

# CONSTRUCTABILITY PANEL

WITH HIGHWAY CONTRACTOR  
REPRESENTATIVES

# INTENT OF SESSION

- To have respectful and meaningful discussions about constructability issues
- Seeing the issues from a different perspective (contractors/designers)
- Possibly find opportunities to improve constructability on future projects

# PRESENTATION FORMAT

- Discuss the constructability challenge
- Review Plan details, if applicable
- Discuss possible solutions to improve constructability
- Input/discussion from designer's perspective

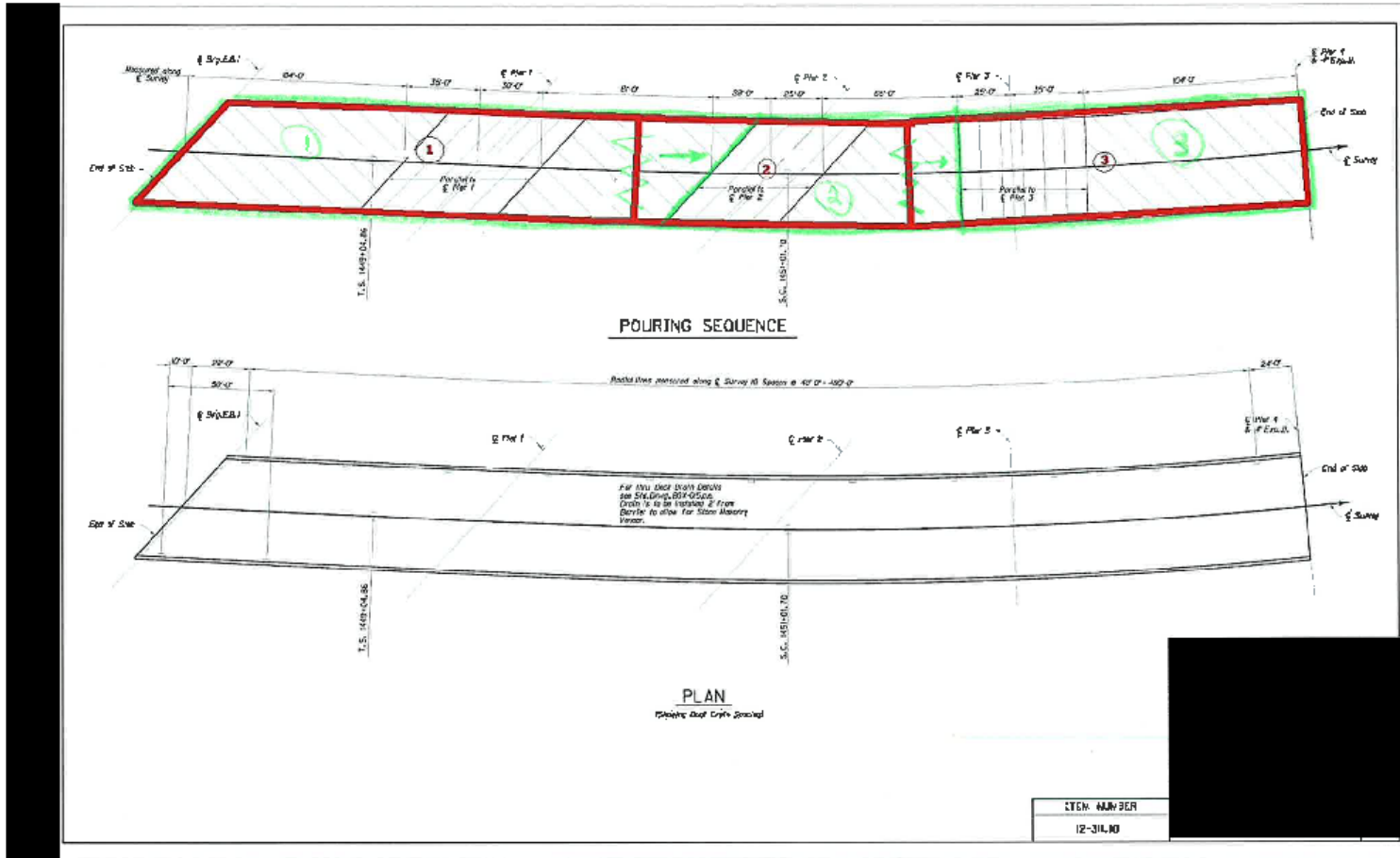
# PANELISTS

- Brian Billings-Vice President of ATS Construction-Lexington
- Fred Clark-Estimator-Bourne-Clark Construction-Mt. Sterling
- Thomas Haydon III-President-Haydon Bridge Company-Springfield
- Kenny Roller-Heavy/Highway Manager-Louisville Paving Company-Louisville



