DESIGN A PARKING LOT TO FIT THE SPACE BELOW.

REQUIREMENTS:
- Assume 20% of spaces are handicapped, 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.

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

\[ SB' = (10', y/3, 60°) \]

HC:

\[ \frac{PW}{\sin 60°} = \frac{12'}{\sin(60°)} = 13.25' \]

\[ \frac{115'}{13.25'} = 8.67 \Rightarrow 8 \text{ HC Stalls} - 1 \text{ (Because } 8 \neq 90°) = 7 \text{ HC Stalls} \]

LUXURY:

\[ \frac{PW}{\sin 60°} = \frac{10'}{\sin(60°)} = 11.03' \]

\[ \frac{115'}{11.03'} = 10.1' \Rightarrow 9 \text{ Stalls} - 1 \text{ (Blc B ≠ 90°)} = 8 \text{ Luxury Stalls (Max)} \]

Since only 4 are needed: Find remaining space:

\[ (4 \text{ Stalls})(11.03') = 44.12' \Rightarrow 115' - 44.12' - 14' = 56.88' \]
\[ \text{AREA b:} \]
\[ \frac{\text{STD:} \text{ REQUIRES W3, T24, 90°, WIDTH = 66'}}{\text{PW = } 8.5' \frac{115 + 66'}{8.5} = 21.29} \Rightarrow 21 \text{ STALLS/ROW} \]
\[ \Rightarrow 42 \text{ STALLS/LOT} \]

\[ \text{REMAINING WIDTH = } 160' - (\text{STD, W3, 90°}) - (\text{HC/LUX, W3, 65°}) \]
\[ = 160' - 66' - 55.083' = 38.92' \]

\[ \text{CANT FIT ANY (STD, W4, 0°) MODULES IN 38.92' SO...} \]

\[ \text{AREA c:} \]
\[ \text{TRY COMPACT ROW} \Rightarrow (\text{COMP, W1, 80°}) = 38' 2'' = 38.177' \text{ PER LOT} \]
\[ \text{PW = } 8' \frac{115 + 66' - 14'}{8.13} = 20.54 \Rightarrow 20 \text{ STALL-1 (HC OR LUX)} \]
\[ \Rightarrow 10 \text{ COMP STALLS} \]

\[ \text{ROUGH CHECK:} \]
\[ 4 \text{ LUX STALLS - OK!} \]

\[ \text{TOTAL STALLS (SO FAR):} \]
\[ 4 \text{ LUX} \]
\[ 7 \text{ HC} \]
\[ 42 \text{ STD} \]
\[ 10 \text{ COMP} \]
\[ 72 \text{ TOTAL} \]

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

\[ \% \text{ COMP} = \frac{10}{72} = 25 \% \text{ ALMOST, BUT TOO LOW} \]

\[ \text{USE REMAINING SPACE FOR COMPACT CARS: (COMP, W3, 65°)} \]
\[ \text{PW = } 8' \frac{56.88'}{8.83'} = 6.44 \Rightarrow 6 \text{ STALLS} \]

\[ \text{CHECK:} \]
\[ \text{TOTAL STALLS (SO FAR):} \]
\[ 4 \text{ LUX} \]
\[ 7 \text{ HC} \]
\[ 42 \text{ STD} \]
\[ 78 \text{ COMP} \]
\[ 78 \text{ TOTAL} \]

\[ \% \text{ HC} = \frac{7}{78} \approx 9 \% \text{ TOO HIGH} \]

\[ \% \text{ COMP} = \frac{25}{78} = 32 \% \text{ LITTLE TOO HIGH} \]

\[ \text{TRY USING PORTION OF HC PARKING IN FLEX AREA FOR STD CARS} \]
HC FLEX AREA:

\[ 115 - 3(13.25) = 75.25' \implies 8.5' \text{ match HC/LUX A} \]

\[ Pw = \frac{8.5'}{\sin(65')} = 9.38' \quad \frac{75.25'}{9.38'} = 8.02 \implies 8 \text{ stalls} - 1 (06 \theta = 00') \]

\[ = 7 \text{ STD STALLS MORE} \]

CHECK: TOTAL STALLS:

| 4 LUX |
| 3 HC |
| 40 STD |
| 25 COMP |

\[ \frac{81}{81} \text{ STALLS} \]

4 LUX STALLS? - YES!

\[ \% HC = \frac{3}{81} = 3.7 \% \geq 3\% ? - \text{YES!} \]

\[ \% \text{COMP} = \frac{25}{81} = 30.8 \% \geq 30\% ? - \text{YES!} \]

GOOD SOLUTION!

LAYOUT:

[Diagram of stall layout with annotations]
PLAN B: TRYING NORTH-SOUTH ROWS;

\[ P_{W} = \frac{8}{\sin(90^\circ)} = 8' \frac{160' - 58' - 14(2)}{8} = 9.25 \Rightarrow 9 \text{ STALLS/ROW} \Rightarrow 18 \text{ STALLS/MOD} \]

\[ \text{AREA A: W4 MODULE COMPACT 90\(^\circ\) (comp, w4, 90\(^\circ\)) = 46'} \]

\[ \text{AREA B: W3 MODULE HC/LUX/STD 90\(^\circ\) (luck, w3, 90\(^\circ\)) = 66'} \]

\[ \text{AREA C: STD STALLS W3 MODULE} \]

\[ \text{REMAINING EAST-WEST WIDTH} = 115' - 66' = 49' \Rightarrow \sin \theta = 45^\circ \]

\[ P_{W} = \frac{8.5'}{\sin(45^\circ)} = 12.02' \frac{160' - 14(2)}{12.02} = 10.98 \]

\[ \Rightarrow 10 \text{ STALLS - 1 (8/C \& 90\(^\circ\))} \]

\[ \Rightarrow 9 \text{ STALLS/ROW} \Rightarrow 18 \text{ STD STALLS/MOD} \]

\[ \text{TOTAL STALLS = 18 comp} \]

\[ 4 \text{ HC} \]

\[ 4 \text{ LUX} \]

\[ 28 \text{ STD} \]

\[ 54 \text{ STALLS} \Rightarrow \text{GO WITH PLAN A} \]

(LOSE TOO MUCH SPACE TO AISLES)