## **Highway Plans 101**

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Kentucky Transportation Center





#### Introductions

#### My Background:

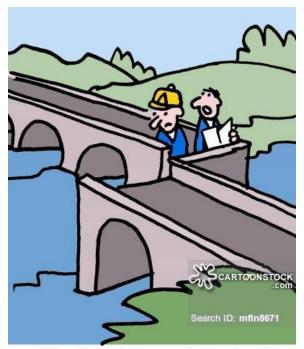
- Research Engineer with KTC since 2012
- Engineer with KYTC 2007-2012, plus some
- I Enjoy Education, Camping,
   & All Things Disney





#### **Session Goals**

- Cover the Basics of Plan Reading
- Present Plan Development Best Practices
- Highlight Guidelines for Plan Organization
- Discuss Types of Plans & Their Purpose
- Talk About Plan Quality & Constructability



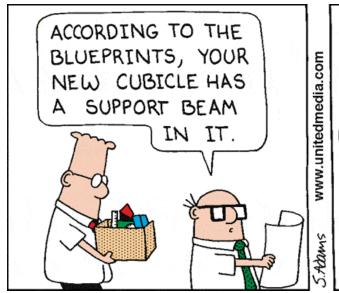
"Yikes! There's a crease in the plans!"

#### Your Goals & Introductions

- Name
- Title & Agency
- Goal for our time today



# Plan Reading Basics



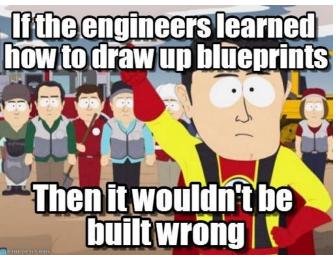






# Why Plan Reading Basics?

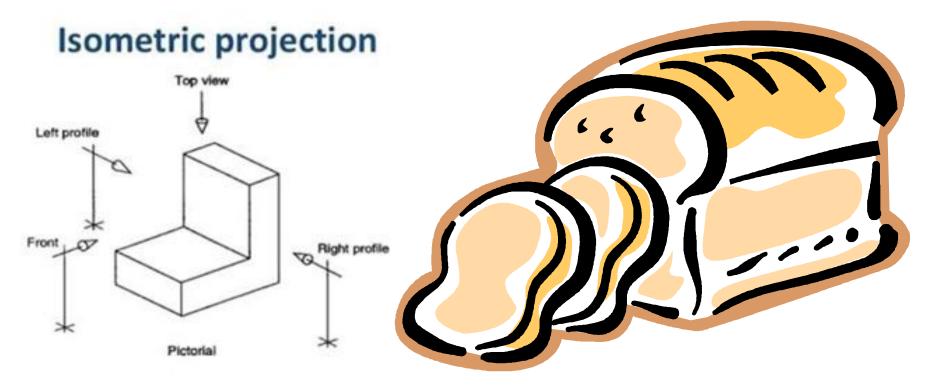
- This is an abbreviation of multiple Plan Reading courses for the end user
  - Very similar...know the audience
- You don't just want to see the plans, you want to read them
- Engineering education void
- A little brush up never hurts





# **Basic Engineering Graphics**

- A Loaf of Bread
  - A Point of View





# **Basic Engineering Graphics**

Point Of View

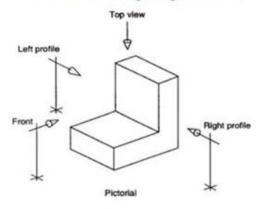


Top



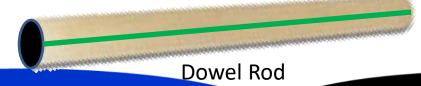
**Front** 

#### Isometric projection





End

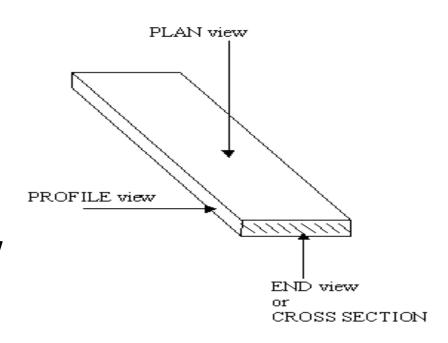




## Views

A view is the way you look at or see the different items that are shown on a set of plans

- Plan View
- Profile View (Longitudinal Cross Section)
- Cross Section or End View
- Section View

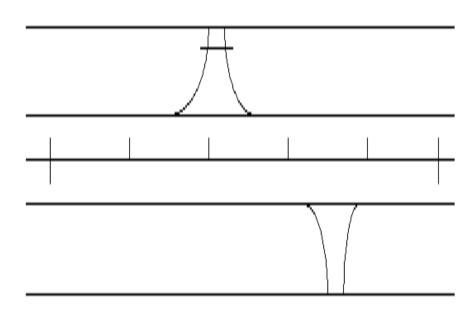




## Plan View



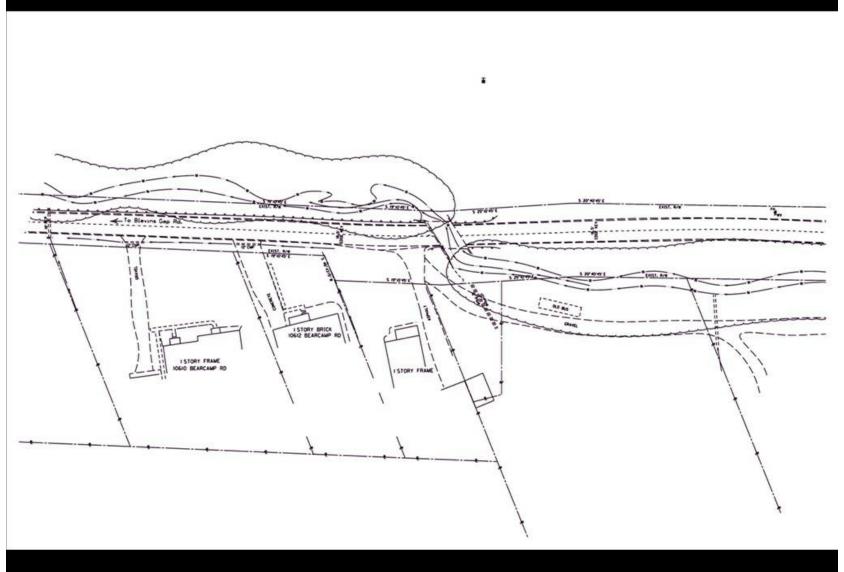
Imagine looking straight down on the project from a point directly above.





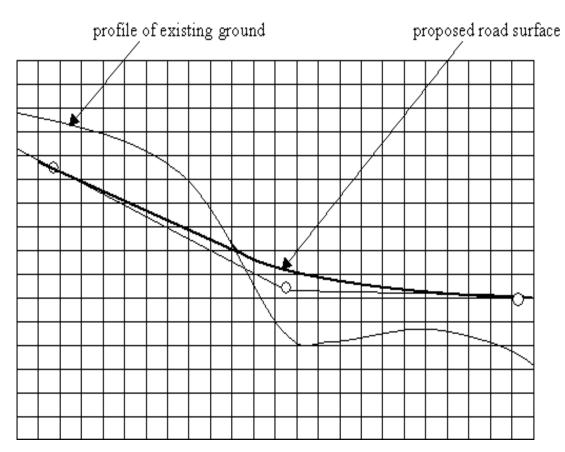








### **Profile View**

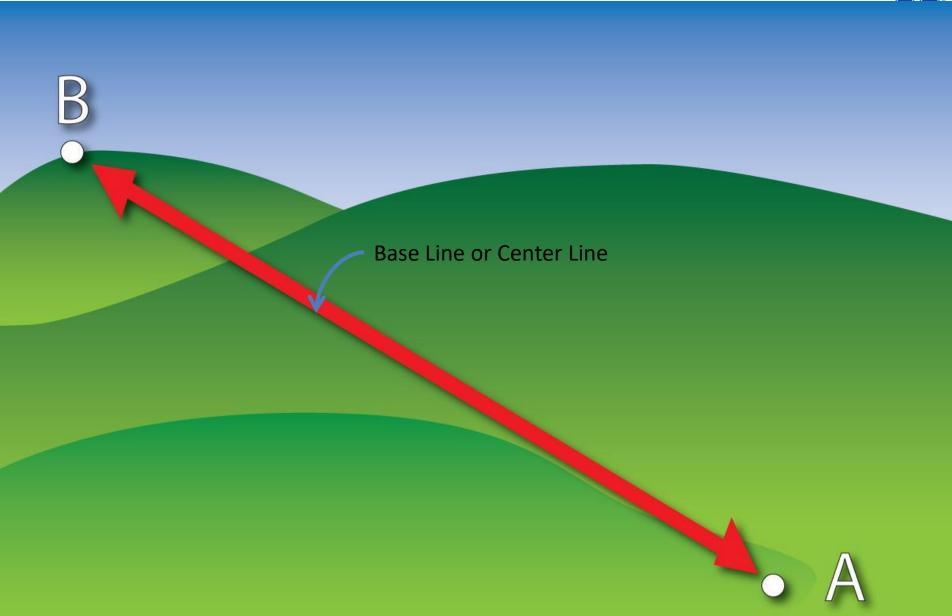


The PROFILE VIEW is like a SIDE VIEW as if you are standing off to one side of the road and looking back at the road.

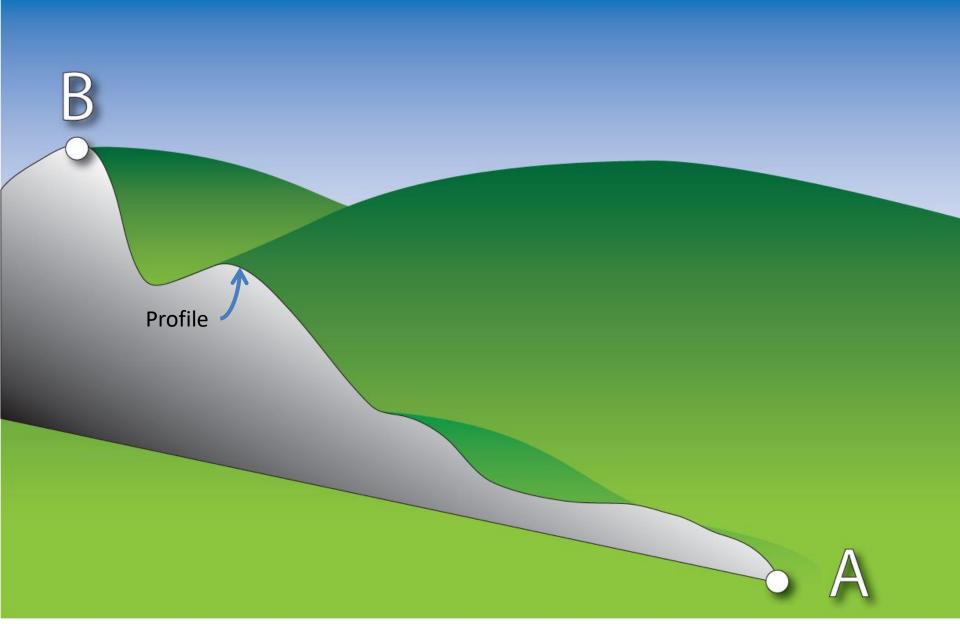




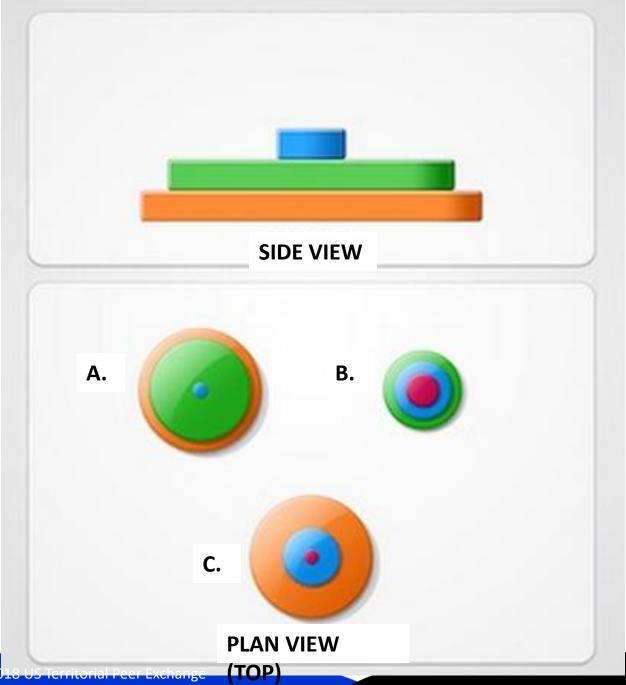


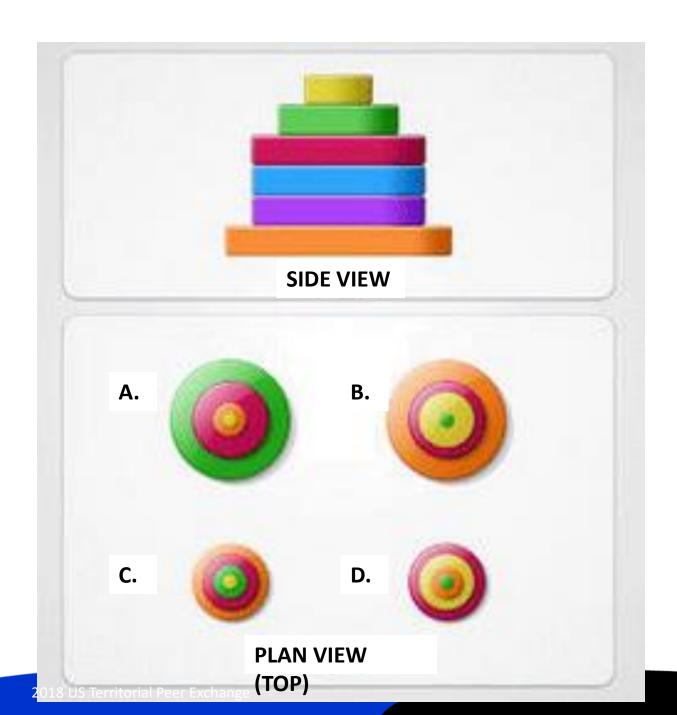






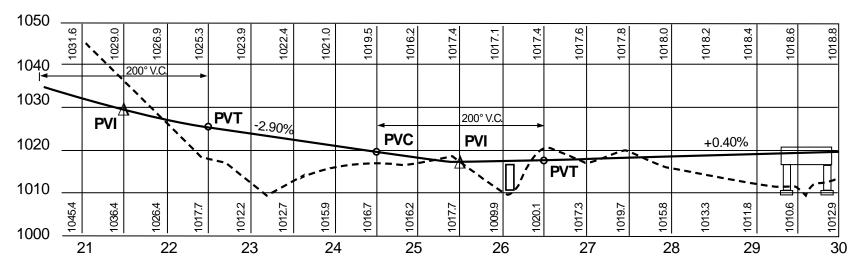








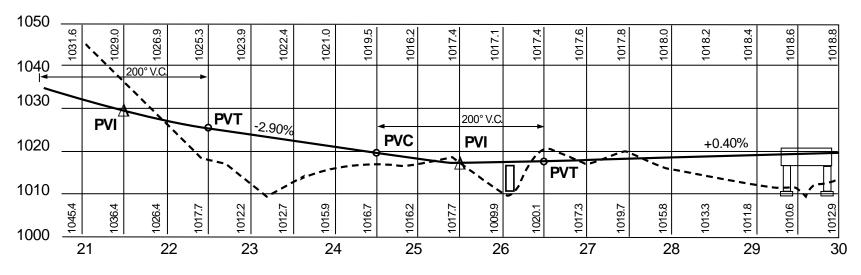
#### **Profile View**



- Side View (Length & Height)
- Stations & Elevations on Centerline Only
  - Existing Dashed Line
  - ➤ Proposed Solid Line



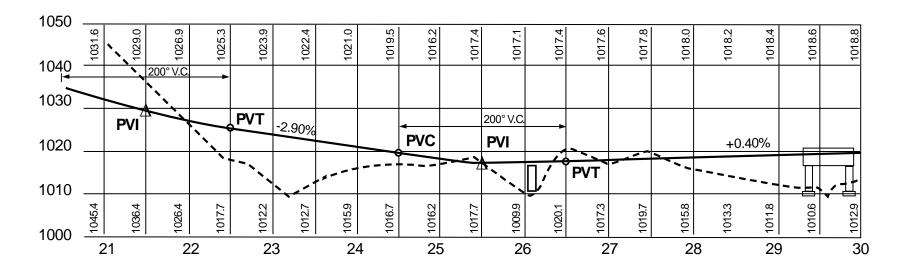
#### **Profile View**



- Horizontal Scale same as Plan View
- Vertical Scale exaggerated for Clarity
- Datum Reference Elevation



### **Profile Grade Line**



Percent Grade - Rise (+) or Fall (-)

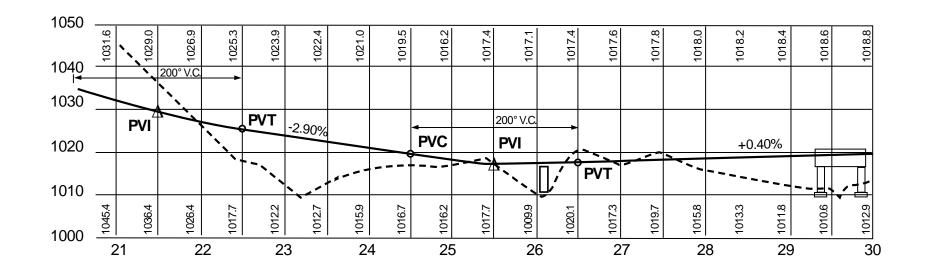
> % = 100 V/H

V = Change in Elevation

H = Horizontal Distance in Feet



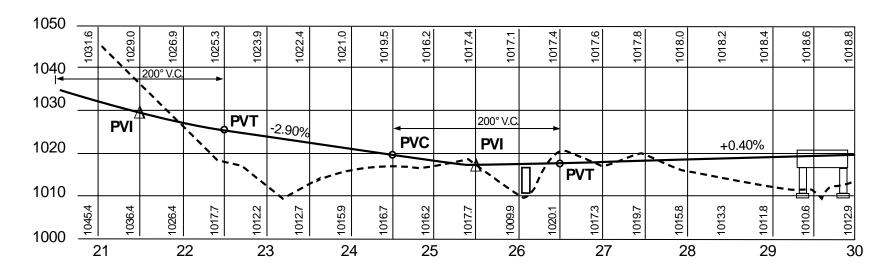
# **Vertical Highway Curve**



- Parabolic Curves
  - ➤ <u>Sag</u> or <u>Crest</u>



# **Vertical Highway Curve**



- PVC Point of Vertical Curve
- PVI Point of Vertical Intersection
- PVT Point of Vertical Tangent
- Length = PVT PVC



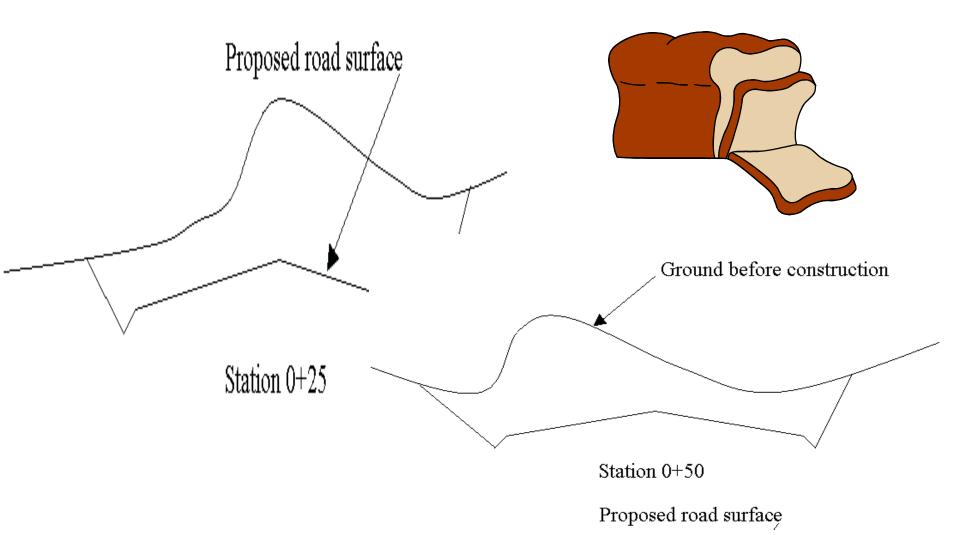
#### **Cross Section View**

- Imagine the road under construction to be like a loaf of bread.
- Looking at the "heel" of the loaf will give you an end view.
- Remove the heel and you will get a cross section of the loaf of bread at this point.
- Imagine each slice of the loaf as occupying 50 feet; one side of the slice will be an even station such as 100+00 and the other side will be 100+50.
- As you remove the slices one at a time you get a cross section view of the highway at 50 foot intervals.



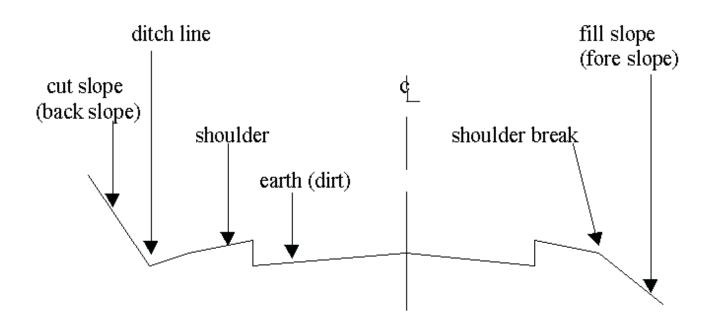


## **Cross Section View**



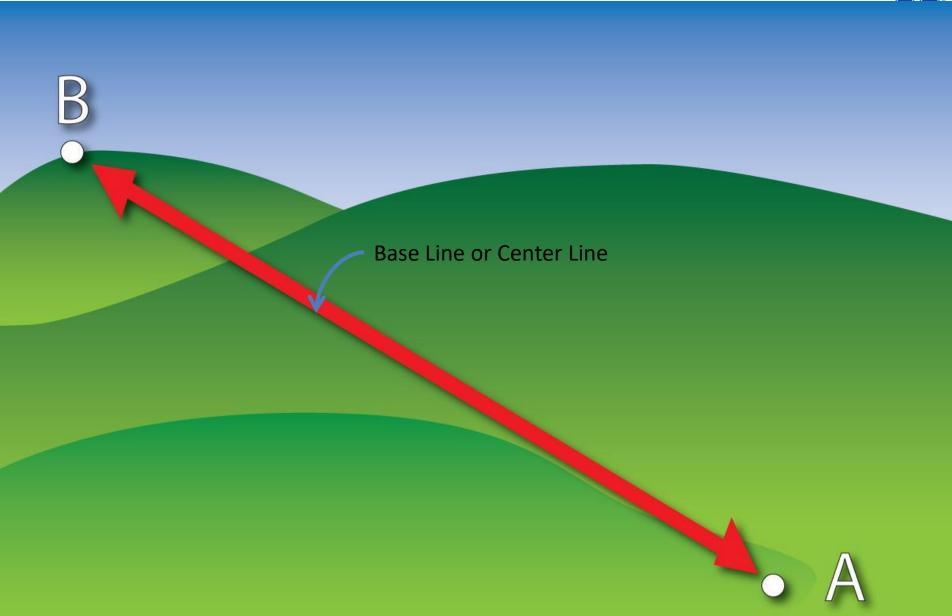


## **Cross Section View**

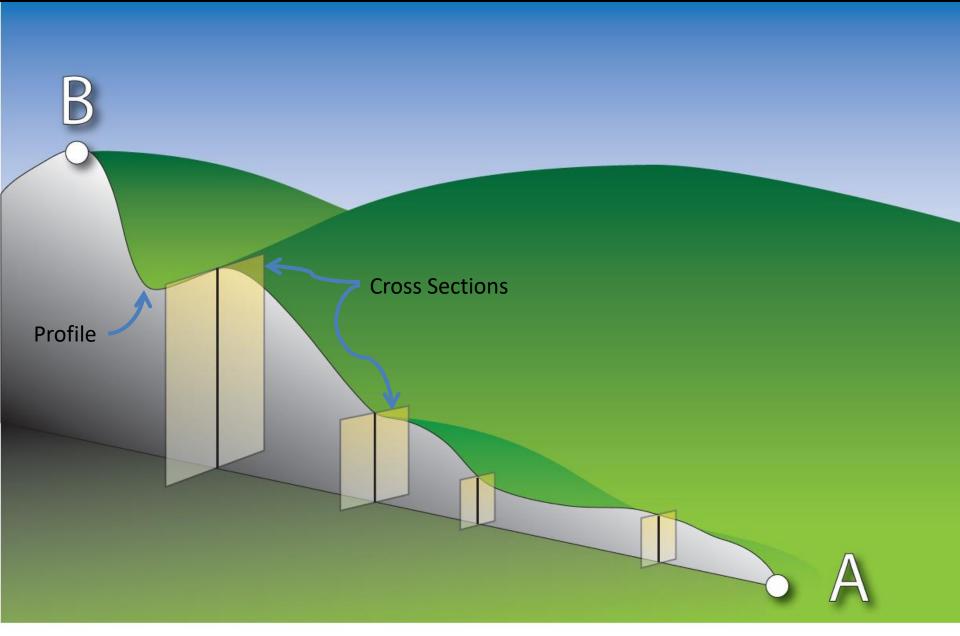


- This drawing labels areas that are of interest in road design and construction.
- The trench (empty space) between the shoulders on the drawing is where the PAVEMENT will be placed.



