Chapter 4a - Answers to Bridge Structure Questions

Answers to Bridge Superstructure Questions

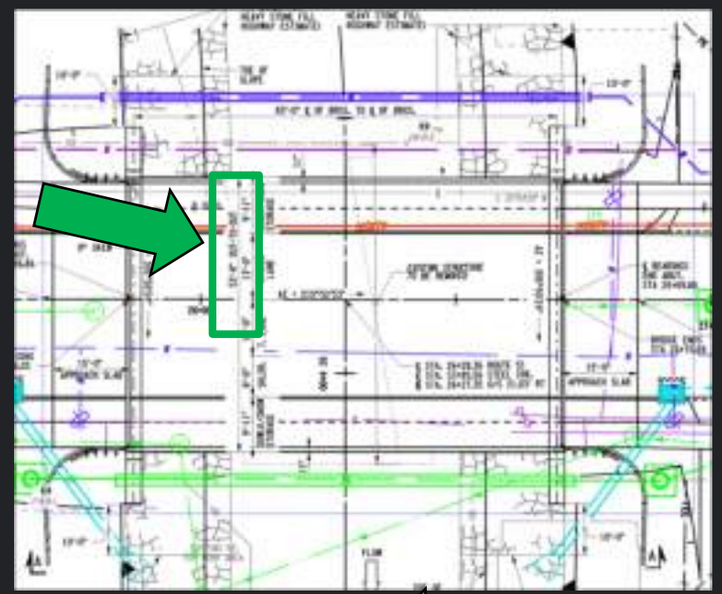
Route 51 over Steele Creek

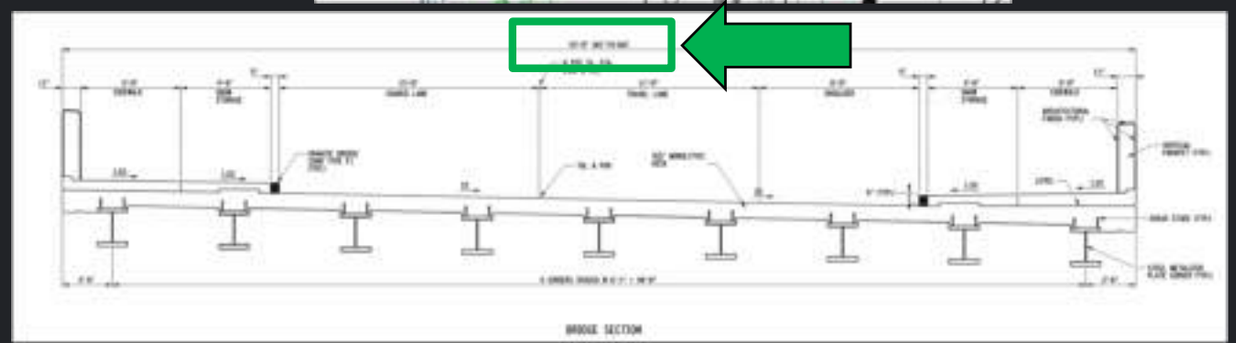
ExPr

1. In feet, how wide is the bridge superstructure, as measured from the outside face of parapet to outside face of parapet?

Answer: 53’-8” = 53.67 feet

Out-to-out dimensions provided on both ST-1 and ST-2. After locating them in units of feet-inches, convert to feet.





