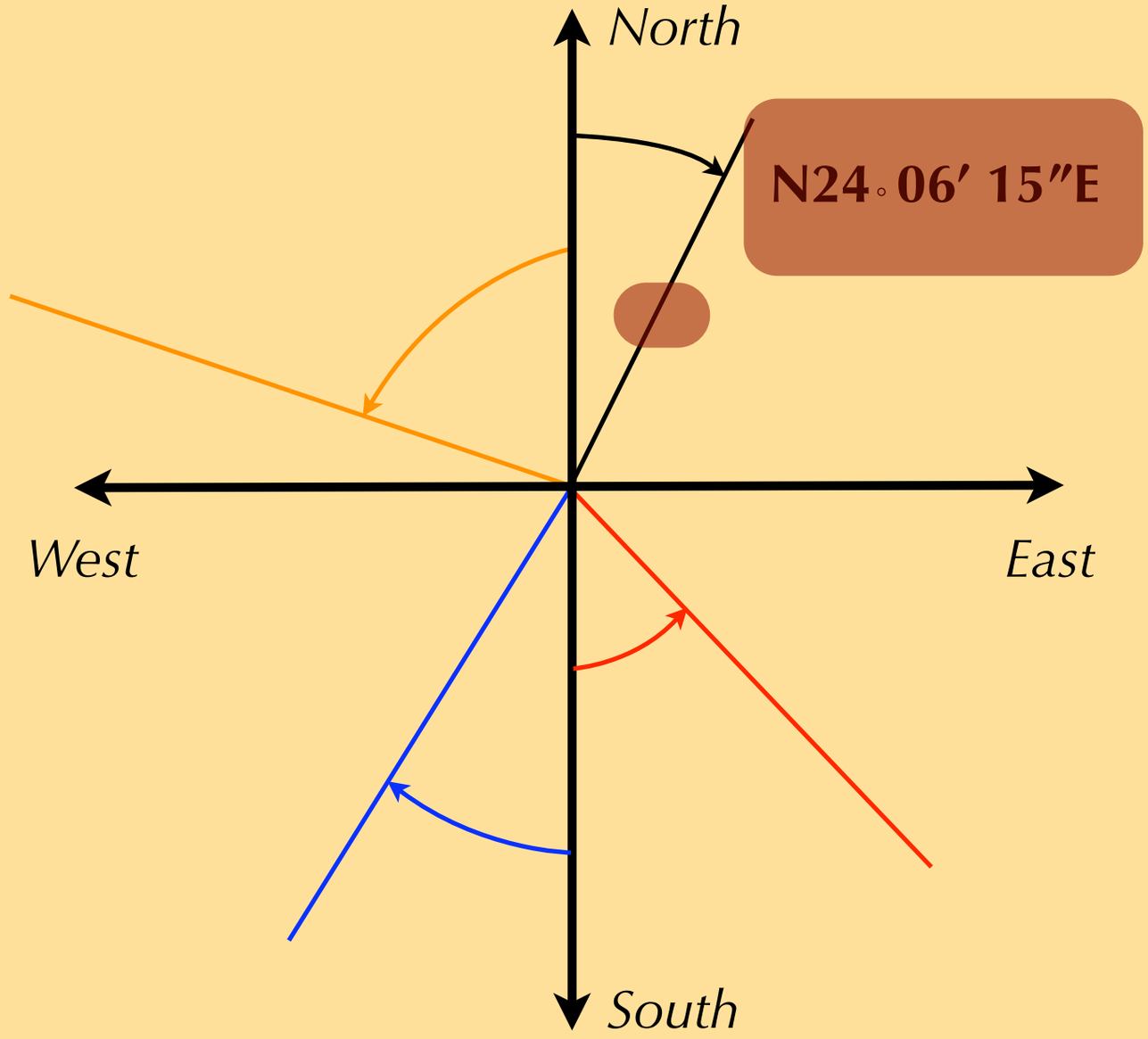
Circular Curve Information: Angles Bearings & Arcs

- ***BEARINGS:*** *the direction of a line specified by a given angle between the line and an established meridian, usually the north-south axis.*

- *An angle less than or equal to 90◦ measured from the North end or South end of a meridian to the east or west (includes quadrant identifier).*

- ***For Example, N 24◦06′ 15″ E***

- ***We will measure and note all our tangents with a BEARING & a Length***

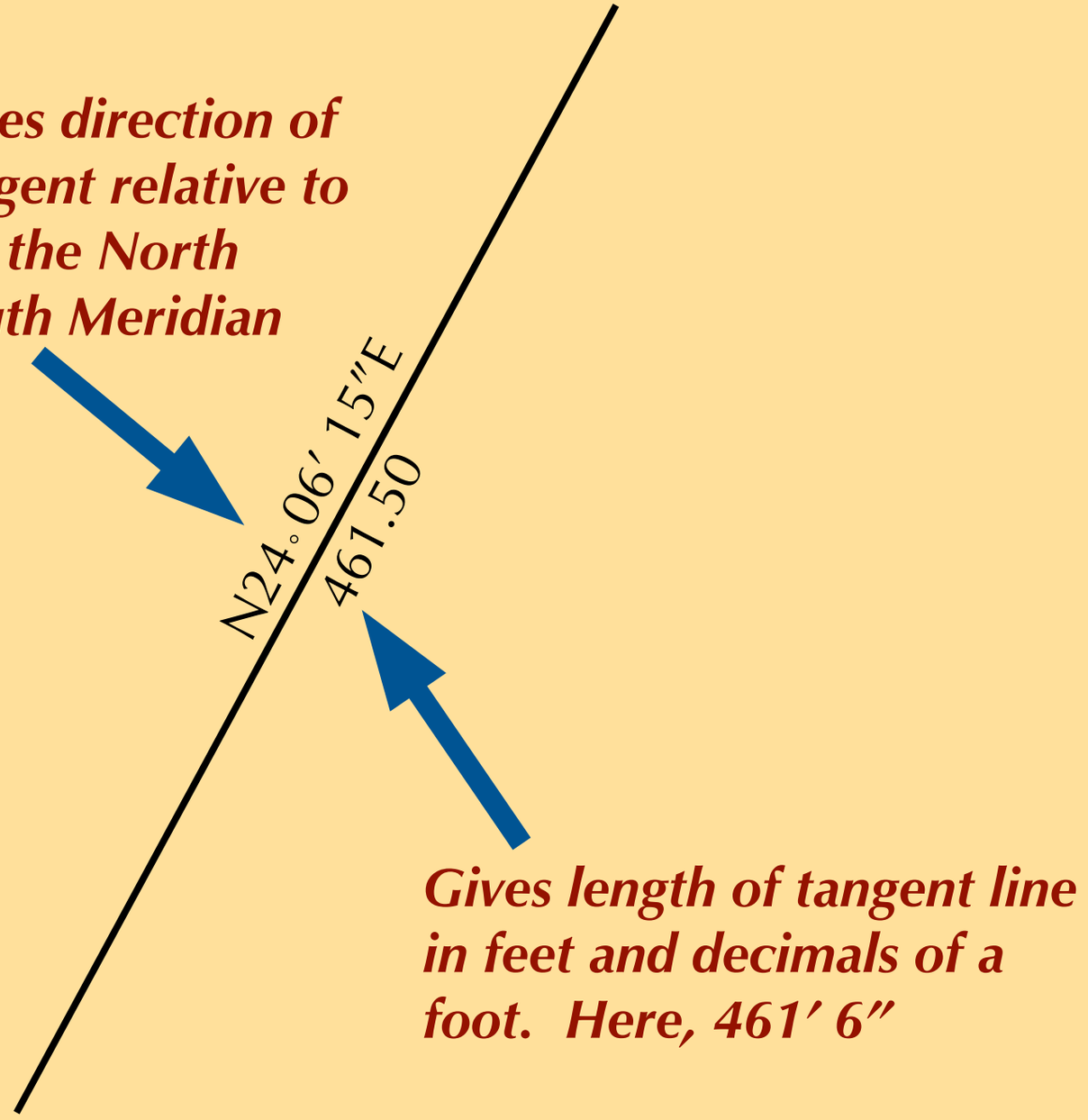


What do we do for this Project with Bearings?

