Background

For a new layout I built, I decided to construct the fiddle yard as a sector table, i.e. shaped as a turntable, but not rotating through 180 degrees.

I have seen many articles on the design of fiddle yards, but do not recall any showing how to calculate the radius of the curved track(s) on turntables. So I decided to go back to first principles, and work out the required mathematical formula. In the belief that this may help others, I offer the results, and some notes on setting out.

Introduction

The mathematics should not be too taxing, I hope. In the discussion below, I have assumed the reader is familiar with basic mathematical operations such as: addition +; subtraction -; multiplication *; and division /. Also that a^2 ("a squared") equals 'a multiplied by itself'; conversely, $\sqrt{a}$ (square root of a) is the 'number which multiplied by itself gives a'. Finally the use of brackets around terms means that the operations inside the brackets are carried out first: $(a + b)/c$ means "add a and b, then divide the result by c". These operations are normally available on basic calculators. Readers who are familiar with computer spreadsheets probably do not need my help to work out the formulae!

I have drawn a diagram of a typical sector table, and marked on the various dimensions, known and required to be found. In stating the resulting formula, I have not gone through every stage of deriving the formula; if readers wish to know my working out, they may contact me via the forum!

Being of a certain age, I work in inches, not metric. However, there is no reason why the dimensions of the sector table should not be stated in round numbers of centimetres (or odd millimetres for that matter!)

Formulae (1 May 2017 – Note: previous error in Formula 3, now corrected!)

The Black outline shows the Turntable, with centre C and radius = s. The horizontal line is the straight track. Blue line P-C of length d is the offset between the straight and curved tracks. The Red arc is the second track, of unknown radius = r. The Red triangle with points O, C, and T has a right angle at point T, since O-T is a tangent to the turntable arc. By the theory of right angled triangles, the square of the hypotenuse is equal to the sum of the squares of the other sides. In other words $(r + d)^2 = r^2 + s^2$.

This may be re-arranged to form our first formula:

$r = (s^2 - d^2)/2*d$ (Formula 1)

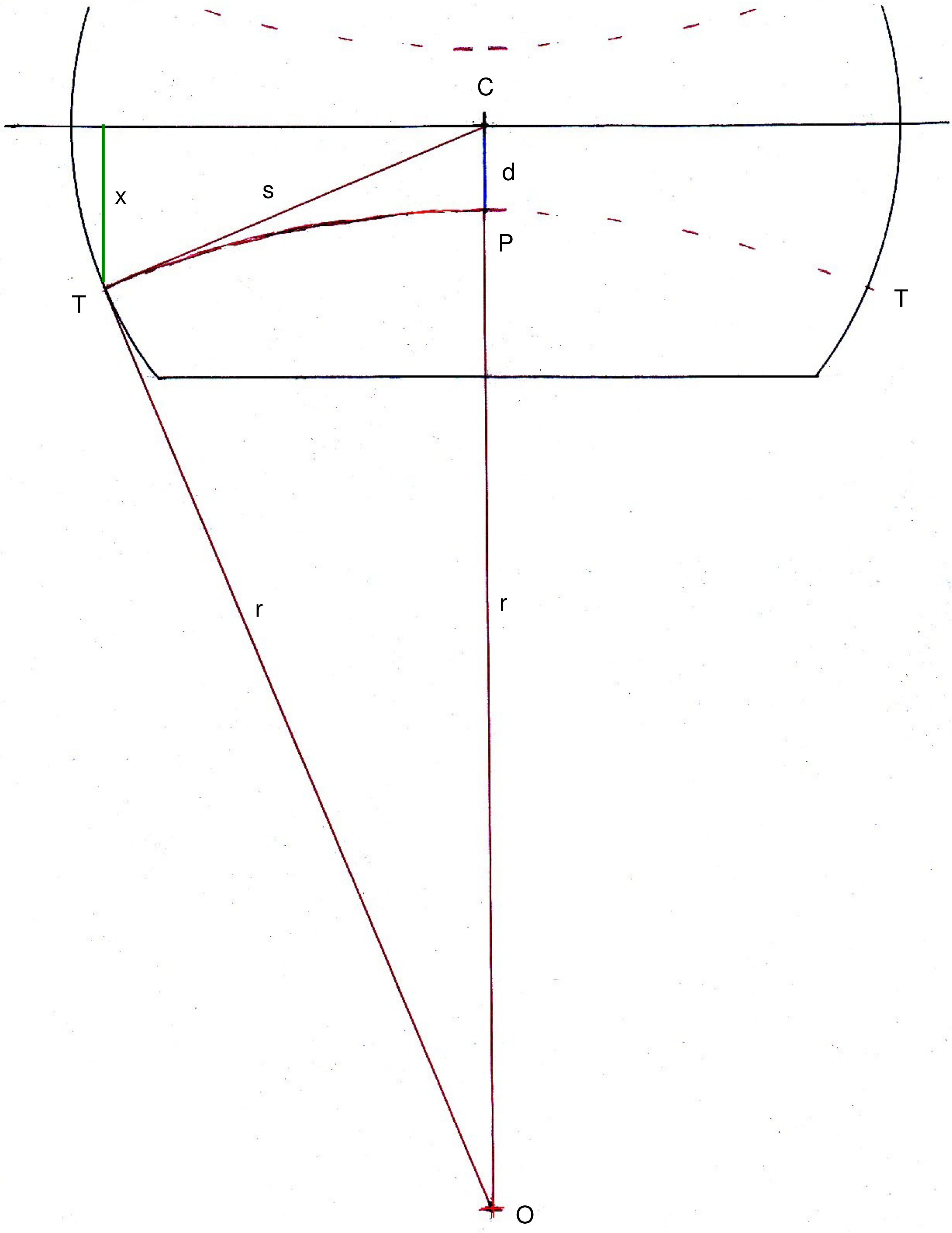
As I will discuss later, it is useful to know the radius of the sector table, if r and d are known, so the formula in terms of s is:

