A.) RESTROOM DESIGN FOR 28 EMPLOYEES, 40% MALE, 1/3 HC

(285 EMPLOYEES)(.40 MALE) = 114 MALE 285 - 114 = 171 FEMALE

FOR MALE RESTROOM 114 EMPLOYEES (TABLE 4.2)

6 STALLS:

(1/3)6 = 2 ⇒	2 HC	× 15 FT²	=	30 FT²
(1/3)6 = 2 ⇒	2 URINALS	× 6 FT²	=	12 FT²
REMAINDER ⇒	2 STD STALLS	× 12.5 FT²	=	25 FT²
114 EMPLOYEES ⇒	6 SINKS	× 6 FT²	=	36 FT²
	1 ENTRANCE	× 15 FT²	=	15 FT²
		TOTAL	=	118 FT²

FOR FEMALE RESTROOM 171 EMPLOYEES (TABLE 4.2)

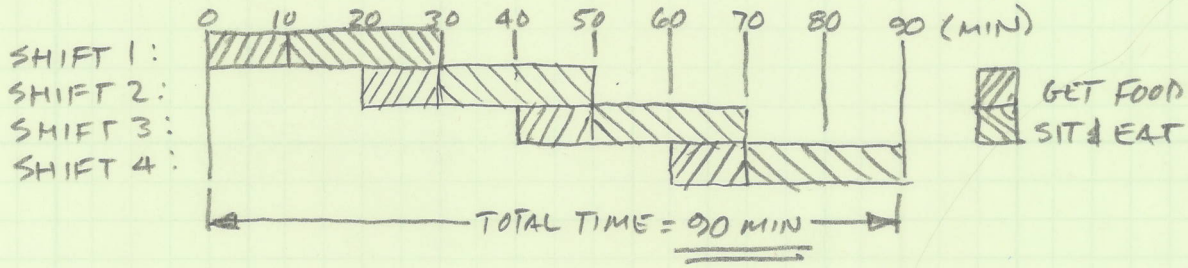
7 STALLS:

(1/3) 7 = 2.3 OR	3 HC	× 15 FT²	=	45 FT²
REMAINDER	4 STD STALLS	× 12.5 FT²	=	50 FT²
	1 COT	× 60 FT²	=	60 FT²
171 EMPLOYEES ⇒	8 SINKS	× 6 FT²	=	48 FT²
	1 ENTRANCE	× 15 FT²	=	15 FT²
		TOTAL	=	218 FT²

TOTAL FOR DESIGN = **336 FT²**

B.) DESIGN FOOD SERVICE FOR 400 EMPLOYEES, 100 PER SHIFT

a.) TOTAL TIME FOR ALL SHIFTS: 30 MIN/SHIFT, 1/3 SHIFT OVERLAP:



b.) MINIMUM SPACE FOR VENDING SERVICE: $(100 \text{ EMP.})\left(\frac{1 \text{ FT}^2}{\text{EMP.}}\right) = \underline{100 \text{ FT}^2}$

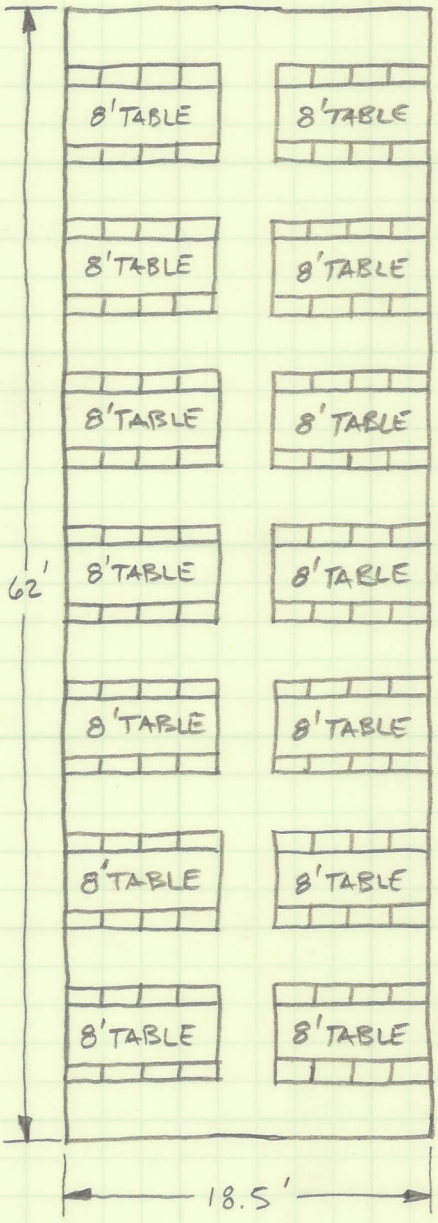
c.) MINIMUM SPACE FOR SERVING LINE:

$$\left(\frac{1}{3}\right)\left(\frac{30 \text{ MIN}}{\text{SHIFT}}\right)\left(\frac{7 \text{ EMP.}}{\text{MIN}}\right)\left(\frac{1 \text{ SHIFT}}{100 \text{ EMP.}}\right) = 0.70 \text{ -OR- } 1 \text{ SERVING LINE}$$

FROM SLIDES: $\left(\frac{300 \text{ FT}^2}{\text{LINE}}\right)(1 \text{ SERV LINE}) = \underline{300 \text{ FT}^2}$

d.) MINIMUM SPACE FOR CAFETERIA: FROM SLIDES (RULE OF THUMB)

$$(100 \text{ PERSONS})\left(\frac{12 \text{ FT}^2}{\text{PERSON}}\right) = \underline{1200 \text{ FT}^2}$$



1147 FT^2

THE BEST MINIMAL ALTERNATIVE (IN THIS INSTANCE) IS TO FIND A COMBINATION OF STANDARD LENGTH TABLES THAT EQUALS 62' (MINUS 2.5' CROSS AISLE), AND THEN FIND THE MINIMUM NUMBER OF TABLE-ROWS THAT WOULD SEAT AT LEAST 100 EMPLOYEES:

$$62\,FT - 2.5\,FT = 59.5\,FT$$

WHICH CAN BEST BE MET BY FIVE 10' TABLES AND AN 8' TABLE, LEAVING AN EXTRA 1.5 FEET FOR THE CROSS AISLE (4' TOTAL).

