

1988: The Railroad Flatcar Problem

Two railroad flatcars are to be loaded with seven types of packing crates. The crates have the same width and height but varying thickness (t , in cm) and weight (w , in kg). **Table 1** gives, for each crate, the thickness, weight, and number available. Each car has 10.2 meters of length available for packing the crates (like slices of toast) and can carry up to 40 metric tons. There is a special constraint on the total number of C_5 , C_6 , and C_7 crates because of a subsequent local trucking restriction: The total space (thickness) occupied by these crates must not exceed 302.7 cm. Load the two flatcars (see **Figure 1**) so as to minimize the wasted floor space.

Table 1.
The thickness, weight, and number of each kind of crate.

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	
t	48.7	52.0	61.3	72.0	48.7	52.0	64.0	cm
w	2,000	3,000	1,000	500	4,000	2,000	1,000	kg
	8	7	9	6	6	4	8	

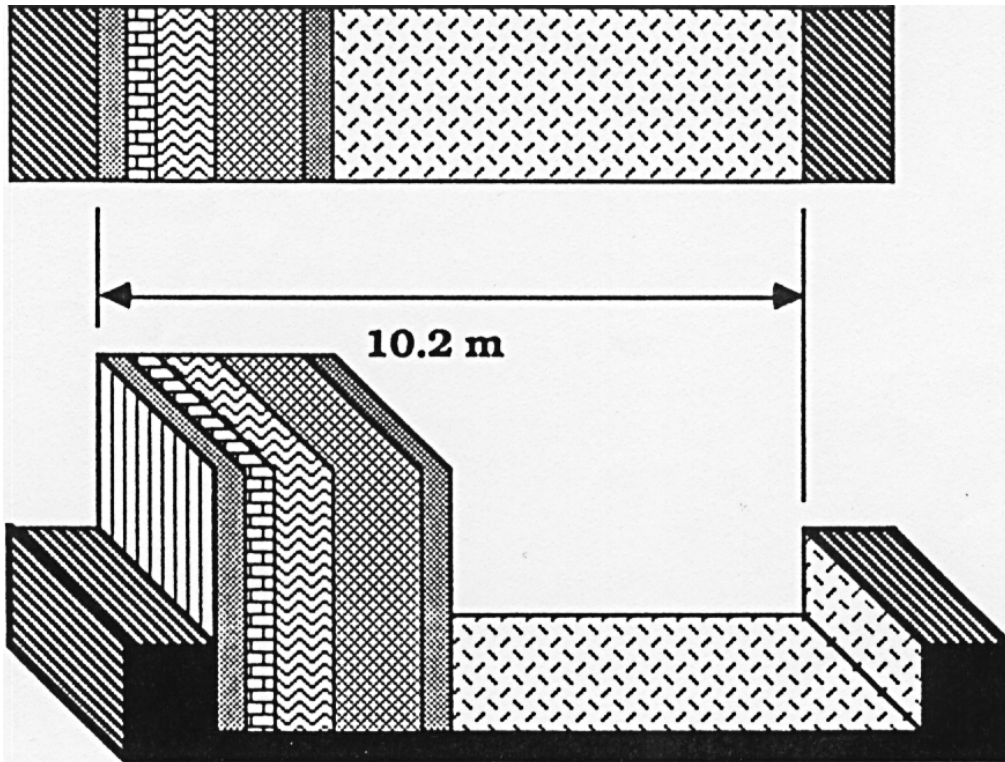


Figure 1. Diagram of loading of a flatcar.

Comments by the Contest Director

The problem was suggested by John J. Bartholdi III (School of Industrial and Systems Engineering, Georgia Institute of Technology). It is a modification of an unsolved problem that surfaced at the Ford Motor Company.

The Outstanding papers were by teams from Harvard University, University of California–Berkeley, University of Toronto, and the U.S. Military Academy. Their papers, together with a commentary by problem author Bartholdi, were published in *The UMAP Journal* 9 (4) (1988): 343–403.