# TOPIC #1-BRIDGES

- Skewed Bridge Deck Construction Joints

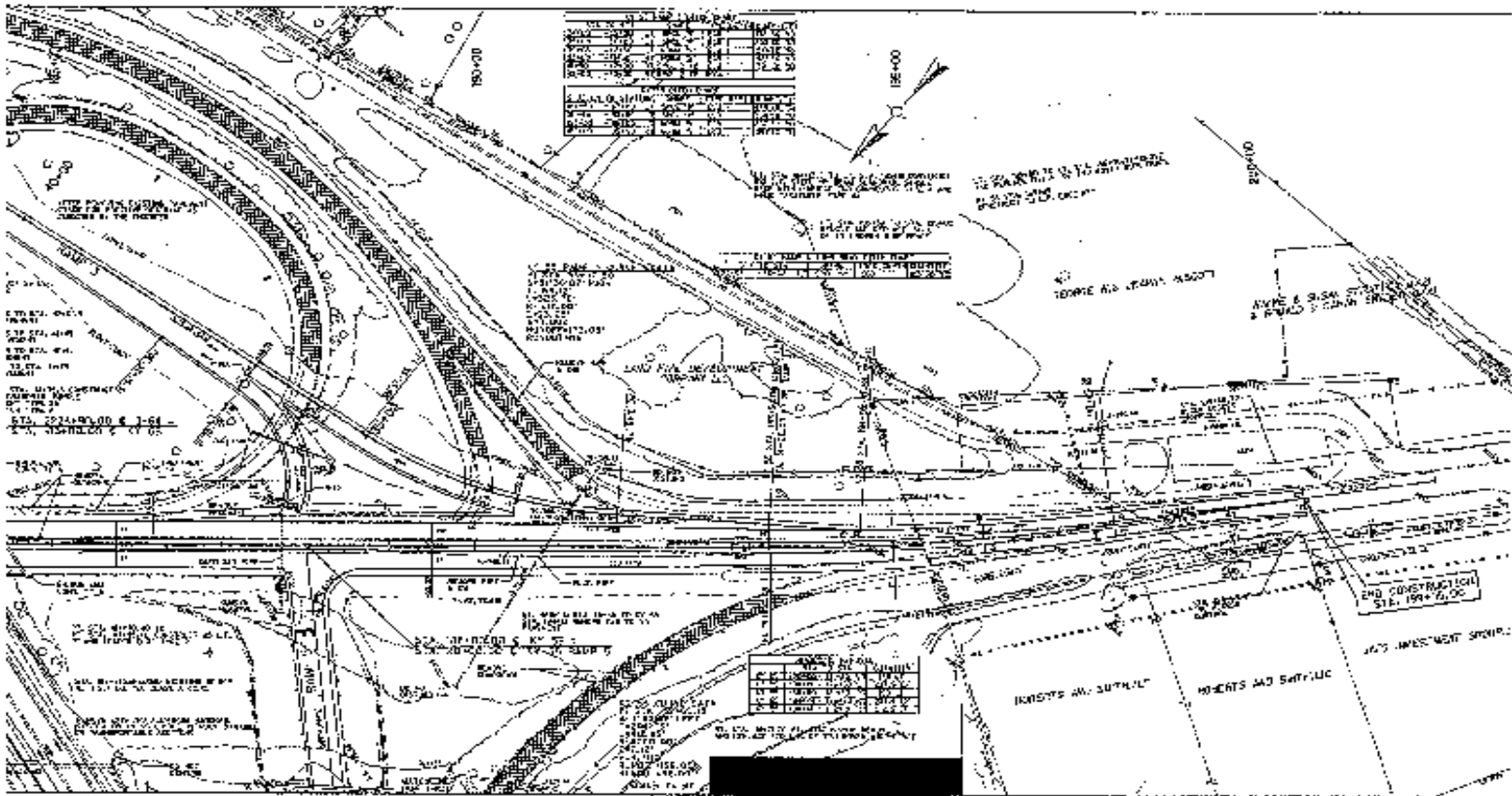


# TOPIC #1-BRIDGES

- Constructability issues
  - Hard to form, brace and finish
- Potential solutions/alternatives to improve constructability
  - Place joints square to centerline

# TOPIC #2-ROADWAY

- Part width construction

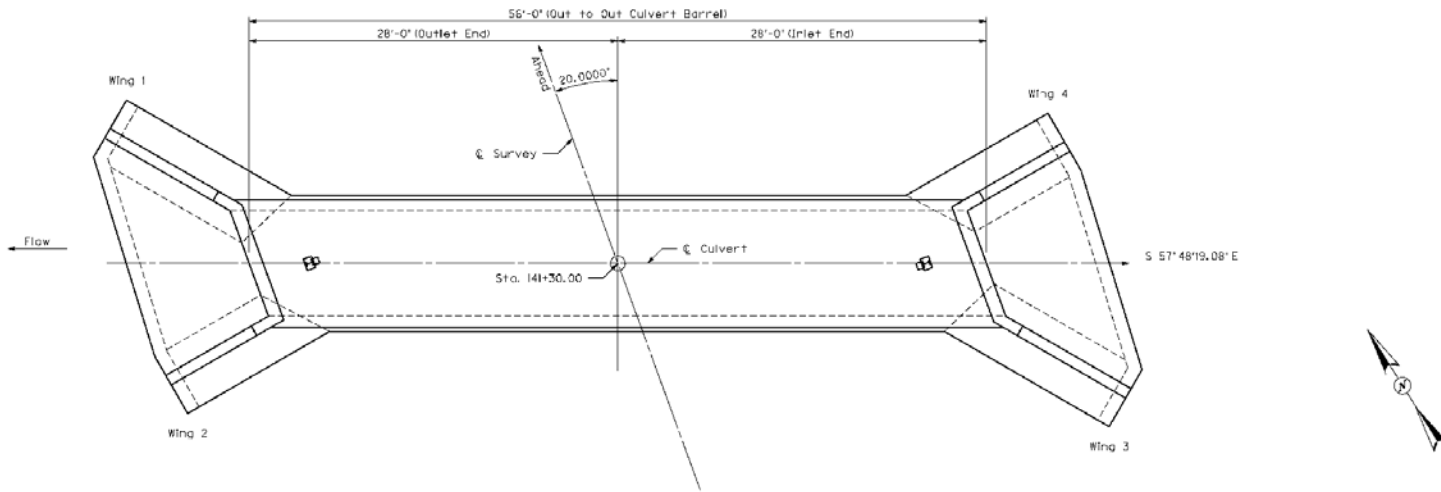


# TOPIC #2-ROADWAY

- Constructability issues
  - Plans call for part width construction on SB from 197+00 - 195+95, restricted to 7pm-5am
  - Pavement design calls for one course asphalt drainage blanket and three courses asphalt base
  - Impossible to construct in a 10 hour shift
- Potential solutions/alternatives to improve constructability
  - Construct temporary diversion
  - Utilize part width construction without time restrictions
  - Temporary road closure with offsite detour

# TOPIC #3-SPECIALTY

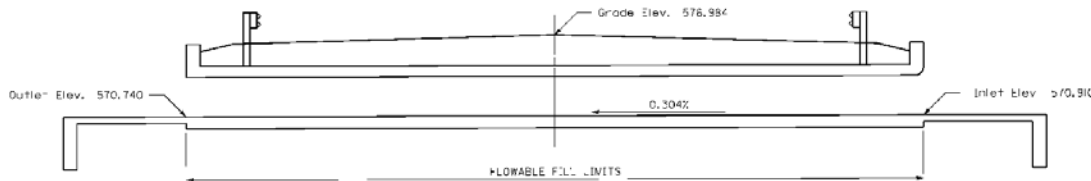
- Placing guardrail post on culvert



For Guardrail Attachment to Culvert Top Slab See Standard Drawing RBR-015

**PLAN**  
SCALE = 1:48

See roadway plans for guardrail location



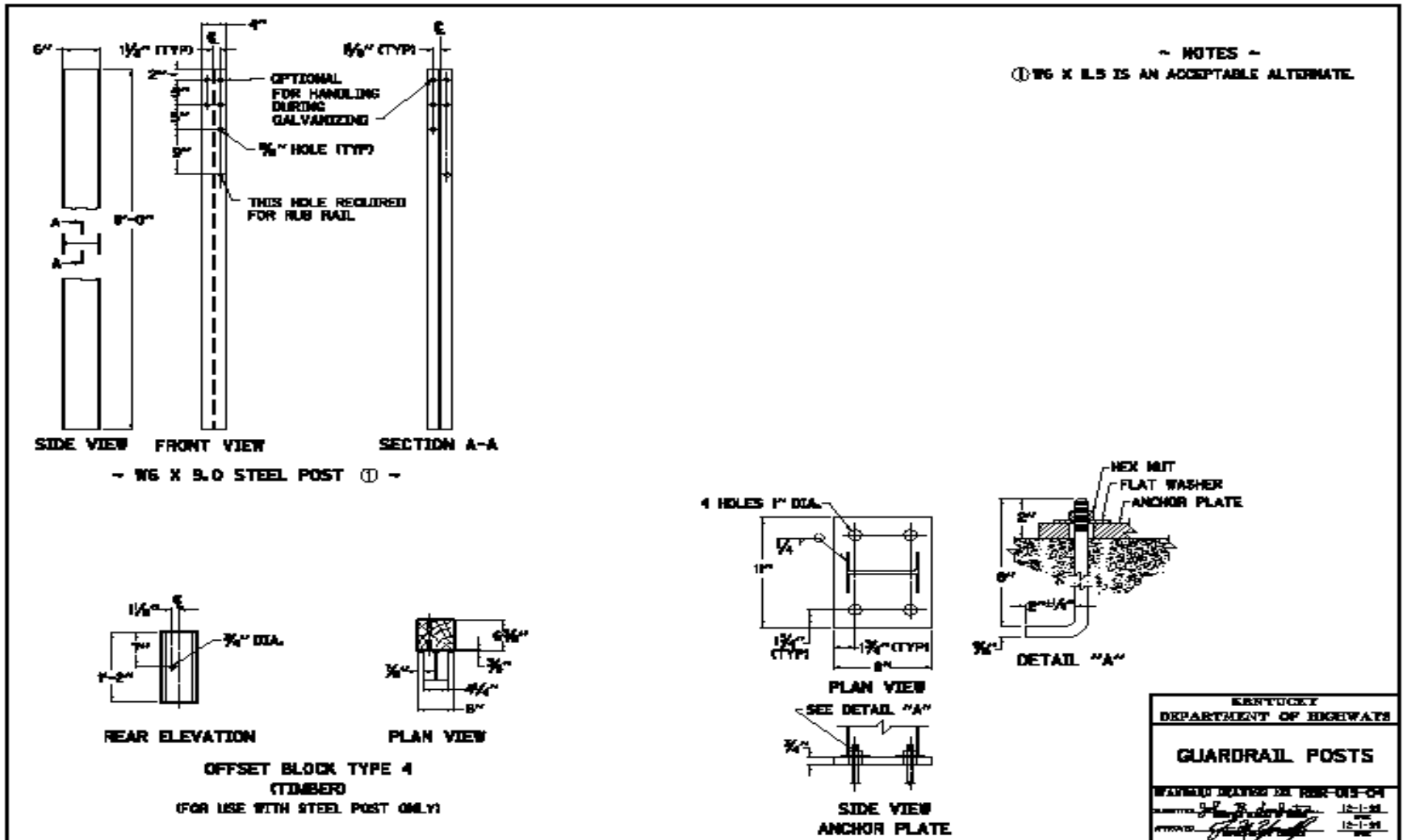
**SECTION ON C**  
Single 8'-0" x 3'-0" x 56'-0" R.C.B.C.  
28'-0" Inlet End and 28'-0" Outlet End  
20.0000° Rt. Skew - KY #L93 Loading - 0.25 F1 Slope  
Yielding Foundation