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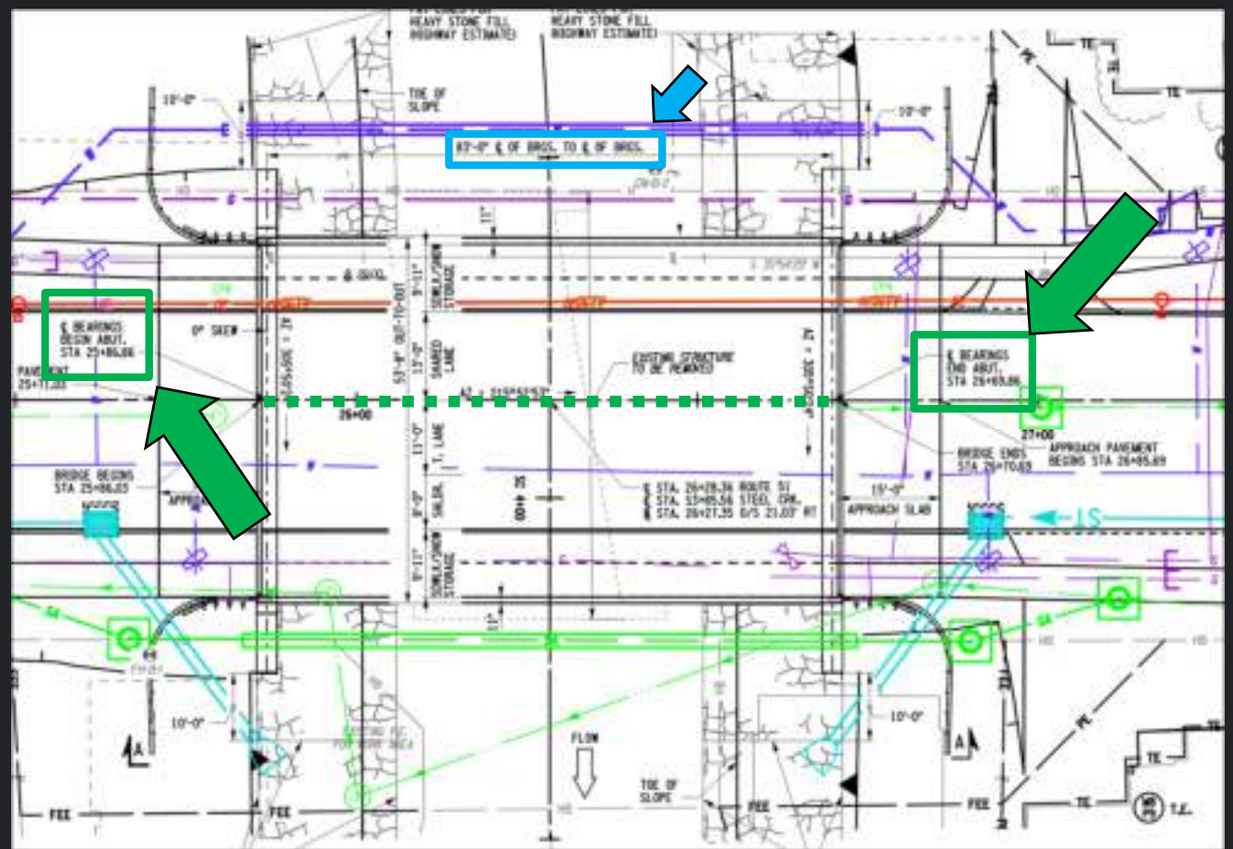
2. In feet, what is the distance between the abutments as measured to the center line of bearing to center line of bearing?

Answer: 83 feet



Calculate the distance between the "Centerline Bearings Begin Abut." and "Centerline Bearings End Abut." stations on plan.

