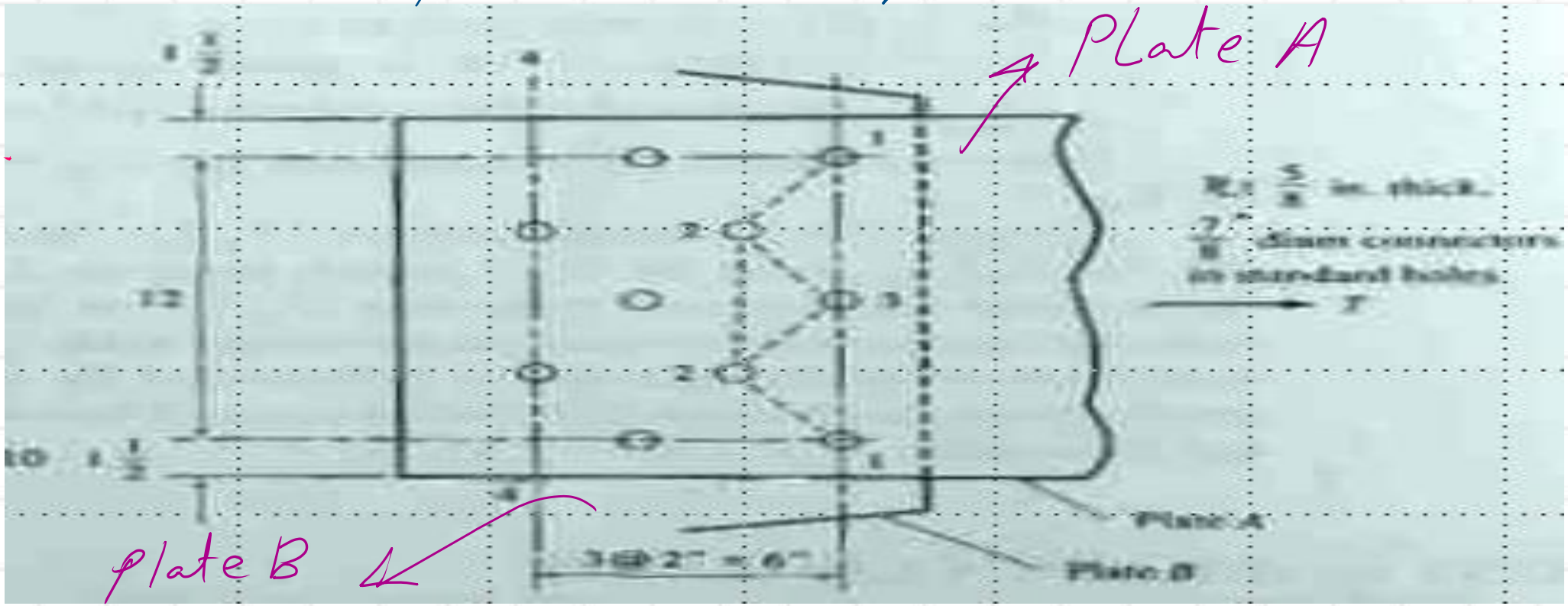
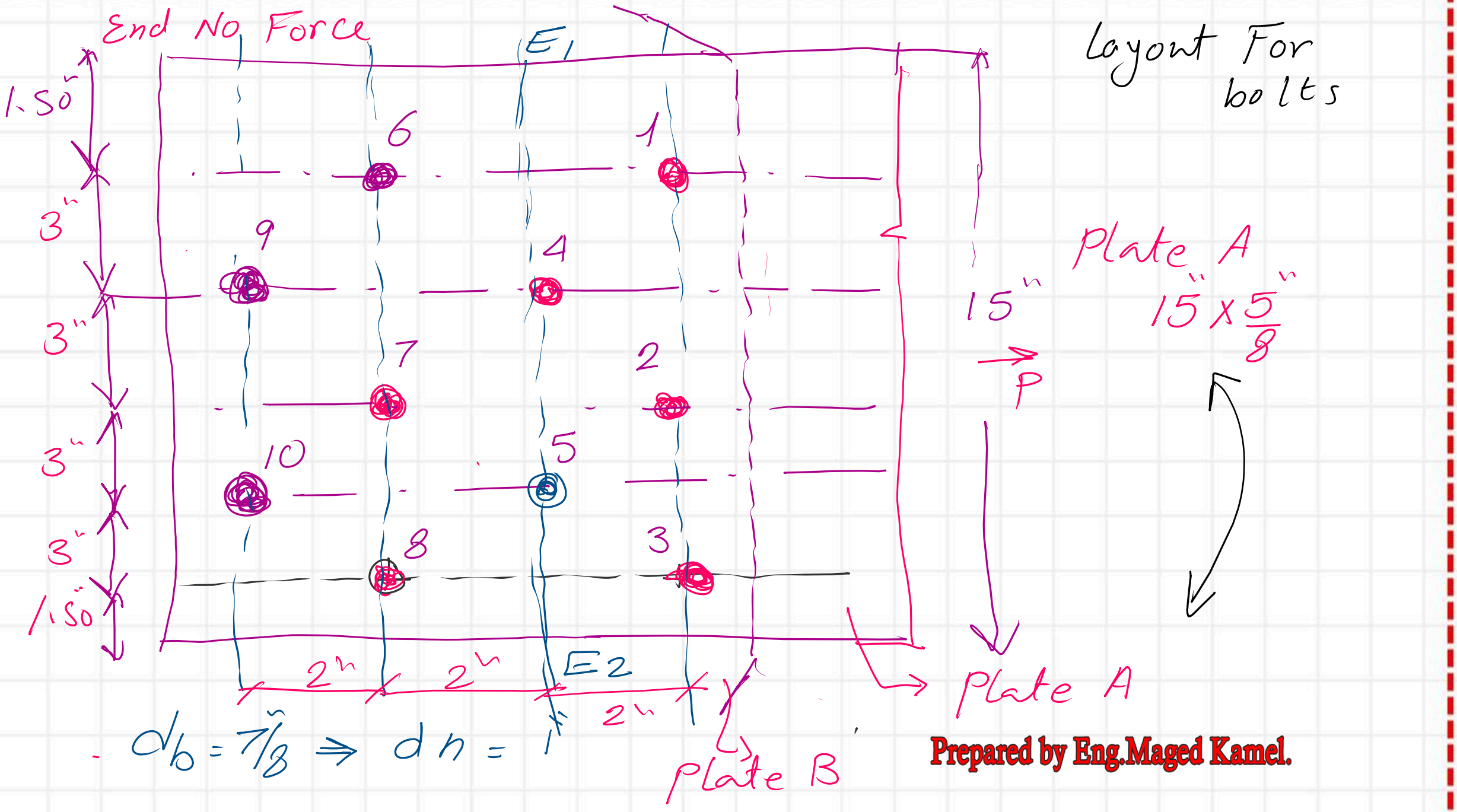
Calculate the governing Net area For plate A of the single Lap Joint and show the Free body diagrams of portions in plate A with sections taken through each Line of holes. Assume plate A has adequate net area and does not control the strength.




