Frame sketcher

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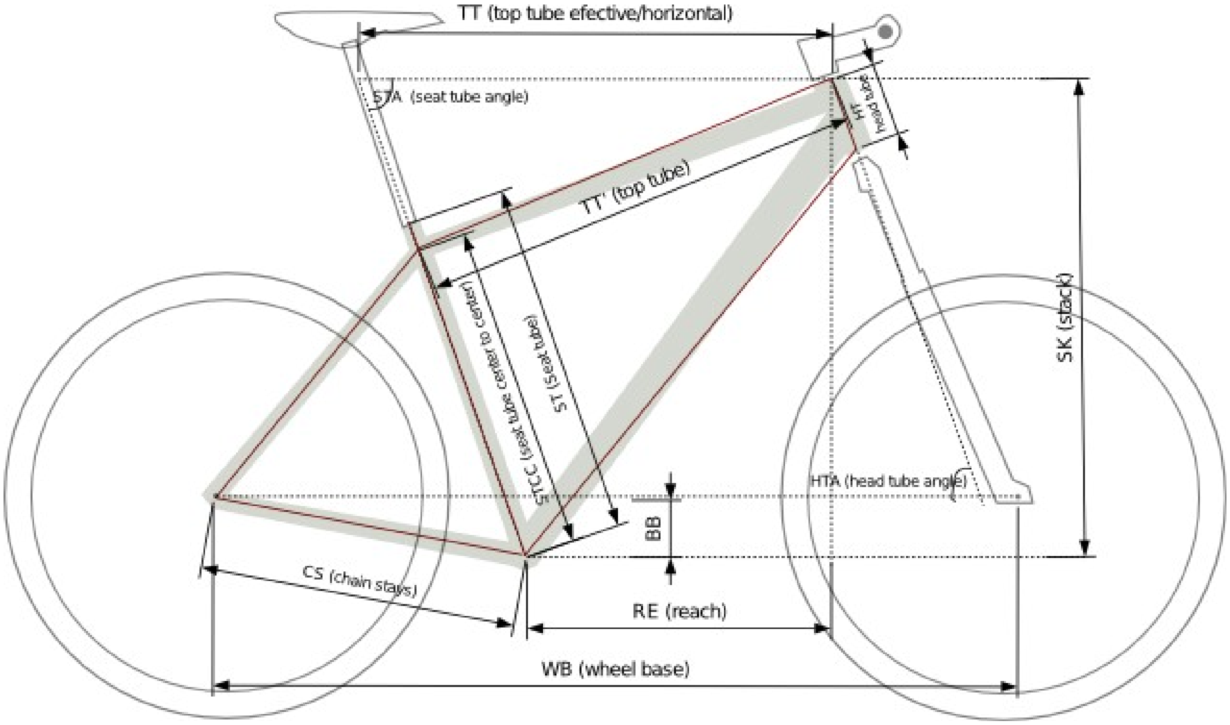
http://www.len.ro/tools/frameSketcher/