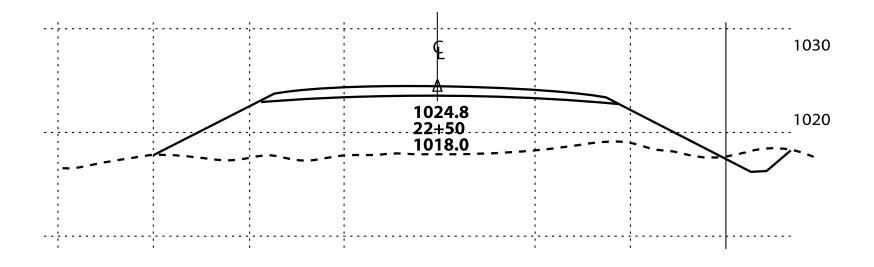








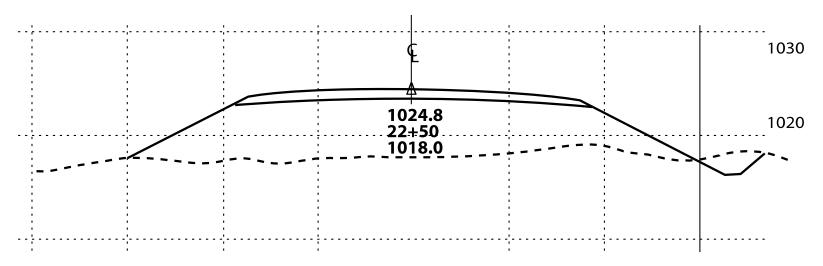
## **Highway Cross-Section**



- Shows <u>Construction</u> Details
- Perpendicular to Centerline



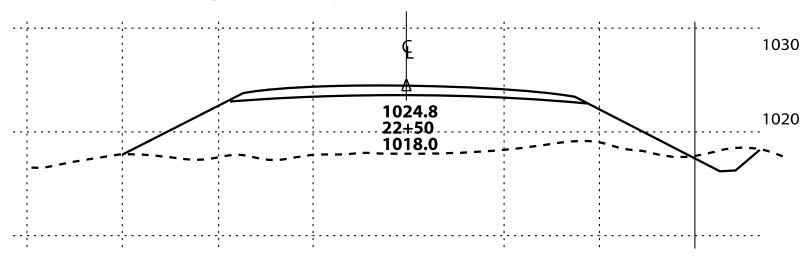
## **Highway Cross-Section**



- Right (RT) and Left (LT) of <u>Centerline</u>
- "Ahead" Direction along Centerline
- Existing and Proposed Elevations at Specific Station

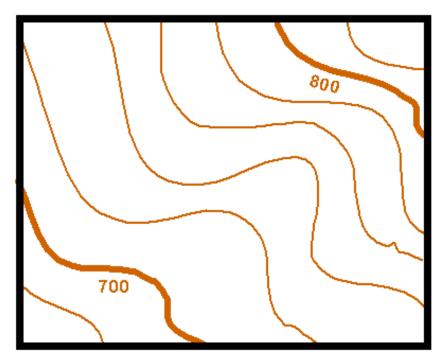


## **Highway Cross-Section**



- Shows <u>Cut</u> and/or <u>Fill</u>
- Profile Grade Point from <u>Profile</u>
- Slope Ratio
- Construction Limits

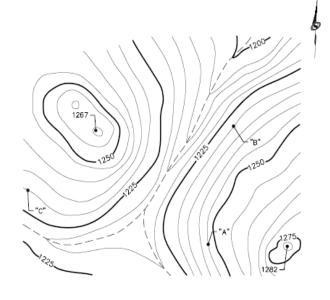




- Topographic maps show many contour lines. To make the drawing cleaner usually only every fifth line is labeled.
- Darker lines are used for the labeled lines and they are called index contours.



#### **Contours**



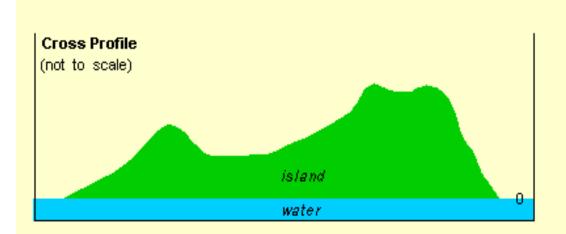
Lines of <u>Equal</u> Elevation

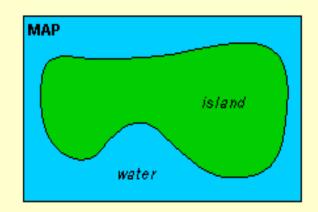
• Shows *Shape* and *Slope* of Land

Interval - <u>Elevation</u> Difference
 Between Contour Lines

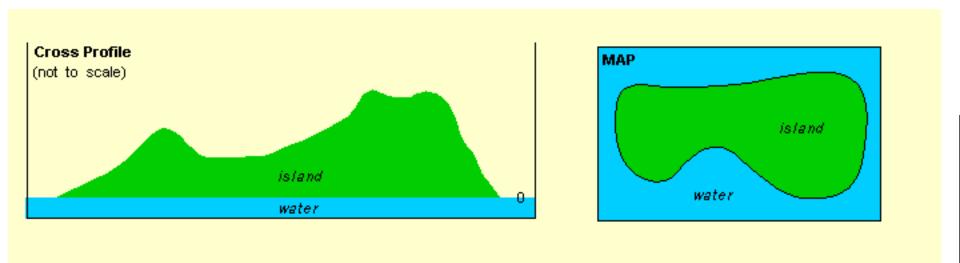


- Contour lines are useful because they allow us to show the shape of the land surface (topography) on a map.
- The diagram on the left is a profile view as seen from a ship.
   The one on the right is a plan view.



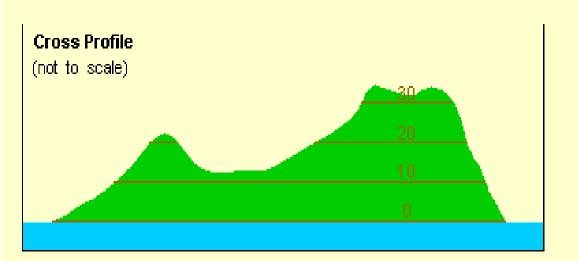






From the profile view it is clear that the islands topography varies (that is some parts are higher than others). This is not obvious on map with just one contour line. The shoreline is the zero contour line. To make it clear we add more contour lines.



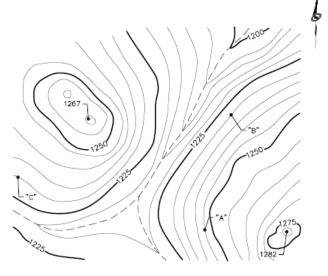




Imagine the water level rising 10 feet. The waterline is the same elevation all around the island.



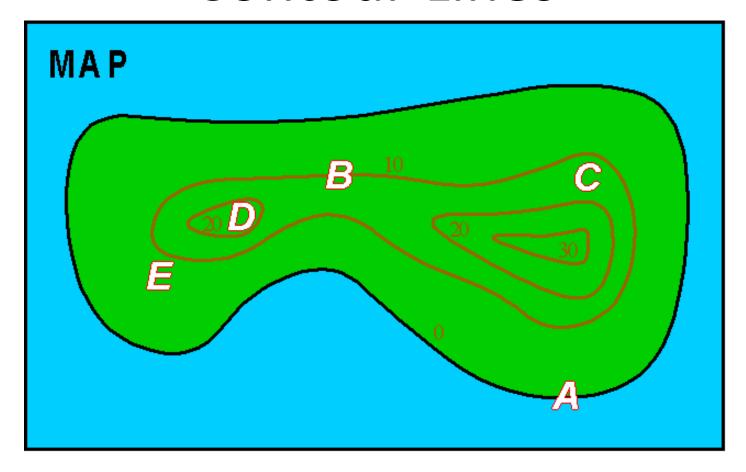
### **Contours**



- Relative <u>Spacing</u> of Lines Indicates Slope
  - ➤ Close Lines = Steep Slope
  - Contours Point <u>Upstream</u>



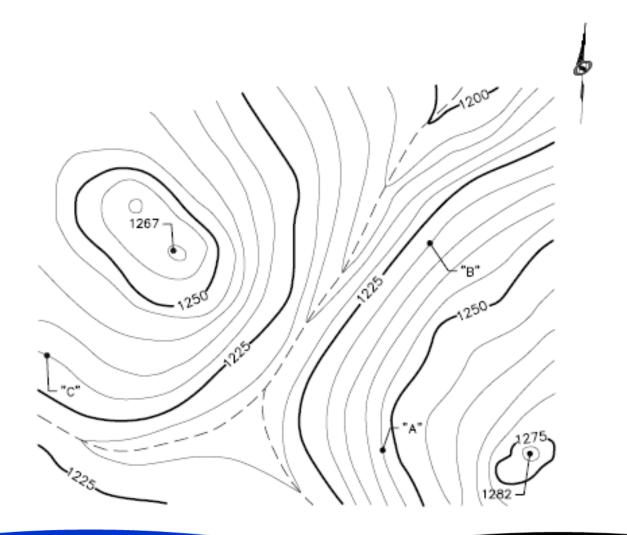
### **Contour Lines**



- Point A = ? feet above sea level
- How about B, C, D, and F?

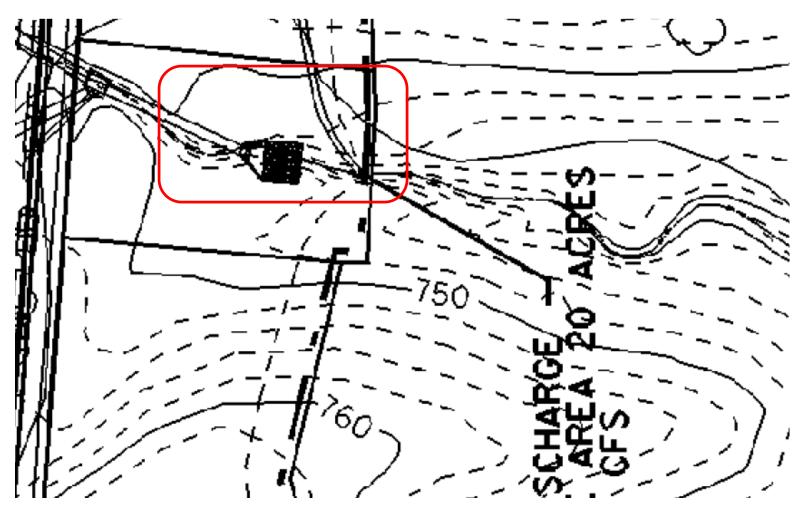


### **Contours**





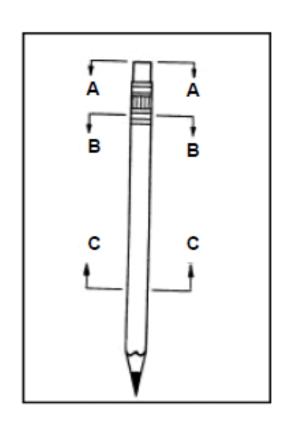
## **Contour Lines**

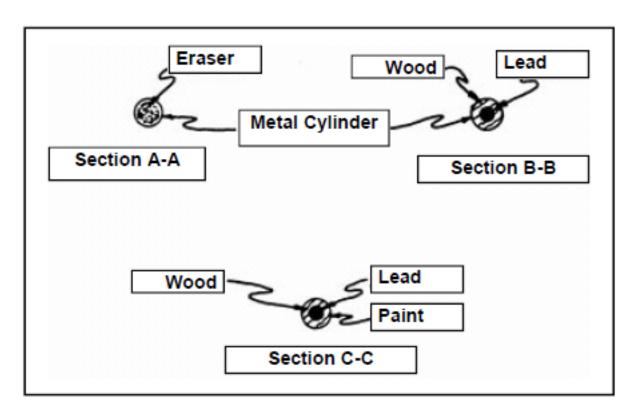


Is the circled drainage structure higher or lower than the 750 contour line?



### **Section View**



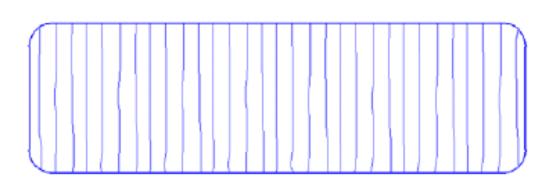


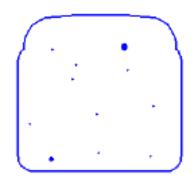
Section views are an inside view – something has been "sliced" away to show how an inside part should be.

\*Use the section cut plane & direction



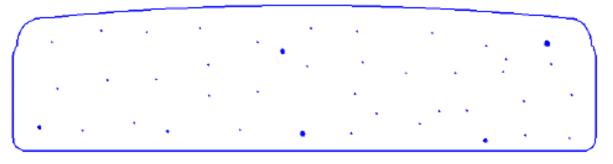
### Views

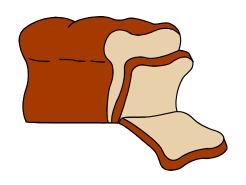




LOAF OF BREAD - TOP (OR PLAN) VIEW

SLICE OF BREAD - CROSS SECTION

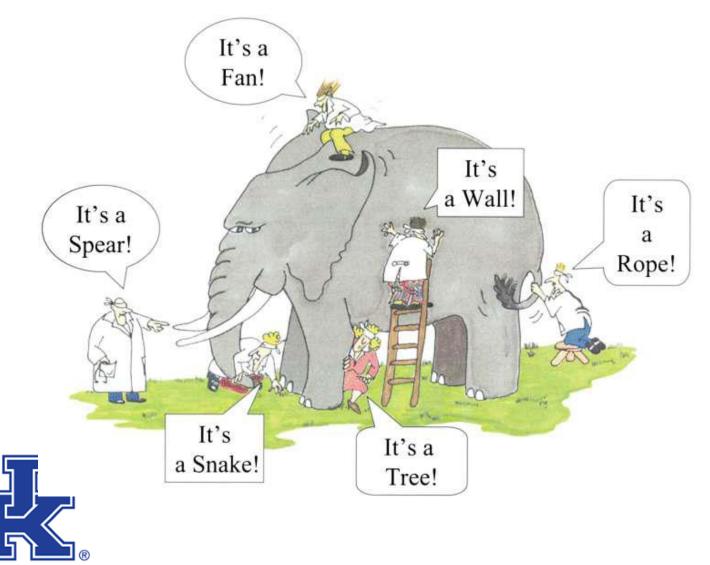




LOAF OF BREAD - LONGITUDINAL (OR PROFILE) VIEW

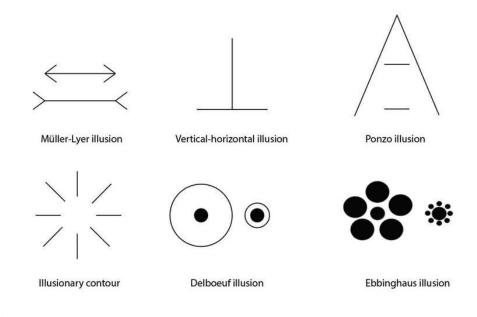
Remember views are as simple as a loaf of bread

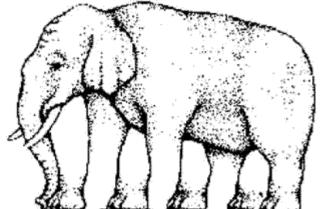
## Why is that important?

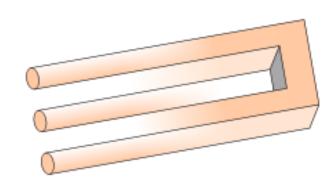




## Why is that important?







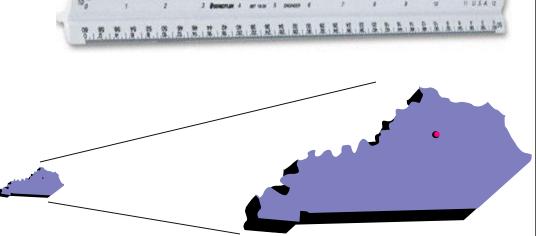
# **Critical Plan Concepts**

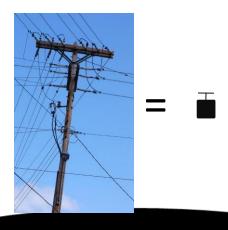






- Scale
  - Scale (a ruler)
  - Scale a size ratio
    - 1 in. = 50 ft.
    - 1:600
  - Not to Scale
    - Symbols vs. Objects

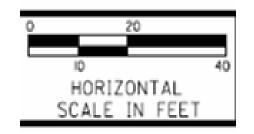






# Using an Engineering Scale

- Plans
  - scale at the bottom of the drawing on each page

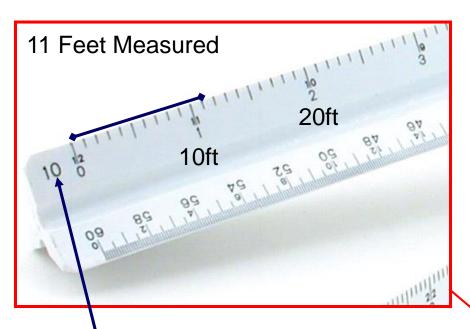




- Typical scales are 1:20, 1:40, 1:50
  - 1:50 means 1 inch equals 50 feet
- Match Engineering rule to correct scale
  - Ex: 1:50 use 50 scale ruler

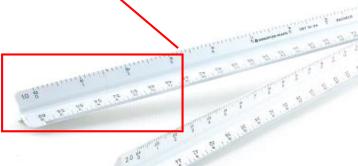


# Using Engineering Scale



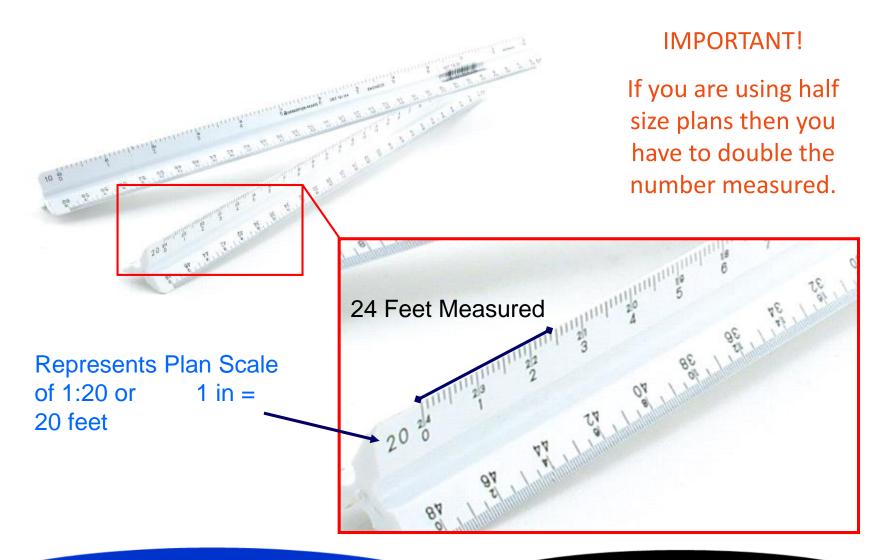
- Always Add a
   Decimal (Zero) to the
   Measured Amount
- As Shown, 2 on ruler represents 20 feet

Represents Plan Scale of 1:10 or 1 in = 10 feet





# Using Engineering Scale

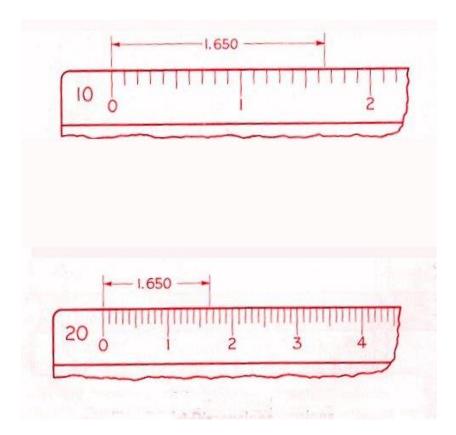




### More About Scale

<u>Scale</u>	<u>Distance</u>
1 in = 1 ft	1.65 ft
1 in = 10 ft	16.5 ft
1 in = 100 ft.	165 ft

<u>Scale</u>	<u>Distance</u>
1 in = 2 ft 1.65 ft	
1 in = 20 ft	16.5 ft
1 in = 200 ft	165 ft

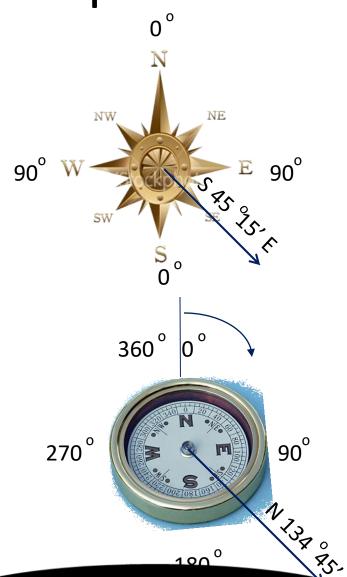


**Note: Half Size Plans** 



- Course or Direction
  - Bearings
    - Compass NE, SE, SW, NW
  - Azimuth
    - Compass North or South
  - North Arrow

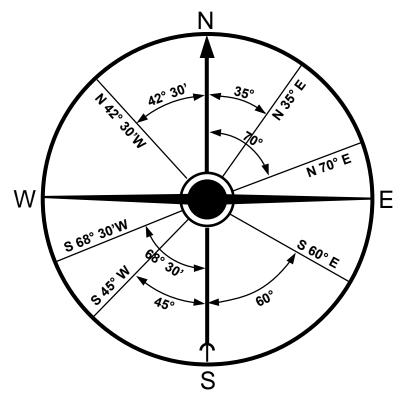






# **Compass Bearings**

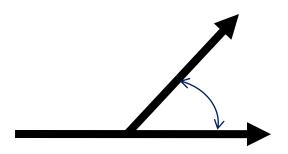
Shows Direction of Centerline or Property line

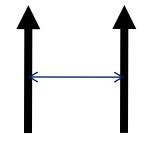


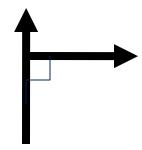
60 seconds equal one minute 60 minutes equal one degree



- Relative
  - Angles between lines
  - Parallel Perpendicular



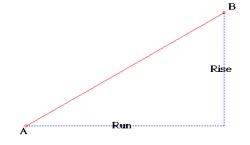






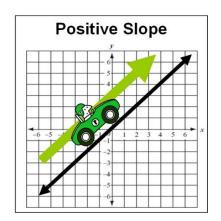
### - Slope

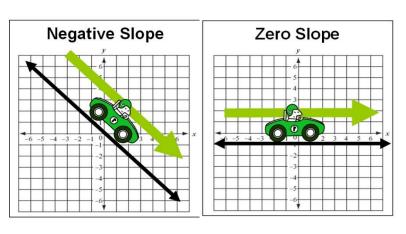
- Angle between the constructed line and "flat"; i.e. how steep is the physical feature compared to horizontal
- "rise over run" in which run is the horizontal distance and rise is the vertical distance

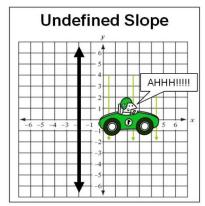




- Slope Measurement
  - Angle (ex. 26.6<sup>o</sup>)
  - Ratio (ex. 2:1)
  - Percent (ex. 50%)
  - Foot per foot or inch per inch (aka '/' and "/") (ex. 1' per 2' or 1" per 2")









### **TALLADEGA SUPERSPEEDWAY**

TALLADEGA, ALABAMA





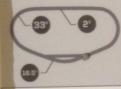




#### Map of AL



#### Track Banking



Straights 16.5° front 2° back

#### About the Track

The longest oval with the steepest banking in NASCAR is what sets Talladega apart from the rest. Bill Elliott blistered the track in 1987 to NASCAR's all-time fastest qualifying lap record of 212.809 mph. In 1988, officials mandated carburetor restrictor plates to reduce speeds here and at Daytona. The result is whiteknuckle racing with cars bunched together and fans on the edge of their seats.

#### **Track Facts**

Superspeedway Track Type 1969 Year Opened Asphalt Surface 80,000 Capacity 2.66 miles Track Length

#### **Hosted Series**





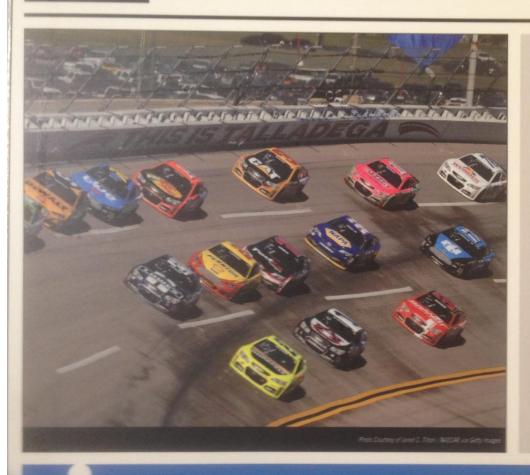








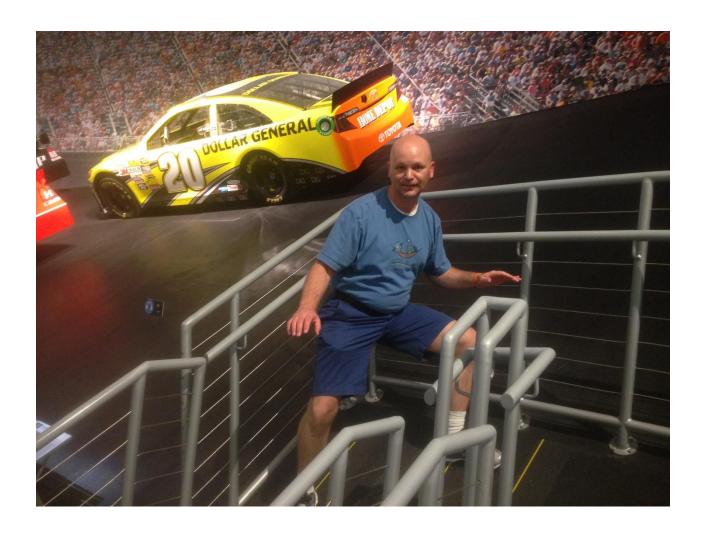
# **33-DEGREE BANKING**EXTREME BANKING



Compare this extreme 33-degree banking with the moderate 14-degree banking down the ramp. A car can go faster on a banked turn than on a flat turn, in part because the driver doesn't have to slow down as much going into the turn. Steeper banking equals higher speeds.

