

FUN WITH FUNDAMENTALS

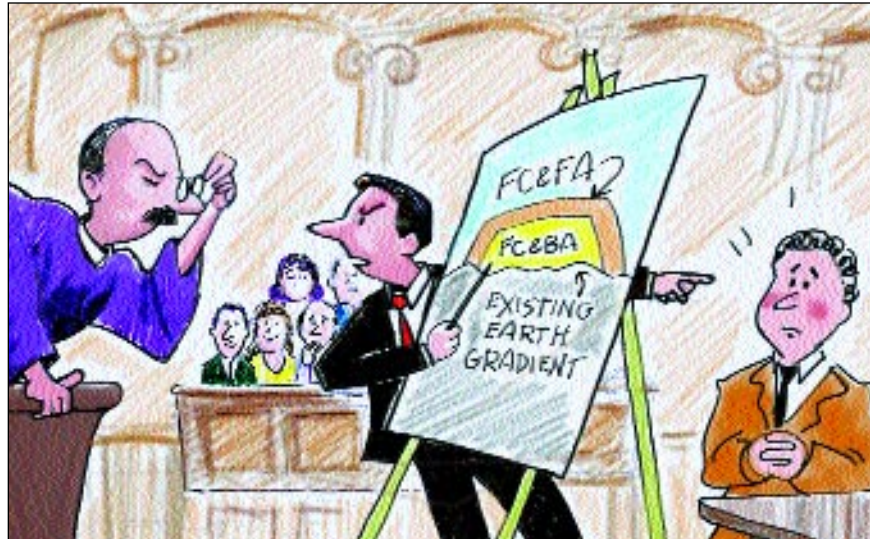
Base rate

Problem 161 — A mound of dirt by any other name can also smell as sweet, as this month's problem by James White of Henderson, Ky., demonstrates.

"Mr. Wurme, do you have anything further to add to your testimony?" The case of *Lee Key Hydraulic Co. vs. Finagel J. Wurme* was now in its fifth week. The case centered on the company's on-site landfill, which had overflowed into a nearby river. Eight years ago, Wurme had been in charge of digging the landfill and assuring it could handle Lee Key's needs for the next ten years. Wurme contended it was Lucius Bluff's inept management of waste disposal that caused the mishap.

Wurme's design of the landfill called for a base layer covered by a top layer. The base layer is composed of filter cake (FC) and bottom ash (BA); and the top layer, FC and fly ash (FA).

"Your honor, I present the following statement that proves the landfill should



have been able to last us for ten years," snipped Wurme. "When I made the calculations for this landfill eight years ago, it could have lasted us for ten years easily."

Wurme's statement gave the following information:

- 1,750,000 yd³ had been the total space available for both layers.

- 387,000 yd³ was the space available for the top layer.

- Lee Key produces FC at a rate of 288,000 tons per year. FC has a density of

87.5 lb/ft³.

• The company produces 30,000 tons per year of BA. It has a density of 60.0 lb/ft³.

• Of the space available for top layer, 356,122 tons were allotted for FC.

• The production rate of FA is inconsequential, since any amount over the landfill's capacity is sold.

Ladies and gentlemen of the readership, you have the facts before you. Given the above yearly production rates and capacities of the landfill, for how many years could the landfill have been used? Is Wurme guilty or innocent of an EPA violation?

Remember, the FC goes to both base and top layer.

Send your answer to:

Fun With Fundamentals
POWER TRANSMISSION DESIGN
Penton Publishing
1100 Superior Ave.
Cleveland, OH 44114-2543

Deadline is June 10. Good luck!

*Technical consultant: Jack Couillard,
Menasha, Wis.*

Solution to last month's problem 160

— You know what your leverage is if you answered **80 ft**. Here are the pivotal forces:

Divide the problem into two parts, and let F_1 be the force on the rope exiting the large pulley and F_2 , the 10-lb upward force on the long end of the lever. First, solve for F_1 :

$$F_1 = w \times R_a$$

where:

w = weight of water, given as 833.6 lb (8.336 lb/gal \times 100 gal).

R_a = mechanical advantage of pulley system. In this case it is the small pulley diameter divided by the large, or $4/25$.

Thus,

$$F_1 = 833.6 \text{ lb} \times \frac{4}{25} = 133.4 \text{ lb}$$

Now, let:

s_1 = length of short end of lever, given as 6 ft.

s_2 = length of long end of lever, ft.

$$F_1 s_1 = F_2 s_2$$

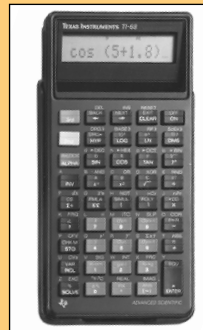
Solving for s_2 :

$$s_2 = \frac{F_1 s_1}{F_2} = \frac{133.4 \text{ lb} \times 6 \text{ ft}}{10 \text{ lb}} = 80 \text{ ft}$$

Thanks to Wurme, Bluff's presentation was all wet!

Contest winner — Congratulations to Hugh Wesler of Springfield, Mass. who won our March contest by having his name drawn from the 136 contestants who *answered 137 ft.* for that month. Total responses were 163. A TI-68 calculator is in the mail to him.

The TI-68 Advanced Scientific Calculator by Texas Instruments can solve five simultaneous equations with real and complex coefficients and has 40 number functions that can be used in both the rectangular and



polar coordinate systems. Other functions include formula programming, integration, and polynomial root finding. The calculator also features a last-equation replay function that lets you double-check your work.

To enter the contest, send your answer on a postcard or letter to POWER TRANSMISSION DESIGN, 1100 Superior Ave., Cleveland, OH 44114-2543.

You can also receive a TI-68 and credit in the magazine if you send in an *original* problem with solution, and we publish it.