

## Ans (1)

- \*. Gradients  $\Rightarrow$  it is the base of rise of the road with respect to the horizontal. it is expressed as a ratio limit (vertical unit to horizontal units). Sometimes the gradient is also expressed as a percentage i.e.  $n\%$  (in 100)

### Types of Gradients

A. Ruling Gradients  $\Rightarrow$  (i) This is dependent on the terrain length of the grade. Speed pulling power of the ~~road~~ value vehicles to the presence of the horizontal curve.

(ii) value The IRC has recommended ruling gradient value of  $3\%$  on plain & rolling terrain,  $4\%$  to  $6\%$  on mountainous terrain and  $16.7\%$  on steep terrain.

B. Limiting Gradients  $\Rightarrow$  (i) it is steeper than the rolling gradients

(ii) This gradient is adopted when the ruling gradient result in enormous increase in cost of construction

(iii) it may be frequently necessary to climbing gradients

c. Exception gradients  $\Rightarrow$  (i) Exceptional gradients are very steep gradients given at unavoidable situations

(ii) They should be climbed for short structure not exceeding about (100M)

d. minimum gradient  $\Rightarrow$  (i) it depends on the rainfall, types of soil and other site conditions

(ii) A minimum of 1 in 500 may be sufficient for concrete drain & 1 in 200 for open soil drains are found to give ~~same~~ satisfactory performance.