End = 26+69.86 = 2669.86 feet

Begins = 25+86.86 = 2586.86 feet

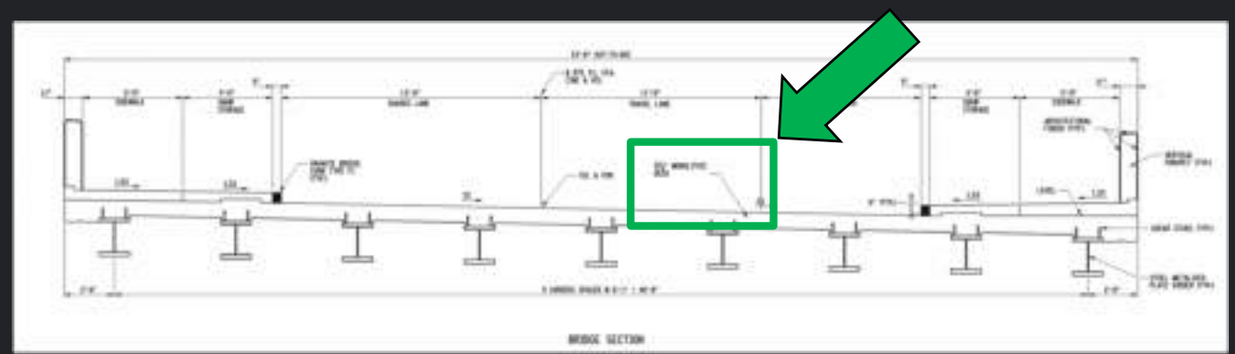
Distance between = 83.00 feet

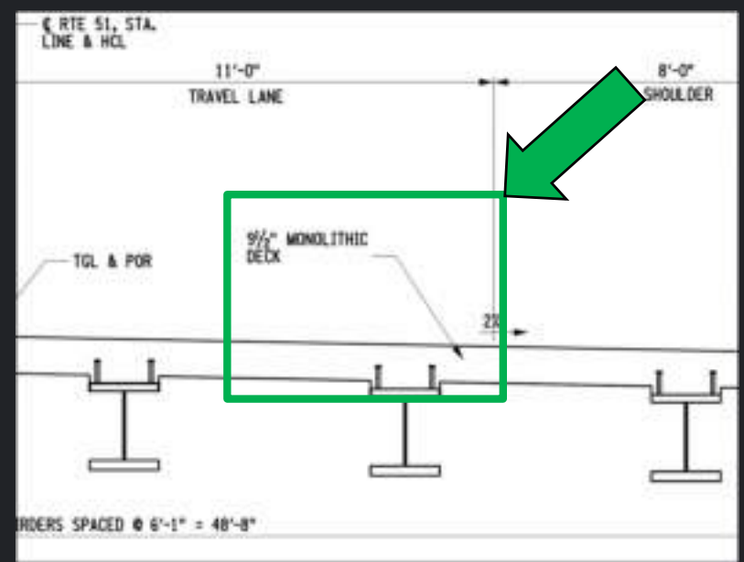
Distance also provided directly on plan is 83'-0".

3. In inches, how thick of a concrete slab must be poured on the steel girders, in inches?

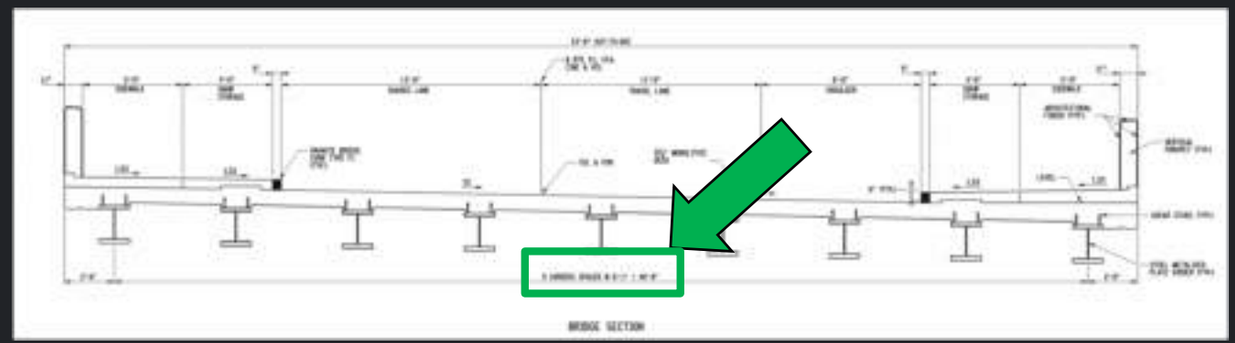
Answer: 9.5 inches

The thickness of the “monolithic” deck is called out on ST-2.