At speed, drivers can experience pressure two to three times the force of gravity each time they turn.

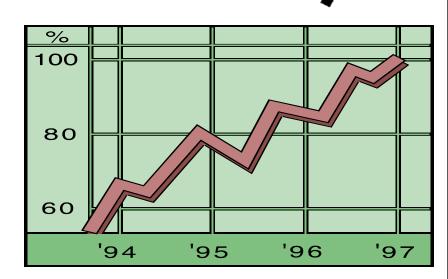






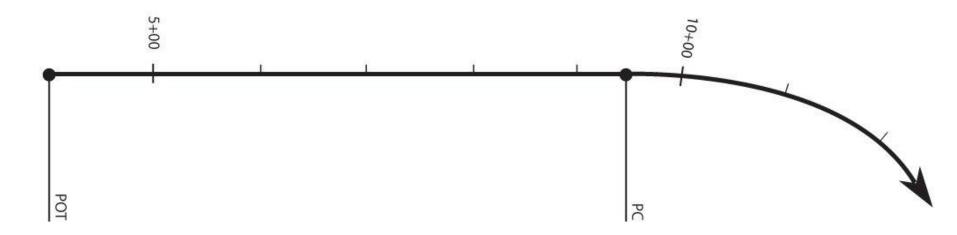
- Reference Systems
  - Coordinate Systems
    - X,Y .....Z
    - Graphs Charts
    - Longitude and Latitude







- Reference Lines Control Lines ...
   Horizontal Direction of Project
  - Centerlines
  - Baselines





- Marked in 100' Intervals
- Always Numbered Positive
- Used for Reference and Location
- Intermediate Points Called "+" (Plus)
- Directions: "BK" Back, "AH" Ahead,
   "LT" Left, "RT" Right

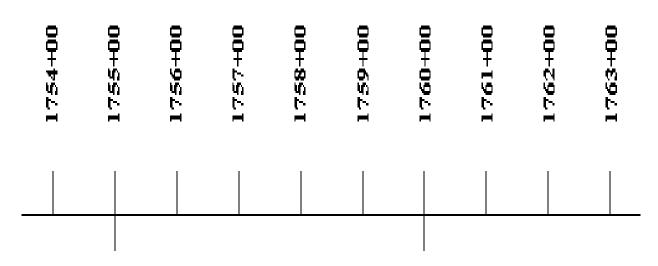






- Highway stationing might be compared with a rope having knots at 100-foot intervals. The beginning end of the rope would be 0, the first knot at 100 feet would be Station Number 1 and would be written as 1+00.
- The second station number would be 2 (which is 200 feet from the beginning) and would be written as 2+00, and so on.





Stations are based on a reference point which may, or may not, be on this particular project. It is not uncommon to see a project begin with a number that is quite high, not zero as you might expect.

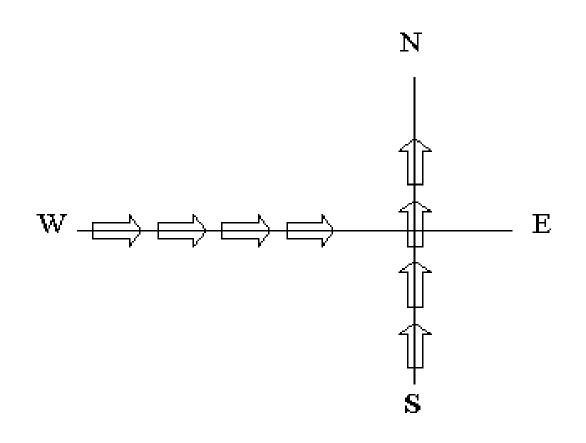
What station number does our project begin with?





Station numbers usually increase from the beginning of the project to the end of the project and from left to right on the plan sheet.

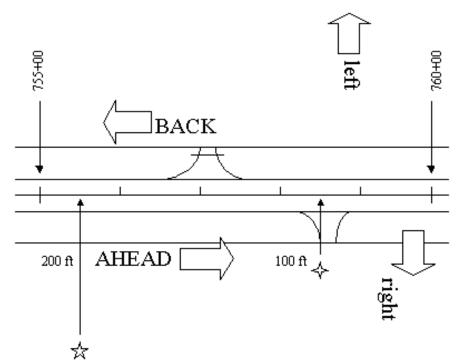




Stationing usually runs from South to North or from West to East.

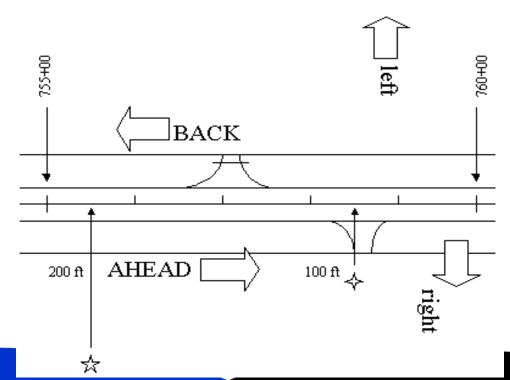


- The word AHEAD is used to denote the direction in which the project is going (station numbers increase).
- The word BACK is used to denote the opposite direction (decreasing station numbers).





- LEFT or RIGHT relates to facing AHEAD on a project.
- Locate point on the plan below. You will find it 200 ft. to the right of the centerline at station 755+50.
- The location is: Station 755+50, 200 ft. to the right of the centerline.





- To find the distance between any two stations simply subtract the lower station from the higher one, ignoring the plus sign. You will get the answer in feet.
- To find the distance from Station 20+60 to Station 12+80, you can write the numbers without the + sign like this:

2060

-1280

= 780



## **Station Equations/Equalities**

- Used When Stations Not Continuous
- Point has Two or More Station Numbers
  - One Back and One Ahead

Calculating Correct Distance Between Stations

➤ Add Individual Segment Lengths

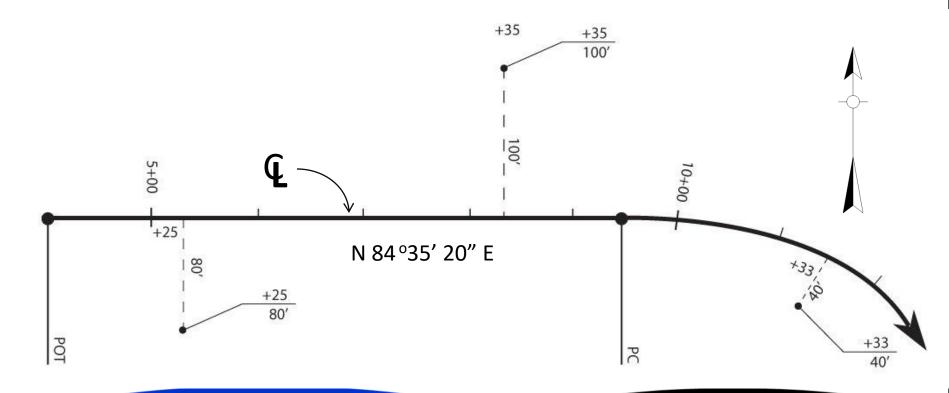


### **Offsets**

- Perpendicular Distance <u>Right</u> or <u>Left</u> of Centerline
  - ➤ Locate any Point off Centerline
  - ➤ Use *Radial* Line on Curve



- Centerlines Baselines
  - Station and Offset



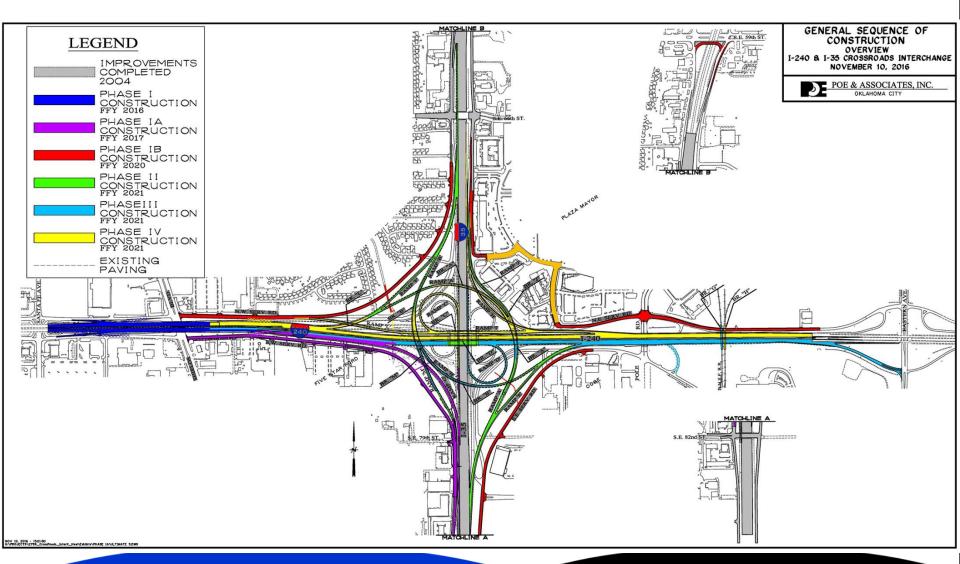


## Lines & Symbols

- All lines are not equal
  - Property Line
  - Border Line
  - Object Line
  - Hidden Line
  - Center Line
  - Dimension Line ← ## → ##
    - Various terminators
  - Long Break in Line
  - CHECK THE LEGEND
  - USE MATCH LINES WHEN CONTINUING ON MULTIPLE



#### ...sheets...or even on the same sheet





### Symbols Continued

Cutting Plane Lines

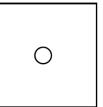


- X is section ID, Y is Sheet Label, & the arrow shows the direction the section is facing
- Symbols relay material types
- Symbols relay element types...manholes, valves, etc.



## Symbols

The standard symbols are graphical representations (pictures) of the corporation lines, centerlines, edges of pavement, R/W lines, trees, stumps, utility poles, etc. that can be seen in the plan and profile sheets and throughout the plans. These standard symbols are shown in the same manner on nearly every plan.



**Existing ROW Marker Symbol** 



Proposed ROW Monument Symbol



# Symbols



0

Existing ROW Marker Symbol

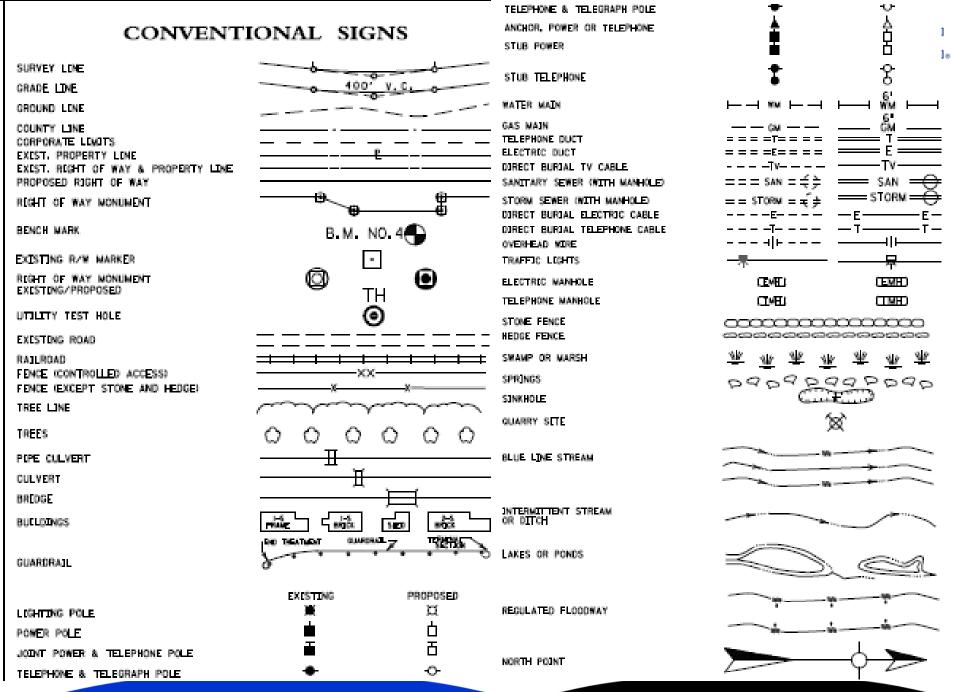


# Symbols - Examples

TREES PIPE CULVERT CULVERT BRIDGE 2-S BRICK I-S FRAME 1-S BRICK BUILDINGS END TREATMENT GUARDRAIL PROPOSED EXISTING LIGHTING POLE POWER POLE JOINT POWER & TELEPHONE POLE

The more you use plans; the more familiar you will become with these.

TELEPHONE & TELEGRAPH POLE





### Abbreviations

It is often necessary to abbreviate words on plan sheets. Some standard abbreviations are:

Ahd/FWD = Ahead

Emb = Embankment

Pd = Pond

Asph = Asphalt

Beg = Begin

Hwy = Highway

R/W = Right-of-Way

Surf = Surface



### **Abbreviations**

QUIZ
What is an ESA?





## **Highway Contract & Plans**





#### "Contract documents"

105.05 COORDINATION OF CONTRACT DOCUMENTS. All documents defined under Contract in Subsection 101.03 are essential parts of the Contract. A requirement occurring in one is as binding as though occurring in all. They are complementary and describe and provide for a complete contract. In the case of a discrepancy, the governing ranking will be:

#### Dimensions

- 1. Plan
- 2. Calculated
- Scaled



#### "Contract documents"

#### **Documents**

- 1. Questions and Answers from the Division of Construction Procurement Website
- 2. CAP report
- Special Notes
- 4. Special Provisions
- Plans
- Standard Drawings
- Supplemental Specifications
- Standard Specifications

Do not take advantage of any apparent error or omission in the Contract. Immediately notify the Engineer upon discovering such an error or omission. The Engineer will then make any necessary corrections and interpretations deemed necessary for fulfilling the intent of the Contract.

 Plans communicate a ton of information but are just one piece of the story...all of these items are needed for the full picture



## First...Reading the Plan set

 Give capture something from the next slide in 5 secs men swung in the bowlines; still wordless Ahab stood up to the blast. Even when wearied nature seemed demanding repose he would not seek that repose in his hammock. Never could Starbuck forget the old man's aspect, when one night going down into the cabin to mark how the barometer stood, he saw him with closed eyes sitting straight in his floor-screwed chair; the rain and half-melted sleet of the storm from which he had some time before emerged, still slowly dripping from the unremoved hat and coat. On the table beside him lay unrolled one of those charts of tides and currents which have previously been spoken of. His lantern swung from his tightly clenched hand. Though the body was erect, the head was thrown back so that the closed eyes were pointed towards the needle of the tell-tale that swung from a beam in the ceiling.\*

Terrible old man! thought Starbuck with a shudder, sleeping in this gale, still thou steadfastly eyest thy purpose.

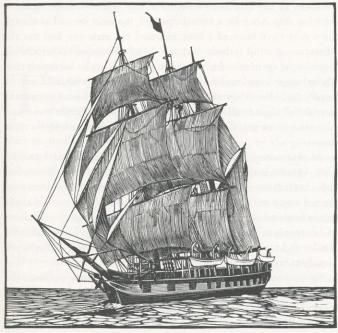
#### CHAPTER 52 THE ALBATROSS

OUTH-EASTWARD from the Cape, off the distant Crozetts, a good cruising ground for Right Whalemen, a sail loomed ahead, the Goney (Albatross) by name. As she slowly drew nigh, from my lofty perch at the fore-mast-head, I had a good view of that sight so remarkable to a tyro in the far ocean fisheries—a whaler at sea, and long absent from home.

As if the waves had been fullers, this craft was bleached like the skeleton of a stranded walrus. All down her sides, this spectral appearance was traced with long channels of reddened rust, while all her spars and her rigging were like the thick branches of trees furred over with hoar-frost. Only her lower sails were set. A wild sight it was to see her long-bearded look-outs at those three mast-heads. They seemed clad in the skins of beasts, so torn and bepatched the raiment that had survived nearly four years of cruising. Standing in iron

\*The cabin-compass is called the tell-tale, because without going to the compass at the helm, the Captain, while below, can inform himself of the course of the ship.

hoops nailed to the mast, they swayed and swung over a fathomless sea; and though, when the ship slowly glided close under our stern,



Bark at sea

we six men in the air came so nigh to each other that we might almost have leaped from the mast-heads of one ship to those of the other; yet, those forlorn-looking fishermen, mildly eyeing us as they passed, said not one word to our own look-outs, while the quarter-deck hail was being heard from below.

"Ship ahoy! Have ye seen the White Whale?"

But as the strange captain, leaning over the pallid bulwarks, was in the act of putting his trumpet to his mouth, it somehow fell from his hand into the sea; and the wind now rising amain, he in vain strove to make himself heard without it. Meantime his ship was still

241

240



### Reading the Plan set

What is the book about?

 Uniformity & consistency in highway plans leads to efficiency, comfort, and maybe even lower bid prices



### KYTC Plan set composition

- Content
  - Project ID and Location
  - Mapping (planimetrics, topo)
  - Engineering Details
    - Roadway Plans
    - Structures
    - Signing
    - Traffic Signals, Lighting (etc)
  - Quantities and Data



### **KYTC Plan Set Composition**

- Organization
  - Sheet Numbering
    - RSTUX
      - **R** Roadway (R1, R2,....etc.)
      - S Structures (S1, S2,....etc.)
      - **T** − Traffic (T1, T2,....etc.)
      - U Utilities (U1, U2,....etc.)
      - X Cross Sections (X1, X2,....etc.)
      - Others Lighting, signals, erosion control, etc.



### **KYTC Highway Plans**

- Layout Sheet (R1)
  - Index of sheets
  - Project Location
  - Project Length
  - Project ID (numbers)
  - Design Criteria
  - Type of Access Control
  - Approval Signatures



### **KYTC Highway Plans**

- Right of Way Revision Sheet (R1A)
  - List of R/W Revisions
    - Revision No. #
    - Sheets Affected
    - Date of Change



COUNTY OF	ITEV NO.	SHEET NO.
FRANKL IN	05:1034.00	_RIA

RIGHT OF WAY REVISION NO.1

REVISED PLANS DATE: SEPTEMBER 1, 2006
SHEETS REVISED: R5-R6

PARCELS INVOLVED: P4

REMARKS: CHANGED EXISTING PROPERTY LINE

RIGHT OF WAY REVISION NO. 2

REVISED PLANS DATE: OCTOBER 9, 2006

SHEETS REVISED: R3, R5-R6
PARCELS INVOLVED: P2

REMARKS: CHANCE OF OWNERSHIP

RIGHT OF WAY REVISION NO. 3

REVISED PLANS DATE: FEBRUARY 26, 2007
SHEETS REVISED: R2,R3,R4,R5,R6,R10

PARCELS INVOLVED: PI

REMARKS: CHANGE PROPOSED R/W AND ESMT.

R/W Revision Sheet



RIGHT OF WAY REVISION SHEET

DATE: 31-JUL-2009 FILE NAME: IP-PIPP: G0187659\R001G0R#.D



### **Highway Plans**

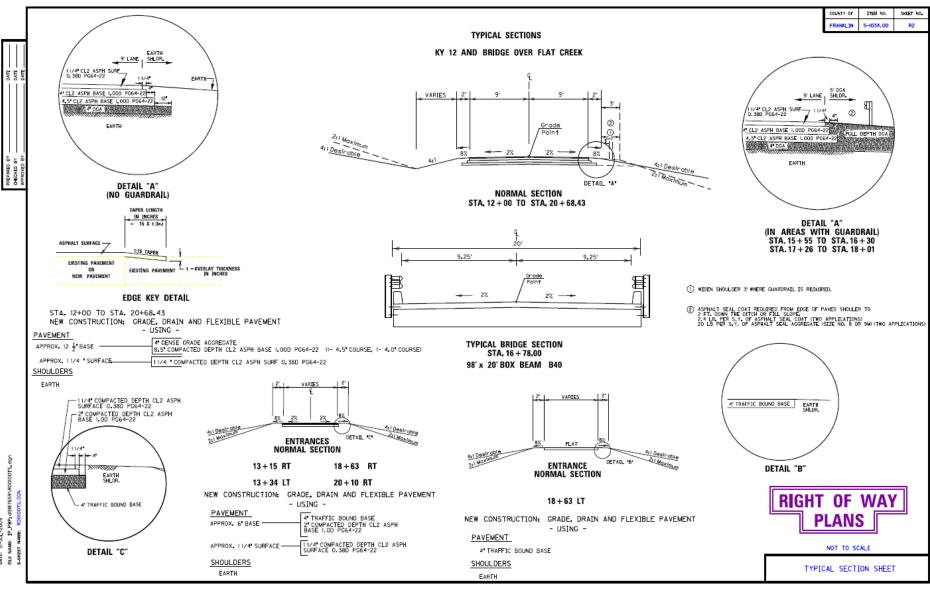
- R/W vs. Construction Plans
  - Pictorial Views, Schematics and Tabular
     Information
  - R/W Plans are a stage of Construction Plans
- Purpose of Plans
  - R/W Plans: Acquisition of Property and Coordination of Utilities
  - Construction Plans: Inform Contractor etc. what to build and where



### **KYTC Highway Plans**

- Typical Section Sheet (R2)
  - Reference System
    - Offset and Elevation
    - Centerline and Grade Point (dowel rod)
    - Slopes and Grades
  - Mainline Typical Section
  - Bridge Typical Section
  - Approach Road Typical Sections
  - Entrance Typical Sections

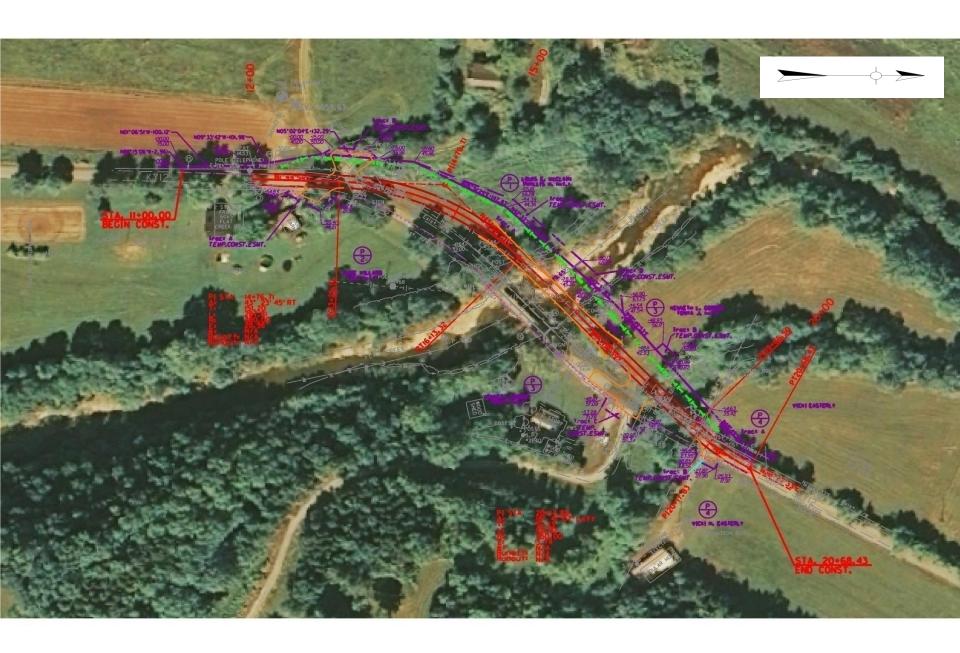




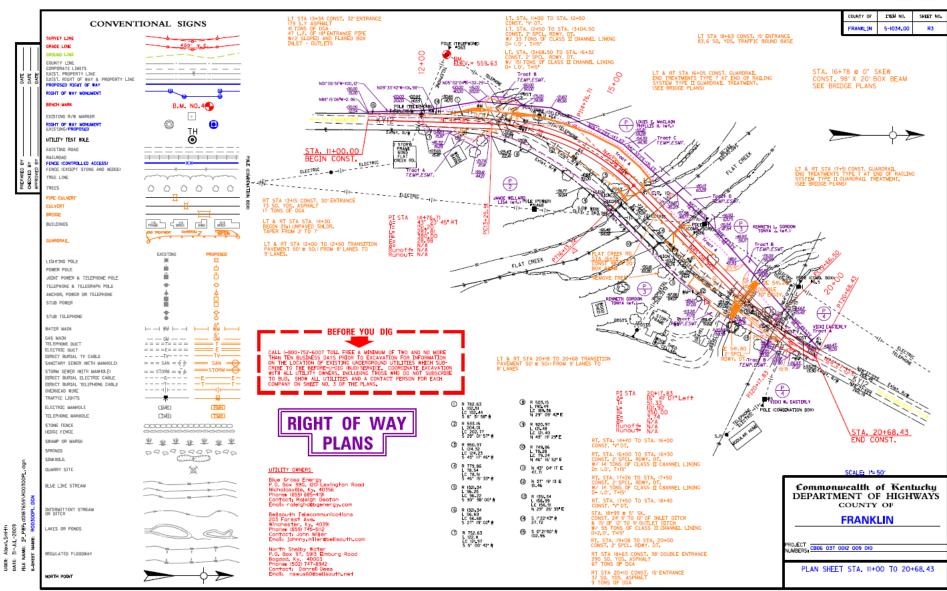


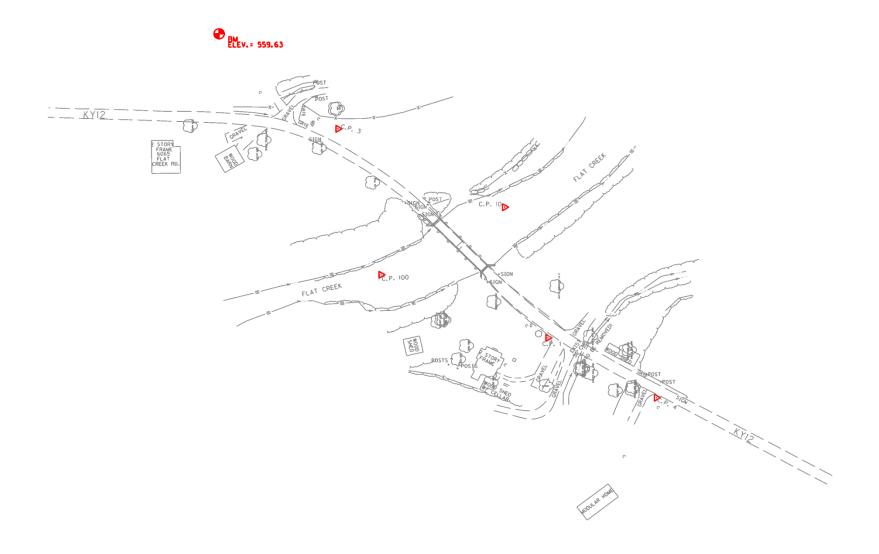
### **KYTC Highway Plans**

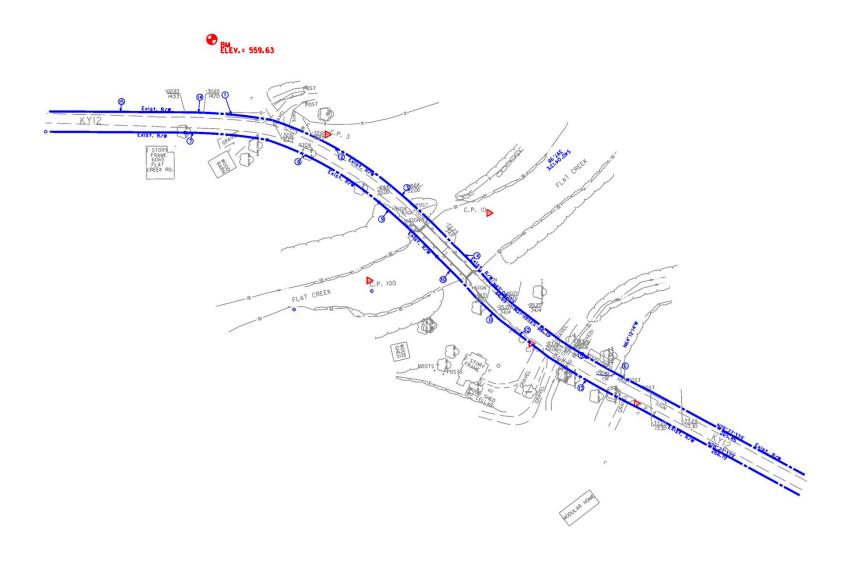
- Plan Sheets (sheet No. R3)
- Conventional Sign and Utility Owners
  - Existing Planimetrics (Buildings, Roads, Driveway, Streams, Ponds, etc.)
  - Existing R/W Lines
  - Property Lines
    - Easement Lines
    - Lease Lines
  - Utilities Lines
    - Underground
    - Overhead

