## Analysis & Probability/Geometry: Geologist
U.S. Department of the Interior
Job Description: Administer the minerals (precious metals) on public lands.

Problem:
A company has a contract to remove 15,000 cubic yards (truck volume) of pit run (unprocessed) volcanic cinders from Horse Butte Cinder Pit. The cinders are being placed on a new road in a nearby subdivision. The contractor's truck drivers are required to place a signed and dated load ticket in a ticket box located at the pit entrance each time a load of cinders is hauled out of the pit. You, the inspector, have measured his bottom-dumping trucks to determine the volume they hold. They all have the following shape and measurements:
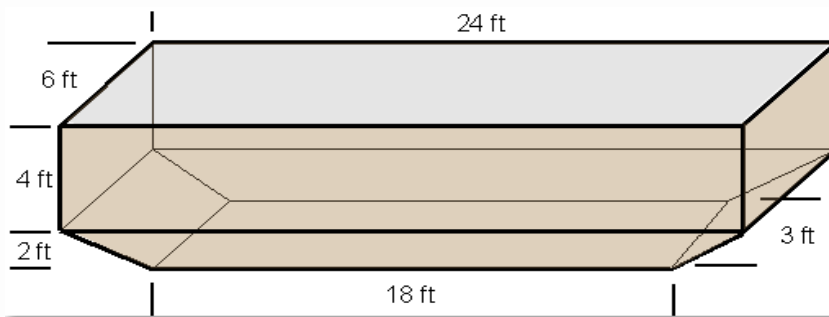
When you once visited the pit, you noticed that trucks heaped to overflowing sailed right by the ticket box without leaving tickets on several occasions. (Your presence was not observed). You mention this to the contractor, but still observe some truckers not stopping.

After the contractor has finished hauling cinders, you count all load tickets. There are 479. You are concerned and decide to make measurements of the road in the subdivision to determine the volume of cinders hauled. Cinders were placed on 6.6 miles of road.

These are your measurements taken at several places along the road:

Distance (mi)	Width (ft)	Thickness (in)
1.0	24	8
2.0	25	10
3.0	23	9
4.0	24	6
5.0	23	9
6.0	25	7

The cinders on the road were partially compacted by the haul trucks and traffic from the subdivision.
Was the contractor in violation of the permit (figure 10% compacted)? If so, how much?

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See problem for details.

Solution:
Calculations for truck volume problem

24 ft. x 6 ft. x 4 ft = 576 cu. ft.

[(18 ft. x 3 ft. + 24 ft. x 6 ft) ÷ 2] (2) = 198 cu. ft.

Total truck volume = 576 cu. ft. + 198 cu. ft. = 774 cu. ft.

27 cu. ft. in 1 cu. yd.

Convert to cu. yd. = 774 cu. ft. ÷ 27 cu. ft./yd. = 28.67 cu. yd.

479 loads x 28.67 cu. yd. = 13,731.3 cu. yd.

Heaped Truck:

774 cu. ft. + 198 cu. ft. = 972 cu. ft.
Convert to cu. yd. = 972 cu. ft. ÷ 27 cu. ft./yd = 36 cu. yd.

Distance = 6.6 miles; convert to feet = 5280ft/mi x 6.6mi = 34848 ft

Average width = 24 ft.

Average thickness = 8.2 inches; convert to feet 8.2 in. ÷ 12 in/ft. = 0.683 ft

Total hauled = (total road length) x (road width) x (road thickness)
= (34848 ft)(24 ft)(0.683 ft) = 571,507 cu. ft. = 21,166 cu. yd.

Material compacted about 10%: 21,166 ÷ .9 = 23,518 cu. yd.

The contract volume is 15,000 cu.yds. Therefore, the contractor is in violation (+8,518 cu.yds) = 23,518 cu. yd. – 15,000 cu. yd.

This problem demonstrates a case of having more information given than is actually needed.