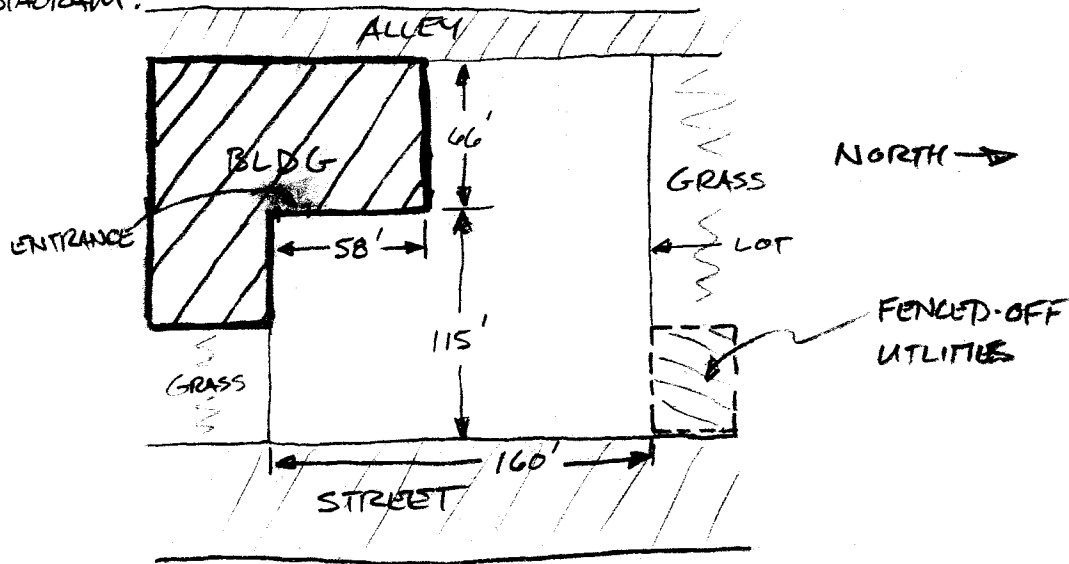


DESIGN A PARKING LOT TO FIT THE SPACE BELOW.  
REQUIREMENTS:

- ASSUME 30% OF SPACES ARE HANDICAP, AND HC SPACES ARE 12' WIDE
- ASSUME 30% OF SPACES ARE FOR COMPACT CARS, AND SPACE WIDTH IS AT THE LOWER END FOR SMALL CARS
- ASSUME 4 LUXURY CAR SPACES (UPPER WIDTH END) ARE NEEDED FOR EXECUTIVE PARKING, NEXT TO HC PARKING.
- MAXIMIZE THE REMAINING, STANDARD CAR STALLS AT THE LOWER END OF THE ALL-DAY PARKING RANGE
- ASSUME 14' WIDTH FOR CROSS-AISLES, UNLESS USING THE STREET OR ALLEY BETWEEN ROWS

DIAGRAM:

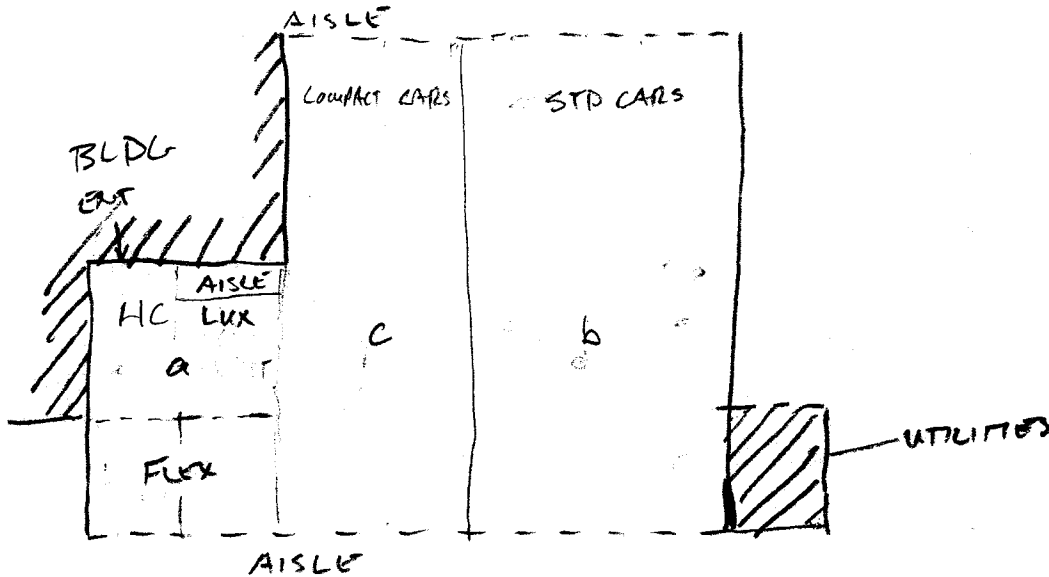


NOTE: THIS PROBLEM IS COMPLEX, AND WILL REQUIRE MORE TIME THAN THE TYPICAL EXAM PROBLEM!

