

## The JETS Challenge

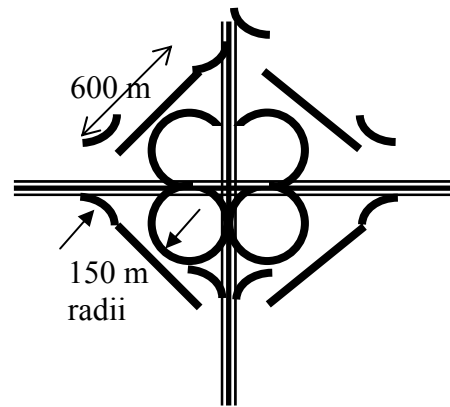
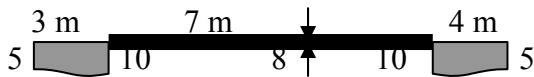
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Penn State University-Fayette

### Challenge 64 – The Cloverleaf Challenge

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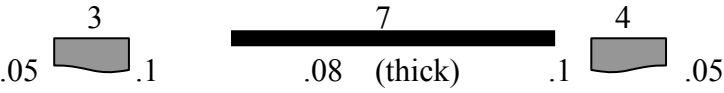
#### Problem:

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



Determine how many 15 cubic meter truckloads of asphalt will be required to complete the job (solid lines only in above diagram).

**Solution:**

|  |   |  |
|--|---|--|
| <p>Four 270° inside loops</p> $\text{length} = \frac{3}{4}(2\pi r)$ $= \frac{3}{2}\pi(150)$ $= 225\pi \text{ m}$ <p>× 4 of them</p> $900\pi \text{ m}$   | <p>Eight outside turns (45°)</p> $r = 150\text{m}$ $\text{length} = \frac{1}{8}(2\pi r)$ $= \frac{1}{4}\pi(150)$ $= \frac{150}{4}\pi$ <p>× 8 of them</p> $300\pi \text{ m}$ | <p>Four 600 m straightaways</p> $4 \times 600$ $= 2,400 \text{ m}$ |
| <p>Cross Section Area ↓</p>  $A = \frac{1}{2}(.0 + .05)(3) = .225$ $A = 7(.08) = .56$ $A = \frac{1}{2}(.0 + .05)(4) = .3$ <p>Total Area = 1.085</p> |   |  |
| <p>Volume</p> $= (1.085)(900\pi + 300\pi + 2400)$ $= (1.085)(6,169.9112)$ $= 6,694.35\text{m}^3$   |   |  |
| <p>How many 15 m<sup>3</sup> truckloads?</p> $\frac{6,694.35}{15} = 446.3$ <p>Answer = 447 truckloads</p>  |   |  |