End No Force
E1
E2
1.50"
3"
3"
3"
3"
3"
1.50"
6
1
9
4
7
2
10
5
8
3
2"
2"
2"
15"
P
plate A
plate B
plate A
15" x 5/8"
Layout For bolts
$d_b = 7/8 \Rightarrow d_h = 1"$
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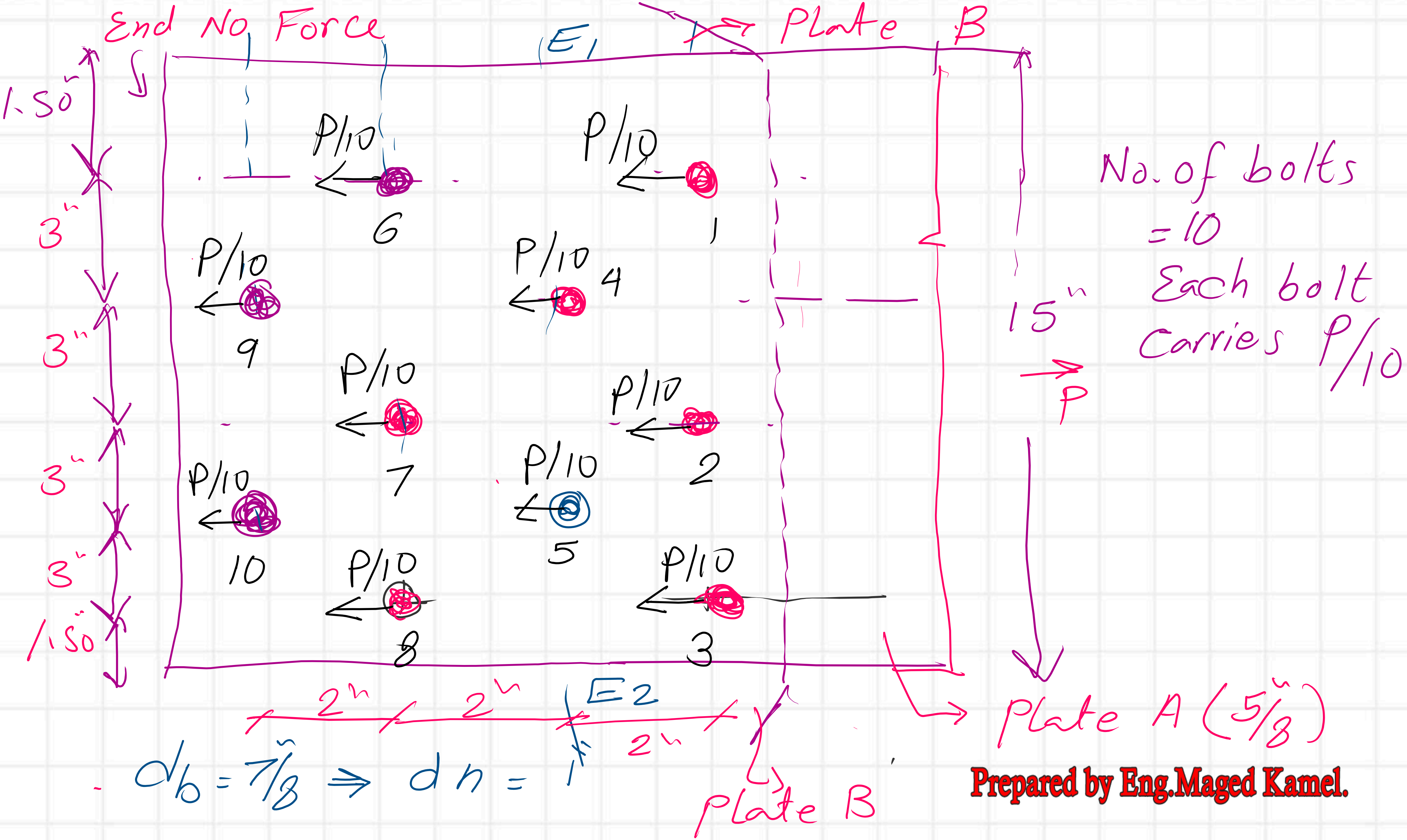