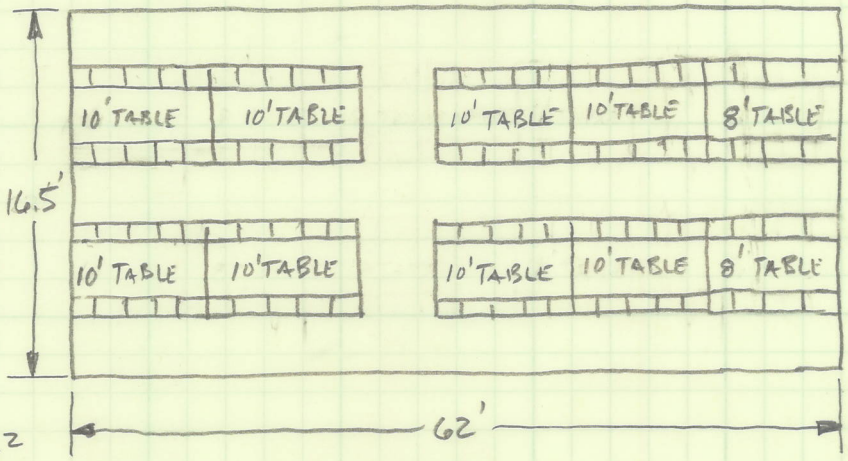
THE TOTAL SEATS PER TABLE ROW IS 58, SO TWO TABLE ROWS ARE NEEDED TO SEAT AT LEAST 100 EMPLOYEES PER SHIFT.

USING OUR EARLIER RESULT FOR TABLE ROW AND AISLE WIDTH WITH $n = 2$ GIVES:

$$(2)(6FT) + (2+1)(1.5\,FT) = 16.5\,FT$$

THUS THE TOTAL SPACE REQUIRED HERE IS:

$$(62\,FT)(16.5\,FT) = \underline{1023\,FT^2}$$



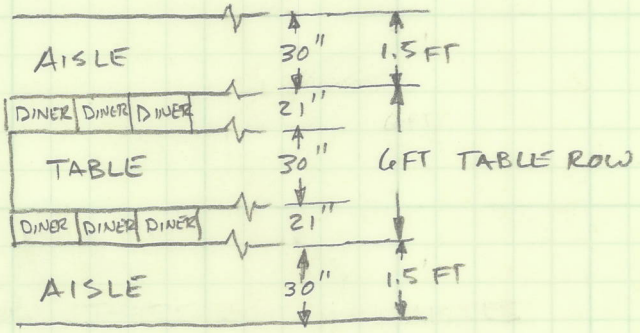
BEST LAYOUT: 1023FT^2

e.) DESIGN MINIMUM SPACE LAYOUT IF ONE DIMENSION IS 62 FT AND SEATED DINERS ARE STATIONARY, USING STANDARD TABLES:

SINCE ALL STANDARD TABLES ALLOW 2 LINEAR FEET PER SEATED PATRON, ESTIMATE THE SEATED DISTANCE PER PERSON. TEXTBOOK (SLIDES) ALLOW 6 FT^2 PER PERSON OF PERSONAL SPACE, AND SINCE STANDARD TABLES ARE 30" IN WIDTH:

$$\left(SD + \frac{2.5\,FT}{2}\right)(2\,FT) = 6\,FT^2 \quad \Rightarrow SD = 1.75\,FT \text{ -OR- } 21"$$

ASSUMING TEXTBOOK STANDARD 30" (OR 2.5 FT) AISLE SPACE BETWEEN STATIONARY OBJECTS (SEATED DINERS), A TABLE ROW REQUIRES:



FOR EVERY n TABLE ROWS, THERE ARE n+1 AISLES. SO TO FILL 62 FT WITH TABLE ROWS,

$$(n)(6FT) + (n+1)(1.5FT) = 62\,FT$$

$$\Rightarrow 8.5\,n = 59.5\,FT \quad \Rightarrow \quad n = 7 \text{ TABLE ROWS (AND 8 AISLES)}$$

USING STANDARD TABLE LENGTHS, THE MINIMUM LENGTH OF THE 7 TABLE ROWS NEEDED TO SEAT 100 EMPLOYEES IS

$$(100 \text{ EMPLOYEES}) = (7 \text{ TABLE ROWS})\left(\frac{2 \text{ EMPLOYEES}}{2\,FT \text{ TABLE ROW}}\right)$$

$$= 14.28\,FT$$

AND THE CLOSEST STANDARD TABLE LENGTH COMBINATION THAT IS GREATER THAN OR EQUAL TO THAT LENGTH IS TWO OF THE 8 FT TABLES. PUTTING A 2.5 FT AISLE AT THE END OF THE TABLES FOR ACCESS LEADS TO THE LAYOUT (BELOW) THAT MINIMIZES THE REQUIRED FLOOR SPACE:

$$\text{REQ'D SPACE: } (62\,FT)(16\,FT + 2.5\,FT) = 1147\,FT^2$$