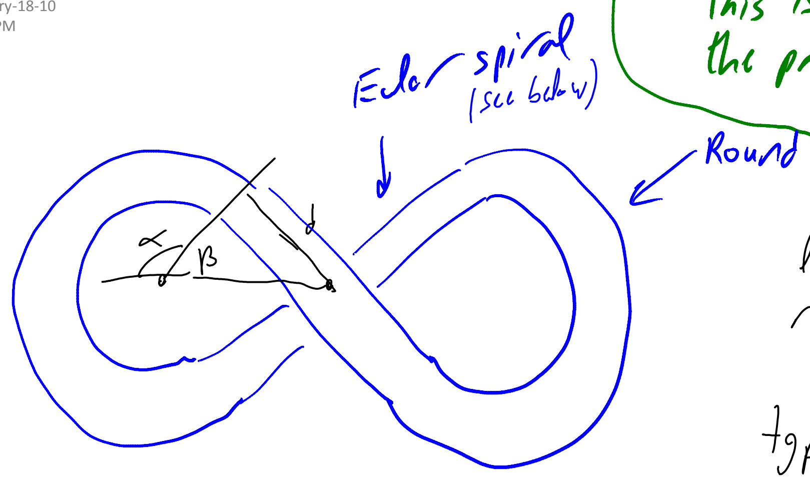
# Naive Velodrome Calculations

January-18-10
3:37 PM




This is the same as the problem of designing train track!

So you can inquire with train & maybe highway engineers.

length = $l$

radius = $r$

$tg\beta = d/r$

$d = r\,tg(180-\alpha)$

$l = 4r(\alpha + tg(180-\alpha)) \geq 4\pi r$

$\Rightarrow$ Must turn $4\pi$!

Oddly, curvature-wise, the best design is OO (two tangent circles)

$\Rightarrow$ Don't do it, unless you have $\geq 400m$.

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According to http://www.bikecult.com/bikecultbook/sports_velodromes.html, the vast majority of velodromes are much longer, and they only need to do half the turning! (and very few are banked more than 45°).

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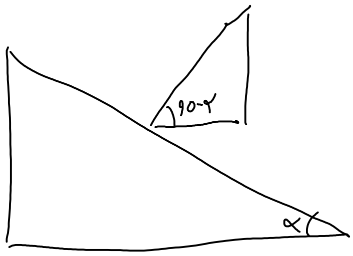


$$\frac{g}{v^2/r} = \frac{1}{tg\alpha} \Rightarrow \frac{rg}{v^2} = \frac{1}{tg\alpha}$$

$$tg\alpha = \frac{v^2}{rg} = \frac{(V_k/3.6)^2}{\frac{l}{2\pi}\cdot 9.8} =$$

$$= V_k^2/20\,l$$

$$\alpha = tg^{-1}\frac{V_k^2}{20\,l}$$

at $l = 90$,

$\alpha = tg^{-1}\frac{V_k^2}{1800}$

| | | | | |
|---|---|---|---|---|
| $V_k$ = | 30 | 40 | 50 | 60 |
| $\alpha$ = | 26.56 | 41.6 | 54.2 | 63.43 |

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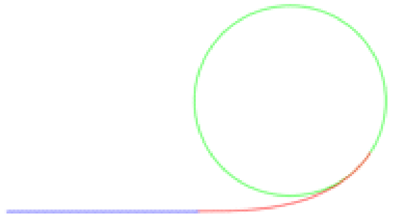
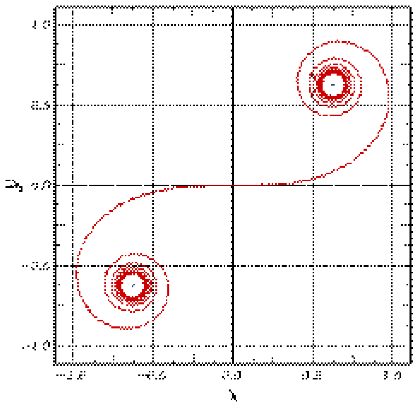
Two pictures from Wikipedia:



Pasted from <http://en.wikipedia.org/wiki/Track_transition_curve>

lots of Fomulas there.



Pasted from <http://en.wikipedia.org/wiki/Euler_spiral>

Must know/decide on the "easement constant"!

After that, this is more or less an easy problem, except, and this is a huge exception, for effects having to do with the width of the track.