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$d_h = 1^{"}$, $t_p = 5/8$

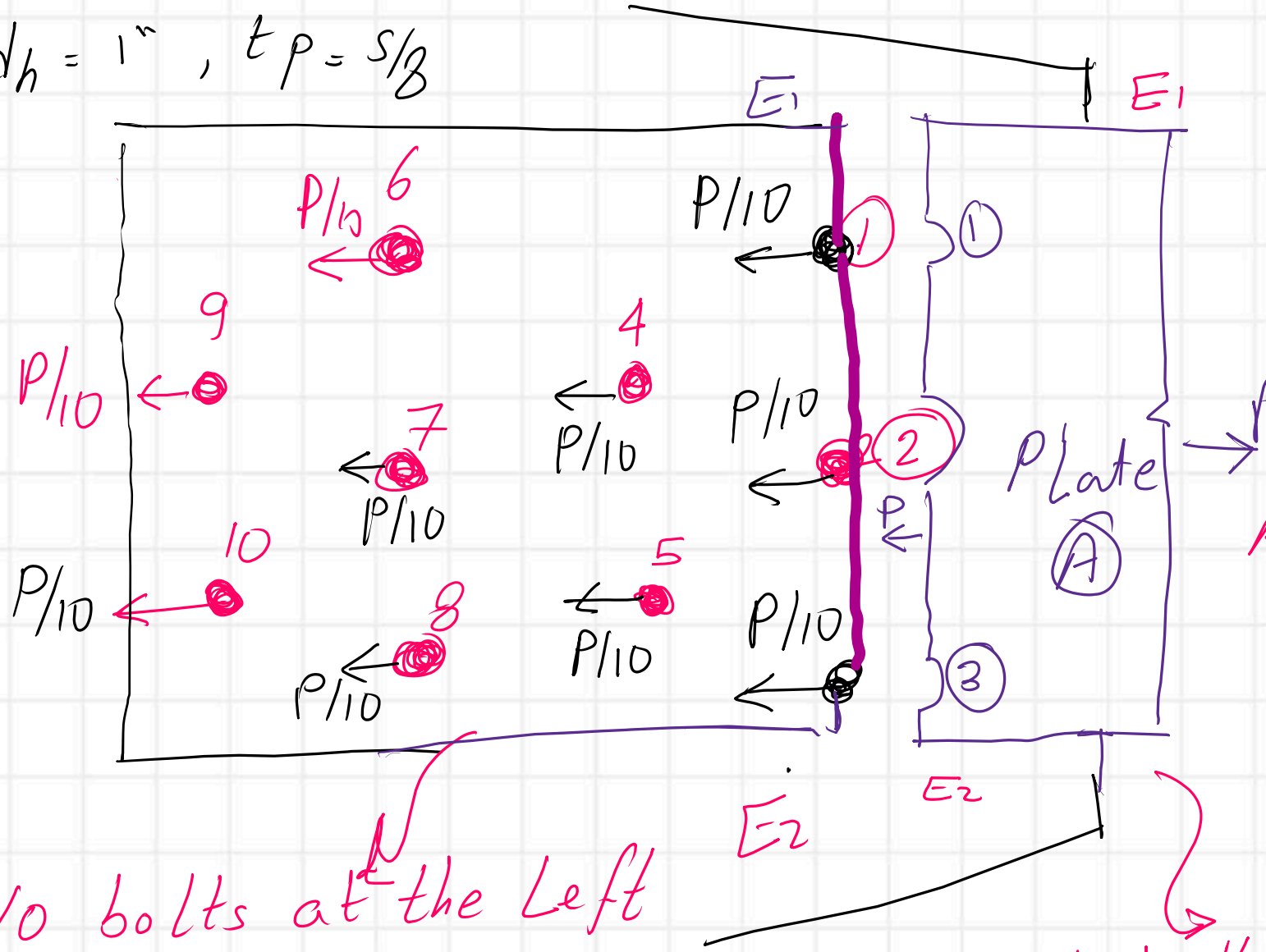


Plate (A)