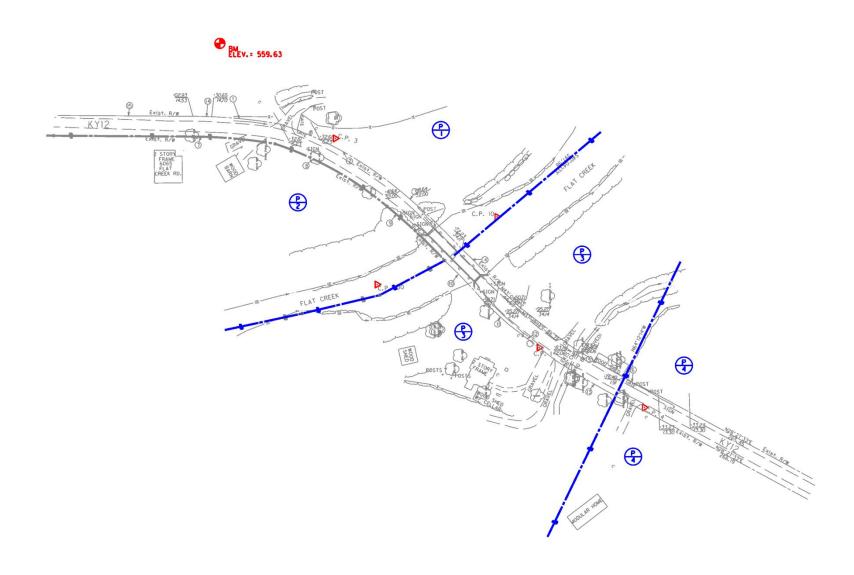


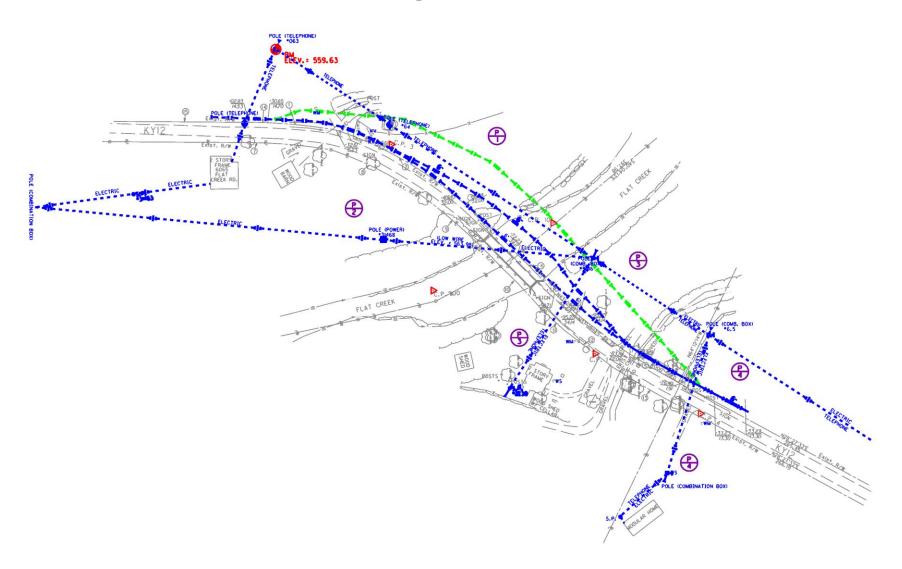








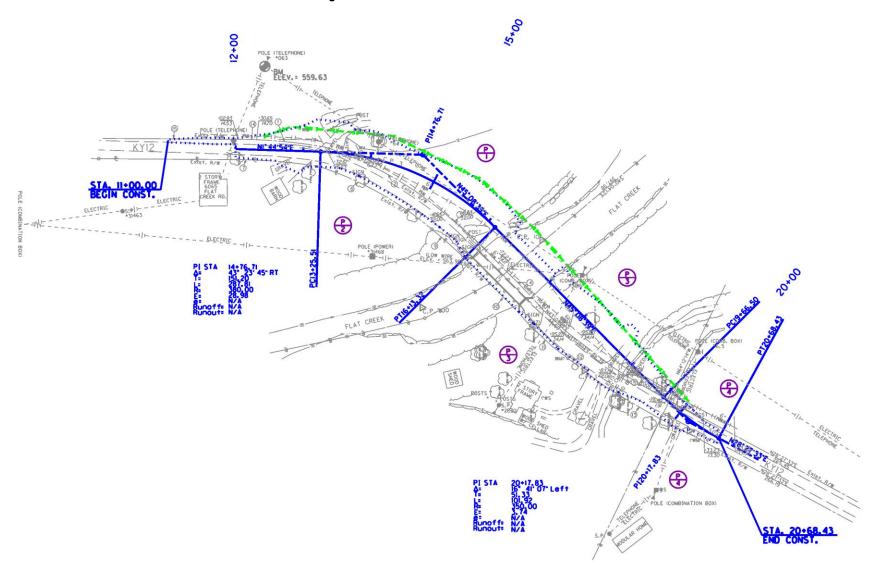


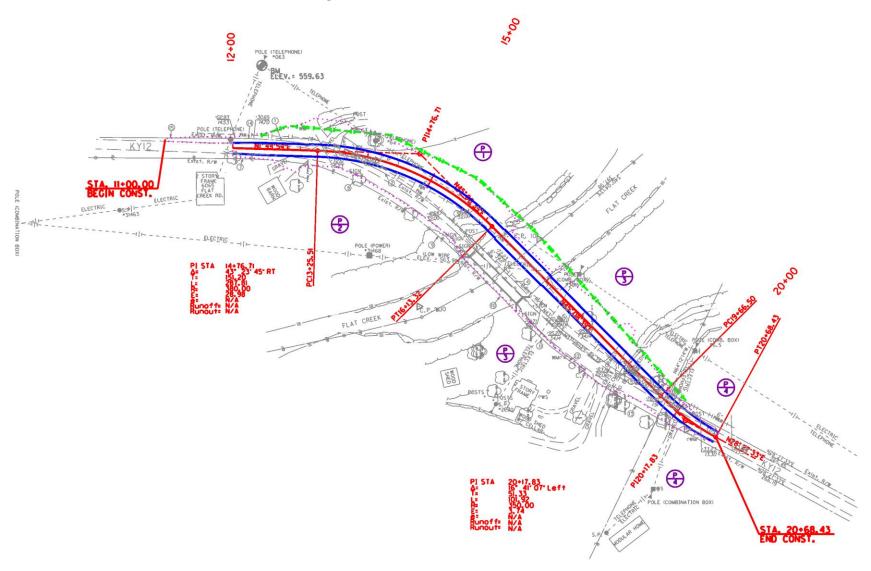


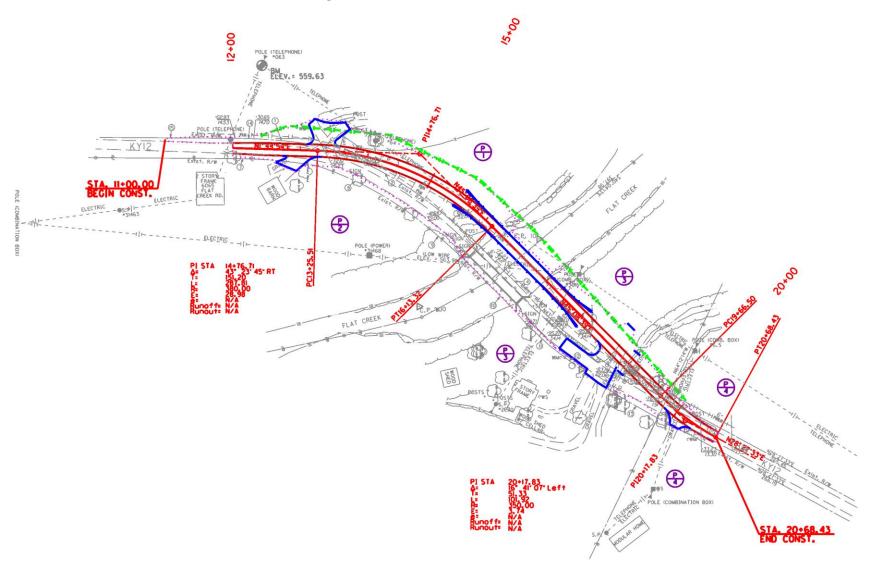


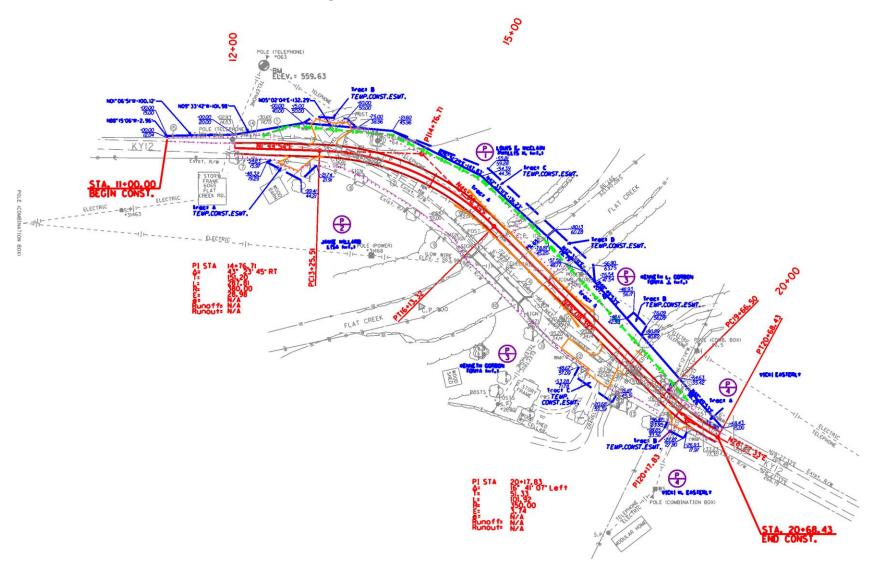
### **KYTC Highway Plans**

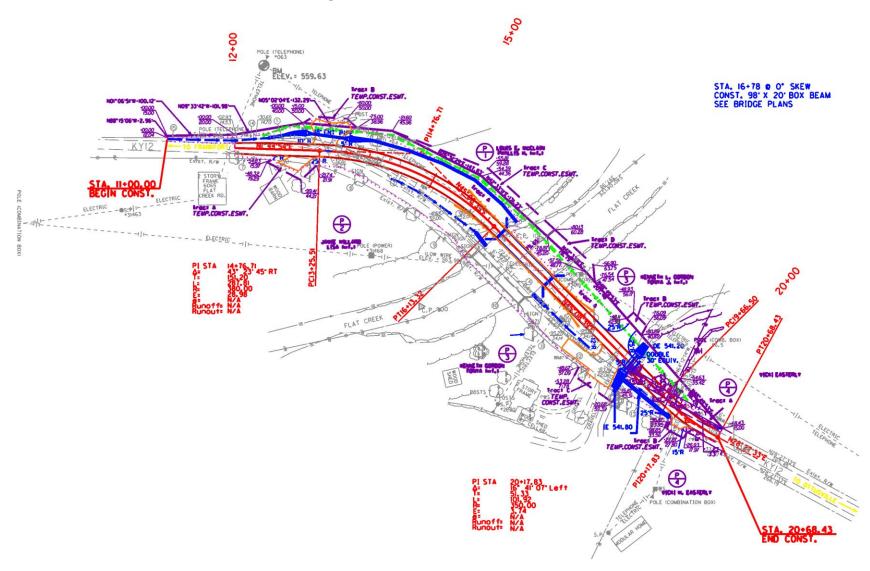
- Proposed Features
  - Centerlines and Baselines
  - Pavement Edges
  - Entrances
  - Proposed R/W and Monuments
  - Access Control Lines
  - Proposed Fences
  - Proposed Utility (some maybe)
  - Property Owners Name and Parcel Number
  - Drainage Features (ditches, pipes, etc.)



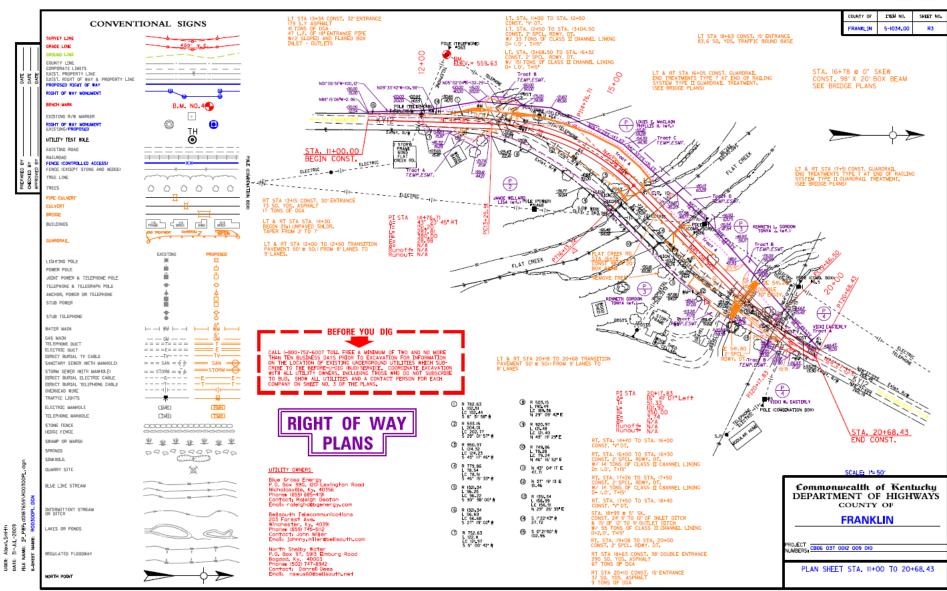














## **KYTC Highway Plans**

- Profile
  - Reference System
    - Elevations and Stations
    - Note Exaggerated Vertical Scale
  - Existing features
    - Ground Line (earth, pavement, top of water, etc)
    - Drainage Features (bridges, culverts, pipes, etc.)
    - Utility Line
      - Overhead (elevation of low wire)
      - Underground (waterlines, sewers, gas lines, etc.)



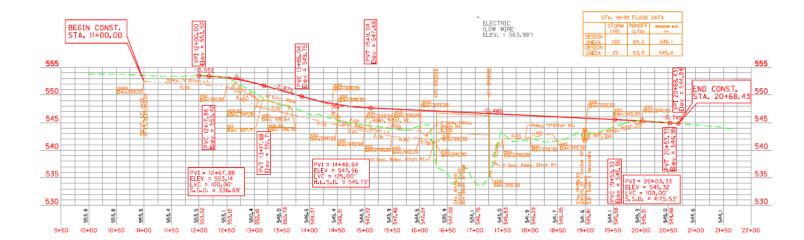
110

## **KYTC Highway Plans**

- Proposed Features
  - Grade (% of Grade)
  - Proposed Drainage features
  - Proposed Utilities (some maybe)



COUNTY OF	ITEM NO.	SHEET NO.
FRANKL]N	5-1034,00	R4



RIGHT OF WAY
PLANS

I\* = 5' VERTICAL SCALE: 1'= 50' HORIZONTAL

PROFILE STA. II+00.00 TO 20+68.43

USER: Alext.Smith
DATE: 31-JUL-2009
FLE NAME: TP\_PRP GDIST559\R0400P
E-SHEET NAME: R00400PF.DDN



## **KYTC Highway Plans**

- Right of Way Summary Sheet
  - Reference System
    - Columns and Rows
    - Parcel Numbers
  - Data
    - Parcel Numbers
    - Owners Name
    - Total Area of Tract
    - Fee Simple R/W (area)
    - Easements (area)
    - Areas Remaining
    - Total Area Remaining
    - Source of Title



COUNTY OF	ITEM NO.	SHEET NO.
FRANKL]N	5-1034,00	R5

-	-	J
ᄣ	DATE	DATE
1	-	- 1

#### RIGHT OF WAY SUMMARY

		TOTAL AREA OF TRACT PERMANENT R/W ACCURSED EASEMENTS  OWNERS:  OWN		AREA SEVERED  LEFT RIGHT			EXCESS PURCHASED PORTION REMAINING		REMAINING	SEWER	SEWER SYSTEM		BUILDINGS ACQUIRED NUMBER			25.11215						
PARCEL NO.	OWNER(S)	ACRES	SQ. FT.	ACRES	SQ. FT.	SO FT.	SO. FT.	ACRES		ACRES	50. FT.	ACRES	SQ. FT.	ACRES	SQ. FT.	SEWER SYSTEM TYPE				F S		REMARKS (HAZARDOUS WASTE)
						30. F1.	30. F1.		54		331111		331				169	NO				
1	Louis E. McClain Phyllis H. (wf.)	116.76			25595		3789	116.17						116.17		4		×			PB 415	
2	Jamie Willard Lisa (wf.)	24.43					1013			24.43				24.43		-		×			PB 208	
3	Kenneth L. Gordon Tonyo J. (wf.)	24.18			20382		2707	2.33		21.38				23.71		1		×			DB 450 PG 171 & 175	Total area is from Tract 2 of this parcel as described by the deed.
4	Vicki W. Easterly	55.94			1592		321							55.90		-		×			P6 742	

NOTE: PERMANENT R/W ACOUDIED + PERMANENT EASEMENT + AREA SEVERED = TOTAL AREA OF TRACT.

TYPE SEWER SYSTEM
1. PROVATE - DADDVIDUAL
2. PROVATE - MULTI PARTY
3. PUBLIX
4. NONE
5. NOT APPLICABLE

BUILDINGS ACQUIRED CODE C - COMMERCAL R - RESIDENTIAL F - FARM S - STORAGE

HAZARDOUS WASTE UST - UNDERGROUND STORAGE TANK

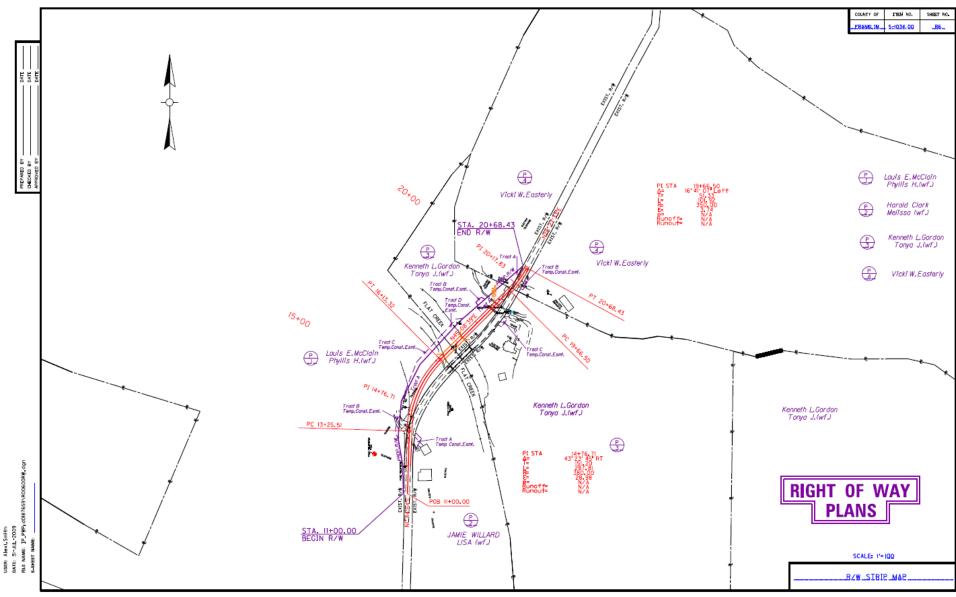
RIGHT OF WAY SUMMARY SHEET



## **KYTC Highway Plans**

- Right of Way Strip Map
  - Reference System
    - North Arrow (compass)
    - Centerlines
    - Station and Offset
  - Features
    - Centerlines
    - Existing and Proposed R/W
    - Easement Lines
    - Control of Access Lines
    - Property Owners Name and Parcel Number
    - Aerial Photos are encouraged







## **KYTC Highway Plans**

- Detail Sheets
  - R/W, Property Line Details
  - Maintenance of Traffic (detours)
- Coordinate Control Sheet
  - Land Survey Monuments and Data



1034,00 ORIGIN OF LEVELS Elevations were derived from GPS methods and are adjusted to the RIGHT OF WAY MONUMENT POINTS + NAVD88 Datum. Geoid model used was Geoid99. A bench mark is a metal spike located on the telephone pole #063 at Sta 12+40.08, Project Coordinates L123.63, with a vertical control mark at Elev = 559.63. State Plane Coordinate STATION and OFFSET DESCRIPTION NORTH (Y) EAST (X) 12+30.65, 14.70 Left R/W Monument 297741.94 1453716.29 297725.49 1453635.98 12+38.00, 45.10 Left R/W Monument 1453605.82 297750.22 1453686.13 297733.77 14+21.60, 45.96 Left 297943.82 297927.36 1453624.42 R/W Monument 15 + 54.39, 44.36 Left 298075.70 1453771.52 1453691.20 R/W Monument 298059 23 17+57.58, 48.77 Left 298230.41 1453913.55 1453833.23 R/W Monument 20+68.43, 15.00 Left R/W Monument 298431.67 1454143.70 R/W monuments will be set in the field prior to Roadway construction. If monuments are disturbed during construction, refer to the special note for R/W monumentation. ELECTRIC - SA63 COORDINATE CONTROL POINTS Project Coordinates POINT DESCRIPTION TATION and OFFSET NORTH (Y) EAST (X) CP 1 298225.617 1454057.164 544.73 18+56.00, 55.93 Right CP 2 CONCRETE MONUM'T 298867.997 1454403.507 542.13 IRON PIN W/CAP 546.17 14+15.37, 0.30 Right CP 3 297924.592 1453748.349 20+26.44, 13.37 Right CP 4 IRON PIN W/CAP 298381.161 1454145.624 545.34 CP 10 16+75.35, 36.08 Left 298163.425 1453864.204 536.48 16 + 21.16, 159.89 Right **CP 100** 297986,281 1453964.015 537.28 297754.05 BENCH MARK 1453607.98 559.63  $12 \pm 40.08$ 12 + 00.00POB MAINLINE 297710.861 1453730.057 MAINLINE 297836.311 1453733.880 13 + 25.51MAINLINE 1453738.494 14 + 76.71MAINLINE 298094.093 1453845.680 16+13.32 MAINLINE 298343.202 1454096.046 19 + 66.50MAINLINE 298379.403 1454132.430 20 + 17.83MAINLINE **RIGHT OF WAY** project datum factor of 1.0000552497 was computed from the central most point to convert the State Plane Coordinates to Project SCALE: 1'= 50' oordinates. Coordinates shown are on Project Datum and to obtain State Plane Coordinates, divide the Project Coordinates by the

Coordinates are in US survey feet. Coordinates shown are project datum coordinates.