ITEM NUMBER

R-158-10

# TOPIC #3-SPECIALTY

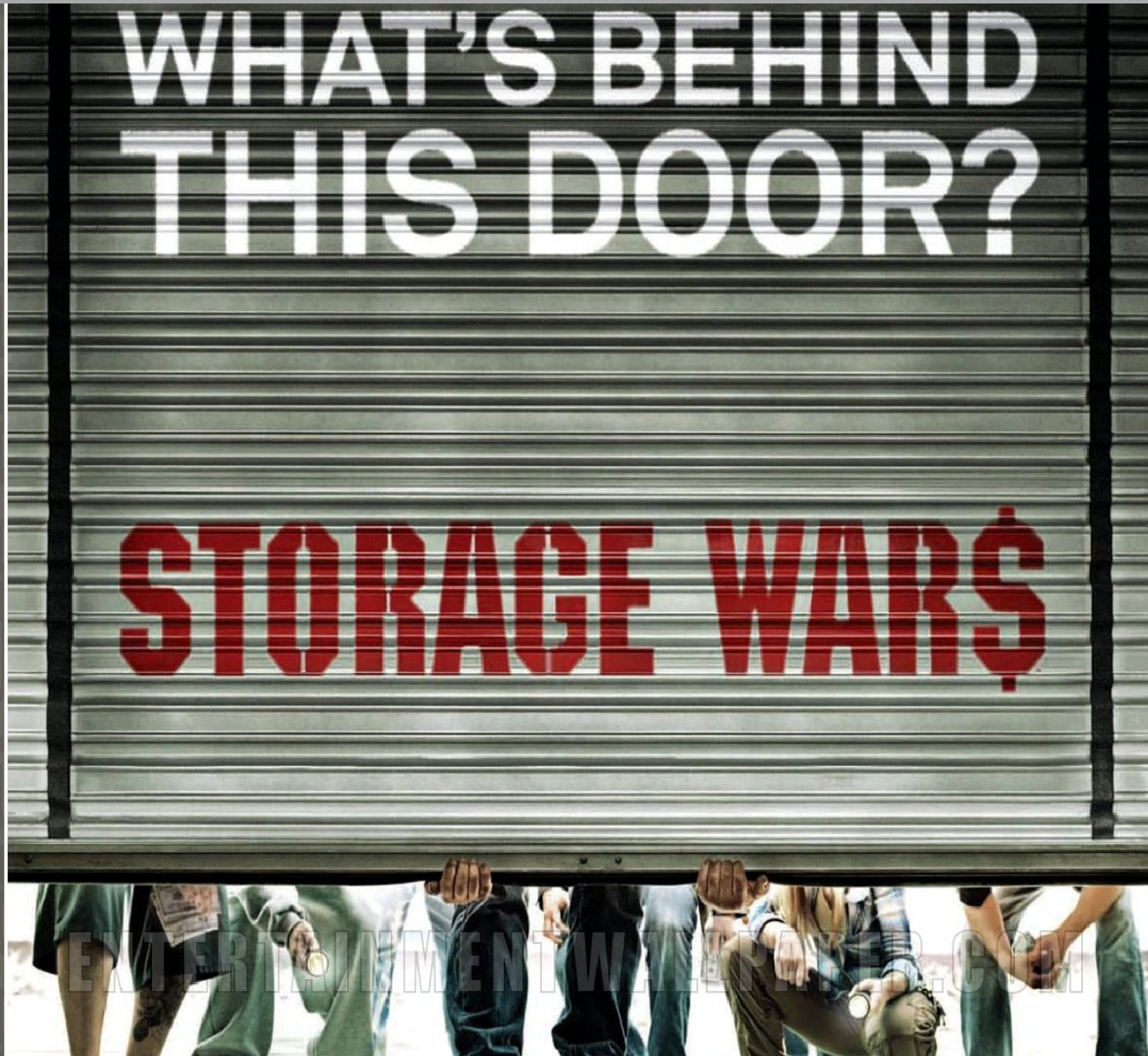
- Standard drawing RBR 015-04



# TOPIC #3-SPECIALTY

- Constructability issues
  - 9/16" X 8" Hook Bolts (RBR-015-04) must be poured in place. Each post requires four of these hook bolts.
  - It is virtually impossible for the bridge/culvert contractor to get these placed in the exact location required for proper alignment for future guard rail.
  - protecting the bolts once they are in place.
    - If you place the posts upon completion of the box culvert, they are in the way of the backfill operation and will likely get damaged.
    - If you backfill with the bolts exposed, they will also likely be damaged.
- Potential solutions/alternatives to improve constructability
  - Pour the deck of the culvert with no hook bolts in place.
  - Allow the guard rail subcontractor to dig/auger down and expose the deck of the culvert at each location where a guard rail post is to be placed.
  - Allow the use of 7/8" Wedge Anchors, specifications and length to be determined by KYTC. Guard rail subcontractor is responsible for backfilling holes upon completing the installation of the posts on the deck.