Route E1 1 2 3

$A_g = 15 \times \frac{5}{8} = 9.375$ inch²

Deduct 3 holes areas

$= 3\left(\frac{5}{8}\right) = 1.875$ inch²

No staggerd Lines

$A_n = 9.375 - 1.875$

$= 7.50$ inch²

100% P

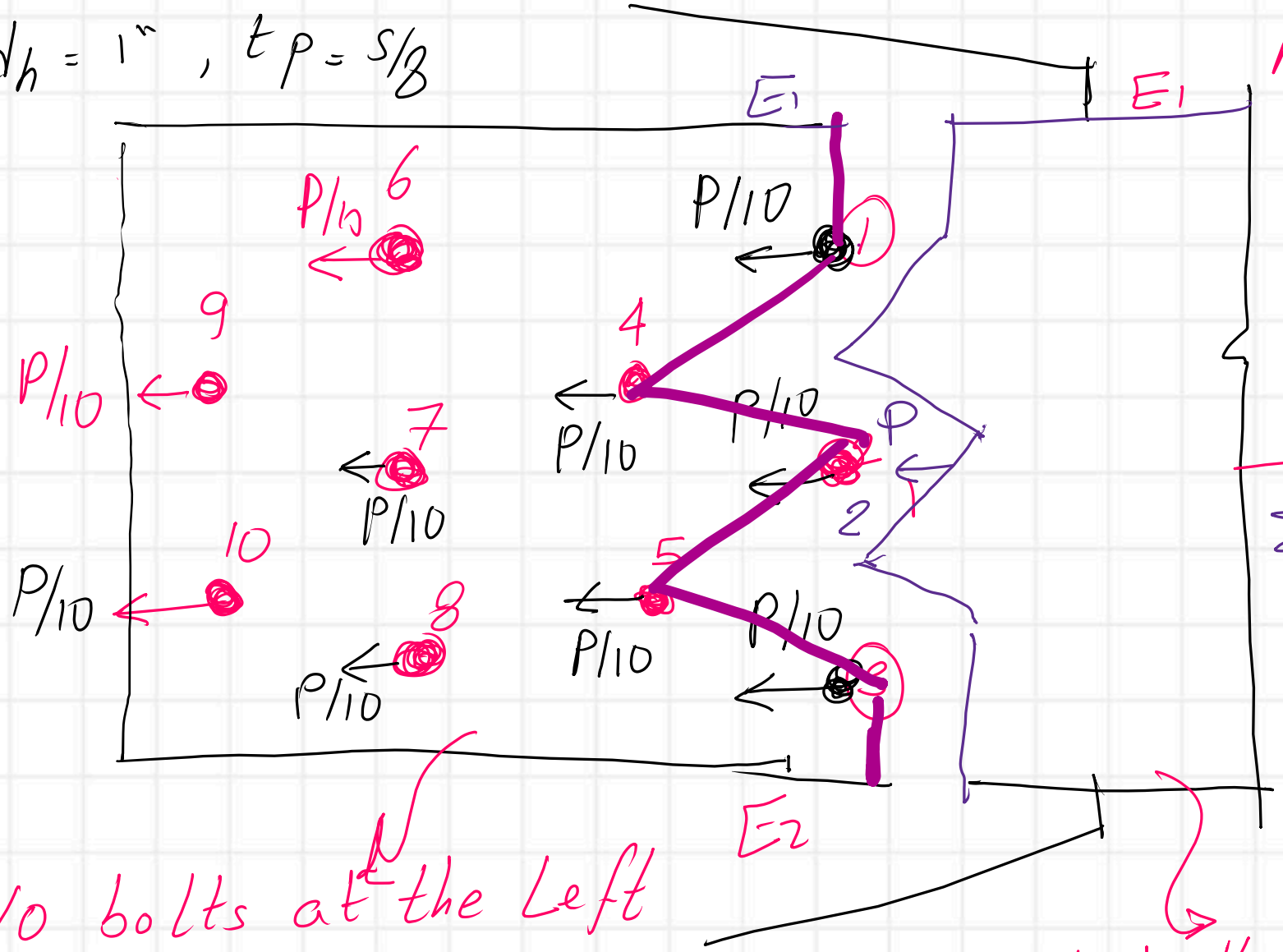
10 bolts at the Left side

$S = 2^{"}$

$g = 3^{"}$

No bolt at the right side

$d_h = 1^{"}$, $t_p = 5/8$



Route E_1 1 4 2 5 3 E_2

$A_g = 15 \times \frac{5}{8} = 9.375$ inch²

