Unimportant Branch Lines, 0.2 in sags, 0.4 on summits.

Ruling grades on curves will be compensated .04 per degree of curve. Light grades should be made continuous on curves and tangents.

## COMPENSATION OF GRADES IN TUNNELS.

Compensation of grades in tunnels is one which is usually eliminated by conditions. Tunnels usually occur near summits and only require grades for drainage. Under special conditions, if length is not much increased, a good rule is to make grade half maximum grade. If a maximum grade is required, the following reductions are figured to allow for bad rail, and decreased tractive power of steam locomotive:—

| Length of Tunnel. | Ruling Grade 0.5 Tunnel Grade. | Ruling Grade 1.0 Tunnel Grade. | Ruling Grade 2.0 Tunnel Grade. |
|---|---|---|---|
| 200 | 0.5 | 1.0 | 2.0 |
| 500 | 0.45 | 0.9 | 1.9 |
| 1000 | 0.4 | 0.85 | 1.75 |
| 2000 | 0.33 | 0.75 | 1.55 |
| 5000 | 0.25 | 0.60 | 1.25 |

Compensation for curves, Tunnel under 500′ .04 per degree.
" " Tunnel 500′ to 1000′ .05 per degree.
" — " Tunnel over 1000′ .06 per degree.

## GRADE REDUCTIONS.

When grades on operated lines are to be reduced, the new ruling grades on adjacent sections or sub-divisions should be so arranged that the least delay to through traffic will be necessitated, and assistance to direct operation reduced to a minimum. Steeper grades over one section may be nullified by using heavier locomotives.

The economic value of different grades will be determined by the number of trains required to handle a certain traffic. On operated line the actual traffic will be taken for as long a period as possible; and with this as a basis, the yearly number of trains required multiplied by the length of the section will