

and that everything beyond this was intended to be left to the future control of the stockholders and managers of the road, whose interests will at all times be at least twice and, perhaps, three times as large as those represented by the government; and further, that in granting a liberal donation of lands and loans of government securities to aid in the construction of these roads, the character of the roads and their outfit was a secondary consideration with Congress when compared with the great importance to the government and country of their speedy construction.

I have therefore advised that the line should be so located as to admit of the present or future adoption of the easiest gradients and curvatures consistent with reasonable length of line and cost of construction; that the excavations, embankments, side-ditches and cross-drainage, should be of liberal dimensions; that the culverts and bridge abutments should be permanently built of stone whenever it was to be found within reasonable distance; and when it was not, to use the most durable timber attainable, with a view to the substitution of stone hereafter; that the truss bridges of long spans should be of the best plans in use, and composed of durable timber; that the cross-ties should be of liberal dimensions, of the most durable timber attainable, and laid not less than twenty-four hundred to the mile; that the iron rails should be of the most approved quality and pattern, weighing not less than fifty pounds per lineal yard, and thoroughly secured to the ties with wrought-iron chairs and spikes; that the track should be ballasted with the best material on hand; that sidings not less than two thousand feet in length should be inserted, and water-stations constructed at intervals of ten, twenty, or thirty miles, as the probable running arrangements of the road would require; that permanent and capacious machine-shops and engine-house should be constructed at the eastern terminus, and at proper locations along the line, to afford the necessary facilities for repairs, at intervals of from two to three hundred miles; that passenger and freight stations should be constructed of suitable dimensions and at proper points, to accommodate the probable business of the road when opened to the public; that the road should be fenced, and cattle-guards put in wherever it passed through cultivated farms or districts; that the rolling stock should be of uniform pattern, of the best quality and workmanship attainable, and sufficient in kind and quantity to accommodate the traffic, and that beyond this no money should be expended at present, except in pushing the work forward with the greatest possible energy and despatch.

I have never for a moment doubted that a road of the character above described would come clearly within the requirements of the law, entitle the company to the government aid which Congress intended should be placed at their disposal, "subserve the purposes for which it was built, and be a credit to the nation."

Having thus stated the general principles which, in my opinion, should govern the action of your board, I will now proceed to state, as concisely as possible, my views on the specific points submitted in your letter.

1. I consider that a rail of good quality of iron, weighing fifty pounds per lineal yard, of the Union Pacific railroad pattern, when properly supported, is the best and most durable rail that can be used for ordinary traffic on level or moderate grades. The weight of rail, or underlying support, should be increased proportionately as the weight or draught of the engine is increased, by reason of steeper grades or other causes.

2. The best joint-fastening now in use I believe to be the *fish-joint*; next to that is the wrought-iron chair of the pattern adopted by the Union Pacific Railroad Company.

3. Cross-ties should be eight feet long, and six by (not less than) eight inches square, and should be laid not less than twenty-four hundred to the mile.

I desire to say in this place that I am not now, and never have been, in favor