One of the greatest fields for the use of reinforced concrete has, so far, been its application to railway structures, such as retaining walls, culverts, abutments, bridges, buildings, etc. It is peculiarly adapted to these purposes for the following reasons:

1st. It is more economical than solid masonry or concrete.

2nd. It is more durable; for concrete, properly reinforced, can stand all stresses, including temperature and shrinkage stresses, without cracking; and steel, protected by concrete, is rust proof.

3rd. It is fireproof.

4th. There is practically no maintenance cost, since the concrete improves rather than deteriorates with age.

5th. It is a material in which the stresses can be accurately determined, and is in consequence of greater reliability than masonry.

6th. Its erection requires very little, if any, skilled labor, and any form of construction can be employed without shop-work, the only materials necessary being timber for forms, materials for concrete, and steel bars.

The introduction of any new material, of course, depends upon its initial cost; the more economical it is, the more general its use will become. For this reason reinforced concrete has already been used extensively by railroads in the United States, principally in the West. A knowledge of its properties is, of course, necessary, the lack of which, and a natural conservatism, makes some engineers reluctant to give it their unqualified recommendation. With the great increase in its use and the greater knowledge thus being gathered every day, it will not take very long before reinforced concrete will be everywhere recognized as a standard form of construction.

The abutment described in the following paper was designed by the writer in order to compare it with a standard abutment of plain concrete made by the National Transcontinental Railway Commission. The end in view was to show the greater economy of material effected by the use of concrete reinforced. The design is detailed in the attached drawings, and specifications covering the reinforced work have also been added.

Before proceeding with the design, it will be necessary to devote a few words to the formulæ employed and the assumptions made. The whole design really resolves itself into the solution of beams and cantilevers, thus making necessary the use of some theory of flexure for reinforced concrete beams. There are a great many of these theories differing from one another in several respects. The majority of these theories are what may be termed straight line formulæ. These are nothing more than approximations, or empirical formulæ, for they assume a constant modulus of elasticity for con-