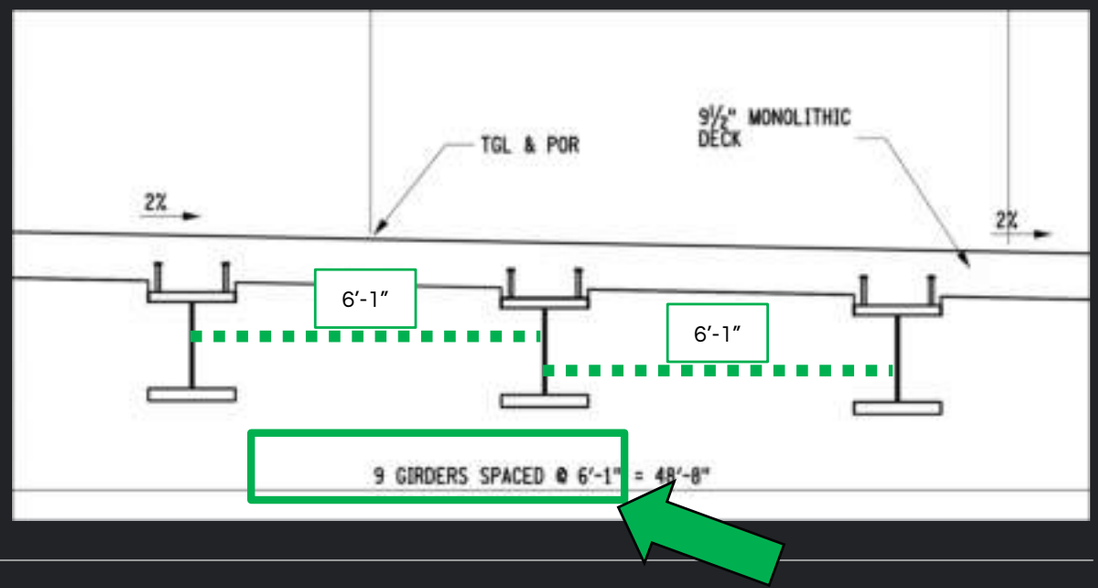


4. In inches, what is the typical spacing between steel girders?



Answer: 73 inches

The spacing between girders is 6'-1", as shown on ST-2.



The question asks for the information in inches, so 6'-1" must be converted to inches by:

6 Feet x 12 in/ft = 72 inches
+ 1 Inch = 1 inch

Total inches = 73 inches.

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5. In square feet, what is the surface area of the Approach Slab Pavement near Station 26+85.69?