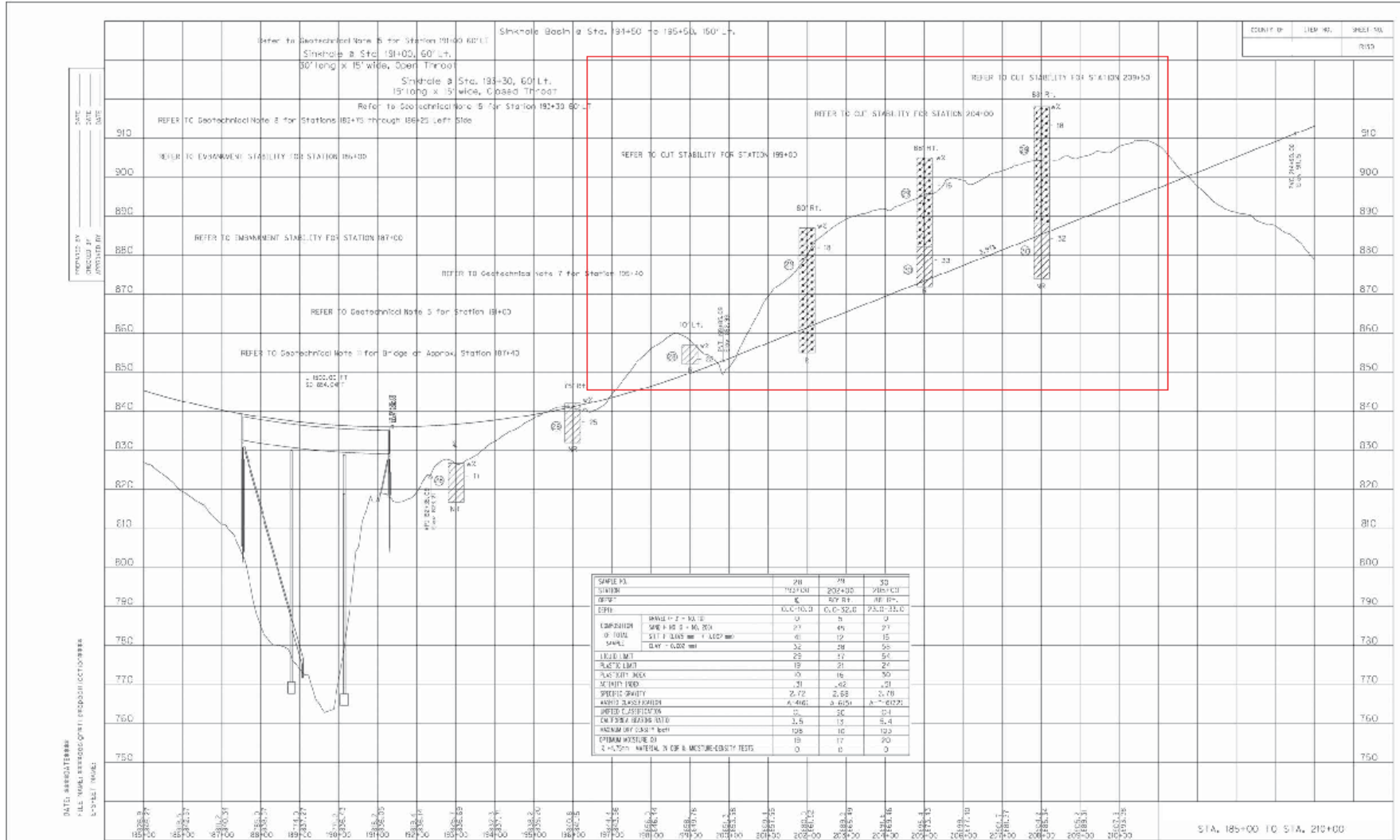
# TOPIC #4-ROADWAY





# TOPIC #4-ROADWAY

- Geotechnical issue



# TOPIC #4-ROADWAY

## Geotechnical Notes

COUNTY OF	LISEM NO.	SHEET NO.
		1030

DRAWN BY: \_\_\_\_\_  
 CHECKED BY: \_\_\_\_\_  
 APPROVED BY: \_\_\_\_\_

The following geotechnical notes and recommendations are based upon reviews of available data, information obtained during the field exploration, results of laboratory testing and engineering analysis, and discussions with the Designer and KTR personnel. The construction limited depths of both the Section 204(0) and Section 204(2). The notes presented herein are intended only for the above construction limits.

- Clearing and grubbing of embankment areas shall be completed in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.
- All water wells and/or streams within the limits of construction, whether open or the plug or not, shall be plugged in accordance with Section 208 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

The following location was identified during the field exploration. Other well and/or stream locations encountered within construction limits will also need to be plugged.

Approximate Station for Initial Construction

Station	Water Well
21+00 to 22+00	Water Well

- A spring has been noted at the following approximate station, and is located within a cut interval. Following roadway excavation and once the spring source has been identified, performance plans for subsurface drainage should be installed to promote positive drainage away from the roadway subgrade. The performance plan shall be in accordance with Kentucky Department of Highways Standard Drawing KHS-030 as directed by the Engineer. This drainage feature shall be installed at the following approximate location.

Approximate Station

Station
28+25

- All pile/cut and wells and associated structures within the limits of construction, whether shown on the plans or not, shall be plugged and removed in accordance with Sections 205 and 109 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction and applicable state and federal requirements.

The following locations are provided only to aid in establishing quantities for clearing purposes. Actual wells and/or associated structures requiring clearing and/or removal may differ significantly from those listed herein.

Approximate Station for Initial Construction

Station	Gas Well
21+65, 175 Right	Gas Well
22+35, 40 Left	Gas Well
22+45, 155 Left	Gas Well
22+60, 207 Right	Gas Well
26+20, 175 Left	Gas Well
28+25, 160 Left	Gas Well
28+55, 157 Left	Gas Well
41+20, 50 Right	Oil Well

- All sheet piling and special diaphragms shall be constructed prior to placement of any embankment material adjacent to them in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. Materials excavated from these areas may be utilized in construction of the embankments, but may require attention to proper moisture contents prior to compaction operations. An extra permit shall be obtained for reworking, hauling, stockpiling and/or distributing these materials.

- In accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction, the relative content of embankment and subgrade materials shall not vary from the optimum moisture content, as determined by KY 64-01, by more than 3.0% or 1/10th the percent. This moisture content requirement shall have equal weight with the density requirement when determining the acceptability of embankment or subgrade construction. Refer to the family of curves for moisture-density relationships.

- All soils, whether from roadway excavation or borrow, may require manipulation to obtain proper moisture contents prior to compaction. Direct payment shall not be permitted for reworking, hauling, stockpiling and/or distributing these materials.

- The Contractor shall conduct erosion operations in such a manner that all from roadway excavation be stockpiled, preferably in otherwise undisturbed areas that utilize quantities are sufficient for a reasonably unaltered meeting meeting specifications in Section 208 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. Removal covers of streambeds and other areas encountered during drilling operations in the soil overburden. These areas may require special handling during construction by the Contractor so that the proposed soil usage materials are essentially free of entrained boulders and rock fragments larger than four inches, which if included in the subgrade might provide loss uniform and undesirable conditions. No extra payment shall be permitted for reworking, hauling, stockpiling and/or distributing these materials.

- The Contractor is responsible for conducting any operations necessary to excavate the cut areas to the required typical sections. The cost of these operations shall be included in the unit bid price for roadway excavation or embankment-in-place.

- Additional cutting and/or undercutting may be required at the following approximate locations, and at other locations, to provide for the removal of any deep organic materials present within possible future cut areas and to be directed by the Engineer.

Approximate Station Limits for Initial Construction

Station
22+00 to 22+20
24+00 to 24+20

Relocated KY 738, Left and Right of Mainline Station 314+50  
44+00 to 48+00

- Lateral flows are located near the top of proposed cuts as shown on the plans. If significant quantities of water/seepage is encountered during roadway excavation in the upper portions of a cut, an erosion control blanket shall be installed in accordance with Section 202 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction and as directed by the Engineer.

The following locations are near lateral flows and are provided to aid in establishing quantities for bidding purposes. Actual locations requiring erosion control blanket material will be determined by the Engineer during construction.