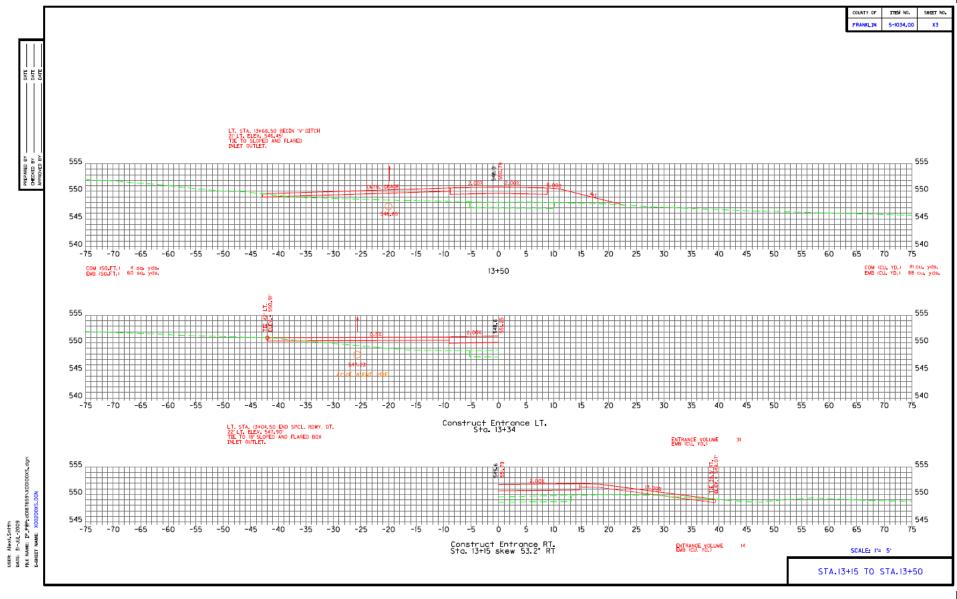
COORDINATE CONTROL



## **KYTC Highway Plans**

- Cross Section (typically not included in the "Plan Set")
  - Reference System
    - Elevation and Station and Offset
  - Ground Line (earth, pavement, top of water, etc.)
  - Template (proposed roadway, ditches etc.)
  - Proposed Entrance Profiles
  - Existing and Proposed Utilities (some, maybe)







#### **KYTC Plan Review**

- Look over this abbreviated plan set
- Document some similarities & difference from your typical plan set



## Wrap-Up & Preferences

- Don't rush the notes (Plan & Special)...
  - Be clear, meaningful, and adequate detail
- Where are we?
  - I need a North Arrow
- Connect the Dots
  - ALWAYS use Match Lines
  - Make sure cut sections show a direction of view
- DECLUTTER THE PLANS
  - Offset station numbers from the CL
  - Notes on sheet only as needed...use references

## Wrap-Up & Preferences



- Help me be clear...
  - At least electronically, use layers such that users might simplify sheets & self declutter
  - For those electronic...storage & nomenclature consistency
- Think of the half size...
  - It's what everyone carries...if it is too cluttered on the full size think of the halfsies
  - CONSISTENCY is a must
    - Terminology, abbreviations, LINE work
    - Use standards...FHWA has them (Federal Lands)
    - Standard drawings...call the correct ones

## Plan Organization & Preparation





## When you look at a set of plans...

- What are your expectations?
- How does that influence your efficiency with the plans?
- Know the expectations of your end user.
- UNIFORMITY





- 23 CFR Part 630 Preconstruction Procedures
  - Subpart B Plans, Specifications, and Estimates
    - Plans and specifications shall describe the location and design features and the construction requirements in sufficient detail to facilitate the construction, the contract control and the estimation of construction costs of the project.
    - PS&E assemblies for Federal-aid highway projects shall be submitted to the FHWA for approval.



#### Guidelines

- https://www.fhwa.dot.gov/design/0630bsup.cfm
- Definitions
  - **Plans** the contract drawings which show the locations, character, and dimension of the prescribed work, including layouts, profiles, cross sections, and other details.
  - Standard Plans (Standard Detail Drawings) -drawings approved for repetitive use showing details to be used where appropriate.
  - Specifications, Standard Specifications, Supplemental Specifications, Developmental Specifications, Required Contract Provisions, and Special Provisions
  - Traffic Control Plan a plan for handling traffic through a specific highway or street work zone or project.



- Guidelines
  - What are plans?
    - Instructions through drawings
      - Contain engineering data or details for geometrics, drainage, structures, soils, pavements, and other appurtenances
    - Plans are not specifications
    - Standard sheets conforming to modern accepted drafting practices



#### Guidelines

- When do you need plans?...may be easier to say when you don't need plans...
  - Abbreviated Plans
    - Minor emergency relief, safety improvements, resurfacing, restoration, rehabilitation, and pavement marking
    - Consists of:
      - » General Plan, Sketch, or Line Drawing
      - » Cross sections if appropriate
      - » Estimate of quantities
      - » Tabulation of construction items (station, offset, elevation)
      - » General notes and special details



- Guidelines
  - What types of plans are there?
    - \*Standard Plans/Standard Drawings/Standard Details
    - \*Contract Plans
      - \*Traffic Control Plans
    - \*Right-of-Way Plans
    - Utility Plans
    - Record Plans
    - As-Built Plans
    - Others

<sup>\*</sup>Plans/Terms within FHWA Guidance



#### Guidelines

- Standard Plans/Standard Drawings/Standard Details
  - Used to reduce the number of drawings required
  - Uniformity of design & construction
  - Can be part of the plan assembly or referenced
  - Keep them current! Remove the old/obsolete

Updates & modification not yet "standard" should be

included in the plans

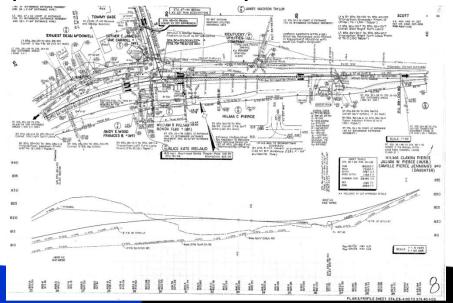
0 :::		DIA. OR				DIMEN	SIONS			CLASS A CONC	REINF STEEL
		EQUIV.	9	С	Ε	F	L	W	Т	C. Y.	LBS.
A (		12"	0	1'-9"	2'-6"	2'-3"	3'-6"	4'-0"	2"	0.58	
171 ( 181) 1117		15"	0	2'-0"	2'-9"	2'-9"	4'-0"	4'-9"	21/4"	0.75	7
1 + A - +		15	0	1'~9"	3'-0"	2'-6"	3'-6''	4'-9"	274	0.68	
€ ₩[.]			0	2'-3"	3'-0"	3'-6"	4'-6"	5'-3"	21/2"	0.93	
8"		18"	2	2'+0"	3'-6"	3'-0"	4'-0"	5'-6"		0.89	8
			ŏ	2'-6"	3'-3"	4'-0"	5'-0"	6'-0"	274"	1,14	
① · ] ] ]		21"	10	2'-3"	3'+0"	3'-6"	4'-6"	6'-0"		1,07	9
			0	2'-9"	3'-6"	4'+6"	5'-6"	6'-6"	3"	1,35	8
PLAN VIEW		24"	0	2'+6"	4'-0"	4'-0"	5'-0"	6'-9"	3/4"	1.30	9
□ r → 8"			0	3'-0"	3'-9"	5'-0"	6'-0"	7'-0"	5/4	1,57	1
0		27"	Ŏ	2'-9"	4'-6"	4'-3"	5'-3"	7'-3"	31/2"	1.51	10
SECTION A-A  DECORATE DE DECOR	INSIGNIF INS		FOR COR EL: MIN' DOWEL IJMENSIO : WARPEI SLOPE V. ID BY PI D/OR DIN D/OR D/O D/OR DIN D/OR D/OR D/O D/OR D/O D/OR D/O D/OR D/O D/O D/O D/O D/O D/O D/O D/O D/O D/O	MUGATE IMUM G BARS. N MINUS TO FI ARTES F PE COM MENSION: MODATE F OF PI VERTICA VIVALENT IVALENT IVAL	D METAL RADE 40  4"). T HEADW 2:1. PUTED U S MAY B FLOW 0 SLOPED PE. FRO	PIPE, BARS  ALL WHE SING IN E ALTEF WATEF IN DIR INT FAC	EVENLY EN PIPE SIDE DIA ED DUR ECTION E OF	SPACED.  IS SKEN	ISOM	ETRIC	
									ARTHE		HIGHWAYS
										WALLS	
TOE OF SLOPES: (5)									12" T	27" F	PIPE
G. STEEPER THAN 2:1 b. 2:1								STAND	AD BUT	NO NO. RE	H-020-03
G. FLATTER THAN 2:1								SUBMETTE.	1	12/10	12-1-99
								-	1000	grage	



- Guidelines
  - Contract Plans
    - "Show the details that are necessary to construct a specific project and should be tailored to provide all information necessary to accomplish work in an orderly manner."

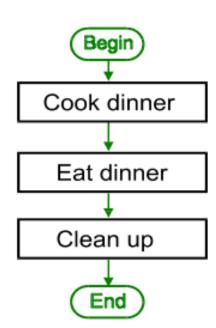
What do you expect to see when you look at contract

plans?





- Guidelines
  - Contract Plans
    - Title Sheet
    - Typical Sections
    - Summary of Quantities
    - Tabulation of Quantities
    - Plan & Profiles
    - Bridges
    - Drainage Facilities
    - Traffic Control Plan (TCP)
    - Standard Plans & Special Details
    - Environmental Mitigation
    - Cross Sections
    - Contiguous Projects

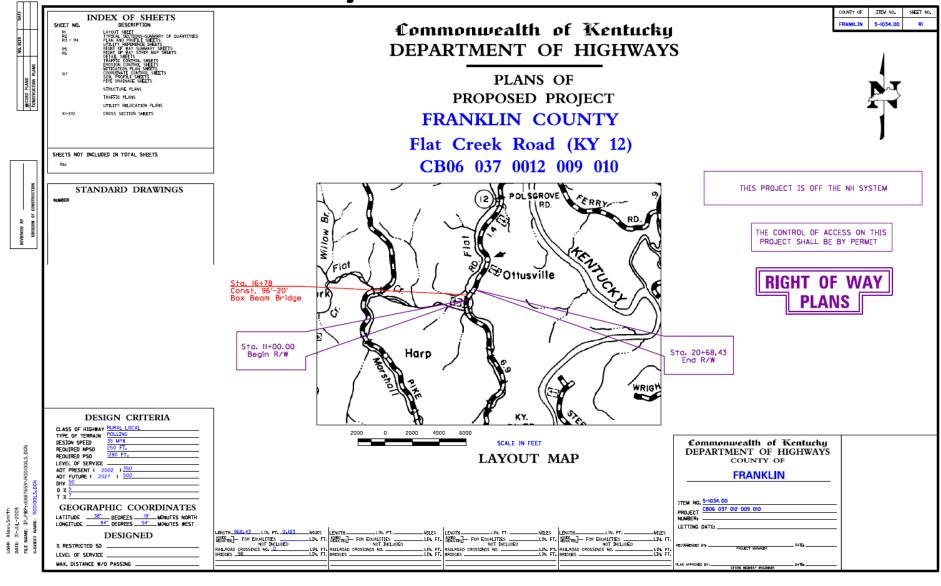




- Guidelines
  - Contract Plans
    - Title Sheet ~conveniently arranged
      - Title
      - Scale(s)
      - Location Sketch (able to be located on a map)
      - Project Length
      - Index of sheets
      - Conventional Symbols
      - Design designation (ADT, design hour volume, directional distribution, % trucks, and design speed)
      - Federal-aid project designation
      - Area for dates and signatures of approving officials
      - Standard Specification & Amendments applicable
      - Standard Plans applicable

## Layout Sheet

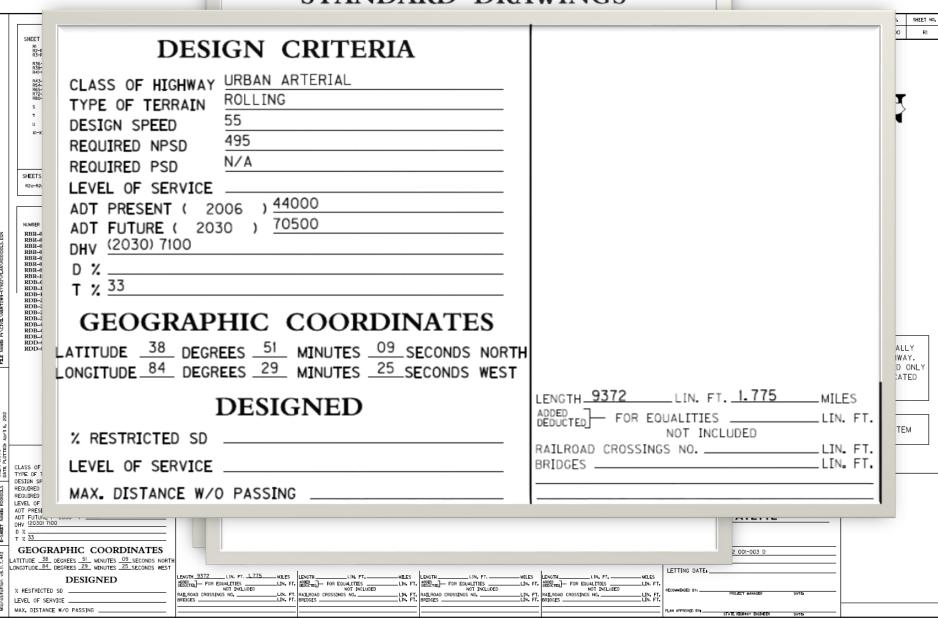




#### Title Sheet Arrangement



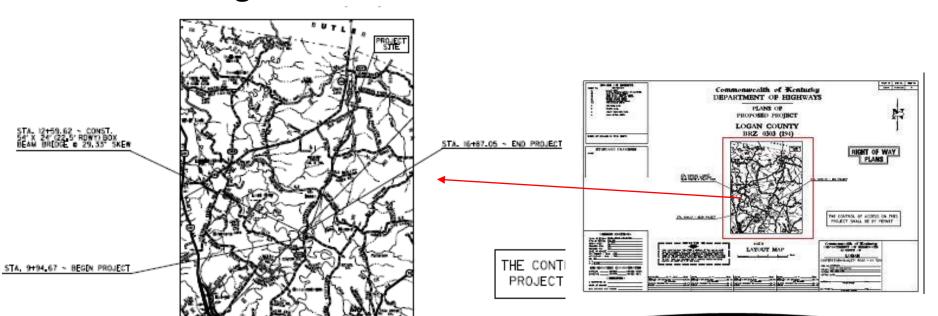
#### STANDARD DRAWINGS





# Layout Sheet Components Area Map – Begin/End Stations

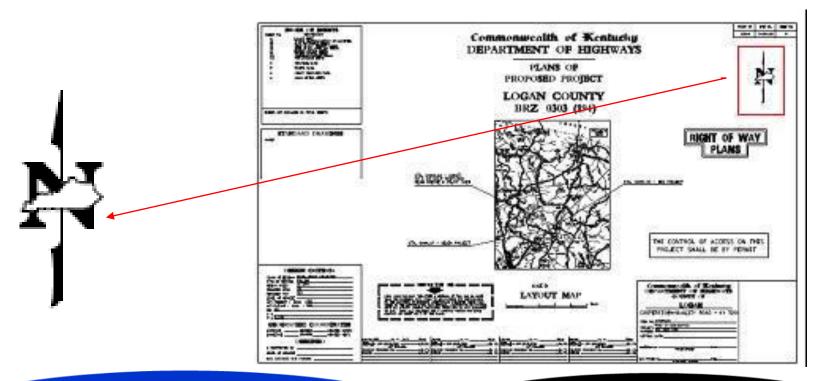
- The area map is located in the center of the layout sheet
- It shows the location of the project and the beginning and ending stations





## Layout Sheet Components North Arrow

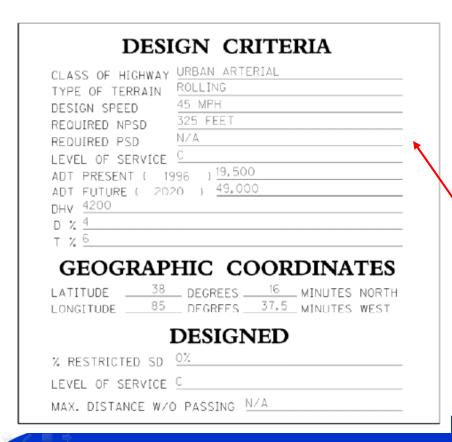
- The North arrow is located in the upper right corner
- It shows North for the Area Map

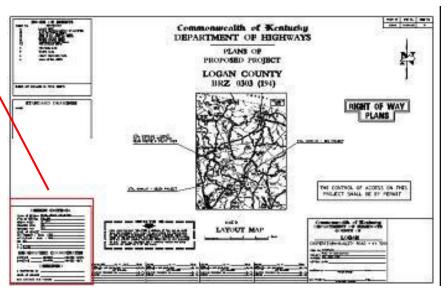




# Layout Sheet Components Design Criteria and Coordinates

Design Criteria and Coordinates are located in the lower left corner



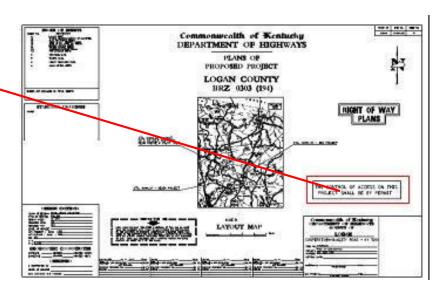




# Layout Sheet Components Type of Access Control

 Located on the lower right. Access control is either by permit or limited. Limited access is broken down into partial control and fully controlled access.

THE CONTROL OF ACCESS ON THIS PROJECT SHALL BE BY PERMIT

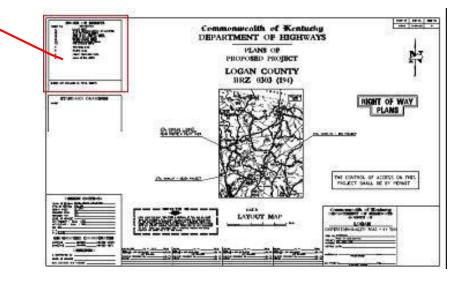




# Layout Sheet Components Index of Sheets

 Located on the top left is an index of the sheets in the plans. It is like a table of contents.

SHEET NO.	INDEX OF SHEETS DESCRIPTION					
R1 R1a R2-R2J R3-22 R23-R28 R29-R32 R33-R37 R38-R45 R46-R55 R56-R59 R60-R64 R65-R71 R72-R74	LAYOUT SHEET RIGHT OF WAY REVISION SHEET TYPICAL SECTIONS-SUMMARY OF QUANTITIES PLAN AND PROFILE SHEETS UTILITY REFERENCE SHEETS RIGHT OF WAY SUMMARY SHEETS RIGHT OF WAY STRIP MAP SHEETS DETAIL SHEETS TRAFFIC CONTROL SHEETS EROSION CONTROL SHEETS MITIGATION PLAN SHEETS COORDINATE CONTROL SHEETS SOIL PROFILE SHEETS PIPE DRAINAGE SHEETS					
S1-S15	STRUCTURE PLANS					
T1-T12	TRAFFIC PLANS					
U1-U20	UTILITY RELOCATION PLANS					
X1-X80	CROSS SECTION SHEETS					
SHEETS NOT INCLUDED IN TOTAL SHEETS R2a-R2J						





## **Sheet Types**

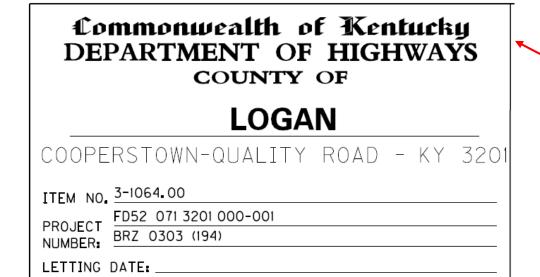
Letters are used to label the various sheet types used in final contract plans. The "sheet type" notation is used to label the sheet number in the sheet information block. The sheets types include the following:

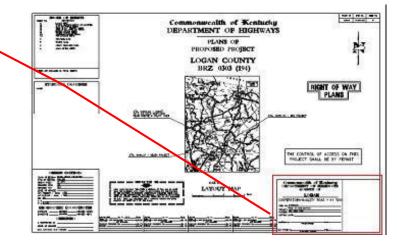
- »R Roadway
- »S Structure
- »T Traffic
- » U Utility Relocation
- » X Roadway Cross Section



# Layout Sheet Components Project Title Block

Located on the lower right side, project title blocks appear on the first plan sheet and the first cross section sheet. The project title blocks shows the county, state project number, and, when applicable, the federal project number.



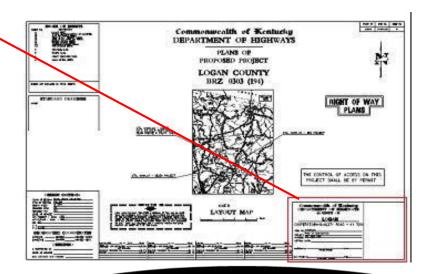




# Layout Sheet Components Project Number

The project number indicates the funding source, county number, state route number, and inclusive termini for the project.

FD52 071 3201 000-001





# Layout Sheet Components Signature Block

- Signature lines are included in the lower right-hand corner of the title/layout sheet
- "Recommended by" is for the project manager
- "Plan Approved," is for the state highway engineer
- The block to the lower right will be used for the consultant information, which includes the firm's name, project engineer's signature and his/her P.E. seal





# Typical Sections and Summary of Quantities

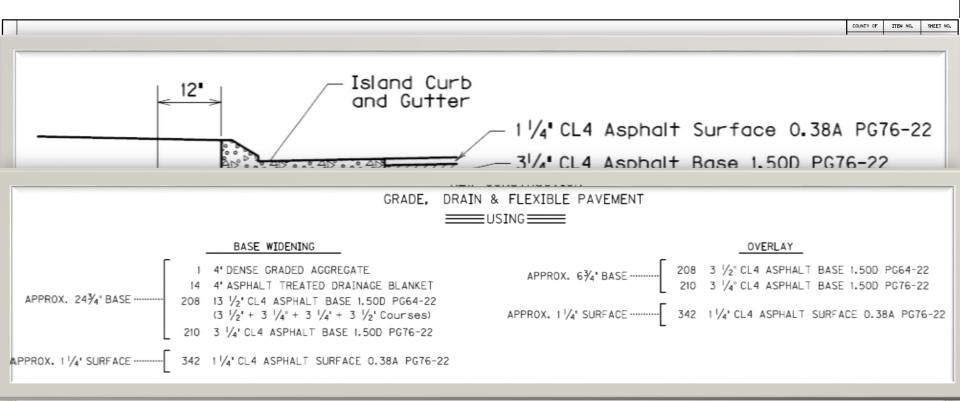
- The typical sections, summary of quantities and general notes follow the layout sheet in the plans and are typically labeled "R2," "R2a," "R2b," "R2c," etc.
- The typical section is a picture, with dimensions, of how the cross-sectional view of the roadway would appear after the construction is completed.
- In general the summary of quantities shows all pay item quantities for the project.

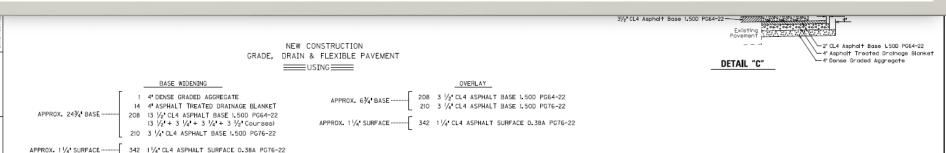


### Guidelines

- Contract Plans
  - Typical Sections ~ should follow Title sheet...exception, if combined roadway and bridge plans...bridge cross-section located with bridge plans
  - Shown to a convenient scale:
    - Different slopes of cut & fill
    - Width of roadbed & median
    - Shape of finished surface & shoulders
    - Curb & gutter (if part of design)
    - Parts of surfacing & shoulders subbase, base course, & surface
    - Location limits for typical sections
    - Ultimate typical for staged projects
    - Thickness of pavement structure elements (variations by table)
    - Relation between either proposed or ultimate status and a control survey line and profile gradeline
    - Lateral location of profile gradeline (grade point)

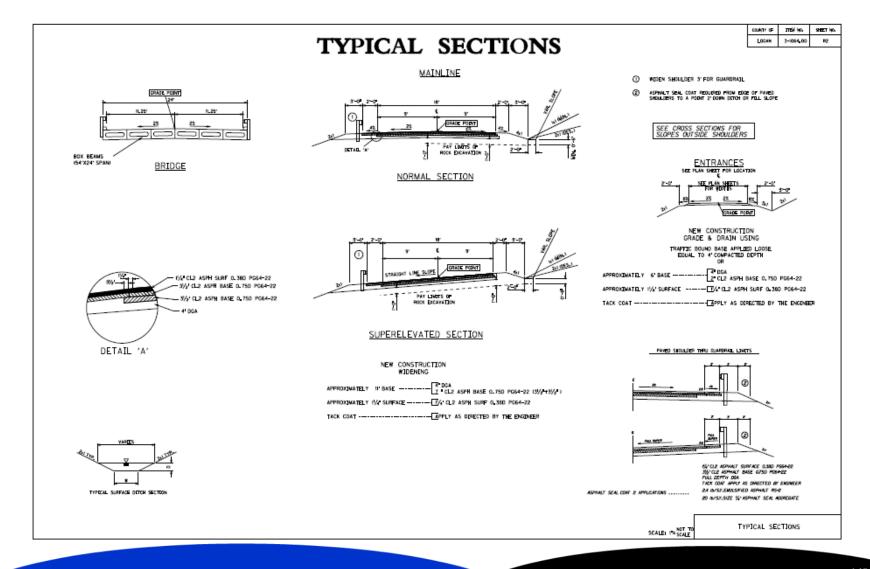
## **Typical Section Arrangement**







# Standard Typical Section

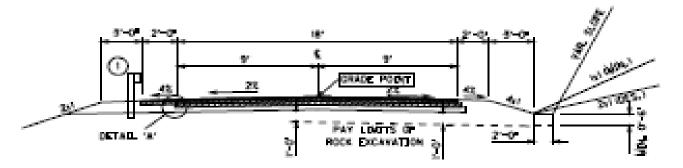




Typical Section sheets normally have cross section views of:

- Mainline roadway normal crown
- Mainline roadway super elevated section
- Bridge typical (if applicable)
- Approach roads and entrances

#### MAINLINE

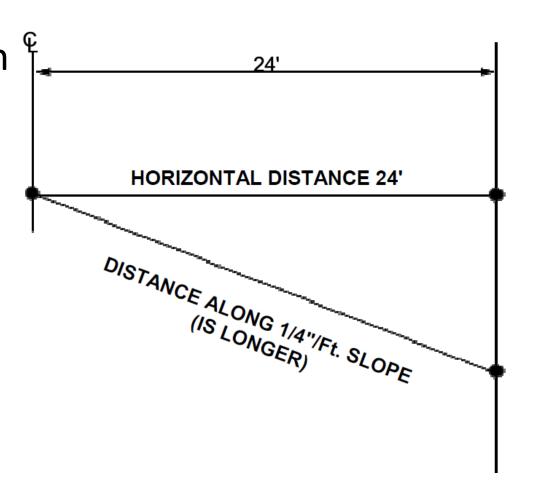


NORMAL SECTION



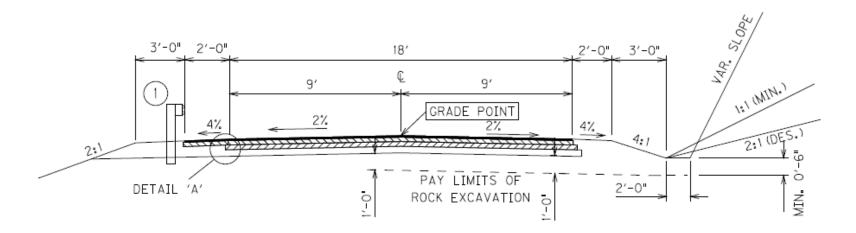
The dimensions given for typical Sections are Horizontal dimensions.