Deduct 5 holes areas

$= 5\left(\frac{5}{8}\right) = 3.125$ inch²

P → P

No

$\sum \frac{s^2}{4g} t = \frac{2^{-2}}{4(3)}(4)\left(\frac{5}{8}\right)$

$= 0.833$ +ve inch²

$A_n = 9.375 - 3.125 + 0.833$

$= 7.083$ inch²

100 %. P

10 bolts at the Left side

$s = 2^{"}$

$g = 3^{"}$

No bolt at the right side

$d_h = 1"$, $t_p = 5/8$

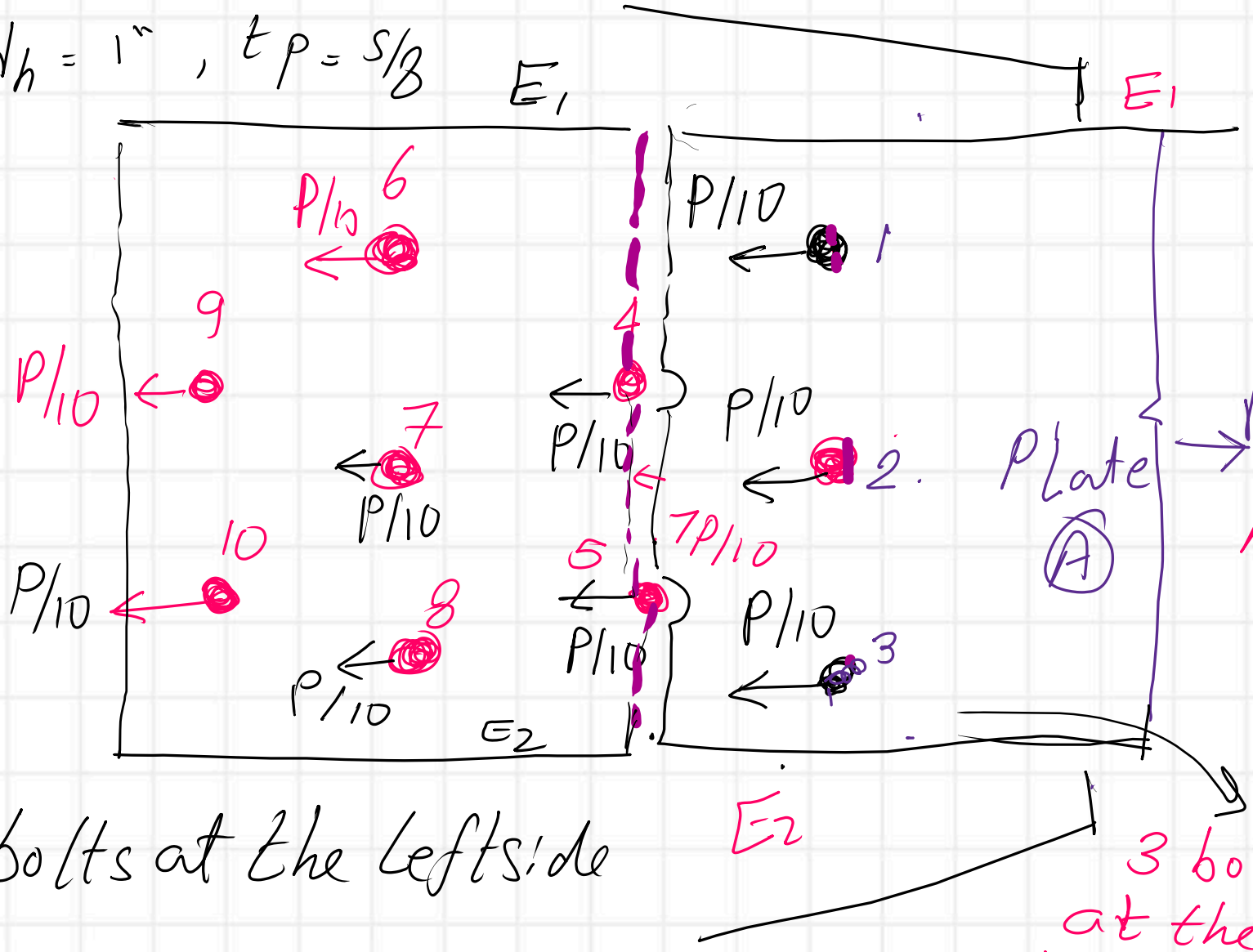


Plate (A)