Answer: ~778 square feet

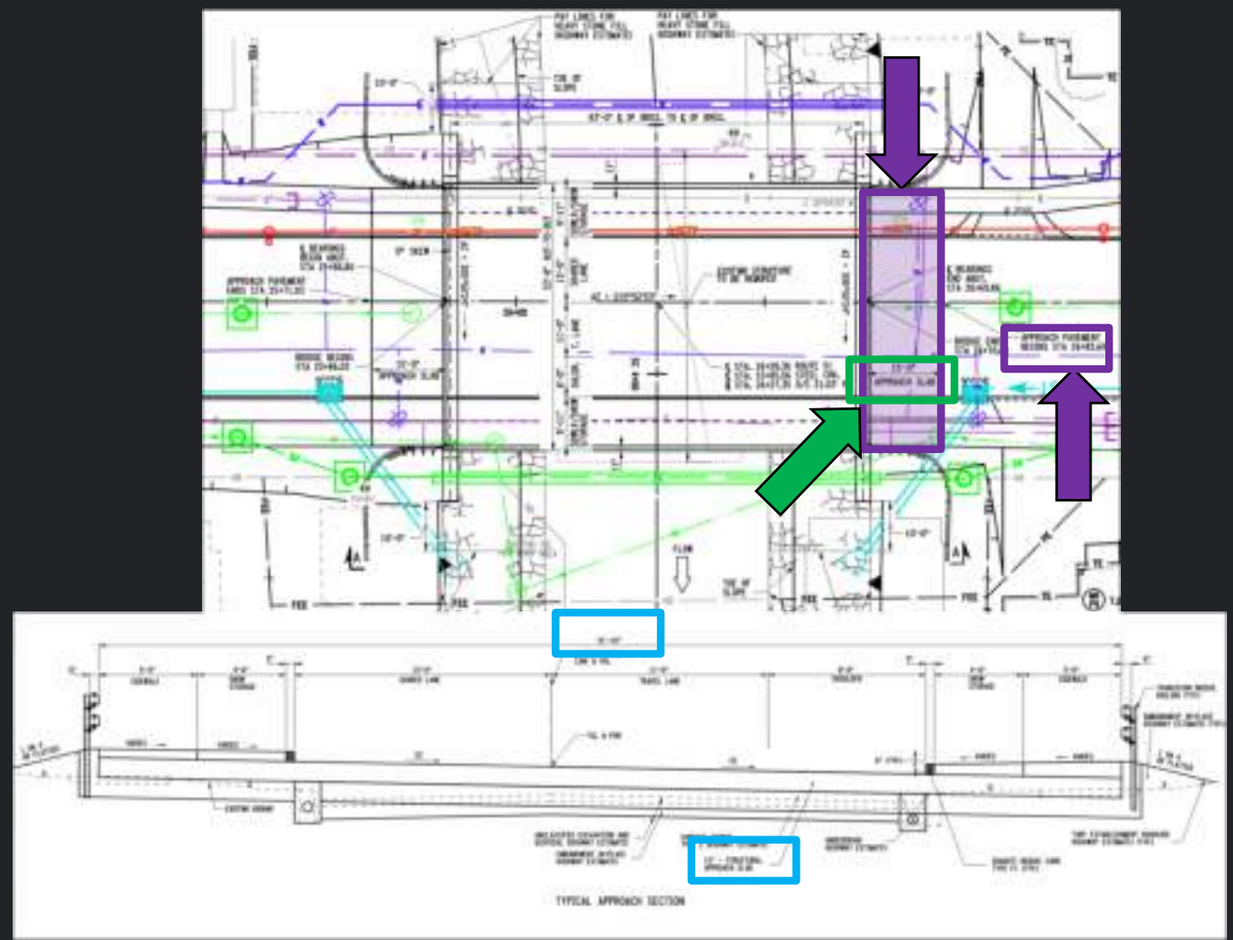
First, locate the "Approach Slab" near Station 26+85.89.

Second, the length is provided as 15'-0", which is 15.0 feet.

Third, the width of the approach slab is provided on the "Typical Approach Section on ST-1 (51'-10" = 51.83 feet).

Multiply length by width to calculate surface area of a rectangle:

(15.0 feet x 51.83 feet) = ~778 square feet.



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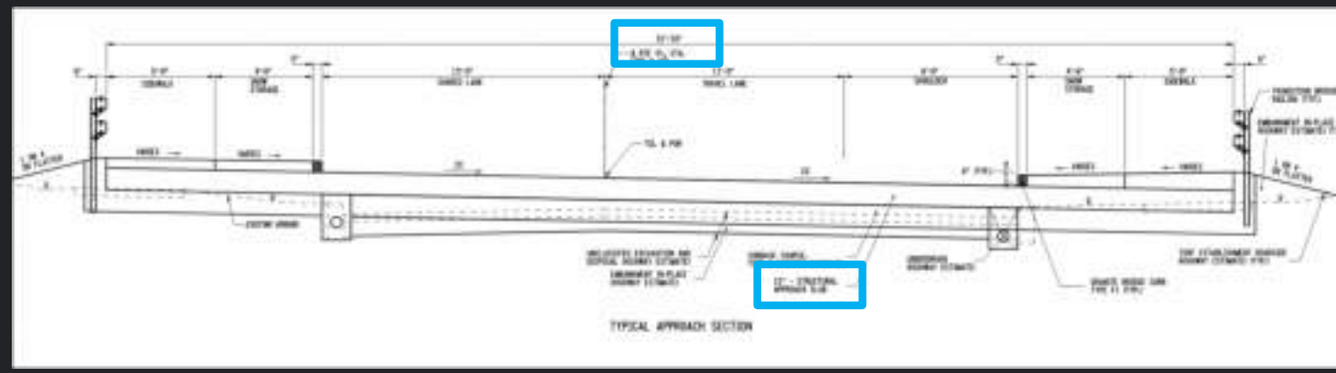
6. In cubic yards, what is the approximate concrete volume of one “approach slab?”