The real bicycle

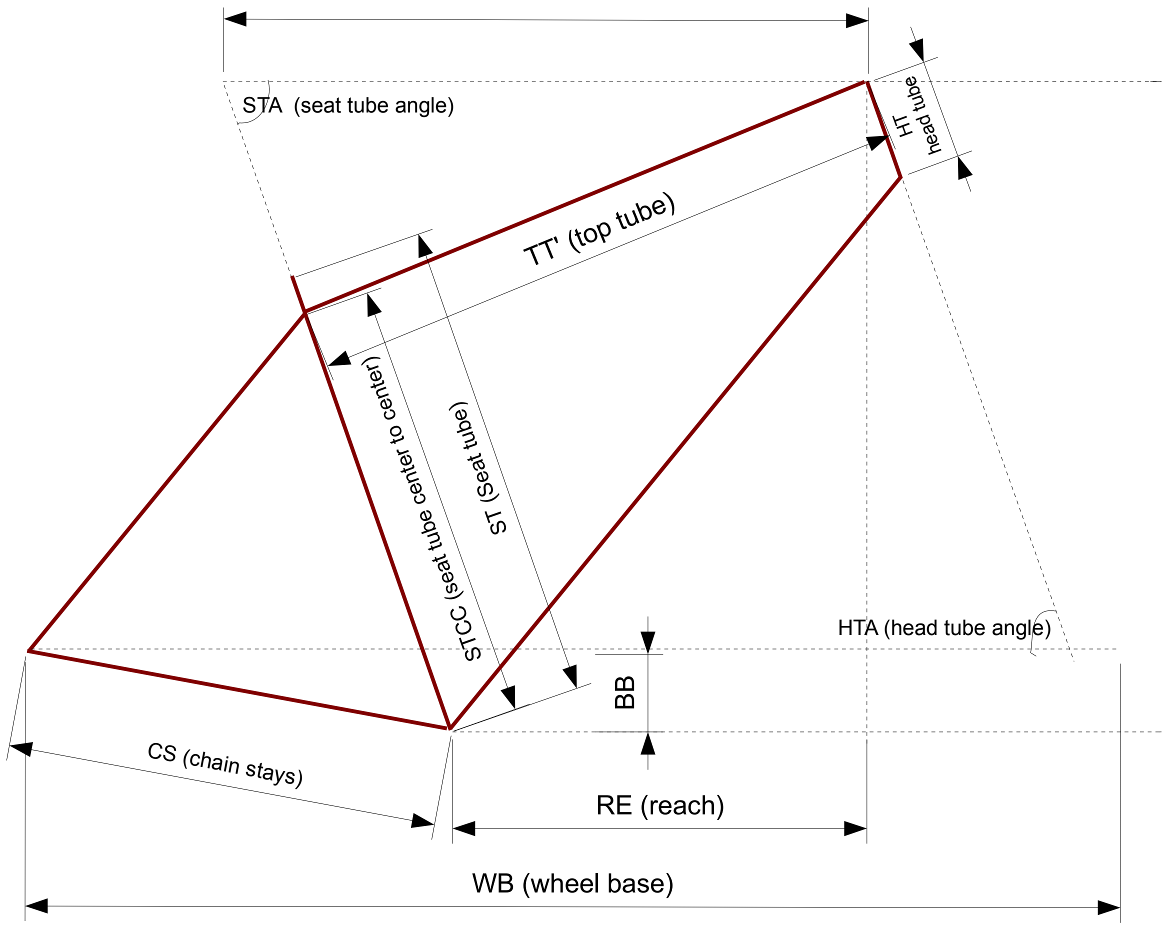
Everything starts with the bicycle:



Based on the above, real, bicycle, one can then create a theoretical bicycle based on the following measurements: Wheel size (WS), Bottom bracket offset (BB), Chain stay length (CS), Seat tube (ST), ST center-center (STCC), Seat tube angle (STA), Wheel base (WB), Head tube (HT), Head tube angle (HTA). These measurements are the ones usually provided as the bicycle geometry. Depending on the manufacturer, sometimes either the Reach (RE) and Stack (SK) or the Top tube horizontal (TT) and Top tube sloped (TT') are provided. The meaning of the above measurements should be obvious from the image above, if not, a good place to start is on wikipedia.