Route E_1 45 E_2

$A_g = 15 \times \frac{5}{8} = 9.375$ inch²

Deduct 2 holes areas

$= 2\left(\frac{5}{8}\right) = 1.25$ inch²

No staggerd Lines

$A_n =$

$= 9.375 - 1.25$

$= 8.125$ inch²

inch²

$\frac{7P}{10}$

$A_{n_{adj}} = \frac{10}{7}(8.125)$

$= 11.607$ inch²

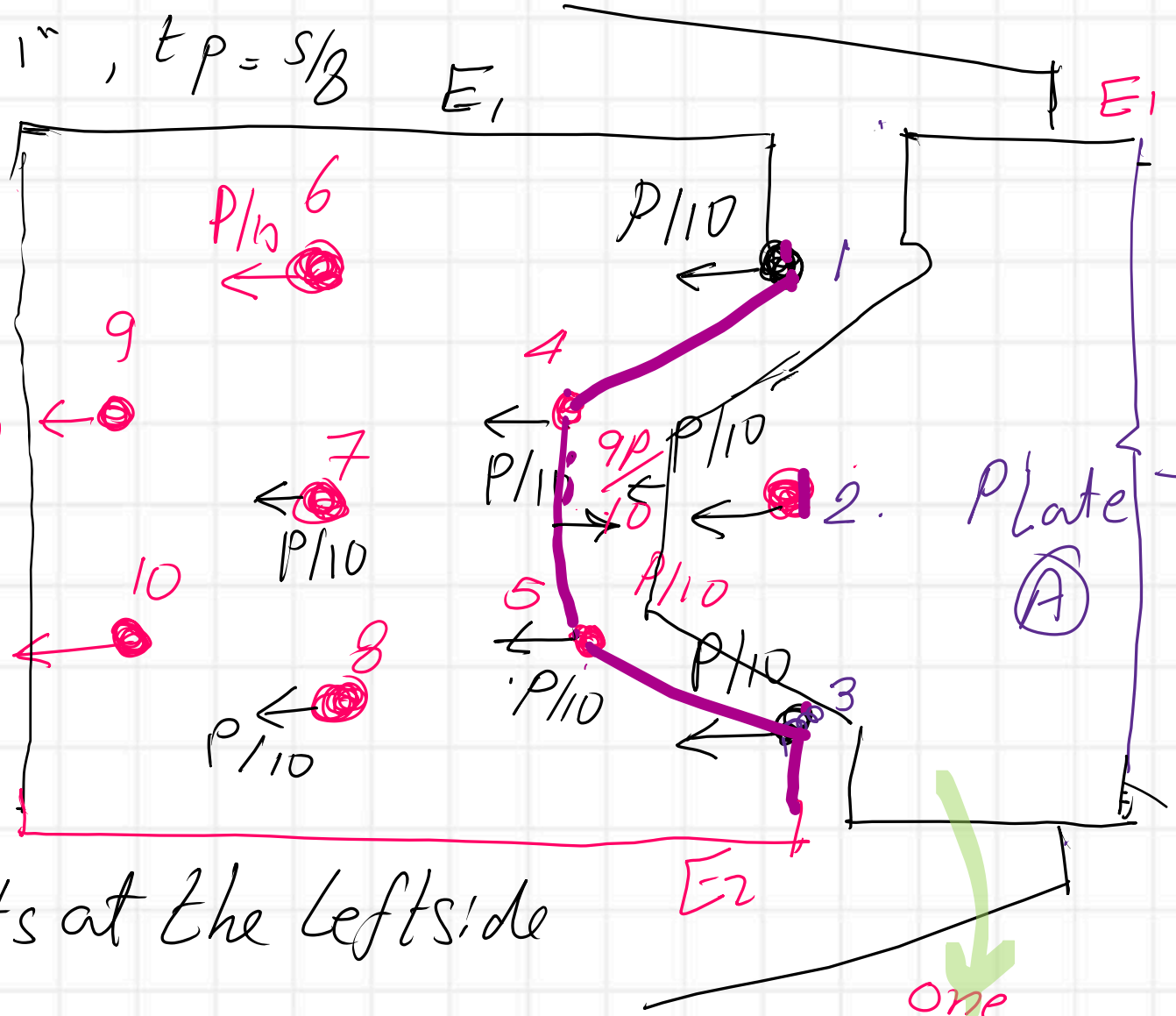
7 bolts at the Leftside

3 bolts at the rightside

$S = 2"$

$g = 3"$

$d_h = 1"$, $t_p = 5/8$



9 bolts at the Leftside

$S = 2"$

$g = 3"$

one bolt at the right side

Route E_1 1 4 5 3 E_2

$A_g = 15 \times \frac{5}{8} = 9.375 \text{ inch}^2$

