1 Definitions

Let $m =$ base of the counter
$MSR =$ most signifcant digit region
$c_0 =$ starting value of counter
$d = \lceil \log_m(c_0) \rceil,$ number of digits per row
$\mathcal{DR} = \left\lceil \frac{d}{3} \right\rceil,$ digit regions per row
$c_f = m^d - 1,$ final value of the counter
$c_\Delta = c_f - c_0,$ number of rows
$l = \lceil \log m \rceil + 2,$ bits needed to represent each digit plus 2 for MSR and MSD
$\mathcal{DR}_{height} = 3 \cdot (l + 30),$ height of a row
$h = c_\Delta \cdot \mathcal{DR}_{height},$ height of constuction without roof tiles

In order to determine the number of digits per row, given some value k, let $R = k \mod 6$. There are 3 distinct cases to consider.

- if $0 \leq R \leq 1$, then $\{\ d \in \mathbb{N} \mid 3 \text{ divides } d\ \}$
  MSR $\leftarrow$ 3 digits
- if $2 \leq R \leq 3$, then $\{\ d \in \mathbb{N} \mid 3 \text{ divides } d - 1\ \}$
  MSR $\leftarrow$ 1 digit
- if $4 \leq R \leq 5$, then $\{\ d \in \mathbb{N} \mid 3 \text{ divides } d - 2\ \}$
  MSR $\leftarrow$ 2 digits

In order to account for odd values of k, when k is odd, one vertical filler tile is added to increase the width of the rectangle. O(1)
$\mathcal{DR}_{1st} = 3l + 90 + 1$
$\mathcal{DR}_{general} = 3l + 90$
$\mathcal{DR}_{last} = 3l + 75$
Let n be the number of counter unit rows, then

$$h = (n-1) \cdot \mathcal{DR}_{general} + \mathcal{DR}_{1st} + \mathcal{DR}_{last}$$
$$= (m^d - 1)(3l + 90) + 6l + 166$$

$$m = \left\lceil \left(\tfrac{N}{93}\right)^{\frac{1}{d}} \right\rceil$$

$$N = 93\left(\frac{N}{93}\right) = 93\left(\left(\frac{N}{93}\right)^{\frac{1}{d}}\right)^d \leq 93\left\lceil\left(\frac{N}{93}\right)^{\frac{1}{d}}\right\rceil^d$$
$$= 93(m^d - 1) \leq 3lm^d + 90m^d \leq 3lm^d + 90m^d + 3l + 91$$
$$= (m^d - 1)(3l + 90) + 6l + 166$$