Answer: ~29 cubic yards

The volume of a rectangular prism is length x width x height, or surface area x thickness.

In the last question, we determined that the surface area of the approach slab was 778 square feet.

The thickness of the slab is also shown on the “Typical Approach Section” on ST-2 as 12 inches. 12 inches is the same as 1 foot.



The volume of the approach slab is therefore:

Surface area x thickness = (778 square feet) x (1 foot thick) = 778 cubic feet.

Or Length x Width x Height = (15 feet) x (51.83 feet) x (1 foot) = 778 cubic feet.

Convert cubic feet into cubic yards, using the conversion (27 cuft = 1 cuyd).

$$\frac{778 \text{ cuft}}{} \times \frac{1 \text{ cuyd}}{27 \text{ cuft}} = 778 / 27 = 28.8 \text{ cuyd} = \text{~29 cubic yards}$$

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7. In cubic yards, what is the approximate concrete volume of the main concrete slab cast integral with the girders?

Answer: ~131 cubic yards

The volume of a rectangular prism is length x width x height, or surface area x thickness.

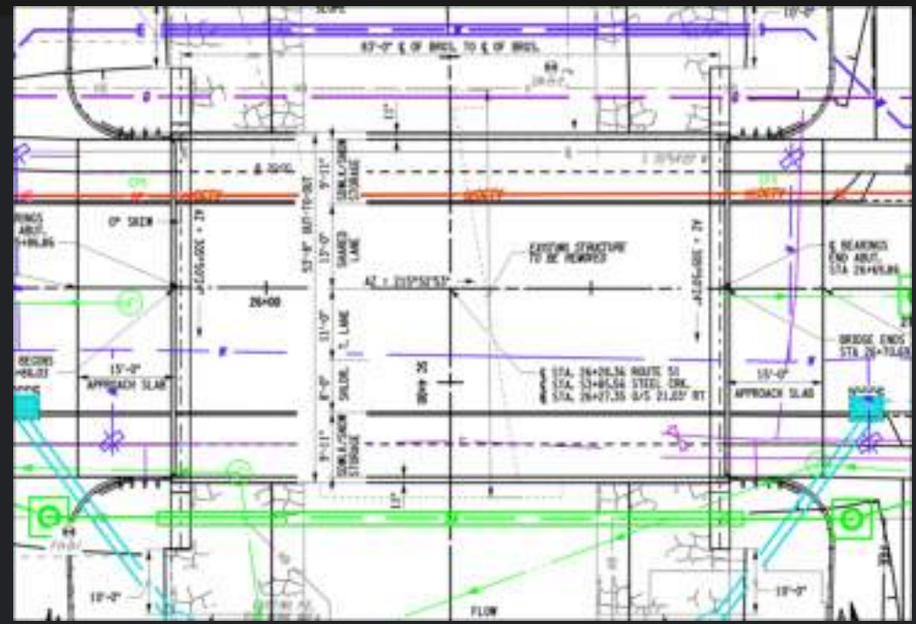
In Question #1, we determined the approx. width of the bridge is ~53.67 feet.

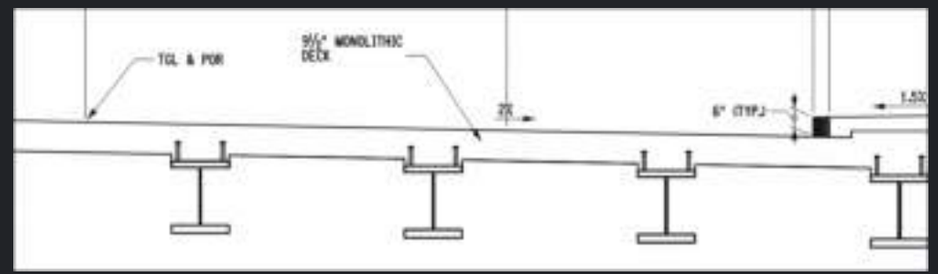
In Question #2, we determined the approx. length of the bridge / parapet is ~83 feet.

