Four per cent. grade 25x2=50 ft. length of approaches for every vertical foot of clearance.

Three per cent. grade 33 ft. 4 in. x 2=66 ft. 8 in. length of approaches for every vertical foot of clearance.

Any gain, by curtailment of vertical clearance requirement, or by change of railway grade, or by both, means corresponding shortening of road approaches, at the high ends. Such a gain of one foot may greatly reduce the cost of a given grade separation, making it practicable when it would not otherwise be so. A vertical gain of two feet would mean a very large addition to the number of practicable grade separations.

The extreme allowance that should be made for brakemen on a car must not exceed 7 ft. 6 ft. 6 in. will clear any brakeman unless he should be over 6 ft. tall, and 6 ft. brakemen are not common, to say the least. What is to be said for the contention, seriously made, that the brakeman on the running board of highest known car, should be allowed room to swing his lantern over his head ? The necessity for brakemen on the tops of cars is becoming less and less, and has in many cases disappeared, rules and regulations of railway companies to the contrary notwithstanding. The air brake is now universally used in train control. In Canada the orders of the Board of Railway Commissioners, in force since December 1908, provide that no regular freight train shall be allowed to proceed on its journey unless at least three-quarters of the cars comprising it are equipped with air brakes in good working order; also that every freight car built shall be equipped with air brakes and with operating levers on both sides of the end.

A stage is reached in the traffic of railways when grade crossings become intolerable, and when the risk and interruption due to them becomes more expensive than their elimination. In Europe, grade crossings, in any considerable centres of population are the exception, and this may soon be said also of main trunk line railways in the older parts of the United States. The Pennsylvania Railroad makes it a rule to avoid all grade crossings on new work, and has within the last nine or ten years eliminated over 50 per cent. of all its grade crossings on main lines. To do this clearance must be made as low as possible. Overhead bridges are as low as 16 ft. 6 in. above top of rail, while many are 18 ft. 6 in. and less. Twenty-one ft., the standard for signal bridges, is recognized as the highest clearance for which there can be any need. In New York State many overhead bridges are only 18 ft. above the top of rail, and this is the case also in Massachusetts and in other States. The New York Central and Hudson River