Deduct 4 holes areas

$= 4\left(\frac{5}{8}\right) = 2.50 \text{ inch}^2$

$\sum \frac{s^2}{4g} t = \frac{2^2}{4(3)} \cdot \frac{5}{8}(2)$

$= 0.417 \text{ inch}^2$ +Ve

$A_n = 9.375 - 2.50 + 0.417$

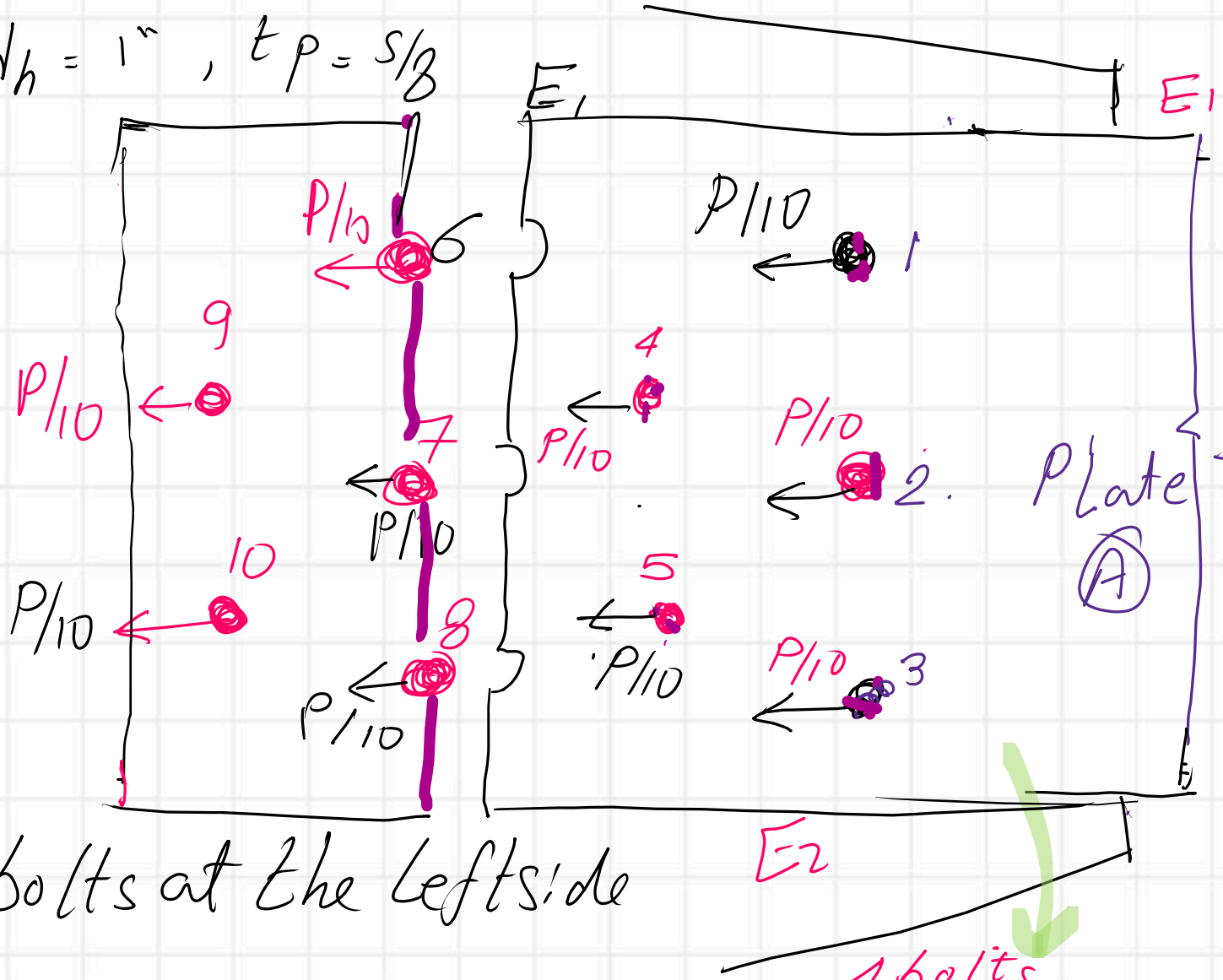
$= 7.292 \text{ inch}^2$

$\Rightarrow 9/10\, P$

$A_{n_{adj}} = \frac{10}{9}(7.292)$

$= 8.120 \text{ inch}^2$

$d_h = 1"$, $t_p = 5/8$



5 bolts at the Leftside

$S = 2"$
$g = 3"$

4 bolts at the rightside

Route E_1 6 7 8 E_2

$A_g = 15 \times \frac{5}{8} = 9.375$ inch²

