edge of the structure restricting the view ahead. Let

A = algebraic difference of grades, percent;
L = length of vertical curve, stations;
S = sight distance, stations;
C = vertical clearance at critical edge of underpass, ft;
h_1 = vertical height of driver's eye above road, ft;
h_2 = vertical height of sighted object, ft.

Two cases will be considered: (1) $S > L$, (2) $S < L$.

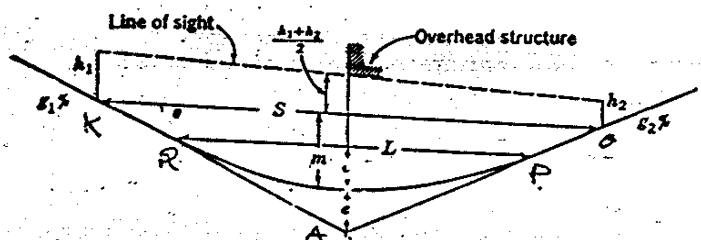


FIG. 108. Sight distance under overhead structure where $S > L$.

注意:
AASHTO 建議
① $h_1 = 6\,ft$ (eye height of a truck driver)
② $h_2 = 1.5-2\,ft$ (height of tail light of a passenger car)
③ C — clearance 淨距
Minimum = 14.5 ft
Desirable = 16.5 ft
④ 若取 $C = 14.5\,ft$, $h_1 = 6\,ft$
$h_2 = 1.5\,ft$
$\Rightarrow L = 2S - \frac{86}{A}$

① 凹形豎曲線 $S > L$

從相似三角形 $\triangle AKO$ 與 $\triangle AQP$ 得,

$$\frac{S}{L} = \frac{e+m}{2e} \leftarrow ? \quad \text{only when } g_1 = -g_2 \qquad (1)$$

又當 $x = \frac{L}{2}$ 時 $\qquad A = |G_2 - G_1|$

$$\therefore e = \frac{1}{2}\frac{A}{L}x^2 = \frac{1}{2}\frac{A}{L}\left(\frac{L}{2}\right)^2 = \frac{AL}{8} \quad — (2)$$

另外,

$$m = C - \frac{h_1+h_2}{2} \quad — (3)$$

由公式(1), (2) 及 (3)

$$\frac{S}{L} = \frac{1}{2} + \frac{m}{2e}$$

$$\frac{S}{L} = \frac{1}{2} + \frac{4\left(C - \frac{h_1+h_2}{2}\right)}{AL}$$

同時乘以 $2L$

$$2S = L + \frac{8\left(C - \frac{h_1+h_2}{2}\right)}{A}$$

$$\therefore L = 2S - \frac{8\left(C - \frac{h_1+h_2}{2}\right)}{A}$$

$$\left(\frac{T}{x} = \frac{e}{m} \Rightarrow e = T\frac{m}{x} = \tan\frac{\Delta}{4}\right)$$

$$(正弦定理)\ \frac{e}{\sin\frac{\Delta}{4}} = \frac{T}{\sin(180^\circ - (90 - \frac{\Delta}{4}))}$$

$$= \frac{T}{\cos\frac{\Delta}{4}}$$

$$e = T\tan\frac{\Delta}{4}$$

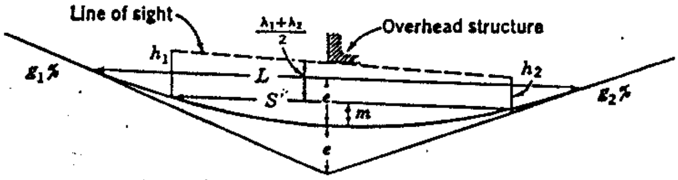
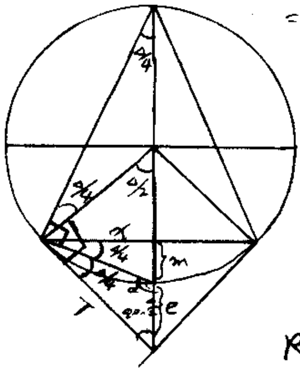
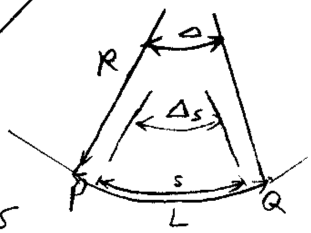


FIG. 109. Sight distance under overhead structure where $S < L$.





② 凹形豎曲線 $S < L$

Since any flat probola is closely a circle

assume R = average radius of the verticle curve

Δ, Δ_s = central angles subtended by L & S

(a) For a probola, $e = \frac{AL}{8}$

For a circle, $e = T\tan\frac{\Delta}{4} = (R\tan\frac{\Delta}{2})\tan\frac{\Delta}{4}$

Assume $\tan\frac{\Delta}{2} \approx \frac{\Delta}{2}$, $\tan\frac{\Delta}{4} \approx \frac{\Delta}{4}$

then $e = R\left(\frac{\Delta}{2}\right)\left(\frac{\Delta}{4}\right) = R\frac{\Delta^2}{8}$ (approx.)

set $e_{probola} = e_{circle}$

$$\frac{AL}{8} = \frac{R\Delta^2}{8} \Rightarrow \Delta^2 = \frac{AL}{R} \quad \text{—— (1)}$$

(b) Assume $m_{probola} = m_{circle}$ then we can write

$$m = R\sin\frac{\Delta_s}{2} \times \tan\frac{\Delta_s}{4}$$

Also assume

$$\sin\frac{\Delta_s}{2} = \frac{\Delta_s}{2}, \quad \tan\frac{\Delta_s}{4} = \frac{\Delta_s}{4}$$

$$\Rightarrow m = R\frac{\Delta_s^2}{8} \quad \text{(approx.)} \quad \text{— (2)}$$

(c) Combine eqs (1) & (2)

$$\left(\frac{\Delta}{\Delta_s}\right)^2 = \frac{AL}{8m}$$

Also note that $L = R\Delta$, $S = R\Delta_s$

$$\Rightarrow \frac{\Delta}{\Delta_s} = \frac{L}{S} \Rightarrow \left(\frac{\Delta}{\Delta_s}\right)^2 = \left(\frac{L}{S}\right)^2 = \frac{AL}{8m}$$

$$\therefore L = \frac{S^2 A}{8m}$$

$$m + \frac{h_1 + h_2}{2} = C$$

$$\therefore L = \frac{S^2 A}{8\left(C - \frac{h_1+h_2}{2}\right)}$$

AASHTO Recommends

set $C = 14.5$ ft, $h_1 = 6$ ft, $h_2 = 1.5$ ft

$$\Rightarrow L = \frac{S^2 A}{86}$$