

the final speed being shown by the intersection of grades, and vertical line corresponding to the distance passed through.

The maximum allowable speed for freight trains is 30 M.P.H. and minimum 10 M.P.H.

After ascending a steeper grade by use of velocity, if ruling grade will follow, assume the limit of speed at 11 M.P.H., if grade is 0.1 less than ruling grade 10 M.P.H., and if 0.2 less, 9 M.P.H., which is the minimum speed to be figured to in any case.

Velocity grades should only be used where considerable saving will be effected by their introduction, and where no incidents will occur in operation which will reduce speed below that assumed, curves at the foot of velocity grades must be avoided or speed reduced to safe limits.

Velocity grades steeper than twice the ruling grade rate + 0.2 should not be used except in special cases.

RECONNAISSANCE.

The field force of a reconnaissance party will vary according to settlement of country through which surveys are being made. For unsettled country it will consist of Engineer in charge, and assistant, with or without subordinates, cook, packer or teamster, and horses.

The first step is to obtain the best available maps of the country, these should be studied by the Engineer, so that the general idea of the watersheds may be clearly fixed in his mind.

The reconnaissance must not be of any line, but of an area, and a thorough knowledge obtained of the controlling features of the country, included in as large an area each side of the line between the two termini as there is any possibility of the line passing through. Prepossessions in favor of the most obvious route should be set aside, especially when such route runs near highways or open districts.

Lines hard to traverse on foot seem worse than they really are, especially if country is covered with a small and close growth of timber. Ruggedness of detail, rock points, etc., extending over short distances, seem much more difficult of economic location than long rolling slopes which will necessitate

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