Approximate Station Limits for Ultimate Construction

Station
285+50 to 286+55, Left

- As directed by the Engineer, existing discontinuous concrete or the following approximate locations that is located within the limits of new roadway embankments, and sections of a distance greater than three feet below proposed subgrade elevations, shall be removed or broken up and disposed of as directed by the Engineer. The cost of disposal shall be included in the unit bid price for subgrade preparation. In accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction, subgrade materials remaining after removal of pavements may need to be stabilized prior to placement of new pavement sections, as directed by the Engineer.

Approximate Station Limits for Initial Construction

Station
226+20 to 226+50
241+00 to 241+00

IS 27 Connector Right of Mainline Station 220+00  
63+00 to 65+00

KY 553 Left and Right of Mainline Station 360+50  
38+00 to 40+00

- As directed by the Engineer, existing discontinuous concrete or the following approximate locations that is located less than three feet from proposed subgrade elevations shall be removed or broken up, as directed by the Engineer, and disposed of with suitable subgrade material.

Approximate Station Limits for Initial Construction

Station
310+65 to 311+35

Relocated Thurston Road Left and Right of Mainline Station 293+62.25  
293+00 to 294+00

Interchange Road, Right of Mainline Station 344+00  
35+00 to 39+00

Relocated KY 738, Left and Right of Mainline Station 314+50  
42+00 to 45+00

KY 203 Left and Right of Mainline Station 340+00  
34+00 to 34+50

Approximate Station Limits for Ultimate Construction

Station
311+35 to 312+00
326+70 to 326+50

- Any saturated and soft subgrade soils encountered during subgrade preparation within new cuts shall be drained and stabilized using a 12-inch thick lift of non-weldable Granular Embankment meeting the requirements of Section 805 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. The coarse aggregate shall be wrapped (top and bottom) with Type III Geotextile Fabric in accordance with Sections 214 and 843 of the current Standard Specifications.

The following intervals are provided only to aid in establishing quantities for coarse aggregate and geotextile fabric for bidding purposes. Actual areas requiring such stabilization shall be determined by the Engineer during construction.

Approximate Station Limits for Initial and Ultimate Construction

Station
239+50 to 254+00
270+00 to 284+00
305+00 to 331+00

IS 27 Connector Left of Mainline Station 210+25  
46+00 to 48+00

IS 27 Connector Right 1  
48+00 to 51+00

IS 27 Connector Right 2  
27+00 to 30+01.97

Relocated KY 738, Left of Mainline Station 314+50  
48+00 to 49+00

KY 553 Left and Right of Mainline Station 360+50  
5+00 to 10+00

- Any saturated, soft, unstable areas encountered within embankment foundation limits under any other use as directed by the Engineer shall be drained and stabilized using non-weldable Granular Embankment meeting the requirements of Section 805 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. A minimum 20-ton working platform shall be constructed in such areas. The coarse aggregate shall be underlain with Type III Geotextile Fabric in accordance with Sections 214 and 843 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

The following intervals are provided only to aid in establishing quantities for coarse aggregate and geotextile fabric for bidding purposes. Actual quantities and locations of new materials will be determined by the Engineer during construction. The cost of placing these materials shall be included in the unit price.

Approximate Station Limits for Initial Construction

Station
301+00 to 303+00
344+00 to 344+00
374+00 to 379+00

KY 553 Left and Right of Mainline Station 360+50  
47+00 to 48+00

Approximate Station Limits for Ultimate Construction

Station
301+00 to 303+00

DRAWN BY: \_\_\_\_\_  
 CHECKED BY: \_\_\_\_\_  
 APPROVED BY: \_\_\_\_\_



# TOPIC #4-ROADWAY



# TOPIC #4-ROADWAY

- Constructability issues
  - Unknown/unexpected geotech issues
    - Significant amount of extra work
    - Delays to project completion
- Potential solutions/alternatives to improve constructability
  - Collection of additional geotech information
  - Designs should not assume best case scenario when interpreting geotech data
  - Geotech plan notes should be written to allow parties to work together for solutions, rather than making any unknowns incidental to the contractor's bid



# TOPIC #5-BRIDGES

- Constructability issues
  - Very expensive to return to drive minimal piling
  - Working room is very limited in this case
- Potential solutions/alternatives to improve constructability
  - Design Phase 2 wing without need for piling

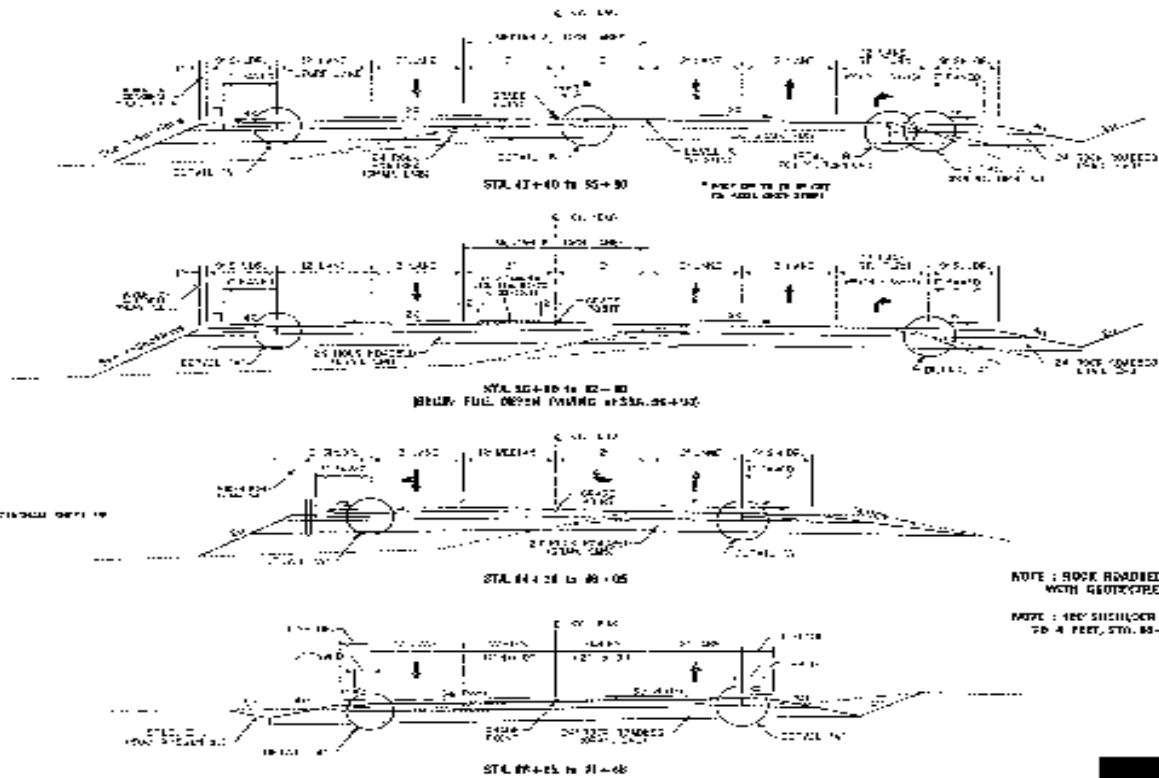




# TOPIC #6-ROADWAY

- Wrapping rock roadbed with geotextile fabric

## TYPICAL SECTIONS -



NOTE: ROCK ROADBED SHALL BE WRAPPED WITH GEOTEXTILE FABRIC TYPE II

NOTE: 400' SHOULDER TYPICAL FROM 4' TO 6' TO 4' FEET, STA. 55+30 TO STA. 67+05

204.21 (1)