PLAN A:

TRYING EAST-WEST ROWS:

- AISLE WIDTH = 14' (GIVEN)
- HC STALL WIDTH = 12' (GIVEN)
- COMPACT STALL WIDTH = 8' (TABLE 4.1)
- LUXURY STALL WIDTH = 10' (TABLE 4.1)
- STD, ALL DAY STALLS = 8.5' (TABLE 4.1)



AREA a: W3 MODULE - 1 ROW HC, 1 ROW LUXURY  
 ↑ USE 10' STALL WIDTH

55'-11" (LUX, 60°, 65°) FOUND BY TABLE 4.1

HC:  $PW = \frac{SW}{\sin \theta} = \frac{12'}{\sin(65^\circ)} = 13.25'$

$\frac{115'}{13.25} = 8.67 \Rightarrow 8$  HC STALLS - 1 (BECAUSE  $\theta \neq 90^\circ$ ) = 7 HC STALLS IN ONE ROW

LUXURY:  $PW = \frac{10'}{\sin(65^\circ)} = 11.03'$

$115' - \text{AISLE} = 101'$   $\frac{101'}{11.03} = 9.15 \Rightarrow 9$  STALLS - 1 (B/C  $\theta \neq 90^\circ$ )  
 = 8 LUXURY STALLS (MAX)

SINCE ONLY 4 ARE NEEDED; FIND REMAINING SPACE:

$(4 \text{ STALLS})(11.03') = 44.12' \Rightarrow 115' - 44.12' - 14' = 56.88'$

AREA b:

STD:

REQUIRES W3, TRY 90° WIDTH = 66' (B/C FENCE)

$$PW = \frac{8.5'}{\sin(90^\circ)} = 8.5' \quad \frac{115' + 66'}{8.5'} = 21.29 \Rightarrow 21 \text{ STALLS/ROW}$$

$$\Rightarrow 42 \text{ STALLS/MOD.}$$

$$\text{REMAINING WIDTH} = 160' - (\text{STD}, w3, 90^\circ) - (\text{HC/LUX}, w3, 65^\circ)$$

$$= 160' - 66' - 55.083' = 38.92'$$

CAN'T FIT ANY (STD, w4, 90°) MODULES IN 38.92' SO...

AREA c:

TRY COMPACT ROW  $\Rightarrow$  (COMP, w1, 80°) = 38'2" = 38.17' PER MOD. (B/C WALL)

$$PW = \frac{8'}{\sin(80^\circ)} = 8.13' \quad \frac{115' + 66' - 14' \text{ AISLE}}{8.13} = 20.54 \Rightarrow 20 \text{ STALL-1 (B/C } \neq 90^\circ)$$

$$\Rightarrow 19 \text{ COMP STALLS}$$

ROUGH CHECK:

4 LUX STALLS - OK'

TOTAL STALLS (SO FAR):

4 LUX
7 HC
42 STD
<u>19 COMP</u>
72 TOTAL

% HC =  $\frac{7}{72} = 9.7\%$  HIGH, BUT MEETS MIN.

% COMP =  $\frac{19}{72} = 25\%$  ALMOST, BUT TOO LOW

USE REMAINING SPACE FOR COMPACT CARS: (COMP, w3, 65°) TO MATCH ANGLE FOR HC/LUX.

$$PW = \frac{8'}{\sin(65^\circ)} = 8.83' \quad \frac{56.88'}{8.83'} = 6.44 \Rightarrow 6 \text{ STALLS}$$

(DON'T LOSE 1 STALL B/C COUNTED IN LUX @  $\neq 90^\circ$ )

CHECK:

TOTAL STALLS (SO FAR):

4 LUX
7 HC
42 STD
<u>25 COMP</u>
78 STALLS

% HC =  $\frac{7}{78} = 8.9\%$  TOO HIGH

% COMP =  $\frac{25}{78} = 32\%$  LITTLE TOO HIGH

TRY USING PORTION OF HC PARKING IN FLEX AREA FOR STD CARS

HC FLEX AREA:

$115' - 3(13.25') = 75.25' \Rightarrow (STD, W3, 45^\circ)$  MATCH HC/LUX &

$PW = \frac{8.5'}{\sin(65^\circ)} = 9.38'$

$\frac{75.25'}{9.38'} = 8.02 \Rightarrow 8 \text{ STALLS} - 1 (\text{B/C } \theta \neq 90^\circ)$