- *All tangents from the starting point on the left side of the sheet and between curves including the ending tangent need to be labeled with bearings and length.*
- *You get the bearings by measuring the angle with a protractor or in ACAD from the north south meridian.*
- *Label the bearings in degrees and minutes read from your protractor, or degrees,minutes & seconds in ACAD. Note, protractor measurements are is not very accurate but we must get the practice and familiarity.*
- *Also label the length of the tangent in feet and inches using the **decimal format**. Approximate the inches as best you can reading from your scale, or give them accurately in ACAD.*

Circular Curve Information:Tangents

- ***Tangents:*** *All tangents on our road project need a bearing & a length.*
- *Measured and Noted along the Center Line of an element ~ our road in this case*
- *Denotes a direction & distance of travel, from a starting point to an ending point with a bearing and a length.*



Gives direction of tangent relative to the the North South Meridian

Gives length of tangent line in feet and decimals of a foot. Here, 461′ 6″

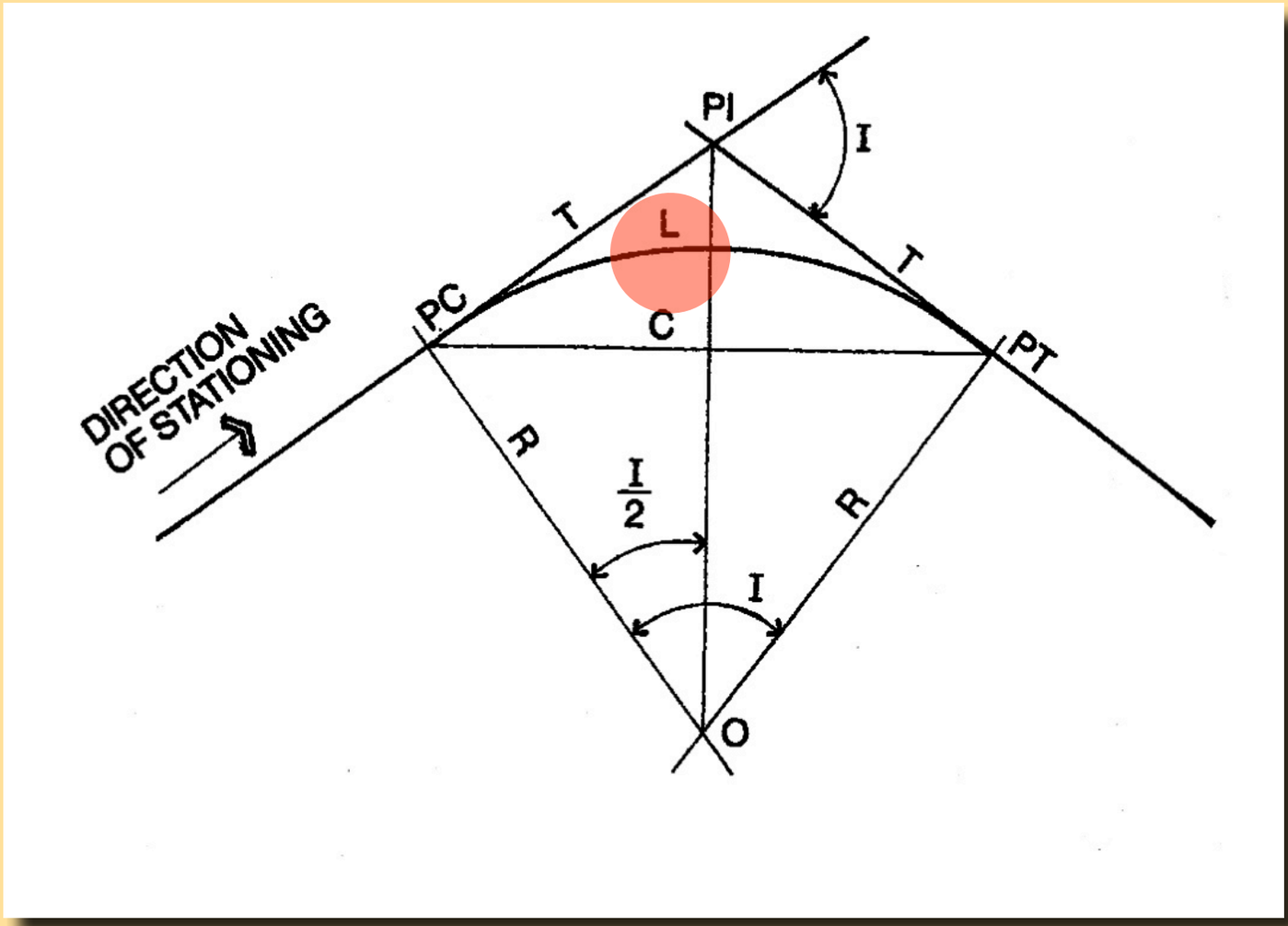
Calculations ~ The Length of Curve (L)

- ***The Length of Curve (L)*** *The length of the arc from the PC to the PT.*

- *Note,* ***a whole station may occur along L*** *and must be indicated on your plan*

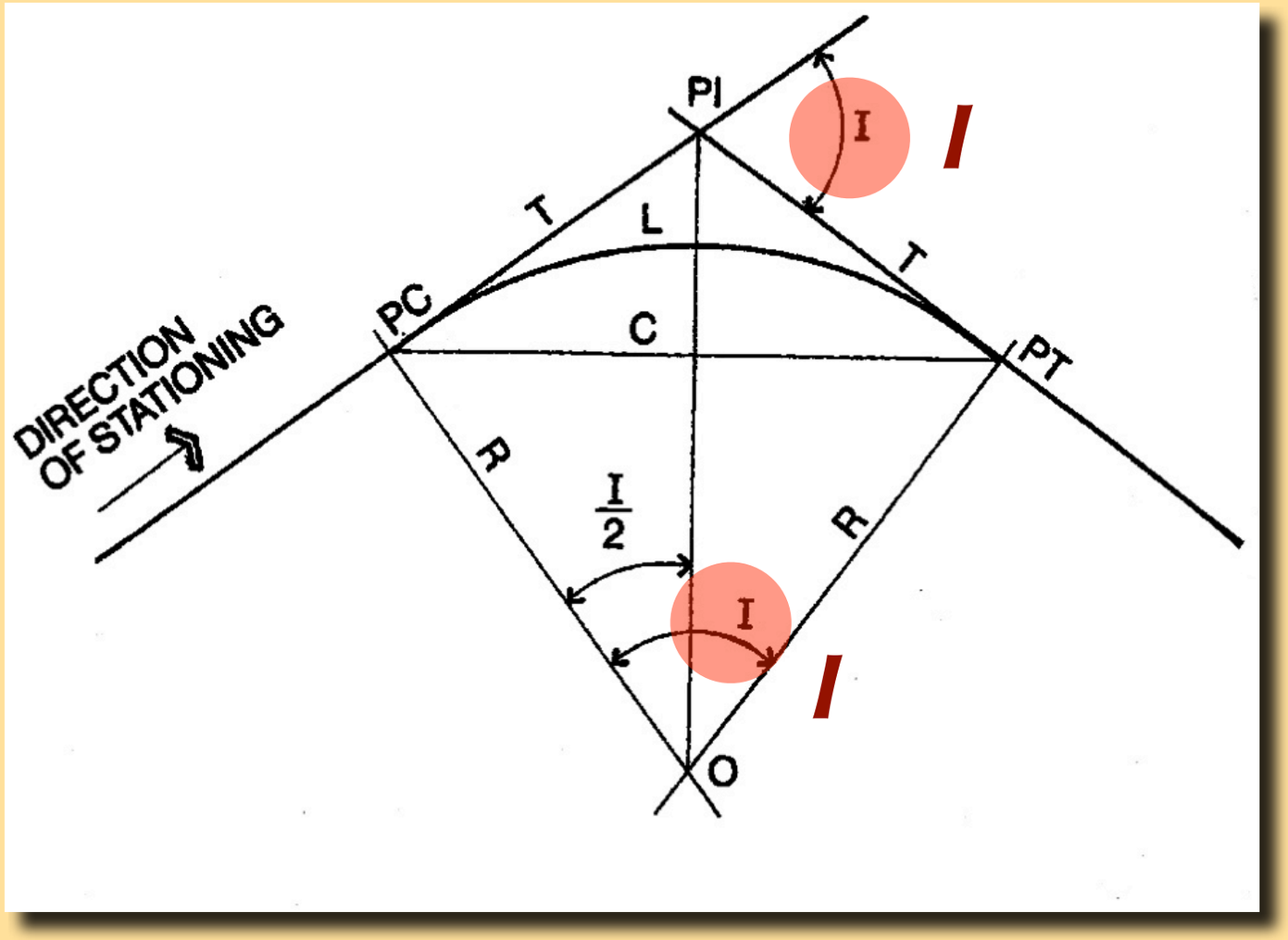
- *Use the following formula:* ***L = (2πR) x I / 360°***