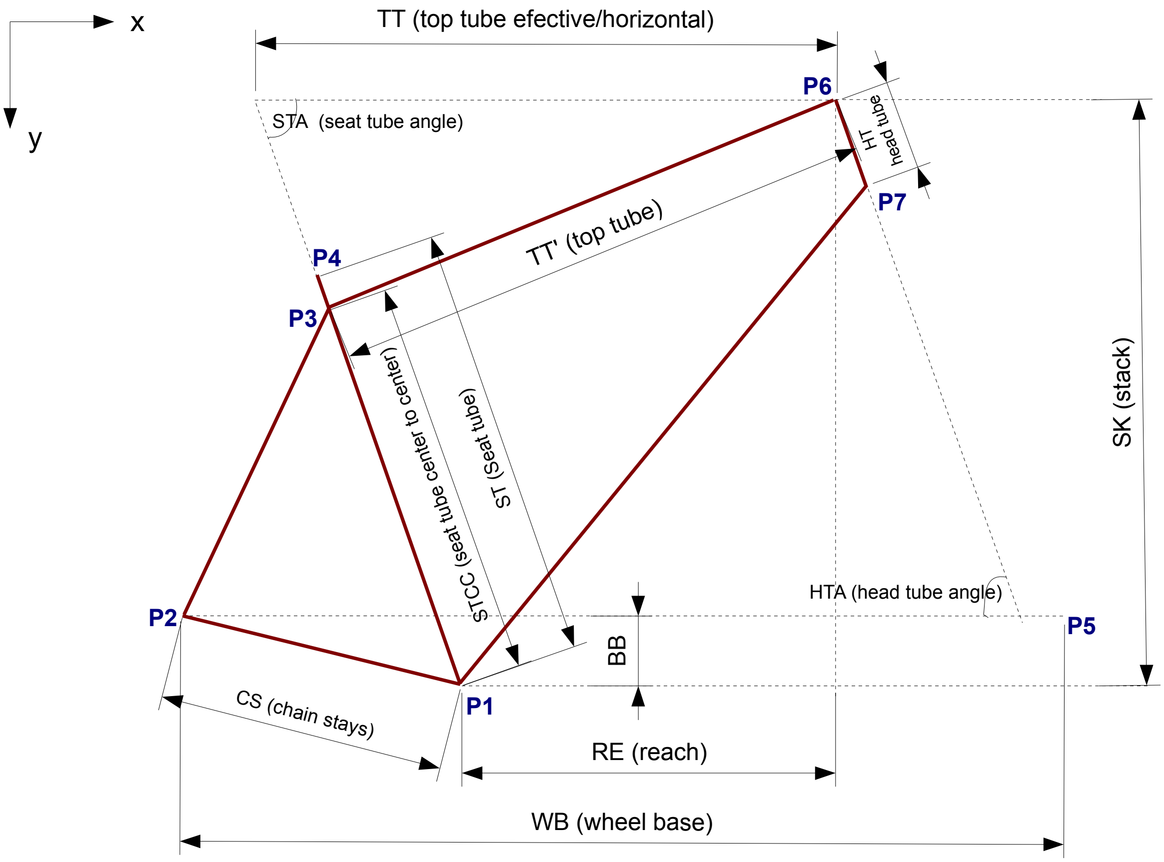
The model

Some things are ignored in the process, such as the frame tubes width, their shapes or their position on the head tube.



It should be possible however, within the theoretical model above, to calculate and sketch frames with an informative degree of accuracy.

Drawing the model frame



The coordinates of the points P_1 - P_7 are:

$$P_1 \rightarrow x = x_0 \quad y = y_0 - (WS - BB)$$

$$P_2 \rightarrow x = x_{p1} - \sqrt{CS^2 - BB^2} \quad y = y_0 - WS$$

$$P_3 \rightarrow x = x_{p1} - (STCC \cdot \cos(STA)) \quad y = y_{p1} - (STCC \cdot \sin(STA))$$