DATE: 11/11/03  
BY: [REDACTED]  
CHECKED: [REDACTED]  
APPROVED: [REDACTED]

DATE: 11/11/03  
BY: [REDACTED]  
CHECKED: [REDACTED]  
APPROVED: [REDACTED]



# TOPIC #6-ROADWAY



# TOPIC #6-ROADWAY

- Constructability issues
  - Plans indicate rock roadbed to be wrapped with geotextile fabric
  - KYTC personnel directed to extend DGA over fabric
  - DGA tends to slide off fabric during rain events
- Potential solutions/alternatives to improve constructability
  - Rock roadbed could be underlain and overlain with geotextile fabric, but not completely wrapped

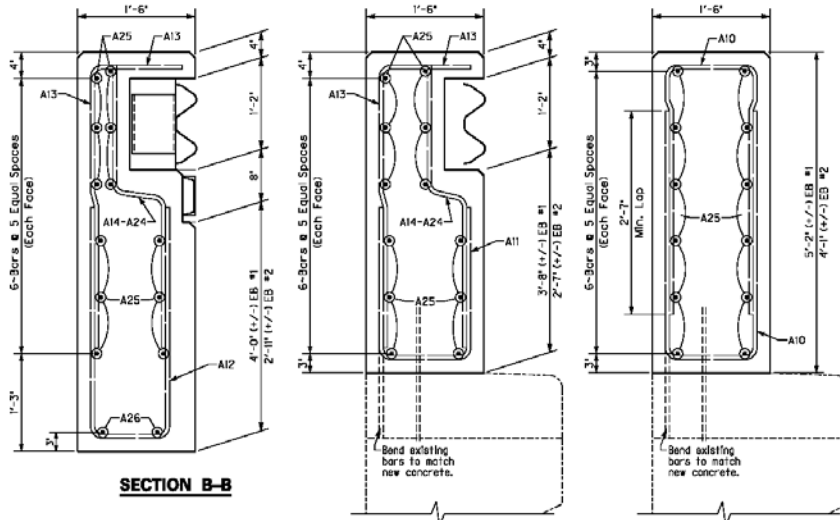


# TOPIC #7-SPECIALTY

- Constructability issues
  - This bridge connector works best when connecting to Rail System Type III.
  - We now see many bridges with architectural features and wider barrier ends.
  - We have seen some barrier ends over two feet thick making it difficult to obtain the long bolts to connect the Bridge Connector Type “A” in accordance with the standard drawing.
- Potential solutions/alternatives to improve constructability
  - On barrier wall ends that are not standard (or normal), consider using a four-bolt assembly to connect the end shoe and a two-bolt assembly to connect the rub rail.

# TOPIC #7-SPECIALTY

## EXAMPLE OF WELL DESIGNED BRIDGE CONNECTION



NOTE:  
 Preserve existing reinforcement and incorporate into new backwalls.

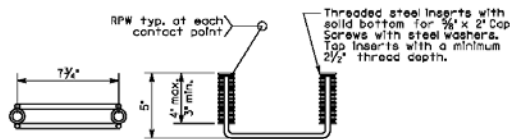
### BOLT INSERT ASSEMBLY NOTES

The cost of the Insert assemblies is incidental to the cost of superstructure concrete.

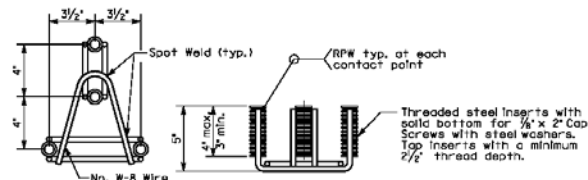
Cap screws and washers are to be galvanized and conforming to ASTM A-325.

No. W-8 gage wire, cold-drawn is to conform to ASTM A-82.

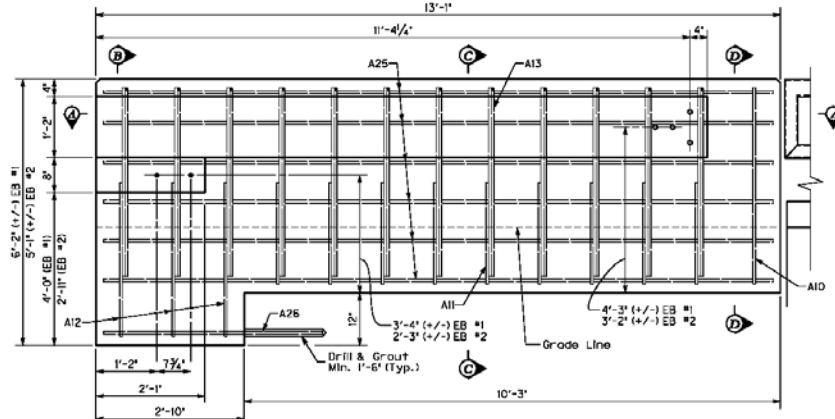
Inserts are to conform to ASTM A-108, Grades C1008 and C1010 or B1113.



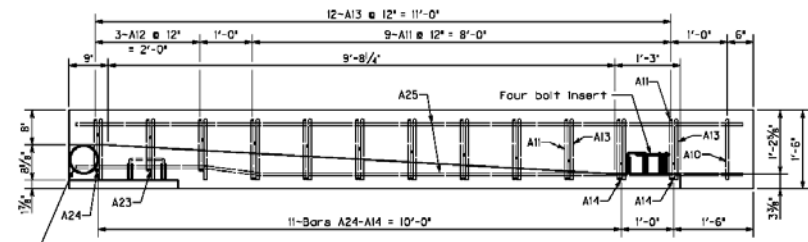
**TWO BOLT INSERT ASSEMBLY**



**FOUR BOLT INSERT ASSEMBLY**



**WING ELEVATION (ROADWAY SIDE)**  
 ~Guardrail not shown for clarity~



**SECTION A-A**

Steel spacer, see Std. Dwg. RBC-001, c.e. for Guardrail Connector Details.

ITEM NUMBER
04-0000.00





# TOPIC #8-ROADWAY

## GEOTECHNICAL NOTES

COUNTY OF	ITEM NO.	SHEET NO.
		004

11. In accordance with Section 205 of the current Standard Specifications, the moisture content of embankment materials shall vary from the optimum moisture content as determined by M 54-B 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 Party of Survey for individual variability correlations.

12. At all times, whether from roadway or borrow, any require incorporation to obtain proper moisture content prior to compaction. Other payment shall not be permitted for reworking, reusing, recycling, and/or recompacting soils.

13. 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.

14. The contractor is responsible for conducting any operations necessary to excavate the cut slopes to the required typical section. These operations shall be incidental to the lift bid price for roadway excavation or embankment-in-place.

15. Perforated pipe for subgrade drainage shall be placed in vertical sag in accordance with RPP-026 at the following approximate locations and/or where designated by the Engineer.

KT 61  
Station 66+00 Station 101+00 Station 119+00  
Station 114+00 Station 124+00

16. The contractor shall construct foundation embankment benches and transverse benches as indicated on this plan and/or as directed by the Engineer, prior to placement of embankments in areas resulting such benches.