$s = \sqrt{(d^2 + 2*d*r)}$ (Formula 2)

Finally, I have marked the dimension "x" as the green line. This serves both to plot point T when drawing the curved track, and to define the width of the table, which should be, say 1½ inches outside of T each side of the table.

To find dimension x, once s, d, and r have been calculated:

$x = s^2/(r + d)$ (Formula 3).


C
d
x
s
P
T
T
r
r
O

Practical example

In the case of the sector table I designed, the length is 15 inches, which gives radius s = 7½ inches. As I work in 009, the chosen offset is 1½ inches – this is probably the minimum for getting your fingers between two trains even in "N" or smaller. Naturally, those working with wider stock in 4mm standard gauge, or larger scales, should choose a suitable offset. Using Formula 1, I found that the required radius, r, is 18 inches (by chance the figures worked out as a round number).

The position x, of point T was calculated from Formula 3, as 2.88 inches. I therefore made the table 9 inches wide (4½ inches either side of the centre line).

I then asked the question 'What if I added a second track each side?' Using the same offset between tracks, the total distance d from centre line to second track would be 3 inches. The required radius, r, came out to be approximately 7.8 inches. Whilst possible for short vehicles (Eggerbahn/Jouef models of the 1960's –'80's used a radius of approximately 5½ inches) I would consider this to be too tight for normal use. Supposing I required a minimum of 12 inch radius. From Formula 2, using r = 12, and d = 3, the radius of the table, s = 9. I.e. a moderate increase of total length to 18 inches. In the end I chose not to go down this route, and finalised on 15 inches long overall, and 9 inches wide.

Setting out

Having marked points C, P and the four points T, the straight route can be marked first, parallel to the sides. Since, in my case, the curved track is of a common radius, I would be able to use a "Tracksetter"™ to join points T, P and T. Alternatively, a suitable trammel may be made from a piece of wood with a nail at one end, and a hole to hold a pencil tightly at the required radius from the nail. Provided the table can be placed on a suitable workbench, and point O marked on the bench (this is obviously outside of the turntable) and at right angles to the centre line of the table, the trammel can be used as a compass to draw the curve. Marking points T help to confirm that the curve is drawn symmetrically. Since I was unable to find my Tracksetters – what I actually did was use the trammel to mark the curve on a piece of stiff card, and then set the radius against this. For two curves, the template was perfectly robust enough.

The description has taken more time than the calculations and actual work. I hope that this proves helpful to someone.