General approach – compare installed braking performance with vehicle characteristic.

Brake Analysis.

$\theta_1 = 30^\circ$ $\theta_2 = 120^\circ$ $\mu = 0.4$ $r = 125$ mm $a = 45 \sec 30^\circ = 90$ mm

$I_s = 1.3660$ $I_{ss} = 1.2184$ $I_{sc} = 0.25$

$\therefore m = \frac{1}{0.4} \times \frac{90}{125} \times 1.2184/1.3660 = 1.6055$

$n = 1 - (90/125)(0.25/1.3660) = 0.8682$

Both shoes (1) & (2) of any of the brakes are subjected to the same actuation moment of $M = (pA)_{hyd} * e$, $e = 160$ mm.

So from (13) with $\lambda_1 = \lambda_2$:

$T_0 = (pA)_{hyd}\, e \left[\frac{1}{m-n} + \frac{1}{m+n}\right] = \frac{2me}{m^2-n^2}(pA)_{hyd}$ $\quad T_0 \to F$

Letting R be the radius of the tyres, the braking force will be, for two wheels:-

(I) $F = 2 * T_0/R = [4me/(m^2-n^2)](pA)_{hyd}/R$.

Brake characteristic

Since the same pressure is applied to both rear & front sets, (until maxima are reached):

$\varphi_R/\varphi_F = F_R/F_F = (A_R/A_F)_{hyd}$ – from above $= 0.5$

i.e. braking is proportional, with limits from (I) corresponding to maximum hydraulic press:

$\hat{\varphi}_R = \hat{F}_R/W = [4me/(m^2-n^2)](\hat{p}A)_{hyd}/WR$.

$= \frac{4 \times 1.6055 \times 0.16}{1.6055^2 - 0.8682^2} * \frac{4 \times \frac{\pi}{4} \times 20.5^2}{1.2 \times 10^3 \times 9.81 \times 0.32} = 0.1975$

$\hat{\varphi}_F = \frac{-----}{---} * \frac{55 \quad 29^2}{---} = 0.5433$

a) These are superimposed on the vehicle characteristic ($c_F = c_R = 1/2$, $h = 1/4$) below. Since the braking characteristic lies everywhere under the vehicle characteristic, the brakes are safe.

b) The max. deceleration occurs at the point A.

$\hat{z} = 0.1975 + 0.5433$ (eq (23)) $= 0.740$

i.e. max. deceleration $= 0.74 \times 9.81 = 7.3\ m/s^2$

The corresponding adhesion coefficient, from (22a) $= \underline{0.79}$

c) From (7b), (5b) & (9)

$M = (pA)_{hyd} * e$

$= \mu N r I_s (m - \Delta n)$

where

$N = p_0 w r = p_m w r \frac{\theta_2 - \theta_1}{I_s}$

whence max p_m, in self-actuating shoe:

$\hat{p}_m = e(\hat{p}A)_{hyd}/\mu w r^2(\theta_2-\theta_1)(m-n)$

Solving for front & rear:

$\hat{p}_{mR} = 0.73$ $\hat{p}_{mF} = 1.34$ MPa