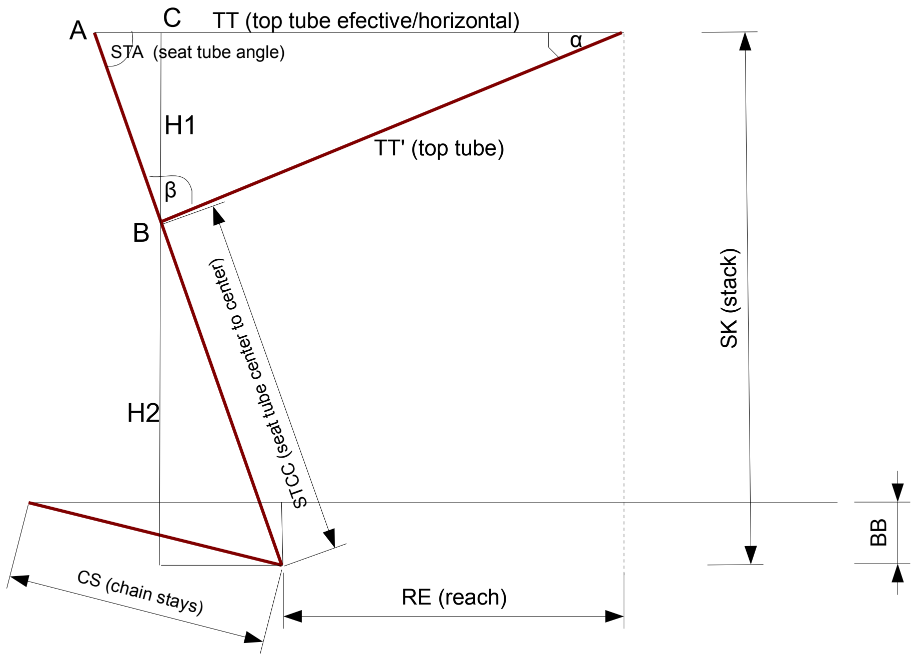
$$P_4 \rightarrow x = x_{p1} - (ST \cdot \cos(STA)) \quad y = y_{p1} - (ST \cdot \sin(STA))$$

$$P_5 \rightarrow x = x_{p2} + WB \quad y = y_{p2}$$

$$P_6 \rightarrow x = x_{p1} + RE \quad y = y_{p1} - BB - SK$$

$$P_7 \rightarrow x = x_{p6} + HT \cdot \cos(HTA) \quad y = y_{p6} + HT \cdot \sin(HTA)$$

Calculations



Different manufacturers provide different values. Either the *Reach (RE)* and *Stack (SK)* or the *Top tube horizontal (TT)* and *Top tube (TT')* are sometimes provided.

1. $(\boldsymbol{TT}, \boldsymbol{TT'}) \rightarrow (\boldsymbol{SK}, \mathbf{RE})$

$$\frac{TT'}{\sin(STA)} = \frac{TT}{\sin(\beta)} = \frac{AB}{\sin(\alpha)} \rightarrow \boldsymbol{\beta = \arcsin\left(\frac{TT \cdot \sin(STA)}{TT'}\right)}$$

$$AB = \frac{TT' \cdot \sin\alpha}{\sin STA} \rightarrow AB = \frac{TT' \cdot \sin(180 - STA - \beta)}{\sin STA} = \frac{TT' \cdot \sin(STA + \beta)}{\sin STA}$$

$$H1 = AB \cdot \sin STA \rightarrow H1 = TT' \cdot \sin(STA + \beta)$$

$$H2 = STCC \cdot \sin(STA) \rightarrow \boldsymbol{SK = STCC \cdot \sin(STA) + TT' \cdot \sin(STA + \beta)}$$

$$TT = SK \cdot \cot(STA) + \mathrm{RE} \rightarrow \boldsymbol{\mathrm{RE} = TT - SK \cdot \cot(STA)}$$

2. $(\boldsymbol{SK}, \mathbf{RE}) \rightarrow (\boldsymbol{TT}, \boldsymbol{TT'})$

