

Calculating Spoke Length

by Benjamin Furst

I have worked out a formula for calculating spoke length based on certain rim and hub dimensions. I'm not sure if everyone who regularly builds wheels knows of a formula. In the event that spoke length is determined by trial and error, this formula might be useful. In

any case, I'm enclosing the formula with enough descriptive information so that it can be easily used.

The formula is used separately for each side of a wheel, so that rear wheels with different lacing patterns, hub flange dimensions, number of spokes, etc, on each side can be easily handled. I believe the formula contains no errors. It worked to within 1 mm for the wheels on two bikes that I have, and I think it actually came closer to that since it was difficult to measure the spoke lengths much more accurately on my wheels.

$$\text{Spoke length} = \frac{1}{2} \sqrt{4d^2 + D_h^2 + D_r^2 - 2D_h D_r \cos \Theta}$$

D_r = diameter of rim

D_h = diameter of spoke hole circle on hub flange being considered.*

d = distance from hub center to hub flange being considered*

Θ = $\frac{\text{cross}}{N} \times 360^\circ$ * *on cross x 2π*

N = number of holes in hub flange being considered.*

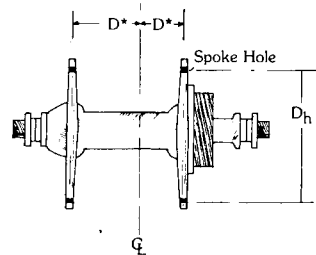
*These may be different for front and rear hubs, and for each flange of rear hub.

• Cos Θ for some values of N & cross.

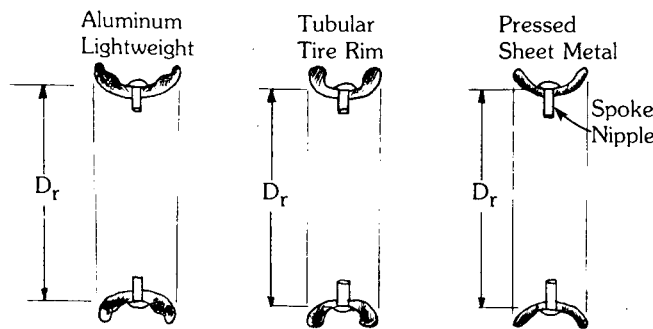
R is a radial pattern

Cr. ↓ \ N →	12	14	16	18	20
R	1.000	1.000	1.000	1.000	1.000
1	0.866	0.901	0.924	0.940	0.951
2	0.500	0.623	0.707	0.766	0.809
3	0.000	0.223	0.383	0.500	0.588
4	-0.500	-0.223	0.000	0.174	0.309

*Distance d is different on each side of rear hubs. On some rear hubs D_h as well as the number of spoke holes may be different on each side.



The dimensions of front hubs may differ from those of rear hubs.



D_r in each case is measured from the nipple head seat in the rim. For many lightweight and tubular rims a good approximation is to measure the inside diameter and add 3-5 mm.

(Continued on page 84)