Where Pi = 3.14 *&*
I= Included Angle measured with your protractor or in ACAD



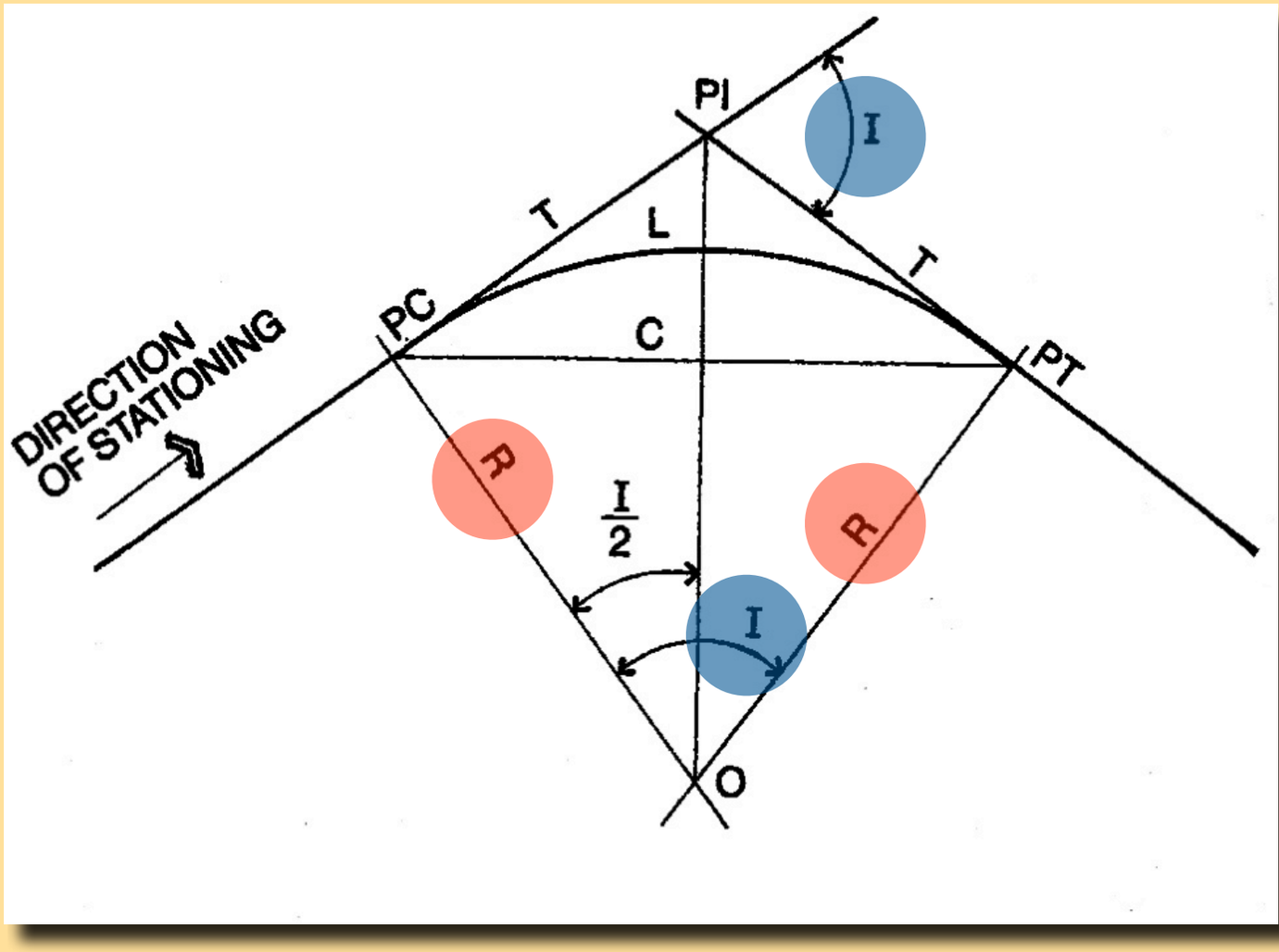
What to Measure? What to Calculate

- ***(I)=Included Angle*** *Measure with a protractor, convert to Degrees and Minutes. Or get in ACAD.*



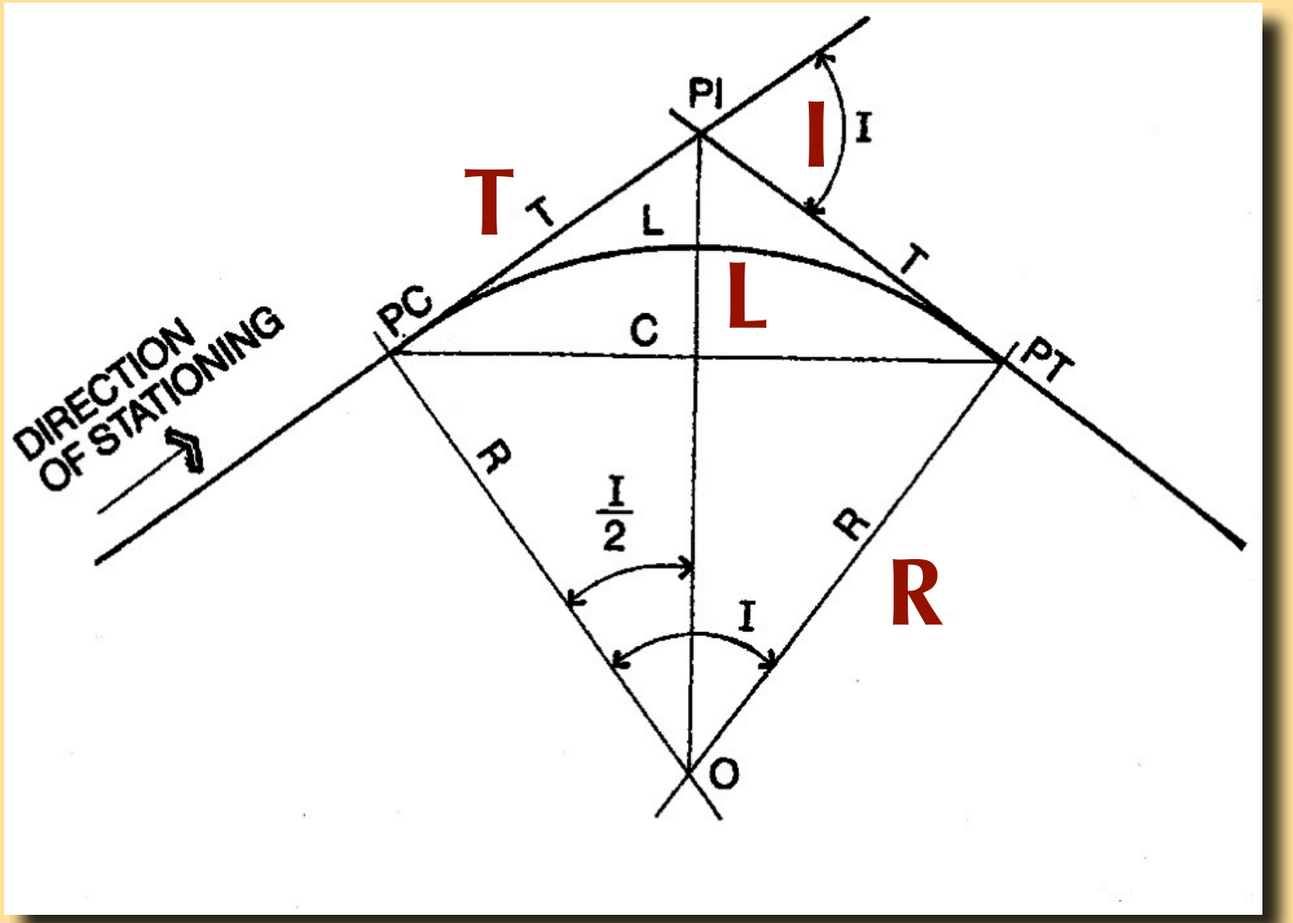
What to Measure? What to Calculate

- ***(I)*** *Measure with a protractor, or in ACAD,convert to Degrees, Minutes, & Seconds.*
- ***(R)= Radius*** *You decide based on design speed. We started with 250 ft. This is a minimum.*
- *You radius will vary depending on your design.* ***Measure the Radius with your scale or in ACAD.***
- *Clearly draft and mark you radii and radius points (0)on trace mockups so you can see them*



