICATION	A-7-6(22)	A-7-6(29)
UNIFIED CLASSIFICATION	CL	CH
CALIFORNIA BEARING RATIO	-	5
MAXIMUM DRY DENSITY (pcf)	-	96
OPTIMUM MOISTURE (%)	-	24
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS	0	0

SCALE: 1" = 10' HORIZONTAL
1" = 100' VERTICAL

334+00 335+00 336+00 337+00 338+00 339+00 340+00 341+00 342+00 343+00 344+00 345+00 346+00

SOIL PROFILE
KY 884
STA. 334+00 to 346+00

COORDINATE DATA SUBMISSION FORM
KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County Warren

Date 1/4/2017

Road Number KY 884

Survey Crew / Consultant Rick Adams

Contact Person Rick Adams

Item # 03-8852.00

Mars # 8963101D

Project # _____

Notes:

Holes #24-56 (03-8852.00)

Elevation Datum = NAVD88 or ASSUMED

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
24	36.898362	-86.468287	24	248+00	48' L	581.4
25	36.898486	-86.467563	25	250+00	35' R	575.79
26	36.898935	-86.4667	26	253+00	45' R	567.85
27	36.899636	-86.466062	27	256+00	55' L	566.64
28	36.90004	-86.46516	28	259+00	22' L	570.75
29	36.900512	-86.46432	29	262+00	20' L	574.63
30	36.90099	-86.463484	30	265+00	20' L	583.02
31	36.901341	-86.462956	31	267+00	35' L	587.37
32	36.901785	-86.46209	32	270+00	20' L	579.63
33	36.902164	-86.461168	33	273+00	23' R	576.98
34	36.902676	-86.460356	34	276+00	20' L	573.37
35	36.90302	-86.45923	35	279+50	21' R	573.3
36	36.903437	-86.458536	36	282+00	20' L	567.01
37	36.903714	-86.457563	37	285+00	20' R	566.52
38	36.903961	-86.456603	38	288+00	20' R	567.26
39	36.904231	-86.455624	39	291+00	20' L	567.94
40	36.904286	-86.454592	40	294+00	20' R	570.57
41	36.904562	-86.453614	41	297+00	22' L	575.62
42	36.904666	-86.452245	42	301+00	20' R	578.02
43	36.904882	-86.451601	43	303+00	20' L	577.18
44	36.90491	-86.450562	44	306+00	30' R	571.93
45	36.905105	-86.44939	45	309+50	28' R	572.72
46	36.905316	-86.448222	46	313+00	20' R	569.19
47	36.905479	-86.447216	47	316+00	20' R	573.49
48	36.905824	-86.445917	48	320+00	20' L	573.04
49	36.906082	-86.444936	49	323+00	20' R	577.47
50	36.9067	-86.444248	50	326+00	20' L	575.11
51	36.907366	-86.443681	51	329+00	20' L	574.21
52	36.908305	-86.44295	52	333+00	35' R	574.54
53	36.909119	-86.442706	53	336+00	20' L	577.41
54	36.909827	-86.442164	54	339+00	20' R	580.72
55	36.910892	-86.441839	55	343+00	20' L	576.46
56	36.911693	-86.441575	56	346+00	20' R	571.4