

## Measurements: Construction Supervisor

### MONROC

**Job Description:** Responsible for coordinating subcontractors' work and arrival of materials. Insures work is done correctly, safely, and on time.

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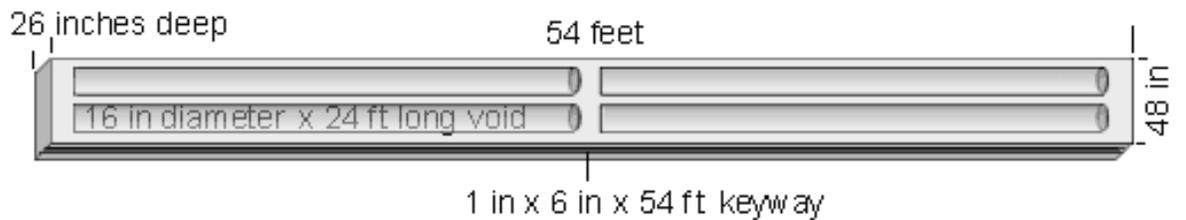
### Problem:

How many cubic yards of concrete will it take to make a bridge girder, called a *voided flat slab*?

The girder is 48 inches wide, 26 inches tall, and 54 feet long.

There are four 16 inch diameter voids within the slab – each is 24 feet long.

On each side of the girder is a 1" by 6" keyway.



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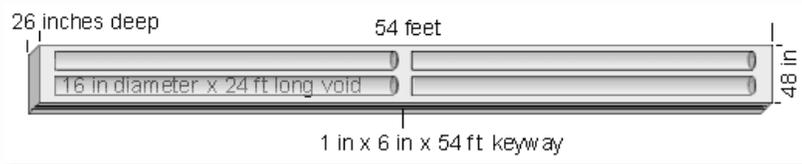
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### Solution:

1. Figure the total possible volume of the voided flat slab.

$$\text{VOL} = W \times H \times L \quad 48'' \text{ width} \times 26'' \text{ height} \times (54' \times 12'') \text{ length} = 808,704 \text{ in}^3$$

$$808,704 \text{ in}^3 \div (12'' \times 12'' \times 12'') = 468 \text{ ft}^3 \text{ (volume)}$$

2. Calculate the 1" x 6" keyways on each side of the girder.

$$\text{Girder length in inches} = 54' \times 12''/\text{ft} = 648''$$

$$1'' \times 6'' \times 648'' = 3,888 \text{ in}^3 \div 12'' \times 12'' \times 12'' = 2.25 \text{ ft}^3$$

$$2.25 \text{ ft}^3 \times 2 \text{ keyways} = 4.5 \text{ ft}^3 \text{ for both keyways}$$

3. Calculate the 16" diameter voids.

$$\text{Volume of cylinder} = \pi r^2 \times \text{length} \quad r = 16 \div 2 = 8$$

$$\text{Length of cylinder in inches} = 24' \times 12''/\text{ft} = 288''$$

$$3.14 \times (8'' \times 8'') \times 288'' = 57,876.48 \text{ in}^3 \div (12\text{in}/\text{ft})^3 = 33.499 \text{ ft}^3$$

$$33.49 \text{ ft}^3 \times 4 \text{ voids} = 133.97 \text{ ft}^3$$

4. Subtract the volume of the keys and voids from the total volume of concrete.

$$468 \text{ ft}^3 - (4.5 + 133.97) \text{ ft}^3 = 329.53 \text{ ft}^3 \div (3\text{ft}/\text{yd})^3 = 12.21 \text{ yd}^3$$

*This is a common geometry problem for engineers and construction supervisors. It requires math and geometry as well as analytical thought.*