What to Measure? What to Calculate

- ***(I) Included Angel*** *Measure with a protractor, convert to Degrees and Minutes.*
- ***(R) Radii*** *You decide based on design speed. We started with 250 ft. This is a minimum. Vary this..*
- ***(L) Length of Curve*** *You must calculate this using the formula.*
- ***(T) Tangents*** *Measure with a scale and protractor or in ACAD. Convert to Bearings & length. Label on Tangent.*



For each curve provide the following data in a chart:

CURVE NO. 1

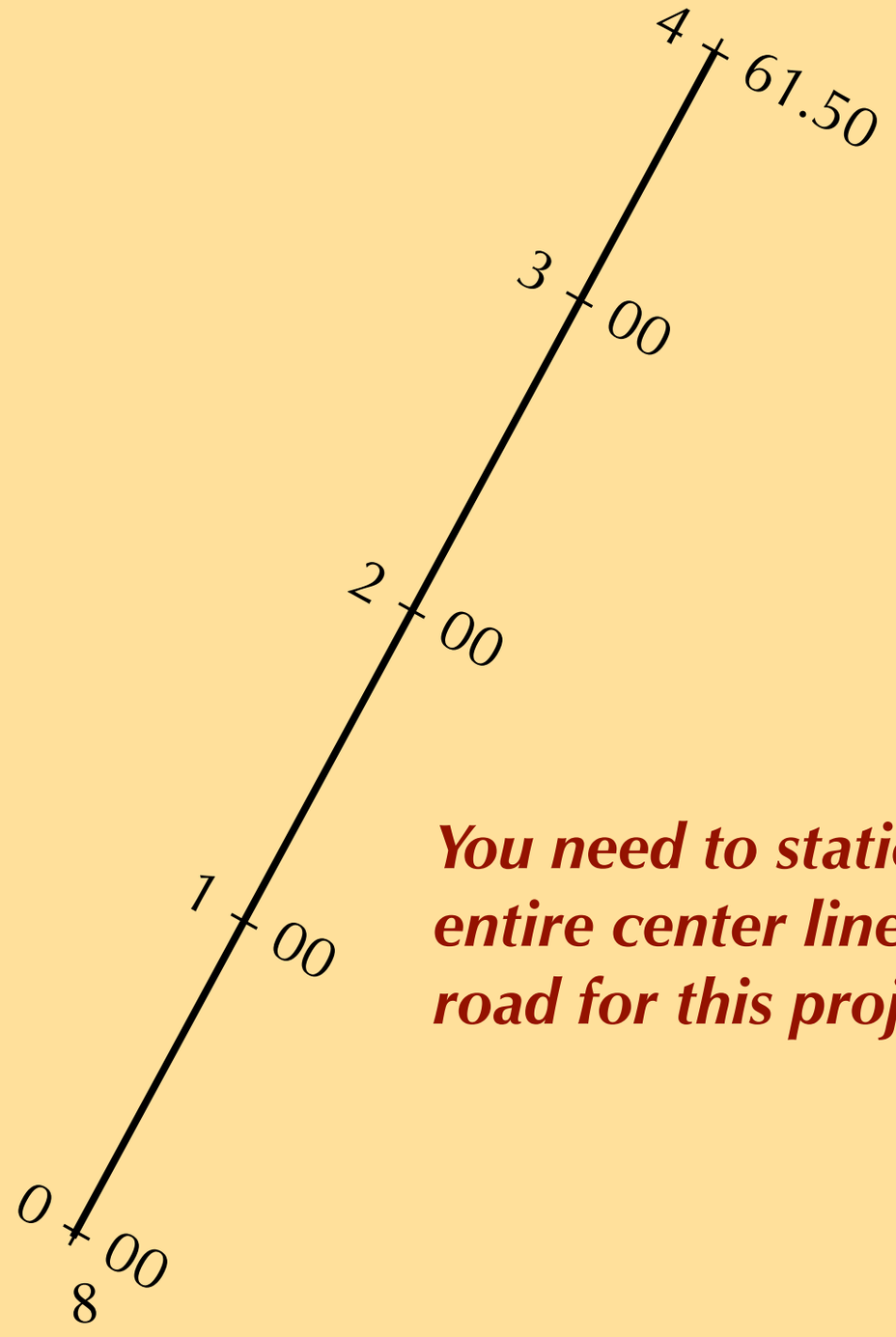
R =

L =

I =

Want to Measure: Record Stationing

- ***Where to Station:***
- ***Beginning Point*** *(POB) 0 + 00*
- ***Every Full Station*** *1 + 00, 2 + 00, 3 + 00, etc. (including along Tangents and Curves).*
- *At the* ***Ending Point*** *4 + 61.50*
- *At the* ***PC and PT of each curve.***
- *Stations are measured at the scale of the drawing.*



You need to station the entire center line of your road for this project

Notes on Grading the Road

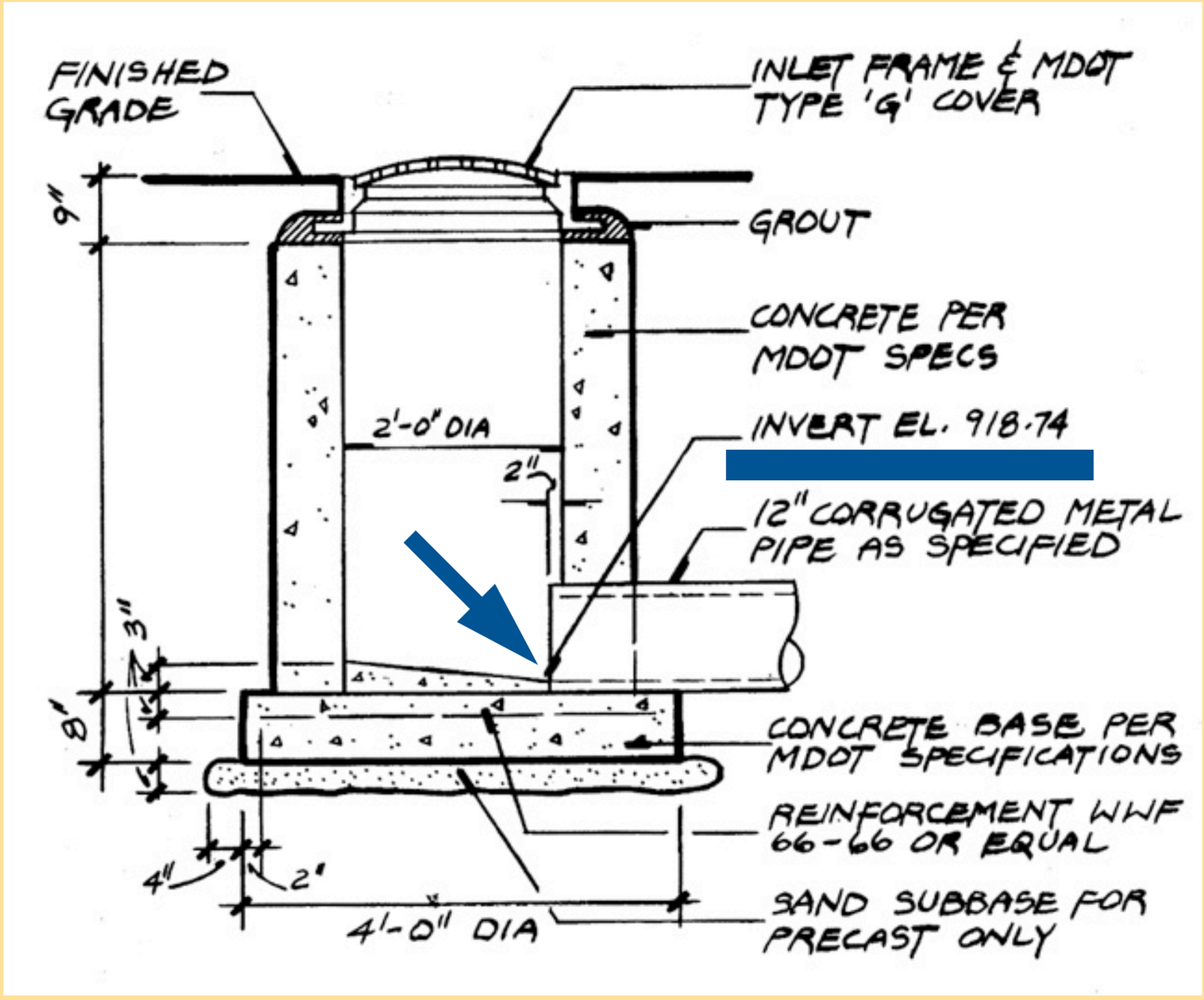
- *Avoid multiple changes in the slope of your road.*
- *Go for long continuous gradients with as few changes in longitudinal slope of the road as is practical*
- *Consider the balance of cut and fill when determining the slopes of your road*
- *Remember when you change the grade of your road, the cross slope contour angles of shoulders and side walk will change*
- *Drain run off on adjacent land areas away from the road*