17. Transverse benching and/or perforated pipe underdrains shall be installed at the following approximate locations and any others designated by the Engineer. Contrary to Standard Drawing RPP-064, transverse benches and perforated pipe underdrains shall be placed on both the upslope and downslope out to fill transitions.

KT 61  
Station 66+00 Station 101+00 Station 121+00  
Station 114+00 Station 120+00 Station 121+00  
Station 114+50

18. Foundation embankment benches shall be placed in accordance with Standard Drawing REX-00 at the locations listed below and/or as directed by the Engineer.

KT 61  
Sections 84+25 to 89+75 Rt.  
Sections 104+25 to 104+75 Rt.

19. The contractor shall conduct grading operations in such a manner that limestone and/or durable sand 150 to 250-foot roadway excavation be adopted, secondary or otherwise mobilized so that good quantities are available for those areas requiring add material. No direct payment will be allowed for such necessary mobilizing of stockpiles, hauling, and/or double handling the material.

20. Any materials, unless material encountered in existing creek beds and/or drainage ditches within embankment foundation limits shall be drained and stabilized with 2 feet of limestone from roadway excavation or as directed by the Engineer. Postive drainage shall be established to prevent seeping water within the roadway embankment. The placement of this material is incidental to the lift bid price for roadway excavation or embankment-in-place. This material shall be underlain with Type III Geotextile Fabric in accordance with Section 214 and 215 of the Standard Specifications for Road and Bridge Construction, current edition.

21. Some of the authorizations and areas on the project are subject to erosion. Necessary procedures in accordance with Sections 22 and 23 of the current Standard Specifications shall be followed on construction.

22. Stone ditches or other M 62, 62a or 62b structures may be used in the easement.

23. The following approximate embankment locations shall be protected with 1-foot of Cyclopean Stone Rip Rap meeting the requirements of Sections 703 & 805 of the Standard Specifications for Road and Bridge Construction, current edition. The protection shall extend from groundline to 1-foot above the 100-year high-water elevation. Place a Type I Geotextile Fabric conforming to Sections 214 and 215 of the current Standard Specifications for Road and Bridge Construction between the embankment and the slope protection.

KT 61  
Station 91+50 to 106+00, Left

24. The cores shall be constructed in accordance with Kentucky Standard Drawings R0X-100 and R0X-105, meeting the material requirements of the current edition of Special Provision 65. Concrete pile cores will be required and quantities shall be calculated for such. The final design shall await the approval of the Engineer.

25. To provide a working platform for embankment construction, a sufficient thickness (estimated to be 2 ft) of limestone and/or durable shale from roadway excavation shall be placed over all soil and/or sandstone foundation areas that may be detected during construction and/or to fill and stabilize the existing ditches located within the limits of the roadway embankment construction, as directed by the Engineer. The placement of this material is incidental to the lift bid price for roadway excavation or embankment-in-place. The rock material shall be underlain with Geotextile Fabric, Type III, in accordance with Section 214 & 215 of the current Standard Specifications. For rockface purposes only, the following areas are anticipated to require the above referenced treatment. Actual thickness and locations of the working platform will be determined by the Engineer during construction. The cost of placing the working platform shall be incidental to the lift bid price for roadway excavation or embankment-in-place on protective fabric, and areas were noted during the subsurface investigations at the following approximate locations:

KT 61  
Sections 99+00 to 103+00

26. Any fill walls shall be treated under the guidance of the Department for Natural Resources, Division of Soil and Gas Conservation, regulations and in accordance with R05 303.

27. Sinkholes/solution features, which will be opened and filled with Kentucky Course Aggregate No. 2, 3, or 23 in situ. The exact locations below. Mitigation of the sinkholes shall be as follows and as shown on the Sill-in-thru Stability Sheet for End Bent No. 2 of the Big Barren Creek Bridge.

Station	Offset
111+59	20' RT
111+61	20' LT

- Excavate embankment soil to bedrock between End Bent No. 2 and approximate Station 111+60, or as directed by the Engineer. The minimum width of the excavation should be equal to the bridge width.
- Expose the rock faces of the sinkholes where possible. (The sinkhole rock openings may not be directly beneath the surface clear sections.)
- Remove debris and soil from any sinkhole rock openings encountered.
- Fill all any sinkhole rock openings encountered to the rock line with KY Course Aggregate No. 2, 3 or 23.
- Construct the embankment of KY Course Aggregate No. 2, 3 or 23 to the elevation required to allow overflow drainage to the creek from sinkhole depressions.
- Place Type IV Geotextile Fabric at all interfaces between soil and course aggregate.

28. Slope protection will be required on a about abatement measure on the KY 61 bridge over Lewis Creek (cross south-thru slopes and shall meet the requirements of Sections 703 and 805 of the Standard Specifications, current edition. The length and thickness of the slope protection shall be designed as specified in HEC 23. Place a Type I Geotextile Fabric, conforming to Sections 214 & 215 of the current Standard Specifications, between the embankment and the slope protection as part of the scour abatement.

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

30. When excavation of the sinkhole openings begins, please advise the Geotechnical Branch so that Branch personnel may visit the site to observe subsurface conditions.



# TOPIC #8-ROADWAY





# TOPIC #8-ROADWAY

- Constructability issues
  - Unknown/unexpected geotech issues
    - Significant amount of extra work
    - Delays to project completion
- Potential solutions/alternatives to improve constructability
  - Collection of additional geotech information
  - Designs should not assume best case scenario when interpreting geotech data
  - Geotech plan notes should be written to allow parties to work together for solutions, rather than making any unknowns incidental to the contractor's bid