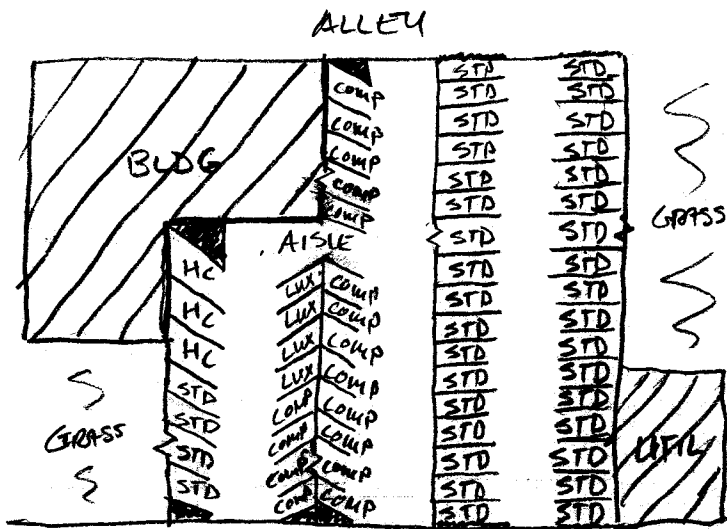
= 7 STD STALLS MORE

CHECK: TOTAL STALLS:

4 LUX
3 HC
49 STD
25 COMP
<u>81 STALLS</u>

4 LUX STALLS? - YES!  
 % HC =  $\frac{3}{81} = 3.7\% \geq 3\%?$  - YES!  
 % COMP =  $\frac{25}{81} = 30.8\% \geq 30\%?$  - YES!  
 } GOOD SOLUTION!

LAYOUT:

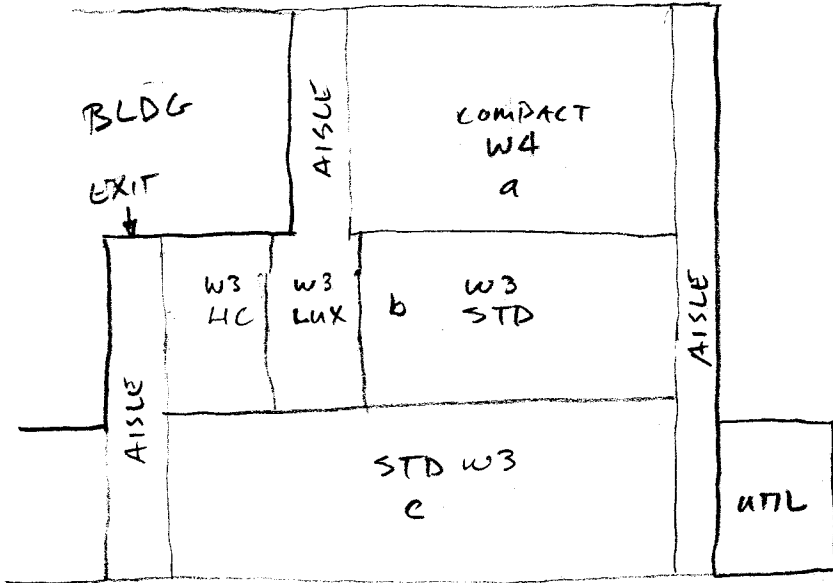


W3 ↑      W1 ↑      W3 ↑      STREET  
 $\theta = 65^\circ$      $\theta = 80^\circ$      $\theta = 90^\circ$

↑	↑	↑	↑	↑	
3 HC	4 LUX	19 COMP	21 STD	21 STD	= <u>81 TOTAL</u>
7 STD	6 COMP				

PLAN B:

TRYING NORTH-SOUTH ROWS:



AREA a: W4 MODULE COMPACT 90° Δ (comp, W4, 90°) = 66'

$$PW = \frac{8'}{\sin(90^\circ)} = 8' \quad \frac{160' - 58' - 14'(2)}{8} = 9.25 \Rightarrow 9 \text{ STALLS/ROW} \Rightarrow 18 \text{ STALLS/MOD}$$

2 AISLES

AREA b: W3 MODULE HC/LUX/STD 90° (Lux, W3, 90°) = 66'

$$LUX PW = \frac{10'}{\sin(90^\circ)} = 10' \quad HC PW = \frac{12'}{\sin(90^\circ)} = 12' \quad STD PW = \frac{8.5'}{\sin(90^\circ)} = 8.5'$$

$$160' - 14'(2) - 12'(2) - 10'(2) = 88' \text{ FOR STD STALLS}$$

2 AISLES      1/2 LUX      1/2 HC

$$\frac{88'}{8.5'} = 10.35 \Rightarrow 10 \text{ STD STALLS/ROW} \Rightarrow 4 \text{ HC STALLS} \\ 4 \text{ LUX STALLS} \\ 20 \text{ STD STALLS}$$

AREA c: STD STALLS W3 MODULE

REMAINING EAST-WEST WIDTH = 115' - 66' = 49' ⇒ USE θ = 45°

$$PW = \frac{8.5'}{\sin(45^\circ)} = 12.02' \quad \frac{160' - 14'(2)}{12.02} = 10.98$$

⇒ 10 STALLS - 1 (B/C θ ≠ 90°)

⇒ 9 STALLS/ROW

⇒ 18 STD STALLS/MOD

TOTAL STALLS = 18 COMP  
4 HC  
4 LUX  
28 STD

54 STALLS ⇒ GO WITH PLAN A

(LOSE TOO MUCH SPACE TO AISLES)