Area Drain Inlet

- *Used for small discreet areas of paved surfaces*
- *Small overall dimensions of Lid and Pipe it drains into*
- *Typical of the type we might have specified our our earlier residence patio*

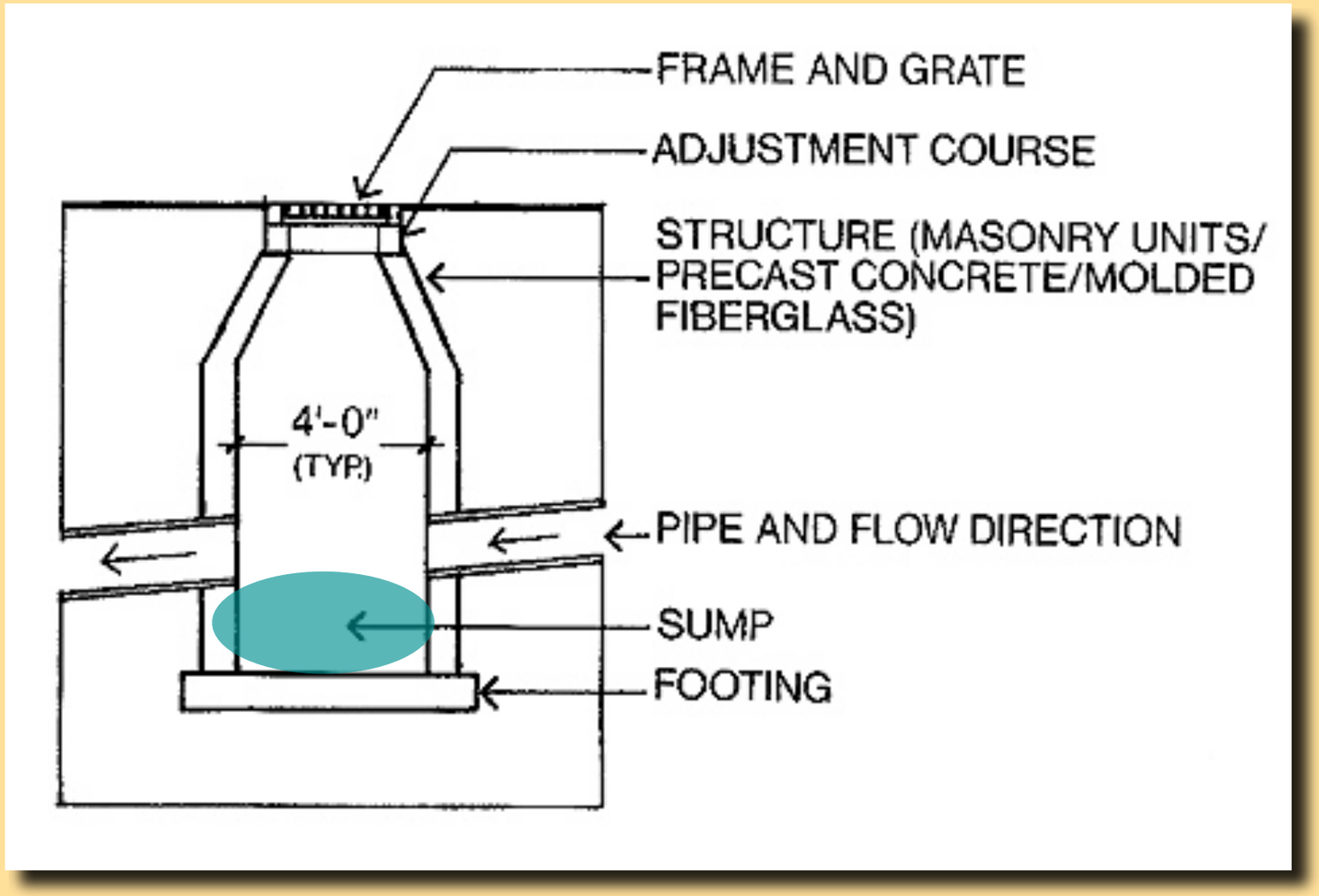
Drainage Structures ~ Drain Inlet (DI)

- ***Drain Inlets*** *have only an outlet pipe. They* ***have no inlet pipe.***
- ***Drain Inlets have no Sump*** *below the outlet pipe*
- *Note Smaller Diameter than CB's*
- *Note Invert Elevation at bottom of pipe*



Drainage Structures ~ Catch Basin (CB)

- *Note **Sump**: Volume of space below pipes entering & leaving for debris & sediment to settle & Collect*
- *Catch Basins have a **pipe in & out***
- *For our project, the **outlet pipe shall have an invert@ the CB 2″ lower than the invert of the pipe coming into the CB where it enters***

