$$v_x = \frac{(v_l + v_r)}{2} \tag{1}$$
$$v_l = v_x + \omega.d \tag{2}$$
$$v_r = v_x - \omega.d \tag{3}$$

using equations 2 and 3, we get

$$v_l - v_r = 2\omega.d \tag{4}$$

and we also know that

$$\frac{v_r}{x} = \frac{v_l}{2d + x} \tag{5}$$

which implies,

$$x = 2d\frac{v_r}{(v_l - vr)} \tag{6}$$
$$d + x = d\frac{(v_l + v_r)}{(v_l - v_r)} \tag{7}$$

replacing $d + x$ by r and using 1 and 4

$$r = \frac{v_x}{\omega} \tag{8}$$