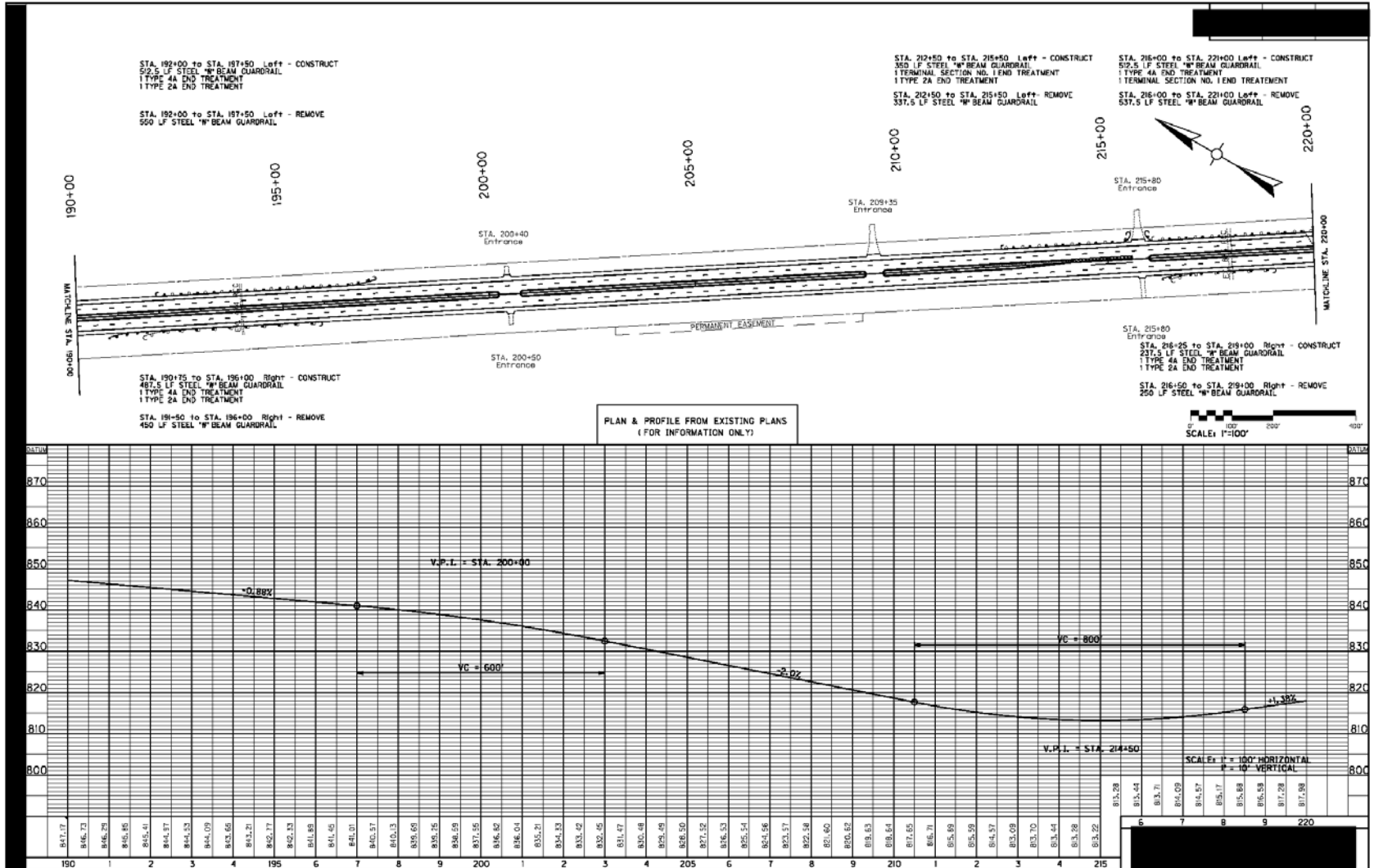


# TOPIC #9-BRIDGES

- Constructability issues
  - Can't be laid out by average field guys
  - Shouldn't have to "survey" point location
- Potential solutions/alternatives to improve constructability
  - On skewed and/or curved bridges, provide enough plan dimension information for the builder.
  - Forget grids being square and just go down a beam line at some spacing beginning at CL Bearing

# TOPIC #10-SPECIALTY

- Plans calling for the use of Type 4A end treatments

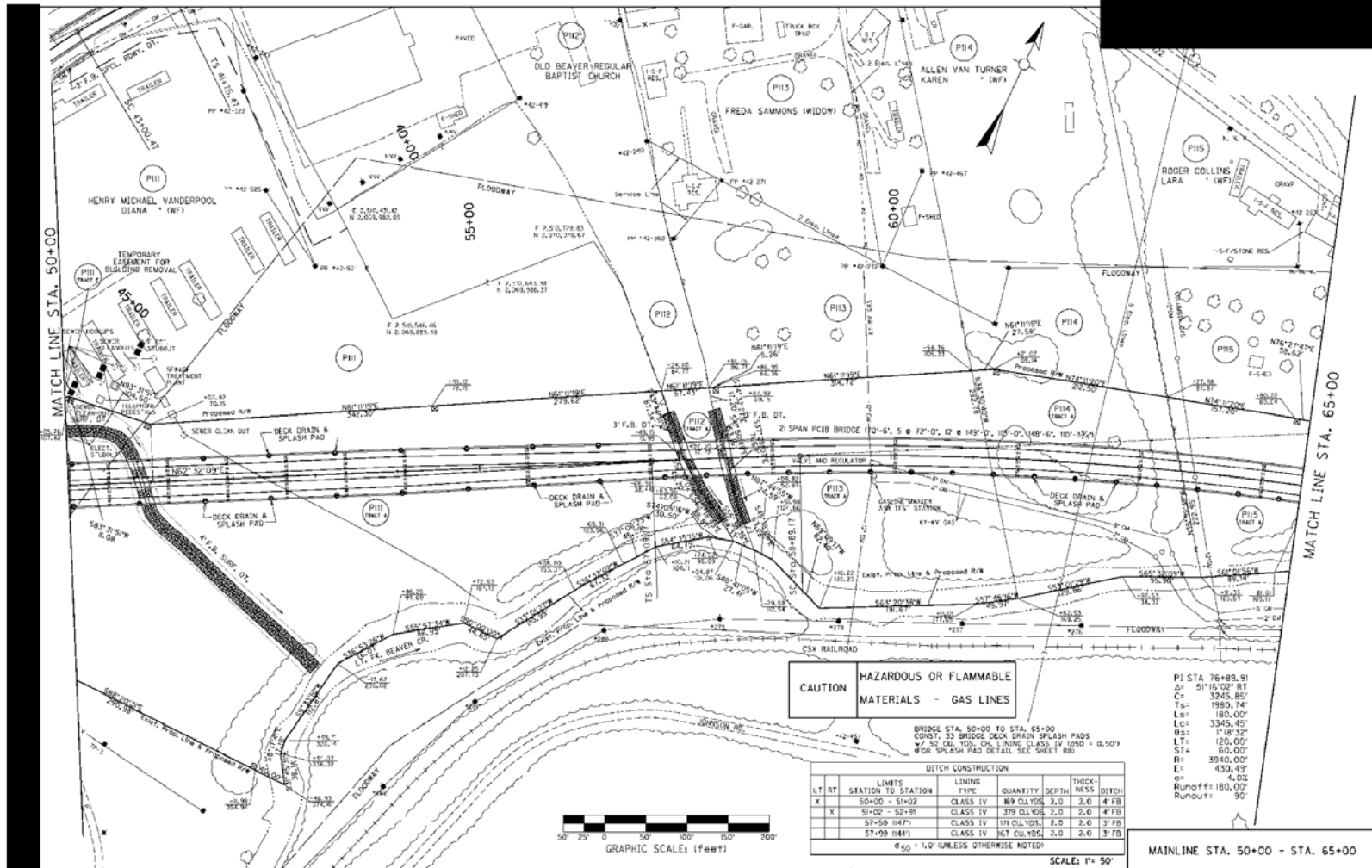


# TOPIC #10-SPECIALTY

- Constructability issues
  - The End Treatment Type 4A is less expensive than the End Treatment Type 1.
  - It also has lower maintenance costs than the End Treatment Type 1.
  - the recovery area required for this end treatment can be in the ditch lines on the project or beyond KYTC right-of-way.
- Potential solutions/alternatives to improve constructability
  - When projects are designed, the cost of one end treatment versus the other should not be the primary consideration.
  - The primary consideration should be if the end treatment will work as intended in the field. Particularly an issue on proposal only projects.

# TOPIC #11-BRIDGES

- Utility location on bridge plans



# TOPIC #11-BRIDGES

- Constructability issues
  - Just easier to see utility conflicts in bridge area with utilities shown on bridge plans.
- Potential solutions/alternatives to improve constructability
  - Put existing utilities on bridge plans





# TOPIC #12-BRIDGES

- Constructability issues
  - Bracing Forms of height and skew
  - Focus is entirely on deck pour.
  - If something goes wrong and the form blows out, you've only lost a diaphragm and not a piece of the deck which could create an emergency joint situation.
  - The deck should finish better as you don't stop to fill up the diaphragm, can continue the deck in a smoother fashion.
  - Deck pours will go quicker with less concrete to place at time of pour
- Potential solutions/alternatives to improve constructability
  - Design and/or allow construction joints in diaphragms when possible.