



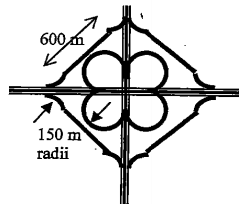
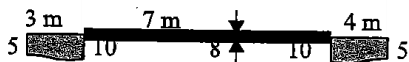
## JETS Challenge 115

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### Repaving the Highway

Your company has just received the contract to replace the pavement at an interchange between Rte. 51 and I-70 in Pennsylvania. It is a perfect cloverleaf with four 270 degree inside turns with a 150m centerline radius and eight 45 degree outside turns with a 150m centerline radius to a 600m straight away. The cross section of the pavement is 7m wide by 8 cm deep with trapezoid shoulders of 10 cm deep next to the road and 5cm deep at the outside. The inside and outside shoulder widths are 3m and 4m respectively.



**The Challenge: Determine how many cubic meter truckloads of asphalt will be required to complete the job (solid lines only in diagram).**

#### 4-270° inside loops

$$\begin{aligned}
 r &= 150 \text{ m} \\
 \text{Length} &= \frac{3}{4} (2 \pi r) \\
 &= \frac{3}{2} (150) \\
 &= 225 \\
 \text{(4 of these)} &= 900 \text{ m}
 \end{aligned}$$

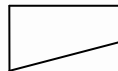
#### 8-outside turns

$$\begin{aligned}
 r &= 150 \text{ m} \\
 \text{Length} &= \frac{1}{8} (2 \pi r) \\
 &= \frac{1}{4} (150) \\
 &= \frac{150\pi}{4} \\
 \text{(8 of these)} &= 300 \text{ m}
 \end{aligned}$$

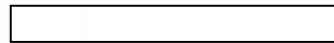
#### 4-600 straight-aways

$$4 \cdot 6 = 2400 \text{ m}$$

#### Cross Sectional Area



$$A = \frac{1}{2}(0.1 + 0.05)(3) = 0.225$$



$$A = 7(0.08) = 0.56$$



$$A = \frac{1}{2}(0.1 + 0.05)(4) = 0.03$$

$$\text{Total} = 0.225 + 0.56 + 0.03 = 1.085 \text{ m}^2$$

$$\text{Volume} = (1.085)(900 + 300 + 2400) = 6694.35 \text{ m}^3$$

$$\text{How many } 15 \text{ m}^3 \text{ Truckloads? } \frac{6694.35}{15} = 447 \text{ truckloads}$$

ANSWER:



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