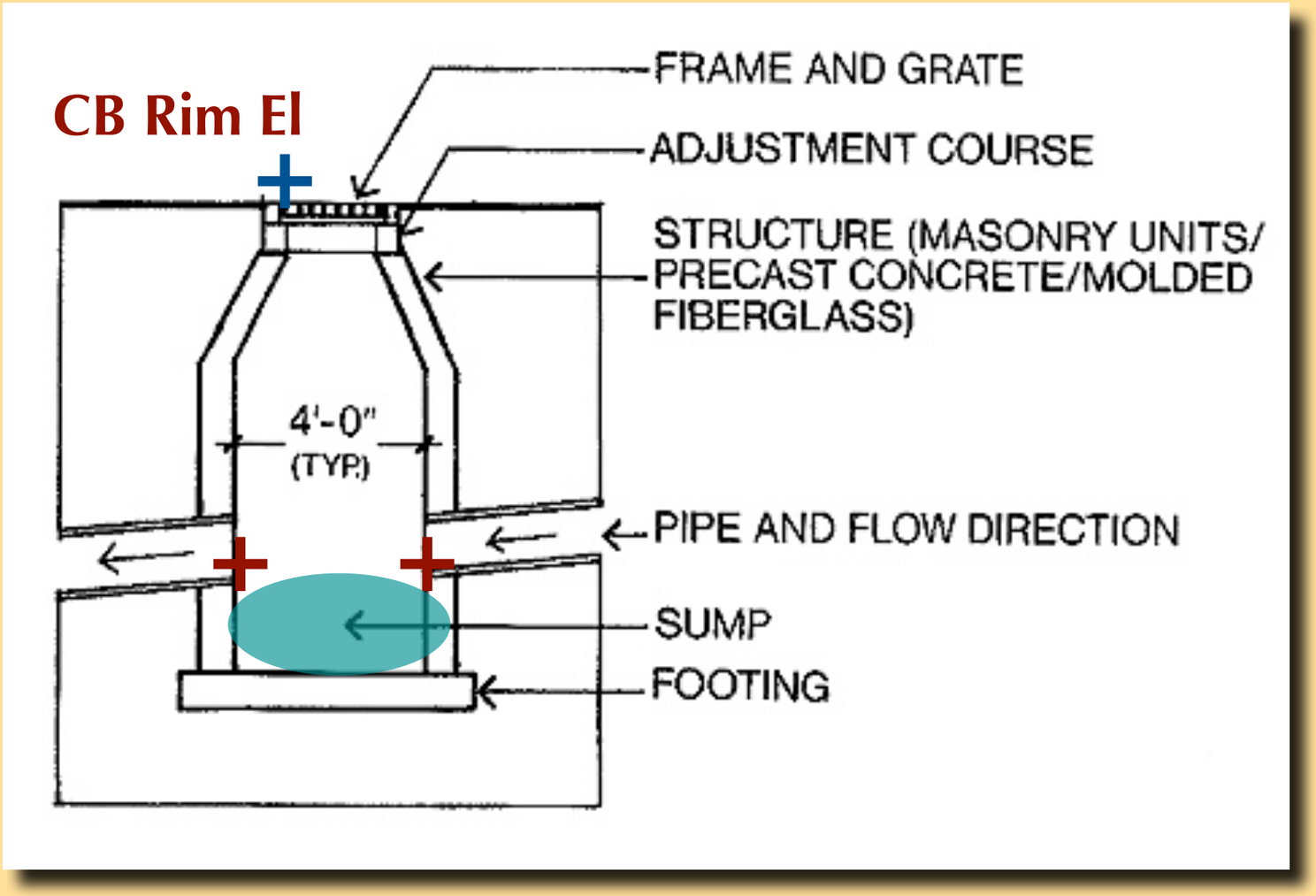


Catch Basin (CB) Required Elevations

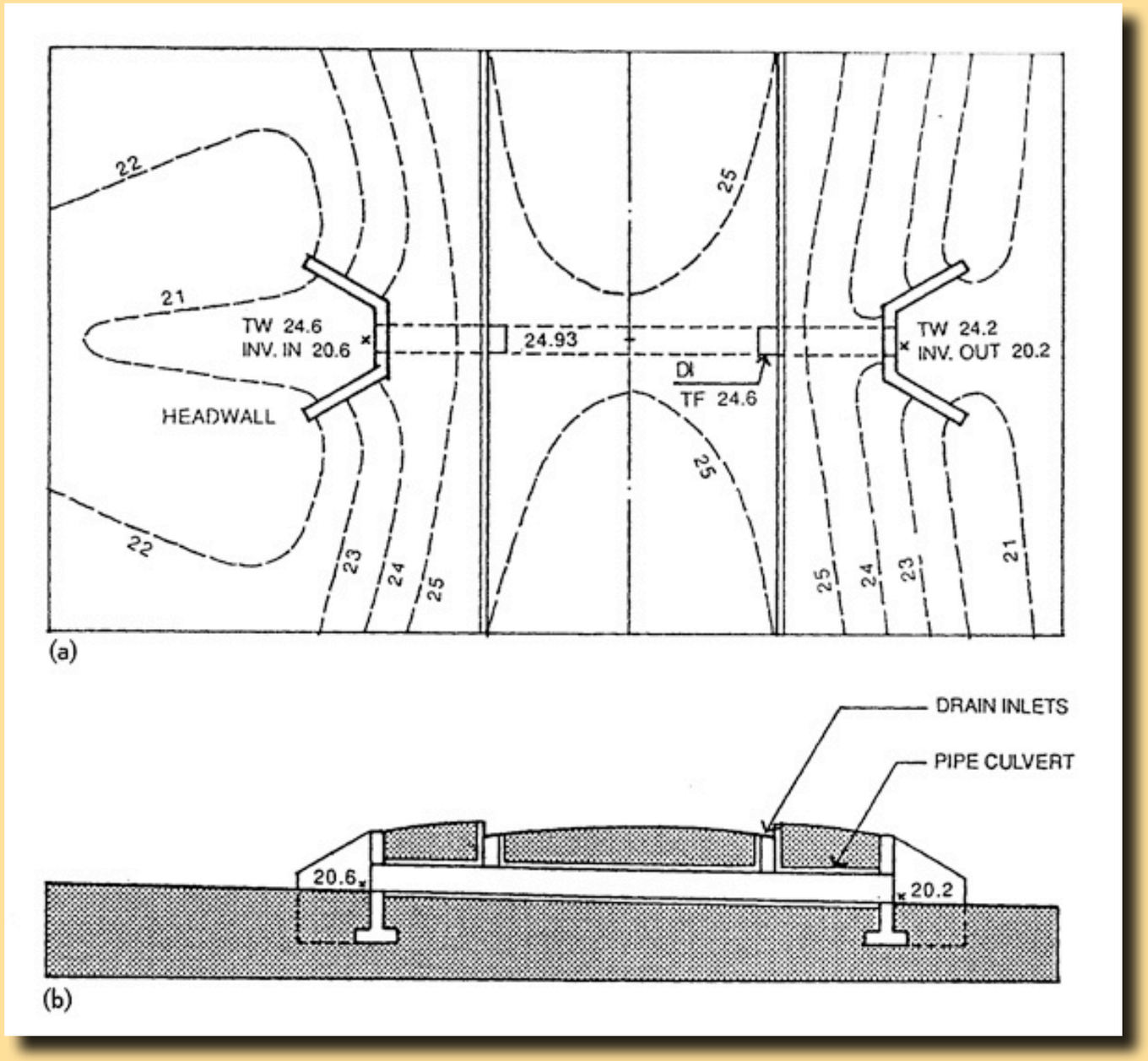
- *Note the **red plus marks**. These represent the **Invert Elevation of the Pipe.***

- *The Invert Elevation represents the elevation of the **Bottom of the Pipe** as it enters or leaves the CB.*

- *The **CB Rim El** is the **elevation of the top of the grate** cover flush with the road/paved surface.*