Deduct holes areas

$= 3(\frac{5}{8}) = 1.875$ inch²

No Staggered Lines

$A_n = 9.375 - 1.875$

$= 7.50$ inch²

$\Rightarrow \frac{5}{10} P$

$A_{n_{adj}} = \frac{10}{5}(7.5) = 15$ inch²

Summary of Routes

A_n : 100% P

$E_1\,1\,2\,3\,E_2$ = 7.50 inch²

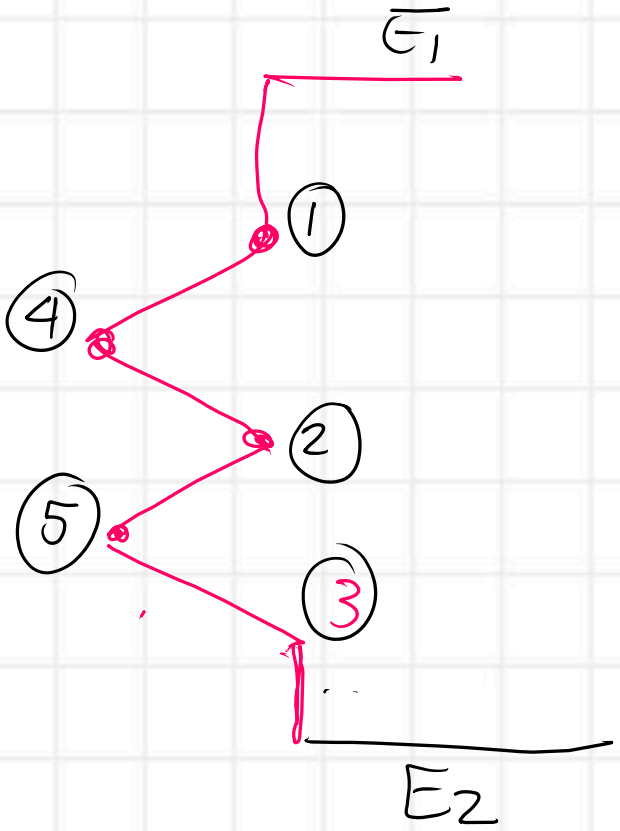
$E_1\,1\,4\,2\,5\,3\,E_2$ = 7.083 inch² ⇒ min A_n value

$E_1\,4\,5\,E_2$ = 11.607 inch²

$E_1\,4\,5\,3\,E_2$ = 8.120 inch²

$E_1\,6\,7\,8\,E_2$ = 15.00 inch²

Select ⇒ 7.083 inch² ≈ 7.08 inch²



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