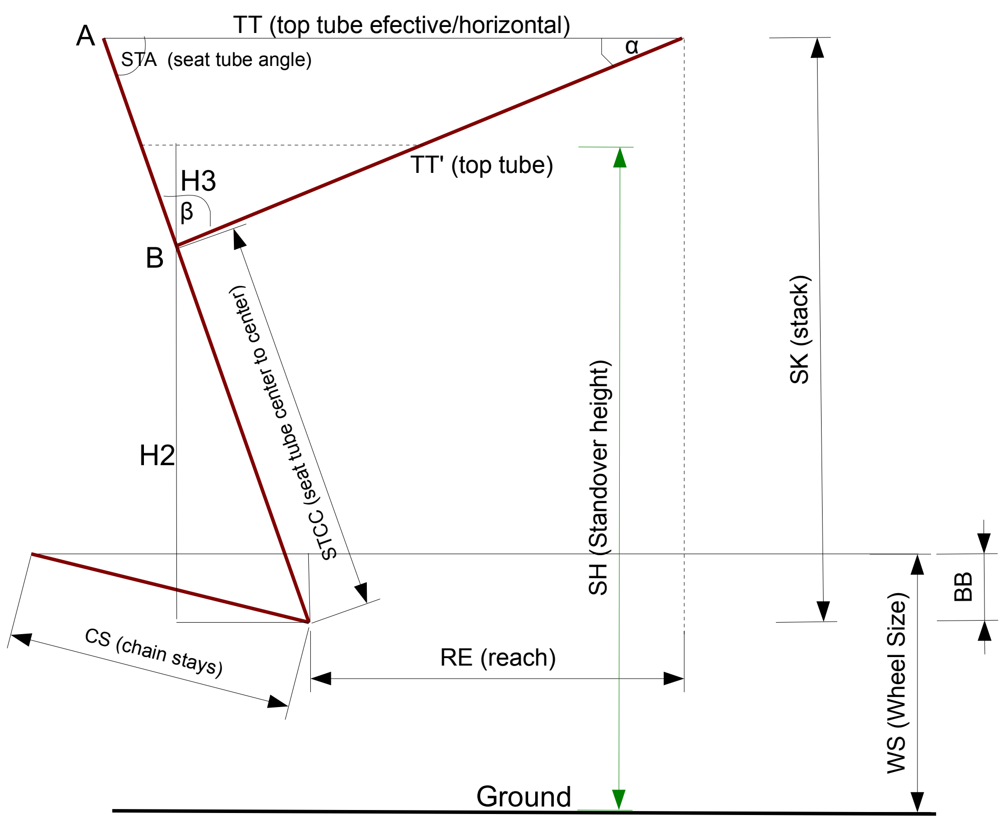
$$\boldsymbol{TT = \mathrm{RE} + SK \cdot \cot(STA)}$$

$$AB = \frac{SK}{\sin(STA)} - STCC \rightarrow H1 = \sqrt{AB^2 - AC^2} \quad AC = TT - \mathrm{RE} - STCC \cdot \cos(STA)$$

$$TT' = \sqrt{H1^2 + (TT - AC)^2} = \sqrt{AB^2 - AC^2 + (TT - AC)^2} = \sqrt{AB^2 + TT^2 - 2 \cdot TT \cdot AC}$$

$$\boldsymbol{TT' = \sqrt{\left(\frac{SK}{\sin(STA)} - STCC\right)^2 + TT^2 - 2 \cdot TT \cdot (TT - \mathrm{RE} - STCC \cdot \cos(STA))}}$$

Calculate the Standover height (SH)



$$SH=(WS-BB)+H2+H3$$

$$H2=\sin STA\cdot STCC\ ,\ H3=\sin(180-\beta-STA)\cdot\frac{TT'}{2}=\sin(\beta+STA)\cdot\frac{TT'}{2}$$

$$\rightarrow SH=(WS-BB)+\sin STA\cdot STCC+\sin(\beta+STA)\cdot\frac{TT'}{2}$$

$$\boldsymbol{\rightarrow SH=(WS-BB)+\sin STA\cdot STCC+\sin\left(\arcsin\left(\frac{TT\cdot\sin(STA)}{TT'}\right)+STA\right)\cdot\frac{TT'}{2}}$$