This means that the distances are not measured along the slopes of the roadway.





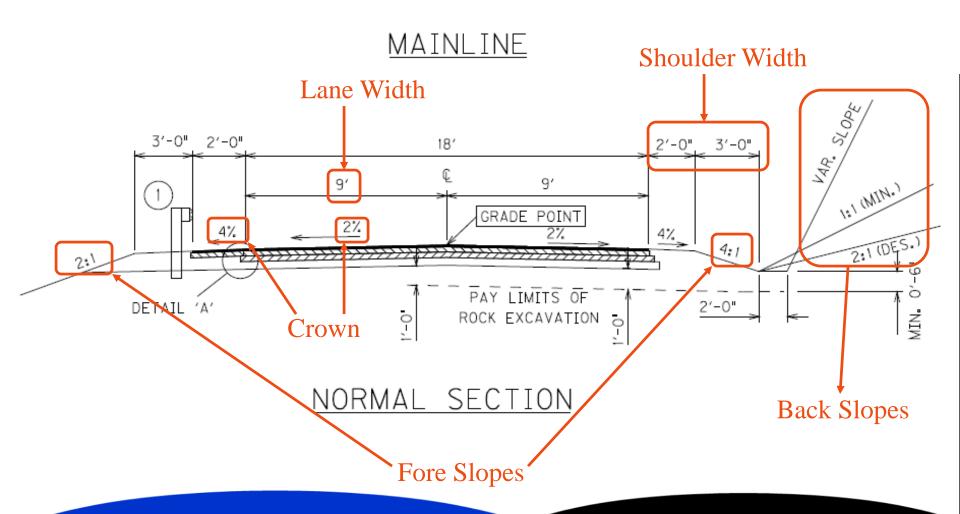
#### MAINLINE



NORMAL SECTION

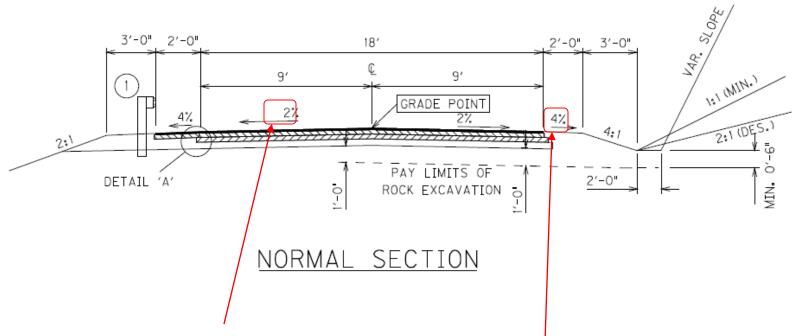
Typical Sections contain a lot of information such as: lane width, crown, shoulder width, fore slopes, back slopes, etc.







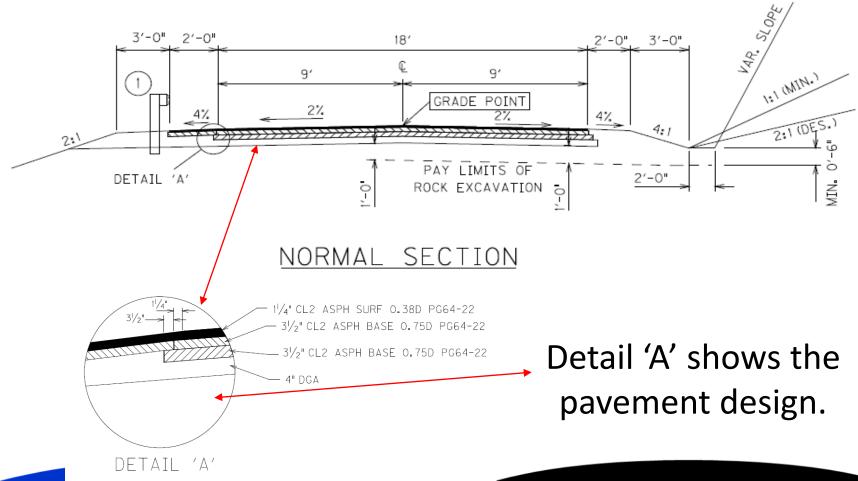
MAINLINE



A crown of 2%. How would you measure that in the field? What about the 4% slope on the shoulders?

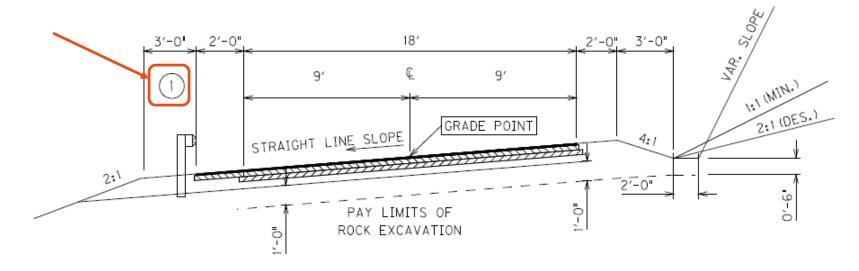


#### MAINLINE





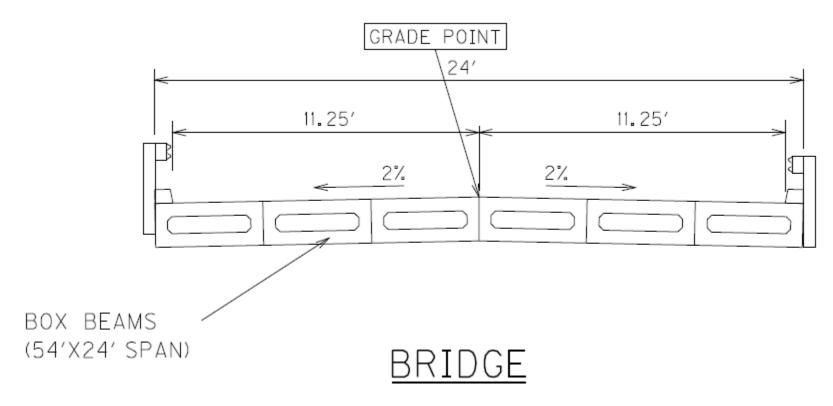
What does note 1 refer to?



#### SUPERELEVATED SECTION

Super elevation is tilting the roadway to help offset centripetal forces developed as the vehicle goes around a curve. Along with friction they are what keeps a vehicle from going off the road.



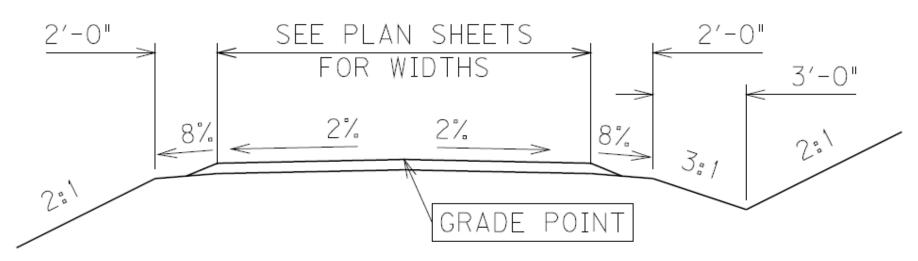


How many box beams are in the bridge detail?



## <u>ENTRANCES</u>

SEE PLAN SHEET FOR LOCATION



Remember 2% = ¼ inch per foot What does 8% = ???



- Guidelines
  - Contract Plans
    - Summary of Quantities
      - Can be on typical sections if not crowded
      - Quantities of each item required (divided according to fund category; but combined for bidding purposes)
        - » Breakdown of urban & rural quantities
        - » County-by-count breakdown
        - » Non-federal-aid identified separate from federal-aid
      - Earthwork (computed by cross section method, photogrammetry, or other methods of demonstrated accuracy)



NEWTOWN PIKE GENERAL & PIPE SUMMARY SHEET

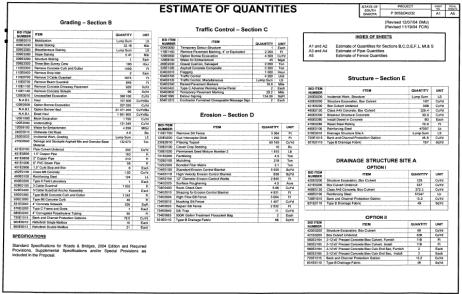
			-16.1-0	
			TEM NO.	SHEET NO.
ITEM	NOTES:  a 1.2 ACRES b Includes Milling for Longitudnal Edge Key c For Wrapping Pipe Trench Backfill & Carried Over from Pipe Summary d Excavation Incidental to Earthwork e See Saturated Subgrade note on General Note Sheet f Includes 6 SQ YD for sidewalk ramp g Temporary Signs	FAVETTE F		RET
6568 PAVE N 6576 PAVE N 6574 PAVE N 6566 PAVE M 6530 PAVE S 6600 REMOVE 78 CRUSHE 2199 TEMP 0 2625 REMOVE	TOTAL PROJECT EARTHWORK  Barthwork calculations are for design purposes and shown for information only.  309 CU YD EMB Assumptions for shrinkage and swell factors are the contractor's responsibility.			
2930 SAPELO 5953 TEMP S 2338R701 PIPELIN- 2358E5505 DETECTABLE	WARNINGS  SO FT 26 26  Temporary Signs  TOTAL PROJECT EARTHWORK  309 CU YD EMB 2777 CU YD COM  Assumptions for shrinkage and swell factors are the contractor's responsibility.			



Summary sheets show all the items of construction that are indicated on the Plan and Profile Sheets. The items are normally lumped together into like categories and then the categories are placed in boxes on the sheet with their representative quantities bid items, and bid item codes.

Types of Summary Sheets include:

- General Summary
- Bridge and Culvert
- Summary
- Pipe Drainage Summary
- Right of Way Summary
- Paving Summary





Standard bid codes and descriptions are used on all projects to ensure uniformity:

00263	ASPHALT MIX FOR PAVEMENT WEDGE	TON
00214	CL3 ASPH BASE 1.00D PG64-22	TON
08104	CONCRETE-CLASS AA	CUYD
00388	CL3 ASPH SURF 0.38B PG64-22	TON
00223	CL3 ASPH BASE 0.75D PG64-22	TON
00001	DGA BASE	TON
02569	DEMOBILIZATION	LS
02568	MOBILIZATION	LS



The Right of Way Summary shows property owners, total acreage, area to be purchased, and easements needed if any.

PARCEL	OWNER(S)	TOTAL	AREA	OF MINATION	FEE S RIGHT	IMPLE OF WAY	EASE	MENTS
NO.	OWNER(S)	ACRES	SQ. FT.	BASIS	ACRES	SQ. FT.	PERMANENT	TEMPORARY
		ACRES	30. 11.	1	ACNES	3u. Fi.	SQ. FT.	SQ. FT.
10	CURTIS RAY ROBISON	1.35		С		5402		
11	MICHAEL SCOTT SUMMERS LISA BEACHAM SUMMERS (WF.)	407		d		14985	1712	1708



COUNTY OF	ITEM NO.	SHEET NO.			
FAYETTE	7-252.01	R2g			

#### ALTERNATE A

#### **PAVING SUMMARY**

ITEM CODE	ITEM	UNIT	NEWTOWN PIKE	TOTAL PROJECT
1	DENSE GRADED AGGREGATE BASE (1)	TONS	2590	2590
194	LEVELING & WEDGING PG76-22	TONS	158	158
216	CL3 ASPHALT BASE 1.00D PG76-22	TONS	832	832
214	CL3 ASPHALT BASE 1.00D PG64-22	TONS	2419	2419
336	CL3 ASPHALT SURFACE 0.38A PG76-22	TONS	919	919
2023	JPC PAVEMENT - 9IN/24 (4)	SY	256	256
2058	REMOVE PCC PAVEMENT (4)	SY	256	256
10020NS	FUEL ADJUSTMENT	DOLL	5917	5917
10030NS	ASPHALT ADJUSTMENT	DOLL	10427	10427

#### ALTERNATE B

#### **PAVING SUMMARY**

	TAVING COMMAN			
ITEM CODE	ITEM	UNIT	NEWTOWN PIKE	TOTAL PROJECT
1	DENSE GRADED AGGREGATE BASE (1)	TONS	3387	3387
194	LEVELING & WEDGING PG76-22	TONS	158	158
216	CL3 ASPHALT BASE 1.00D PG76-22	TONS	832	832
214	CL3 ASPHALT BASE 1.00D PG64-22	TONS	1312	1312
336	CL3 ASPHALT SURFACE 0.38A PG76-22	TONS	919	919
2023	JPC PAVEMENT - 9IN/24 (4)	SY	256	256
2058	REMOVE PCC PAVEMENT (4)	SY	256	256
20263ED	GEOGRID REINFORCEMENT	SY	5100	5100
10020NS	FUEL ADJUSTMENT	DOLL	4403	4403
10030NS	ASPHALT ADJUSTMENT	DOLL	7760	7760

#### NOTES

ALL ASHALT MIXTURES SHALL BE ESTIMATED AT 110 LBS, PER SQ, YD, PER INCH OF DEPTH, UNLESS NOTED OTHERWISE

- ① ESTIMATED AT 115 LBS. PER SO. YD. PER INCH OF DEPTH.
- ② ESTIMATED AT 100 LBS. PRE SQ. PD. PER INCH OF DEPTH.
- 3 ESTIMATED AT 95 LBS. PER SO. YD. PER INCH OF DEPTH.
- TO BE USED WITH THE APPROVAL OF THE ENGINEER ON CONSTRUCTION.

#### **PAVING AREAS**

ITEM   S Q U A R E Y A R   S Q U A R E Y A R   S Q U A R E Y A R   S Q U A R E Y A R   S Q Q Q A R E Y A R   S Q Q Q A R E Y A R   S Q Q Q A R E Y A R   S Q Q Q A R E Y A R   S Q Q Q A R E Y A R   S Q Q Q A R E Y A R   S Q Q Q A R E Y A R   S Q Q Q A R E Y A R   S Q Q Q A R E Y A R   S Q Q Q A R E Y A R   S Q Q Q Q A R E Y A R   S Q Q Q Q Q A R E Y A R   S Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q	D S
3½* CL3 ASPHALT BASE L.00D P076-22 4651 3½* CL3 ASPHALT BASE L.00D P064-22 4296 4296 3½* CL3 ASPHALT BASE L.00D P064-22 3694 4* CL3 ASPHALT BASE L.00D P064-22 3774	<i>U</i> 3
3½: CL3 ASPHALT BASE 1.000 PG64-22 4296 334; CL3 ASPHALT BASE 1.000 PG64-22 3694 4* CL3 ASPHALT BASE 1.000 PG64-22 3774	13371
3¾ CL3 ASPHALT BASE 1.000 PG64-22 3694 4 CL3 ASPHALT BASE 1.000 PG64-22 3774	4651
4 CL3 ASPHALT BASE 1.000 PG64-22 3774	4296
	3694
	3774
2" DENSE GRADED AGGREGATE BASE (4) 256	256
8* DENSE GRADED AGGREGATE BASE 3900	3900
15¾ DENSE GRADED AGGREGATE BASE 846	846
LEVELING & WEDGING PG76-22 2288 2288 2	2288

#### PAVING AREAS

FAVING A	INEAS									
ITEM	NEWTOWN	1							TOTAL	PROJECT
	s c	υ	Α	R	Ε	Y	Α	R	D	S
1/4 CL3 ASPHALT SURFACE 0.38A PG76-22	1337	1		Т				П	133	71
31/4" CL3 ASPHALT BASE 1.00D PG76-22	465	1						$\neg$	465	51
3 CL3 ASPHALT BASE 1 00D PG64-22	429	5						$\neg$	429	6
3 CL3 ASPHALT BASE 1.000 PG64-22	365	3				$\neg$		┪	365	3
2º DENSE GRADED AGGREGATE BASE. (4)	256			Т		Т		П	256	ŝ
12" DENSE GRADED AGGREGATE BASE	379							$\neg$	379	31
151/4" DENSE GRADED AGGREGATE BASE	846			$\top$				$\neg$	846	ő
LEVELING & WEDGING PG76-22	228	3		$\perp$		$\perp$		$\Box$	228	8
		_		4		4		-		
		+		+		+		$\dashv$		
				- 1		- 1		- 1		



- Guidelines
  - Contract Plans
    - Tabulation of Quantities
      - Summary of drainage, signing, guardrail, earthwork, or other items with station and offset
      - Useful for identifying specific locations of items to install
        - » Note: care must be taken for accuracy

#### PIPE DRAINAGE SUMMARY

SHEET NO.		SKEW	COVER HEIGHT	DESIGN PH LEVEL	CULVERT PIPE 24 INCH	STORM SEWER 15 INCH	DROP BOX INLET TYPE 3	DROP BOX INLET TYPE 5D	DROP BOX INLET TYPE 13G	CAP DROP BOX	FABRIC GEOTEXTILE TY IV FOR PIPE	REMARKS
	ITEN	/ CODE			464	521	1496	1511	1559	20098NC	2600	
	UNIT TO BID			LIN	FT			EACH		SQ YD		
R5	L† 97+00-98+51.7	_	2	М	150		1				290	
R7	109+64.8	0,	3	М		3		1		1	6	
R9	112+07.7	0,							1			
TOTAL PROJECT				150	3	1	1	1	1	296		





### Guidelines

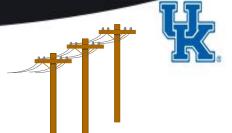
- Contract Plans
  - Plan & Profiles
    - Careful with scale: governed by topography and complexity of the work
    - Plan: usually horizontal scale of 1 inch to 50 feet or 1 inch to
       100 feet, but may vary under appropriate conditions
    - Profile: drawn to same horizontal scale as plan, but vertical scale 5 to 10 times of the horizontal



## Plan and Profile Sheets

- Plan and Profile sheets show what the area looks like now and how we want it to look after construction. They may be combined as one sheet or shown separately.
- Additionally they show quantities, dimensions, etc. needed to layout and construct the project.
- Plan/Profile Sheets give a view of the entire project. They both begin with the lowest station number and the beginning of the project and show the entire roadway ahead to the end of the project.

## Plan Sheets



- Typically the first plan sheet is numbered R3 and will show a list of the utility owners.
- Should have a title block in the lower right corner with the station numbers for that sheet.
- Show the centerline stationing at 100 ft. intervals.
- Contain a North Arrow.

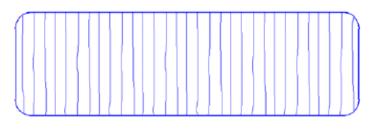


 Typical scale is 1"=50 ft. for rural projects and 1"=20 ft. for urban projects.



## Plan Sheets

- Remember that a PLAN VIEW shows the roadway as if you were flying over the project and were looking down. It shows the horizontal alignment.
- Notes will refer to items being left or right of centerline. Imagine that your are standing on centerline and looking towards increasing station numbers.
- Plan sheets also show curve data and bearings.





- Guidelines
  - Contract Plans
    - Plan Sheets (if possible include the following, otherwise use reference sheets to incorporate the following)
      - Base line of survey (should also be centerline if possible)
        - » If base and center are not the same, relationship should be shown
        - » Divided highways with separate base lines may be treated as separate roadways, with relationships to one another and/or centerline
        - » Special areas such as interchanges and safety rest areas should be should shown with separate survey control lines
      - Stationing reading left to right, including Equations of Stationing



### Guidelines

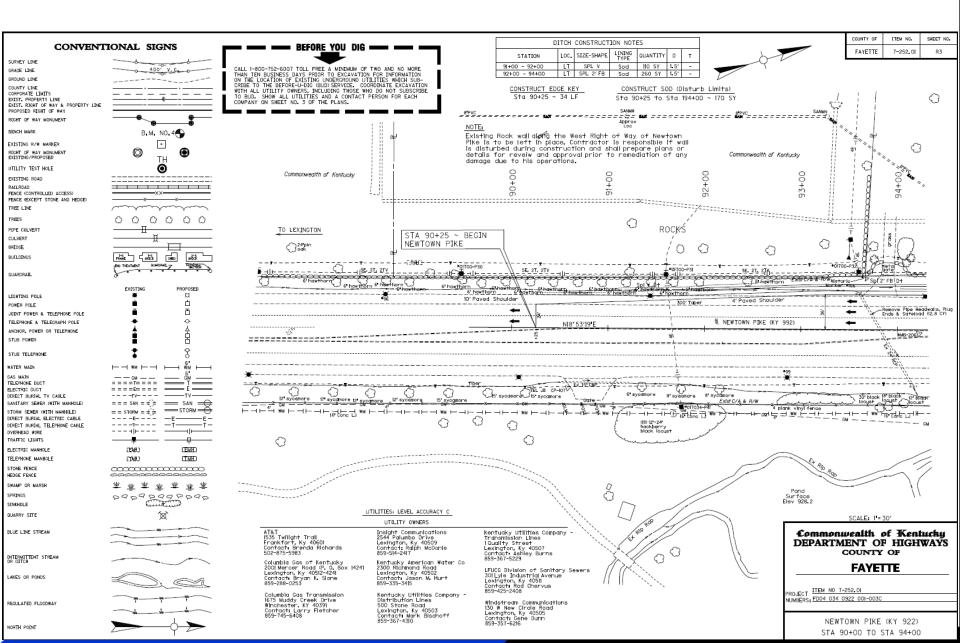
- Contract Plans
  - Plan Sheets (continued)
    - Horizontal position of beginning & ending stations (described by coordinates in the State Plan Coordinate System, datum adjusted)
    - Design data of curves
    - ROW & access control lines, easements, and special use areas
    - North arrow
    - General soils, rock out crop, topography, streams, railroads, and other facilities such as roads, streets, and airports near ROW when there may be influence by or to construction
    - Location of borings, test pits, or other subsurface investigations



- Guidelines
  - Contract Plans
    - Plan Sheets (continued)
      - Incidental construction items (erosion control provisions, guardrail, and retaining walls)
      - Amount & volume of materials available at known sources
      - Existence of & disposition of all public utilities, buildings, or other obstructions or encroachments in the ROW or adjacent to it that may impact construction
        - » Utilities, if within the project, should be shown as present and also as proposed with horizontal and vertical details with any additional details necessary to indicate scope

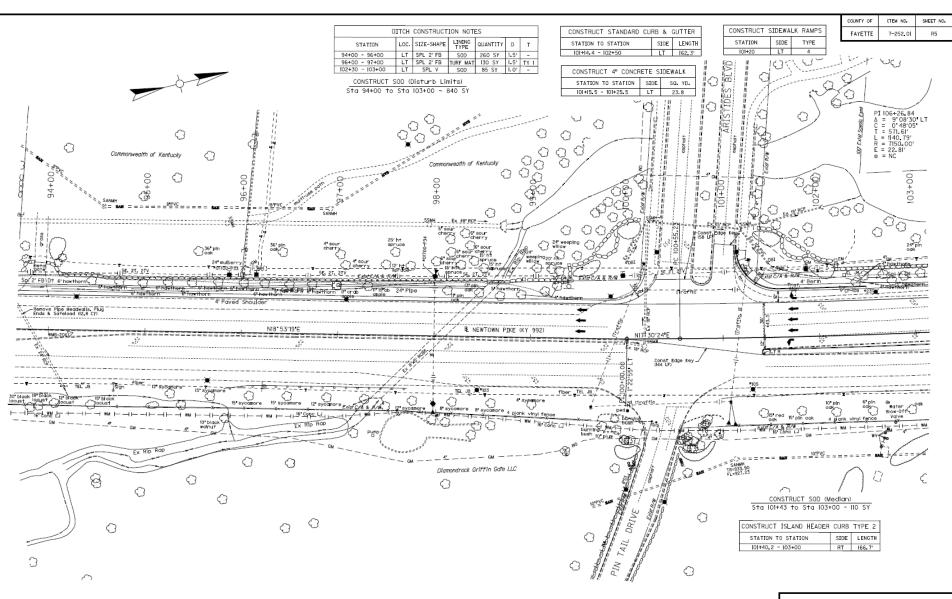
### Plan Sheet







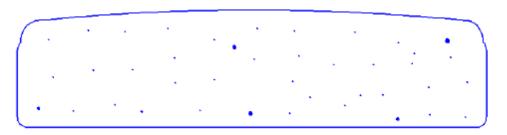
### Plan Sheet



NEWTOWN PIKE (KY 922) STA 94+00 TO STA 103+00

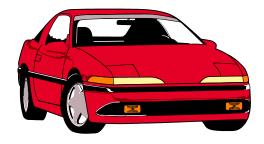


Remember that a PROFILE VIEW shows the roadway as if you were looking at it from the side. It shows the vertical alignment.