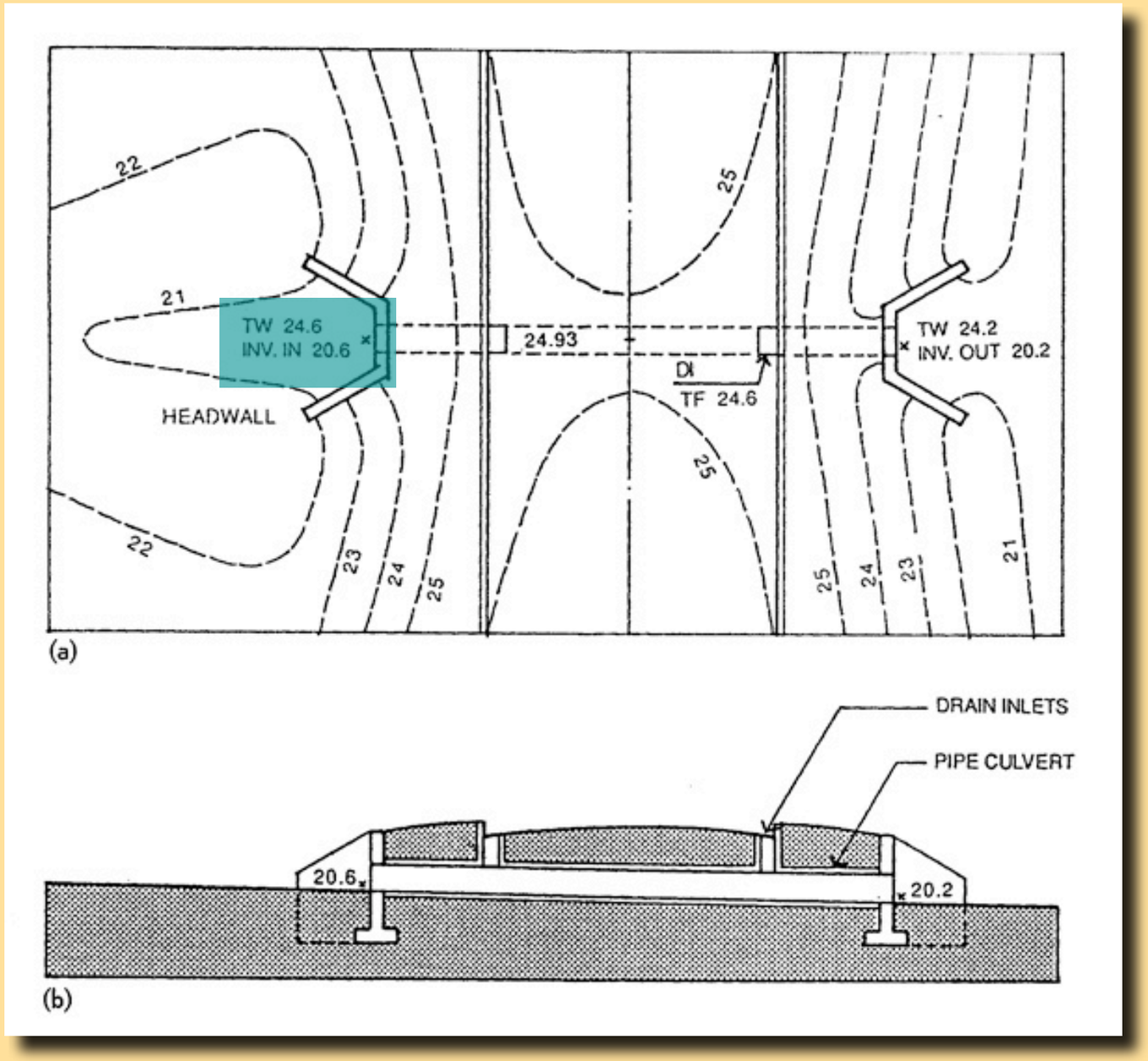


Culvert Basics & Required Information



Culvert Basics & Required Information

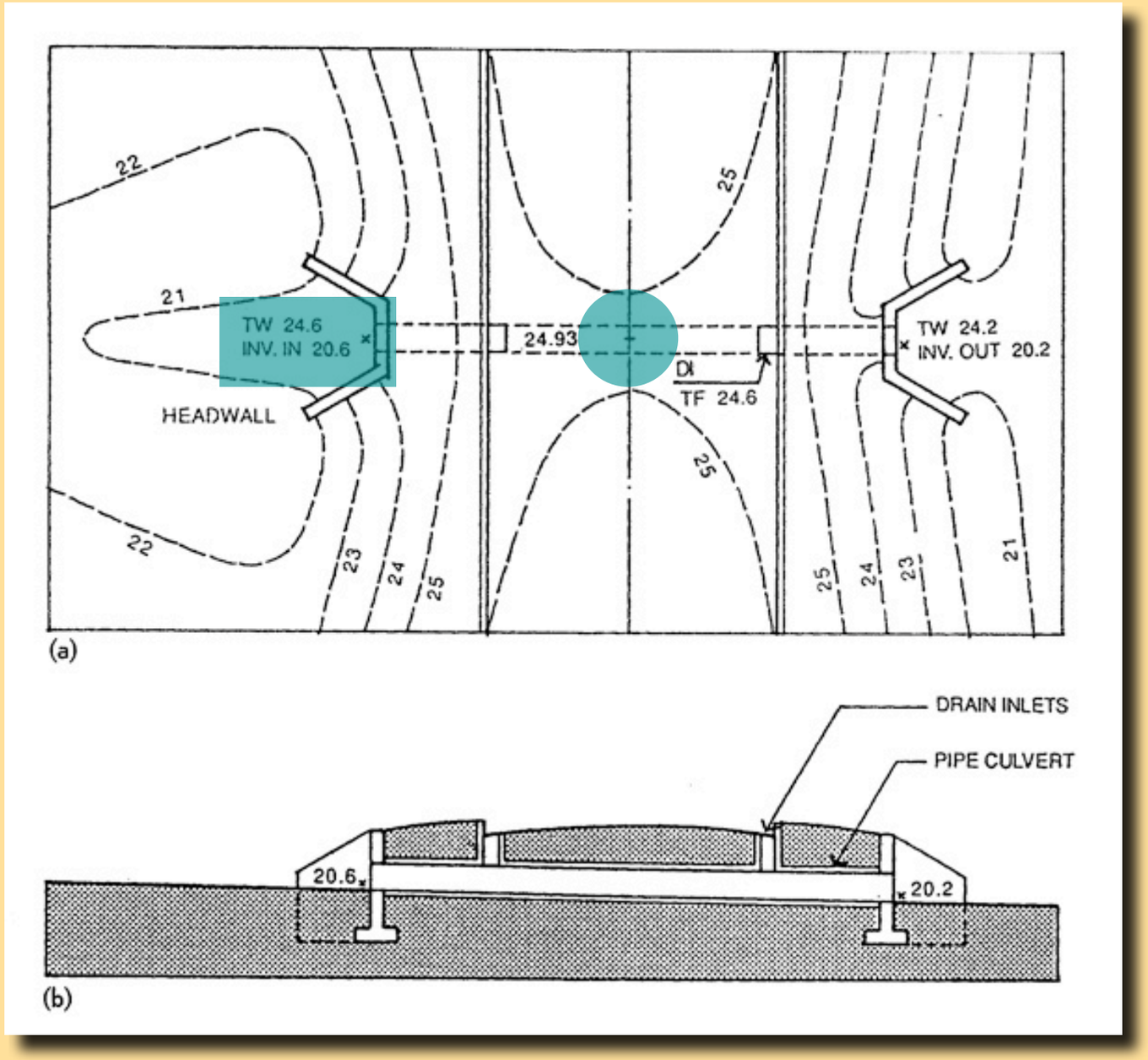
Invert Elevation *(INV. IN, INV. OUT.) Invert refers to the Elevation of the* ***Bottom of the Pipe***



Culvert Basics & Required Information

Invert Elevation *(INV. IN, INV. OUT.) Invert refers to the Elevation of the* ***Bottom of the Pipe***

INV. EL @ CL of road must be 2′-3″ above top of pipe directly below it *to achieve a minimum of 2 FT of cover* ***over the top of the pipe.***



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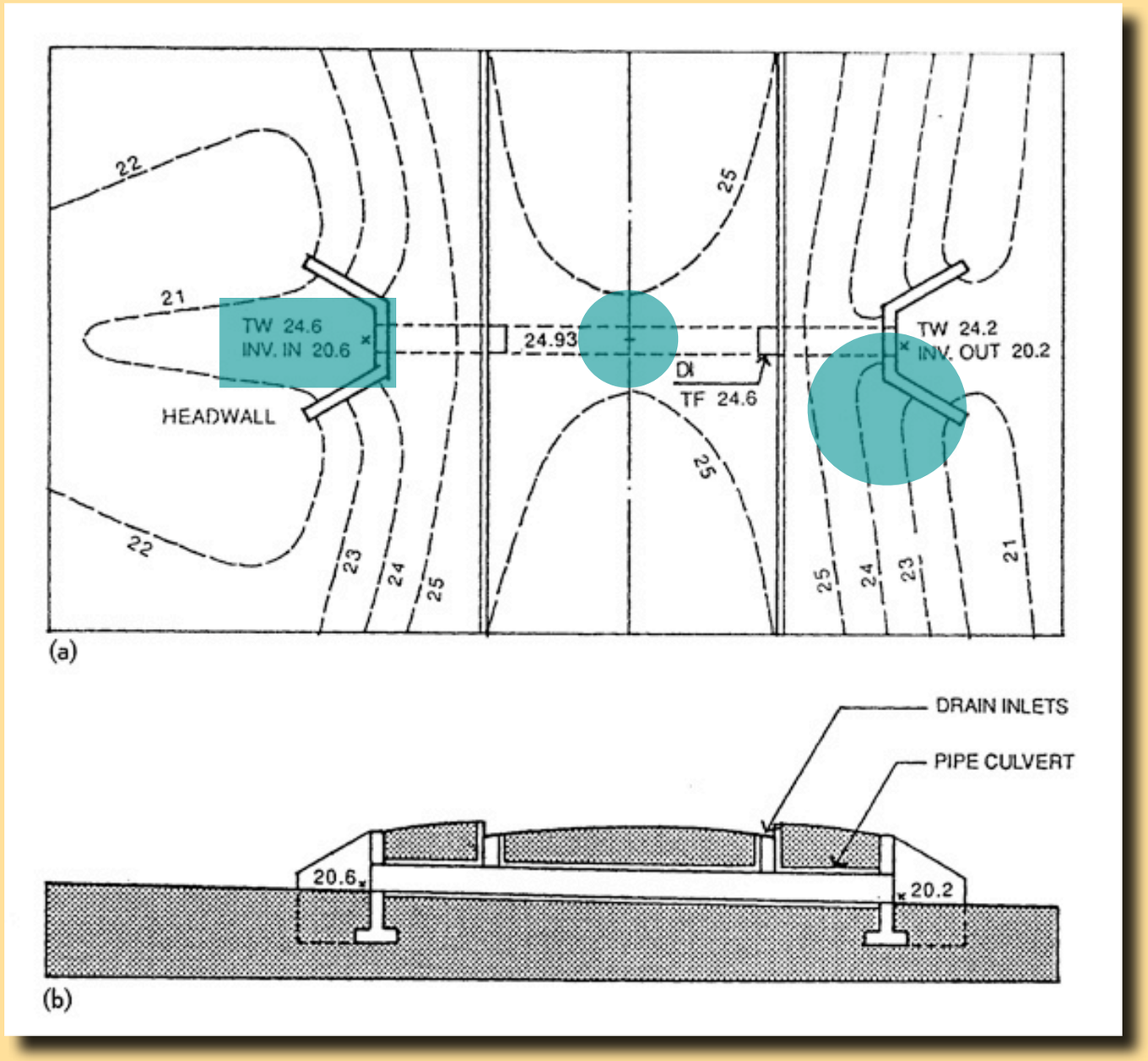
Note interaction of contours with head wall