In Question #3, we determined the thickness of the concrete slab is 9.5 inches, which is the same as 0.7917 feet.

Volume of the slab is: 53.67′ x 83′ x 0.7917′ = ~3,527 cuft

Convert cubic feet to cubic yards by dividing by 27, or
3,527 cuft / 27 = ~130.6 or ~131 cubic yards.





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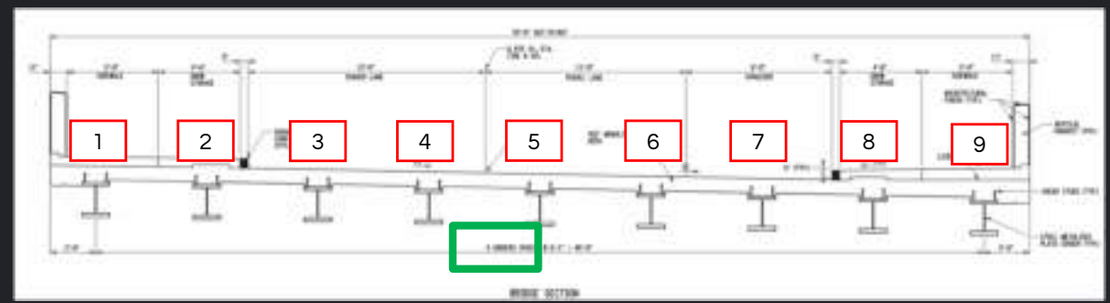
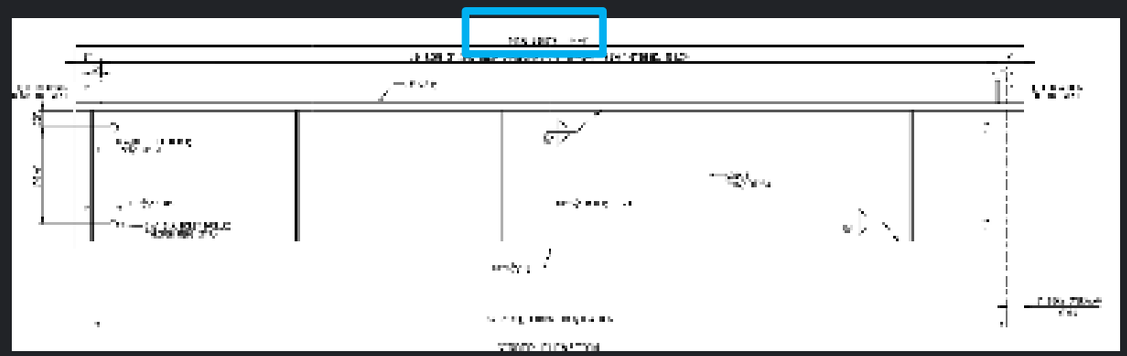
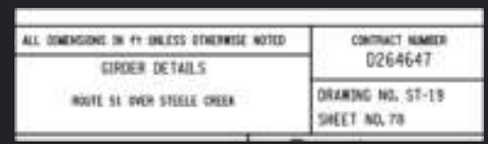
8. In linear feet, what is the total length of steel required for all the steel plate girders in the superstructure?

Answer: 756 feet.







There are nine girders shown on ST-2, and other drawings like ST-17, ST-18.

Each girder is 84'-0" long, as shown on ST-19. (The center to center spacing of its bearing points is 83'-0", but the girder overhangs 6" beyond it on each side).