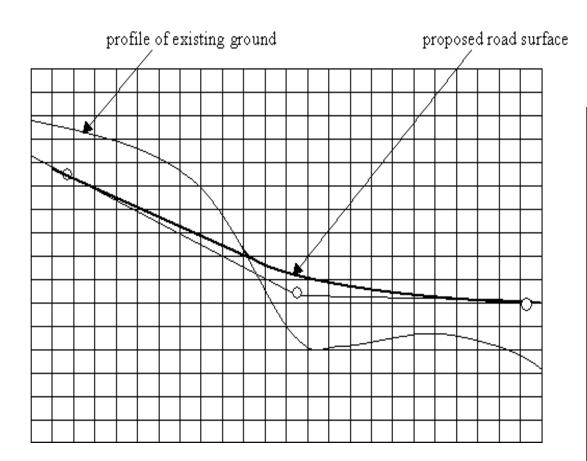
LOAF OF BREAD - LONGITUDINAL (OR PROFILE) VIEW



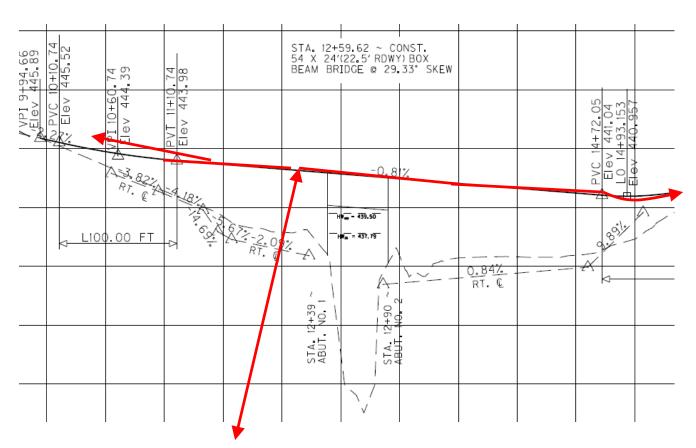




- The existing ground line and the proposed grade line should be shown on the same horizontal scale as the plan.
- The ratio of the vertical scale to the horizontal scale typically is 1:10, resulting in an exaggerated vertical view.

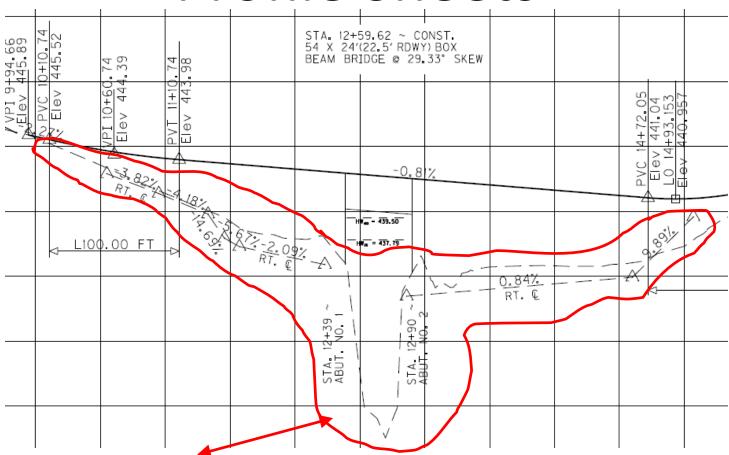






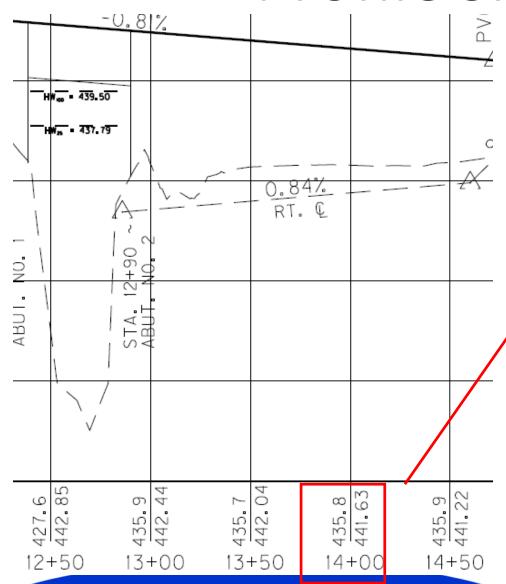
 The profile grade line is a graphical representation of the proposed surface showing all proposed elevations along that surface. It is usually a dark heavy line.





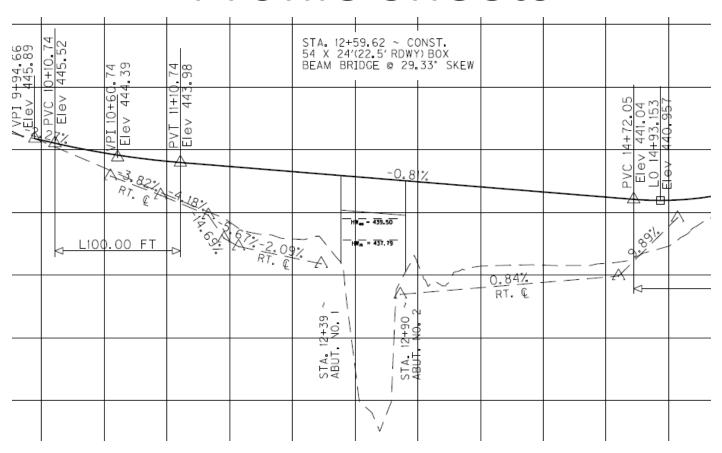
The Original Ground Line is usually shown by a dashed line and is very irregular since the original ground is irregular (or bumpy) before construction begins.





Ground line and grade line elevations are shown at 50-foot intervals.





 When the ground line is above the proposed grade, a CUT is necessary; when the ground line is below the proposed grade, a FILL is required. When both the existing and proposed elevations are the same it is known as a GRADE POINT.



- Grade is the slope of the roadway. It is expressed as a percentage of the horizontal distance. For example, a +3% grade means a RISE of 3 feet per 100 feet of horizontal distance.
- The grade is considered to be + (positive) or (negative) depending upon whether it rises or falls as you proceed along the GRADE LINE in the direction of increasing stations.

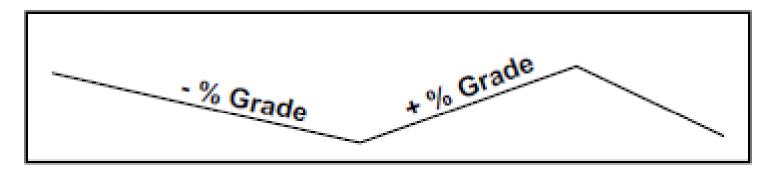
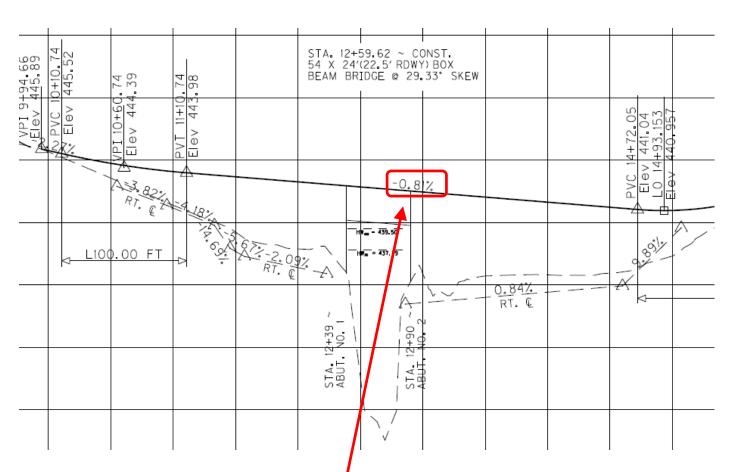


Figure 7-8. Positive and Negative Grades..



## **Profile Sheets**



This part of R4 shows -0.8%. This means that the new roadway will drop 0.8' every 100' in this section.



#### Guidelines

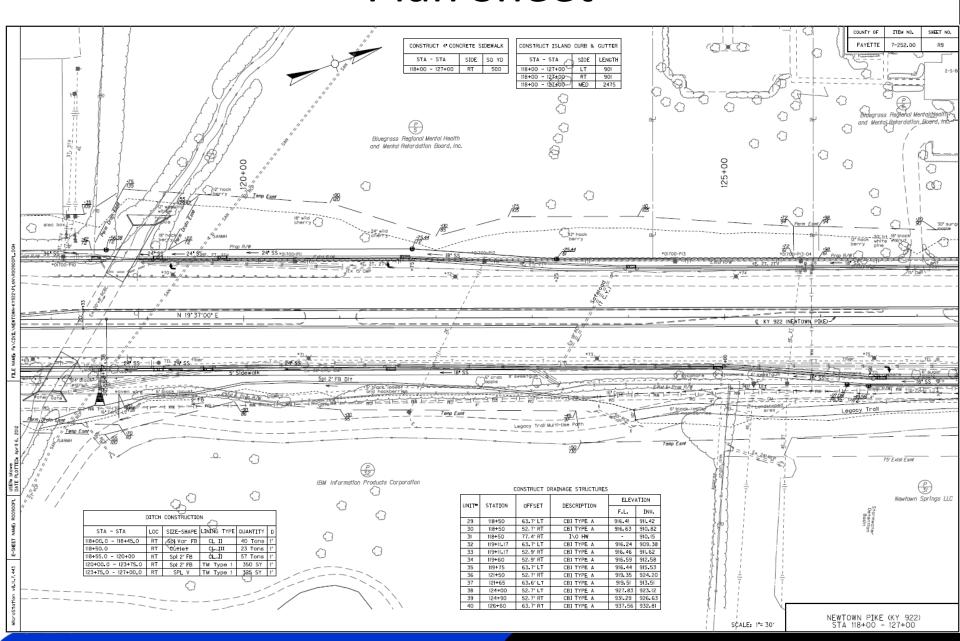
- Contract Plans
  - Profile Sheets
    - Represent the trace of the vertical plane intersecting the top surface of the wearing course, base course or other surface along the designated base line
    - Show the existing ground line as a trace of the vertical plane along the same base line
    - Should show:
      - » Grade and existing ground lines (if using std sheets can shown changes only)
      - » Datum line
      - » Station ordinate lines
      - » Percentage of gradient



- Guidelines
  - Contract Plans
    - Profile Sheets
      - Should show (continued):
        - » Balance points, with excavation & fill quantities
        - » Location & depth of subsurface investigations and associated references
        - » Vertical & horizontal clearances & cross section of the roadbed for railroads, highways, and streambeds under proposed & existing structures
        - » Type & clearance under & over utility lines w/in ROW
        - » Note whether profile represents surface or subgrade
        - » Culverts

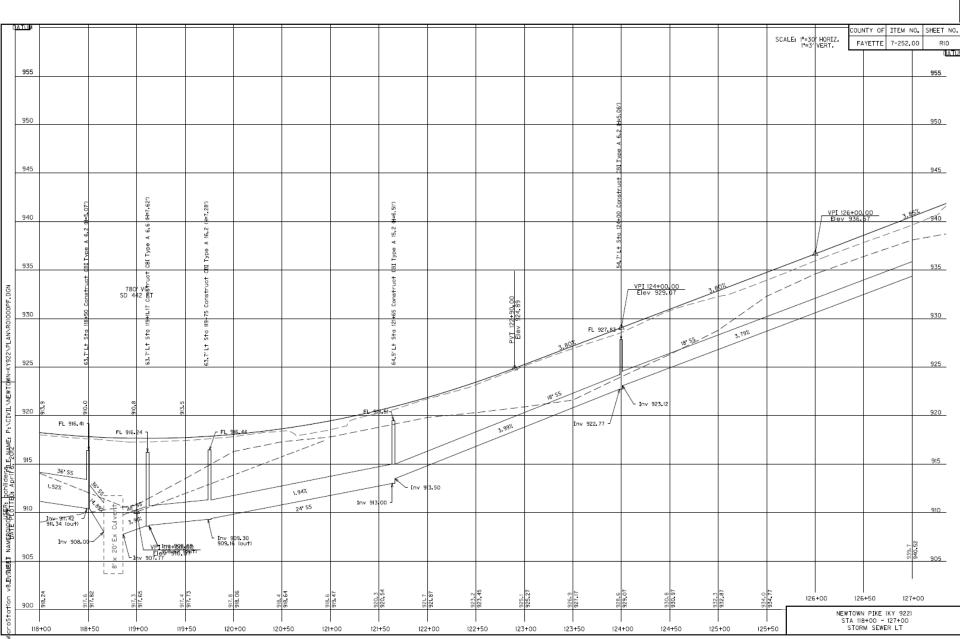


## Plan Sheet



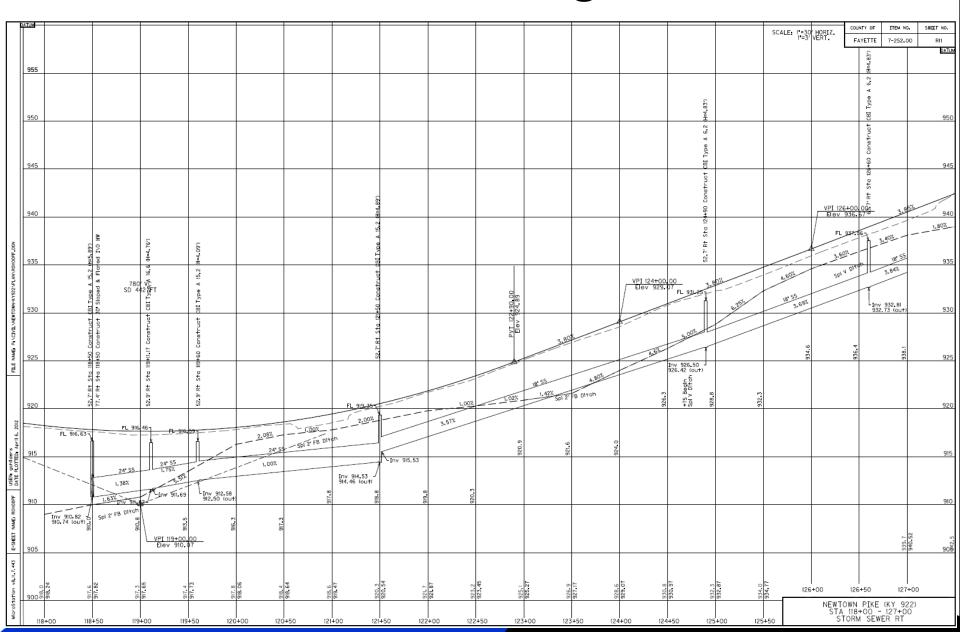


## Profile SS Left





## Profile SS Right





#### Guidelines

- Contract Plans
  - Bridge Plans should include:
    - Site plan
    - Location & log of boring & soundings (reference document)
    - Profile of crossing
    - Typical cross section
    - Sectional drawings as needed
    - Quantities of materials
    - Reinforcing bar list & bending diagrams
    - Design loading, working stresses, classes of concrete, grades of steel
    - Drainage area & applicable runoff of hydraulic properties
    - Design, construction, & other details as needed
    - Reference to applicable specifications

#### Structures Plans



INDEX OF SHEETS

TNG DATE

STRUCTION PROJECT NO.

Sco#126324\_7-122\_50\26324\_0

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TRANSPORTATION CABINET DEPARTMENT OF HIGHWAYS SCOTT COUNTY US 25 OVER

CANE RUN CREEK STA. 274 + 48.00

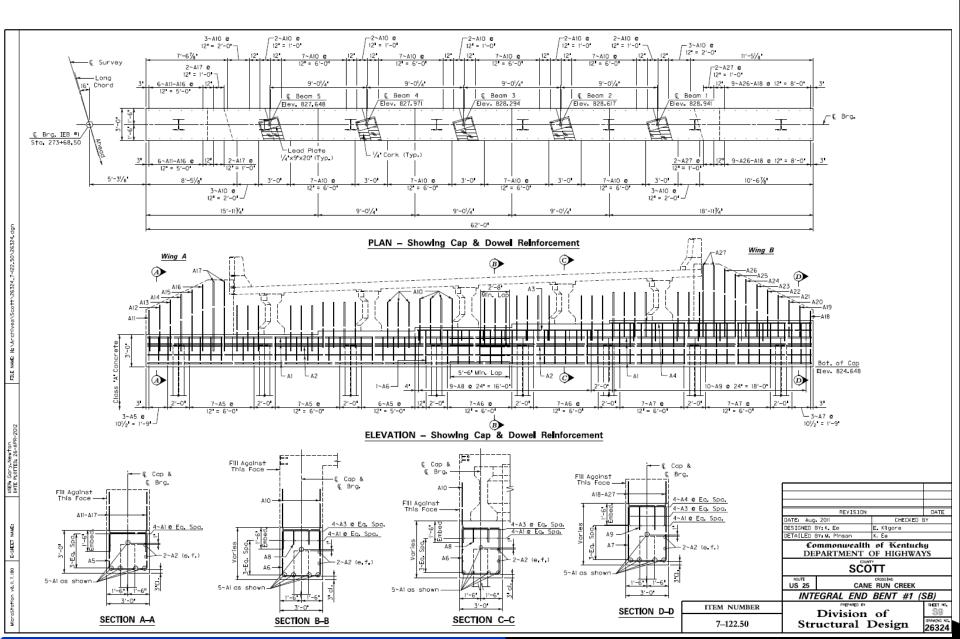
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	General Notes								
	Layout Subsurface Data								
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S12-S14	Integral End Bent #1 (SB) Integral End Bent #1 (NB)								
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S21-S22	Pler #2 (NB)  Pler #2 (NB)  Pler #2 (NB)								
S23-S25	S25 Integral End Bent #2 (SB)								
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BGX-015-0	2 Bridge Drains								
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#### Structures Plans





# Pipe Sheets

- Culvert A structure not classified as a bridge that provides an opening under a roadway usually for water drainage. KY Standard Specifications defines a culvert as any structure under the roadway with a clear opening of 20 feet or less.
- Bridge A structure having a length of over a twenty foot span that is erected over a roadway, stream, railroad, depression, or combination of these.



# Pipe Sheets

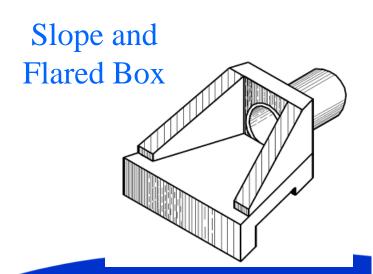
- Pipe sheets show inlets, manholes, pipes, and culverts with the exception of entrance pipes and longitudinal pipes on standard cross section sheets with slope lengths and sizes shown.
- They also show data such as discharge, high water elevations, flood evaluation data, and material quantities.

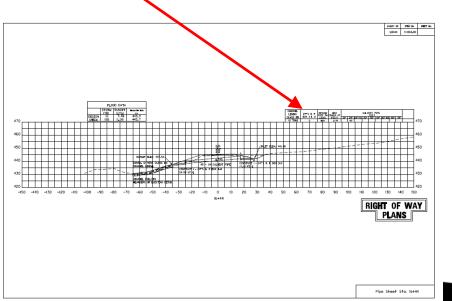


# Pipe Sheet Material Quantities

Each sheet tabulates the materials needed to construct the structure.

CHANNEL LINING	24" S & F	DESIGN PIPE PH	MAX COVER HT	CULVERT PIPE FEET								
CLASS III	BOX I & O	LEVEL	(FEET)	18"	24"	24" EQ	30"	36"	42"	42" EQ	48"	54"
12 TONS	2	MED	2.75′		42'							



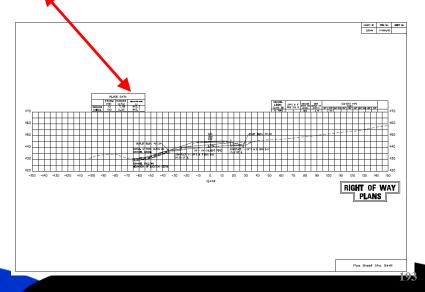




# Pipe Sheet - Flood Data

This information is used to properly size the pipe.

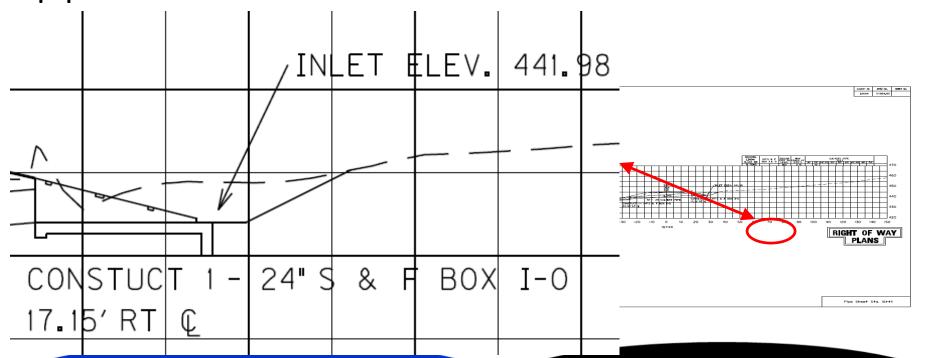
FLOOD DATA									
	STORM (YR)	RUNOFF (cfs)	HEADWATER ELEV						
DESIGN CHECK	10 100	7.48 11.09	443.3 443.7						





# Pipe Sheet - Inlet Data

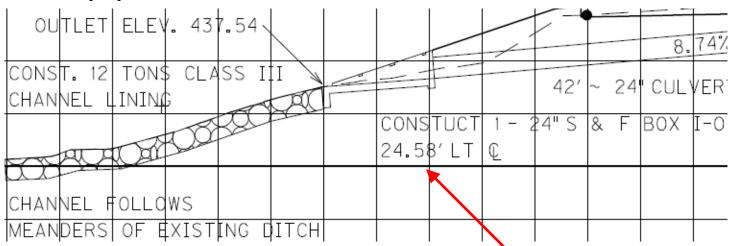
An inlet is where water goes into the pipe. The inlet elevation is the height above sea level for the inlet of the pipe end treatment.

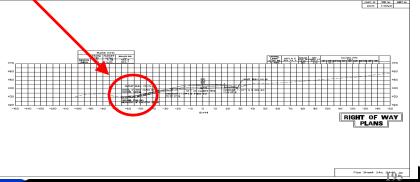




# Pipe Sheet - Outlet Data

An outlet is where water exits the pipe. The outlet elevation is the height above sea level for the outlet of the pipe end treatment.

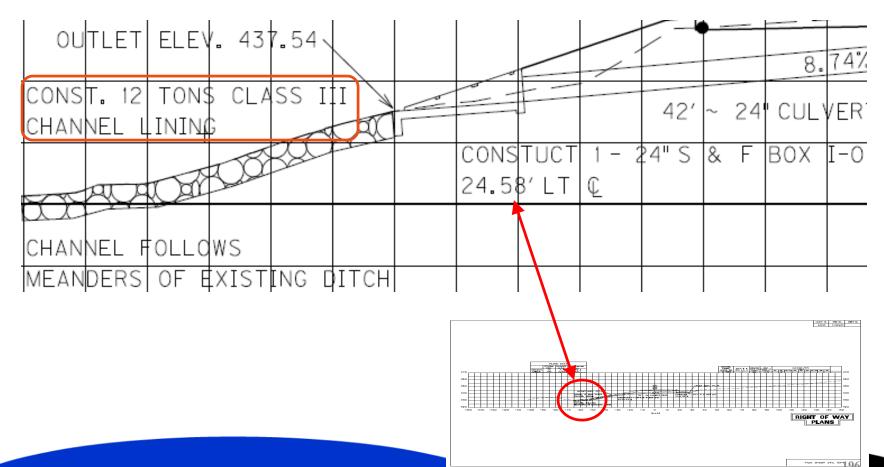






# Pipe Sheet -Outlet Data

The outlet data also shows you where the 12 tons of Class III Channel Lining should be placed.

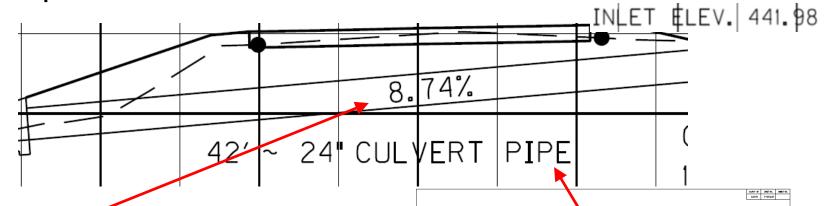




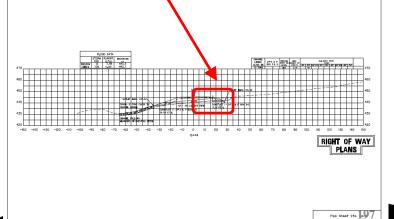
# Pipe Sheet

# Slope Lengths and Sizes

The pipe sheet also lists the length of culvert pipe and the slope that it should be laid on.



8.74% means that it rises 8.74 feet every 100 feet. Does this make sense with the difference between our inlet and outlet elevation?





- Guidelines
  - Contract Plans
    - Drainage Facilities
      - Plans for culverts (drainage structures 20 feet or less in length between abutments measured along the centerline of the roadway) should include the applicable items for contract plans to properly describe the required installation
      - Also detail plans for other minor drainage structures such as erosion control structures, headwalls, inlets, and manholes to properly describe the required installation
      - Large culverts follow guidance for bridges



## **Erosion Control**

- Every project requires erosion control sheets as outlined in the Kentucky Pollution Discharge Elimination System (KPDES) requirements.
- The erosion control sheets are contoured plan sheets plotted over the roadway plan sheets showing centerline, right-of-way and easement lines, permanent drainage features, disturbed areas, point and overland discharge locations, critical erosion control features, and construction notes for all erosion control items.