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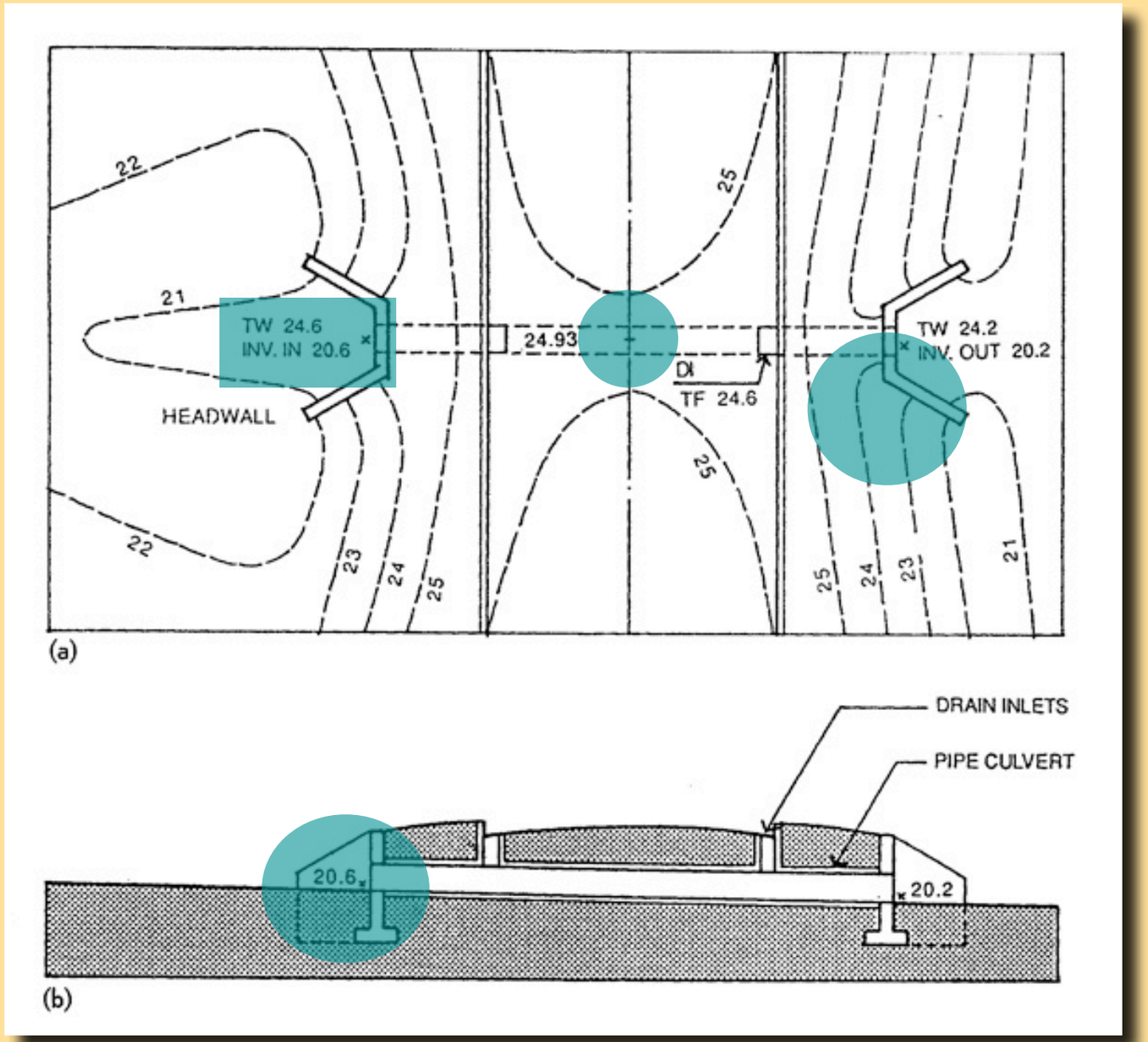
Note interaction of contours with head wall

Note drafting of head wall beyond in concept section/elevation.

Why is headwall needed?



Culvert Basics ~ Understanding what is Happening

1. *Note longitudinal flow direction on road*

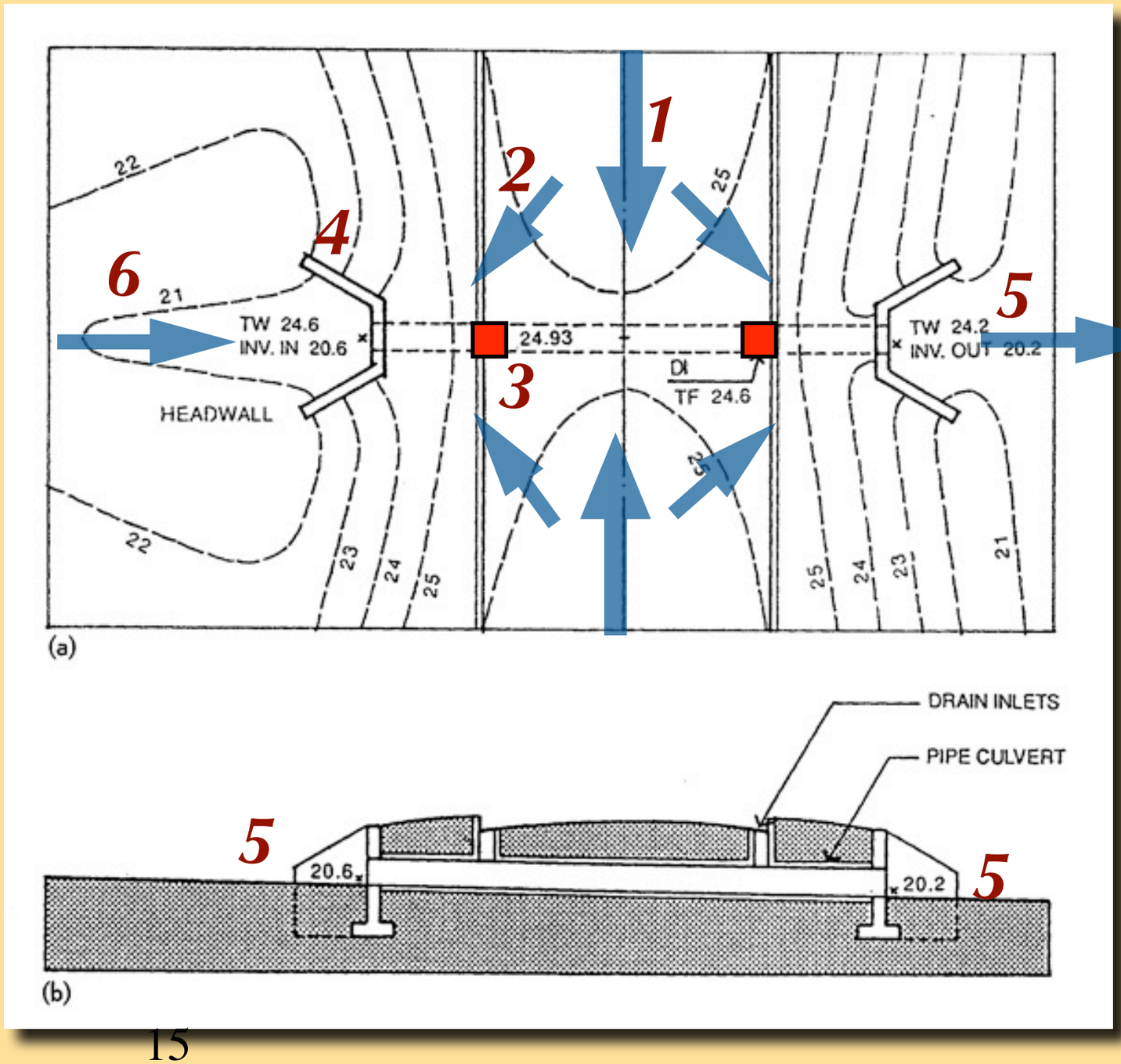
2*. Note water flow direction of cross slope of crowned road*

3. *Note DI/CB locations in red against curb*

4. *Note Contours at Head Wall of Culvert*

5. *Note Invert Elevations at outlet of culvert pipe & drafting of headwall beyond in section elevation*

6. *Flow direction through pipe*



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End of Today's Presentation