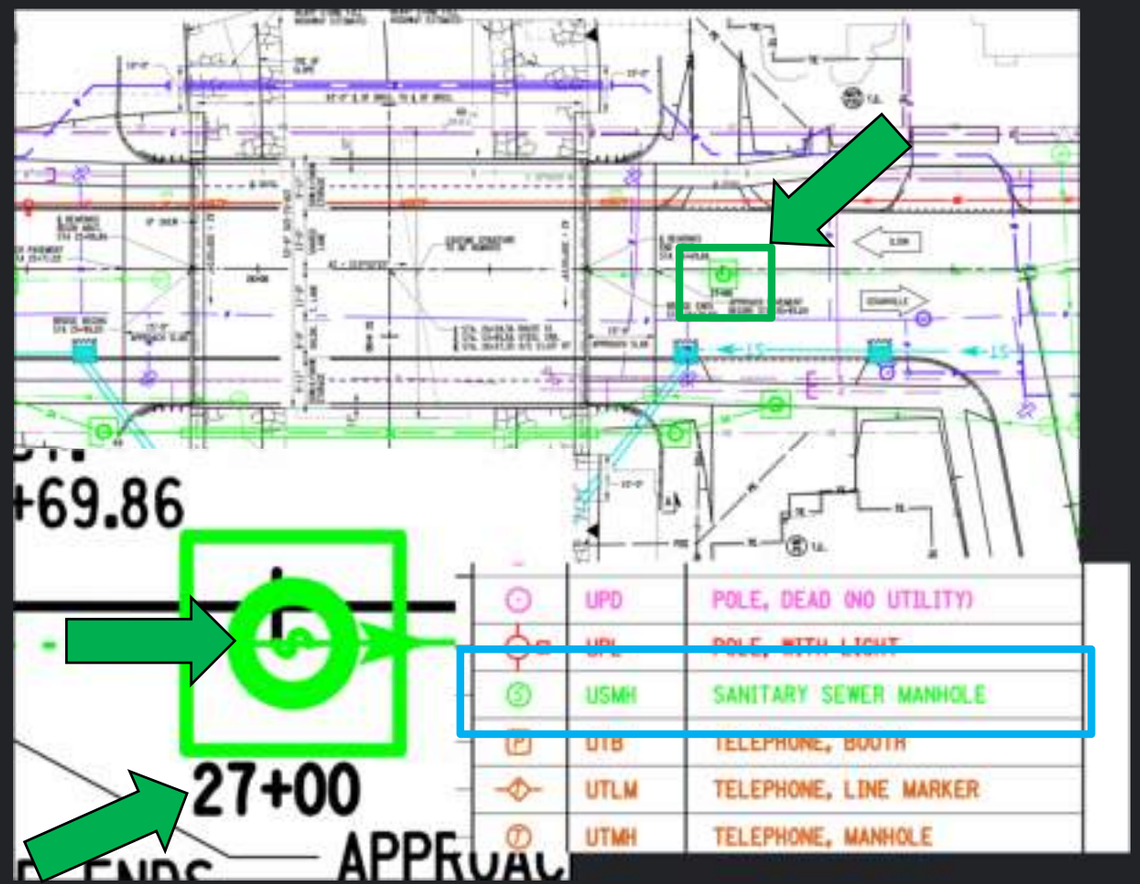
If there are 9 girders and each is 84' long, that means the total length of steel of the plate girders is (9 girders) x (84 feet / girder) = 756 feet of girders.

9. What utility structure is in the middle of the Route 51 road near Station 27+00?

Answer: A Sanitary Sewer Manhole

Near Station 27+00, there is a symbol that looks like a square with a green circle with an S in it.

Looking at the Legend Page on L-02 (Page 4), this symbol represents a Sanitary Sewer Manhole.



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10. In feet, how far away does the storm water drainage structure near Station 26+90 discharge water downstream from the end of the “end abutment”?

Answer: About 10’-0”

About 10 feet away from Station 27+00, there is a cyan symbol that looks like a rectangle with a grating pattern that is aligned with “ST” linework. Looking at the Legend Page on L-02 (Page 4), this symbol represents a Drainage Structure and the ST Linework represents a Culvert Pipe.

The pipe leaves the drainage structure and discharges about 10’-0” from the end of the “end abutment.”