## Definitions – Erosion Control

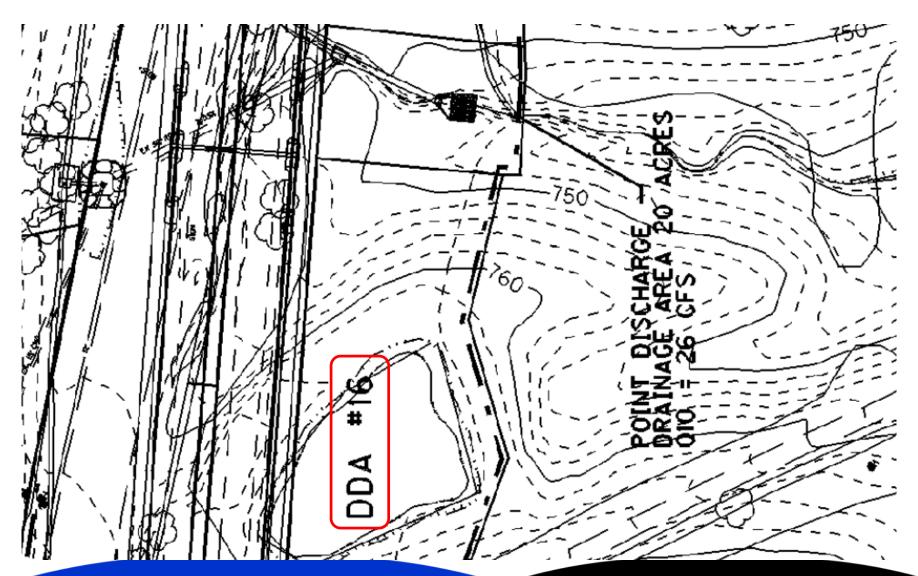
**Disturbed Drainage Area** — All areas of the job site to be cleared and grubbed are divided into drainage areas. Each drainage area has a common point of discharge or overland flow.

 DDA's for each sheet are tabulated and shown with their total area and maximum sediment load.

DISTURBED DRAINAGE AREAS								
SECTION	DESTURBED AREA (ACRES)	MAXIMUM SEDIMENT VOLUME (CU FF)						
DDA 11	4,24	15, 264						
DDA 12	1.86	6,696						
DDA 13	0.12	432						
DDA 14	O <b>.</b> 28	1,008						
DDA 15	0.30	10,080						
DDA 16	5,01	18,036						



## **Erosion Control Sheet**





#### Guidelines

- Contract Plans
  - Standard Plans & Special Details
    - Standard plans not incorporated into separate plan packages or booklets should be a part of the contract plan assembly.
    - Special details should be prepared and included, as necessary, to properly describe the work.
  - Environmental Mitigation
    - Commitments for environmental mitigation features which are contained in the environmental documentation should be detailed as necessary and included in the project plans as special details and/or shown at the appropriate location in the plans.



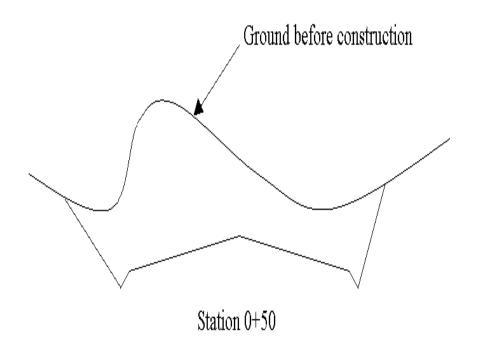
#### Guidelines

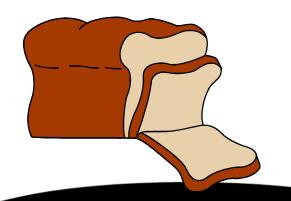
- Contract Plans
  - Traffic Control Plan (TCP)
    - Designed specifically for the project detailing the requirements for controlling traffic through the project, or
    - Referenced to standard plans, a section of the Manual on Uniform Traffic Control Devices for Streets and Highways, or a standard HA manual.
    - The plan should provide for appropriate treatment of all significant hazards likely to be encountered during the project, with the degree of detail depending on the project complexity and traffic interference with construction activity.
    - Appropriate parts of the TCP, showing the applicable items for the contract plans to properly describe the required work, should be included in the plan assembly.
      - » Detours, phasing, etc.



## **Cross Sections**

- Remember that cross section views are like slices of bread.
- They are shown every 50' and at critical locations. The scale is 1:10 or 1:5 vertical and horizontal.
- A cross section is just a typical section shown with the existing ground line.

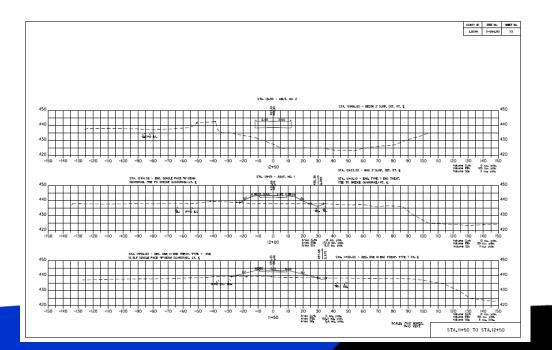






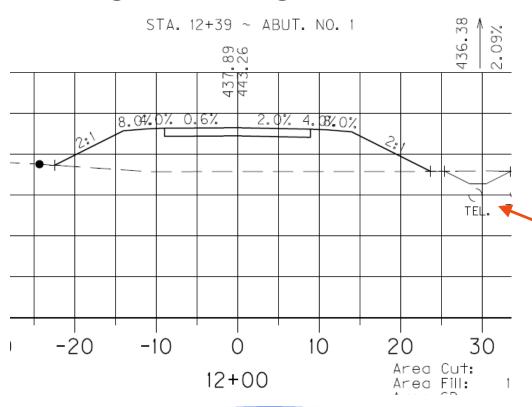
## **Cross Sections**

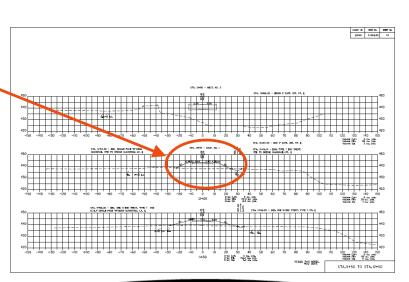
- They show station, offset (left and right) of centerline, the proposed roadway template, permanent drainage features, earthwork quantities, and construction notes.
- You read cross sections from the bottom of the page to the top. As you read up you are going ahead in stations.



## **Cross Sections - Station and Offset**

The station in this view is 12+00. Left and right offset in the view is left and right on the profile view as well. Imagine looking down centerline at increasing stations.



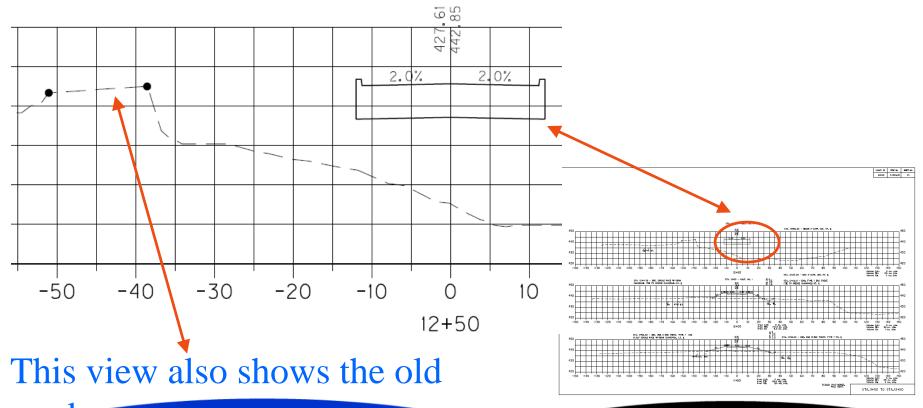




## **Cross Sections**

## Proposed Roadway Template

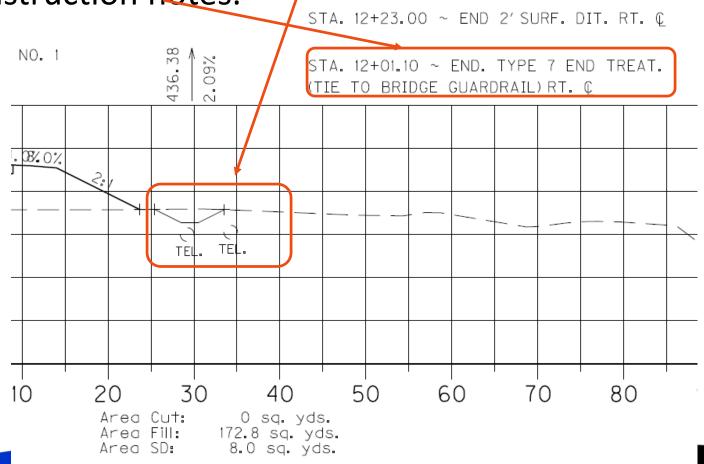
The proposed roadway template is shown. Sometimes as in 12+50 the template is a box beam bridge.





## Cross Sections -Other Features

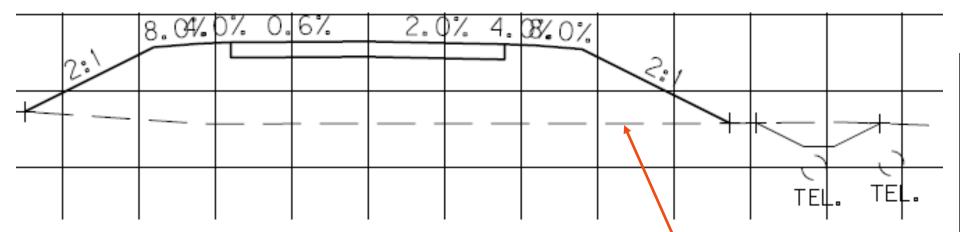
This view also shows permanent drainage features and construction notes.





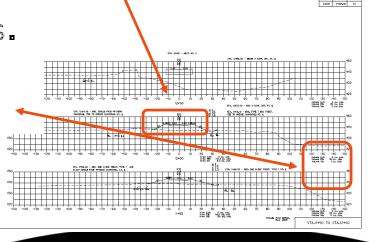
## Cross Sections - Other Features

This view also shows earthwork calculations.



Volume Cut: Volume Fill: 301 cu. yds. Volume SD:

0 cu. yds. 11 cu. yds.





#### Guidelines

- Contract Plans
  - Cross Sections
    - If cross sections are shown, sections should be taken as often as necessary to determine accurately the character and extent of the proposed work.
    - Cross sections should show:
      - » Profile of the ground line,
      - » Proposed cross section,
      - » Station location,
      - » Gradeline elevation,
      - » Areas
      - » Minor drainage structures.



- Guidelines
  - Contract Plans
    - Contiguous Projects
      - A general plan or layout of contiguous construction projects that are to be constructed with either a different class of funds or by another agency should be included to show the location and effect of the work. (Such details and information necessary to establish their relationship to the project should be shown.)



## Other Plans





## **Definitions - Easements**

- Temporary Easement—A temporary easement is the use of a tract of land for a specified time duration (typically the duration of construction), with the land reverting to the owner's exclusive use at the end of the period.
  - The plans and the deed descriptions require a stated purpose for the easement.
  - Such as: "Temporary easement for entrance construction, detour construction, slope construction, building removal, etc."
- Permanent Easement—A permanent easement is an easement for a specific purpose that is ongoing and continuous.

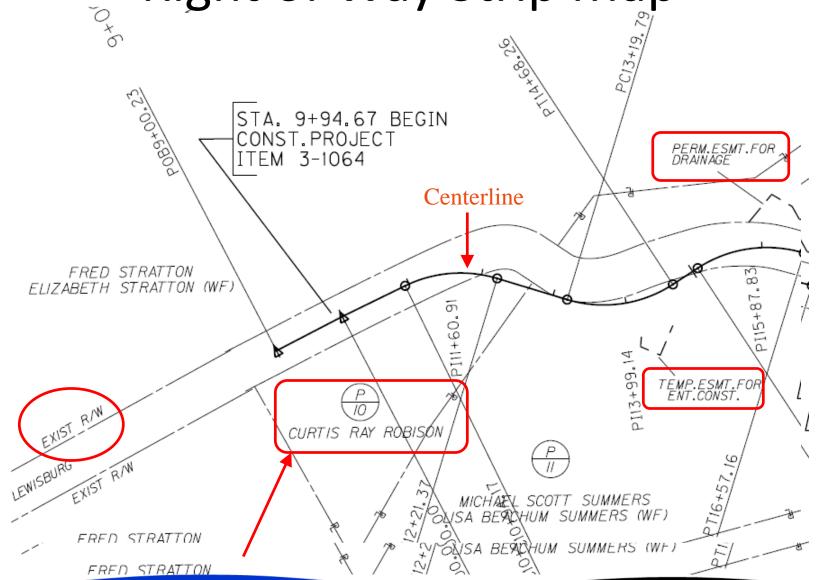


# Right of Way Sheets

- Right of Way Summary Sheets They show property owners, total acreage, area to be purchased, and easements needed if any.
- Right of Way Strip Map Typically these are used to show the centerline, existing and proposed right-ofway lines, permanent easement lines, control-ofaccess lines, property lines, property owners, and parcel numbers.
  - The right-of-way strip map should be drawn to a scale that best depicts the boundaries of the parcels.
  - Using aerial photos with right-of-way strip maps is encouraged.



Right of Way Strip Map





#### Guidelines

- Right-of-Way Plans should show:
  - Right-of-way and access control lines,
  - Width to be acquired,
  - Proposed slope limits,
  - Centerline and stationing with appropriate ties to intersecting property lines and changes in right-of-way widths,
  - Any additional easement areas, either temporary or permanent, that are required to accommodate intersecting roads and streets, land service, access and temporary roads, drainage areas, material storage areas, slope widening, utilities, railroads, or any other special uses,
  - All pertinent data affecting the cost of the right-of-way such as structures, land service or access roads, improvements, drain fields, and fences,
  - All approved points of entry to or exit from the traffic lanes, even where the right-of-way lines and access control lines are coincident,
  - Disposition of improvements within the proposed right-of-way, and



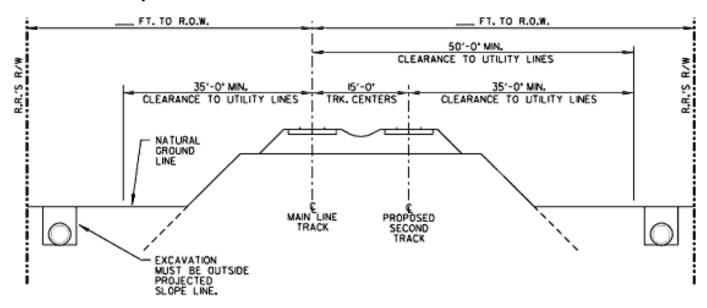
### FHWA Code & Guidelines

- ROW Plans Continued
  - For each parcel to be acquired:
    - » a parcel identification number,
    - » the property ownership lines,
    - » the name of the property owners, and
    - » the area in square feet or acres of the part to be taken and of each remainder of a partial taking.
  - The size, form, and arrangement of right-of-way plans should conform to the general requirements for highway plans and should contain sufficient dimensional and angular data to permit ready identification and correlation with the legal descriptions of all parcel easements and special use areas that are required by the associated highway project.



### FHWA Code & Guidelines

- Guidelines
  - Utility Plans & Utilities in General



### PARALLEL ENCROACHMENTS FOR UTILITY LINES

I. IT WILL NOT BE PERMISSIBLE TO ATTACH UTILITY LINES HANDLING GAS OR FLUIDS TO BRIDGES, COMMUNICATION LINES MAY BE ATTACHED WITH THE ATTACHMENT TO THE BRIDGE STRUCTURE APPROVED ON A PER BRIDGE BASIS.

2. ALL PIPELINES SHALL BE BURIED A MINIMUM OF 5 FEET BELOW NATURAL CROUND.

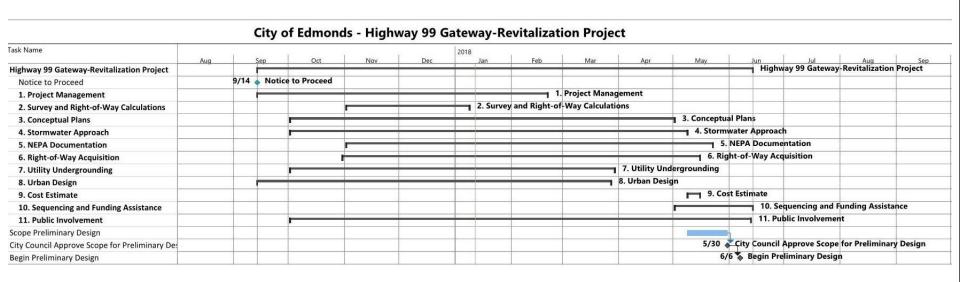


### FHWA Code & Guidelines

- Guidelines
  - Final Note:
- PS&E assemblies should include: complete sets of plans (Applicable plans previously approved as standards should be incorporated by reference and need not be included as part of each PS&E assembly.),
- Proposal assembly including bidding documents, special provisions and required contract provisions (Previously approved standard and supplemental specifications should be incorporated by reference and need not be included as part of each PS&E assembly.),
- Engineer's estimate, and
- Approved agreements with railroads, utilities, and municipalities, if not previously submitted.

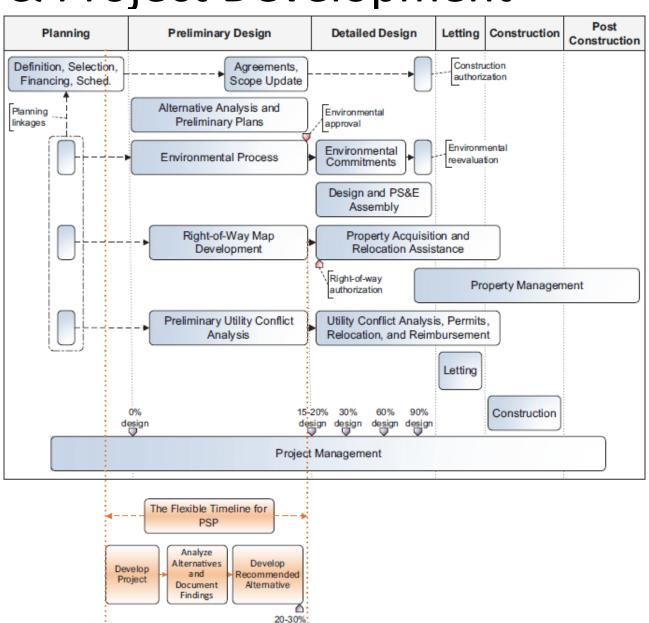








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design:



- Quick Notes on Plan Quality
  - Standardize
    - Standard Drawings, CADD Standards, etc.
      - <u>http://flh.fhwa.dot.gov/resources</u> (Federal Lands)
      - www.fhwa.dot.gov/design
  - Quality Control/Quality Assurance (Programmatic)
    - Document the approach
      - http://www.dot.ga.gov/PartnerSmart/DesignManuals/OtherR
         esources/GDOT QCQA Program.pdf
      - Domestic Scan of Best Practices
      - http://onlinepubs.trb.org/onlinepubs/nchrp/docs/nchrp20-68a 09-01.pdf



- Quick Notes on Plan Quality
  - FHWA Preconstruction Engineering Management
     Website
  - http://sp.design.transportation.org/Pages/Precon structionEngineeringManagement.aspx
  - FHWA QC/QA Guidance for Bridge Design
  - https://www.fhwa.dot.gov/bridge/h0817.pdf

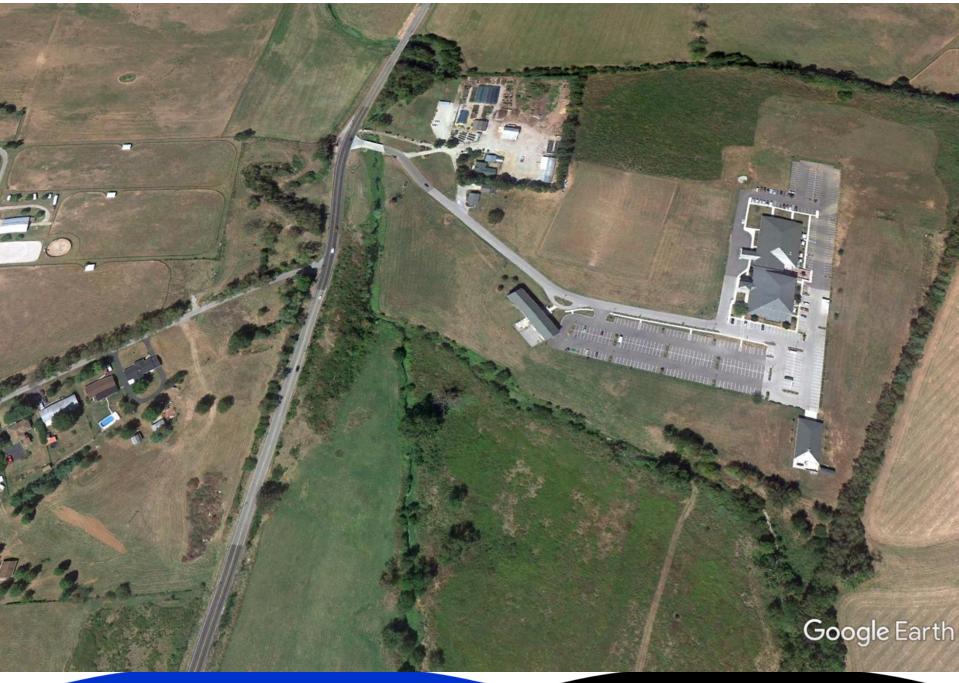


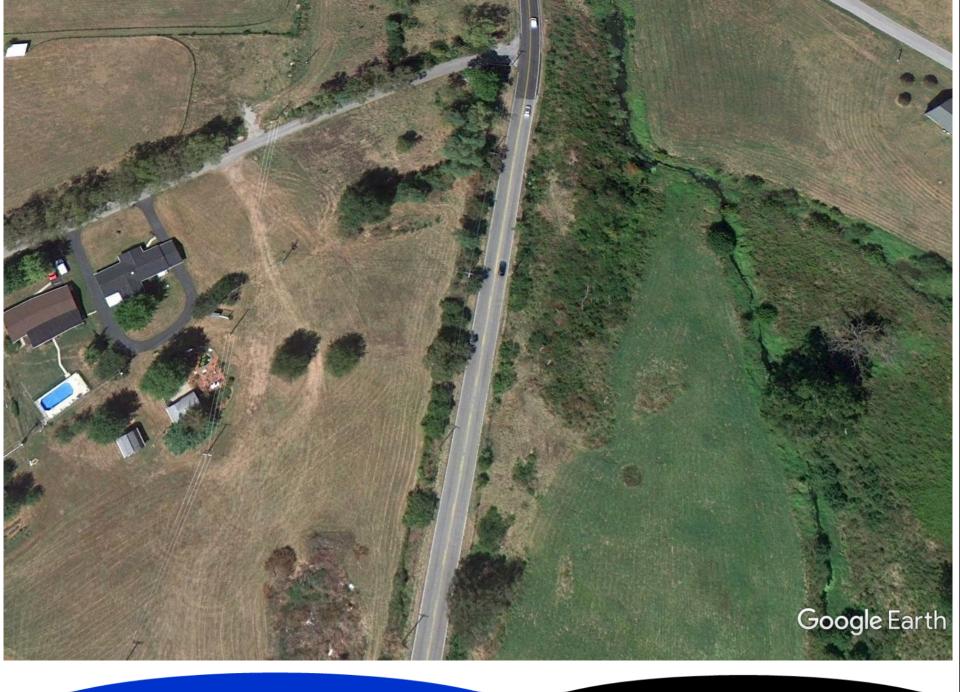
- Quick Notes on Plan Quality
  - Multidisciplinary Teams
  - Early Contractor Involvement
  - Value Engineering
  - Constructability Reviews
    - Varying approaches...single or small groups
    - Early and toward final design
  - Final Note: Check the last things first...



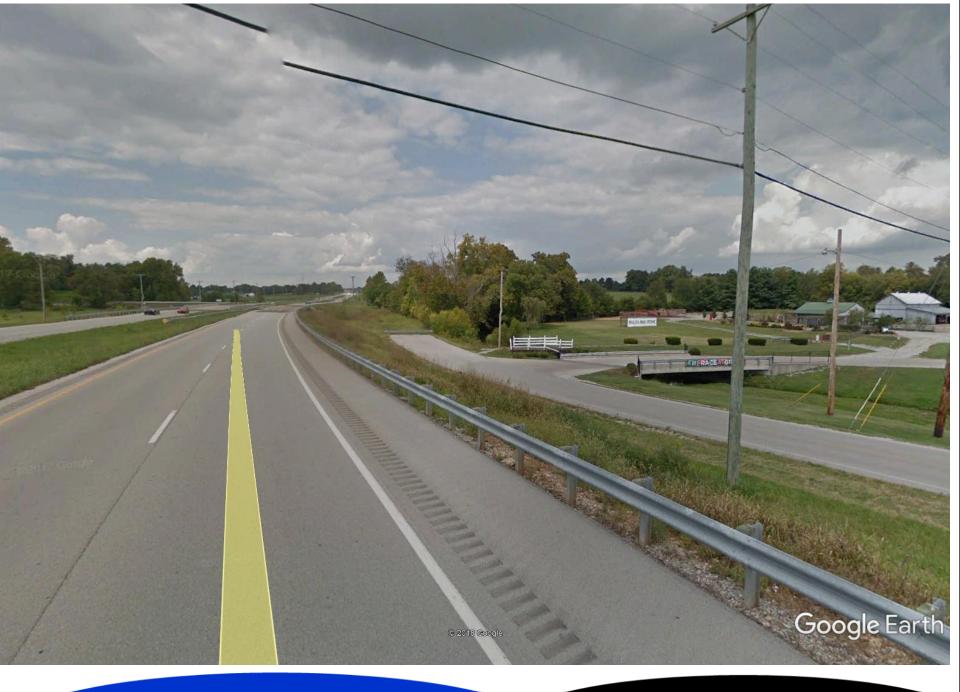
#### **KYTC Plan Review**

- Take a few minutes...can you visualize the existing conditions?
- Can you visualize the designed solution?
- In this particular area, what may have been a problem corrected by the design solution?
- Who did it impact and how?













# Thank you!

- Standards and consistency can lead to efficiency
- The plans are the most impactful communication device from design to construction
- …Learn their expectations and meet them

