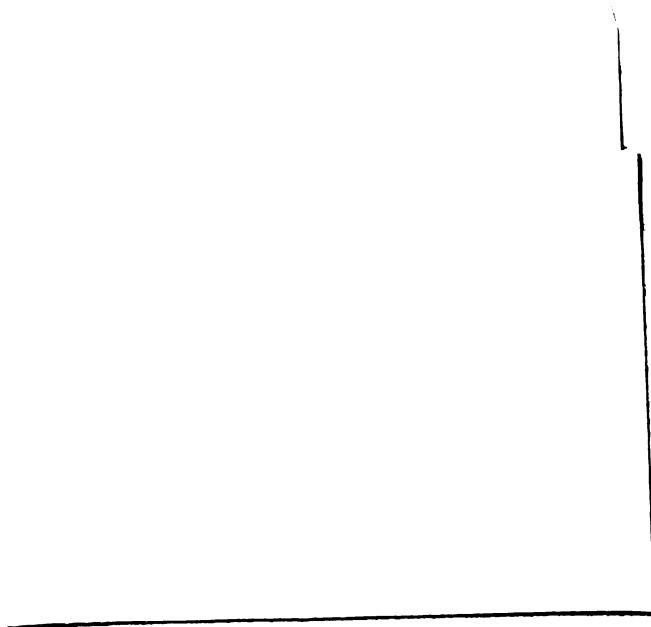


A REINFORCED CONCRETE
STADIUM DORMITORY DESIGN

Thesis for the Degree of B. S.
MICHIGAN STATE COLLEGE
Arthur William Snow
1947

2.1



A Reinforced Concrete Stadium Dormitory
Design

A Thesis Submitted to

The Faculty of
MICHIGAN STATE COLLEGE
of
AGRICULTURE AND APPLIED SCIENCE

by

Arthur William Snow
Candidate for the Degree of
Bachelor of Science

June 1947

THESIS

C. /

ACKNOWLEDGMENT

ONLY with the generous aid and cooperation of the departments of engineering, drawing and design, athletics, and finance, and the college engineers was it possible for me to attack this genuine problem with actual existing data, and arrive at a practical workable solution.

I wish to express my most sincere thanks to Professors C. L. Allen and C. A. Miller of the Civil Engineering Department of Michigan State College and to Professor G. M. Pratt of the Department of Drawing and Design, Michigan State College, for their help, patients, and suggestions. Also Mr. Claude R. Erickson and Mr. Alfred Howell, consulting engineers, who furnished data and technical advice.

INTRODUCTION

In the school of engineering a thesis is required of the student for a Bachelor's Degree. This is to stimulate thinking on a major practical problem, and to bring into play the combined use of a number of his major subjects.

Because of the need of enlarging the present Macklin Field Stadium and the even more important demand for more student housing facilities, I have chosen to make a preliminary stadium dormitory design. No attempt will be made at details or detailing. The purpose of the design is to arrive at a general, practical, workable plan. This to be arrived at upon consideration of all of the major factors for their best employ. In other words, an adequately strong and spacious stadium where everyone has a good seat. And a modern dormitory utilizing maximum space from the stadium, yet pleasing the student in comfort, convenience, and suitability.

DRAWINGS AND SKETCHES

Plate No. 1 -- Macalin Field Stadium Dormitory

Plate No. 2 -- South Elevation

Plate No. 2A - South Elevation

Sk - 1 Sketch of Elevation Section

Sk - 2 Floor Plan Layout

Sk - 3 Framing Sketch

Sk - 4 Sketch of Lamp Location

Sk - 5 Sketch of Seating Plans

Sk - 6 Sketch of Seating Slab

OUTLINE

Thesis on a Stadium Dormitory

I. GENERAL LAYOUT

Seating to meet requirements

Visability

Building plan for maximum dormitory space

II. PROBABILITY OF FILLING THE DORMITORY

20 year research

Future predictions

III. LAYOUTS AND GENERAL PLANS

Floor Plans

Elevations

Ramps and Elevators

IV. DESIGN TEST

Seating slab

Beam

Gridder

Column

Footing

GENERAL LAYOUT

Seating to Meet Requirements

The present seating capacity of Macklin Field Stadium is 23,000 seats. With an ever increasing student body a larger section for students is required and the school is drawing larger crowd attendance by its national football prominence. Therefore the figure of 50,000 seats desired by the athletic department would not seem out of line. This calls for an addition of 27,000 seats.

Now by building up the south end zone (see Plate No.1) to match the existing side stands, about 9,000 seats will be added.

$$*7000 \div 336' = 20.8 \text{ seats/ linear'}$$

$$\text{Average L new end } \frac{560 + 320}{2} = 440 \text{ linear feet}$$

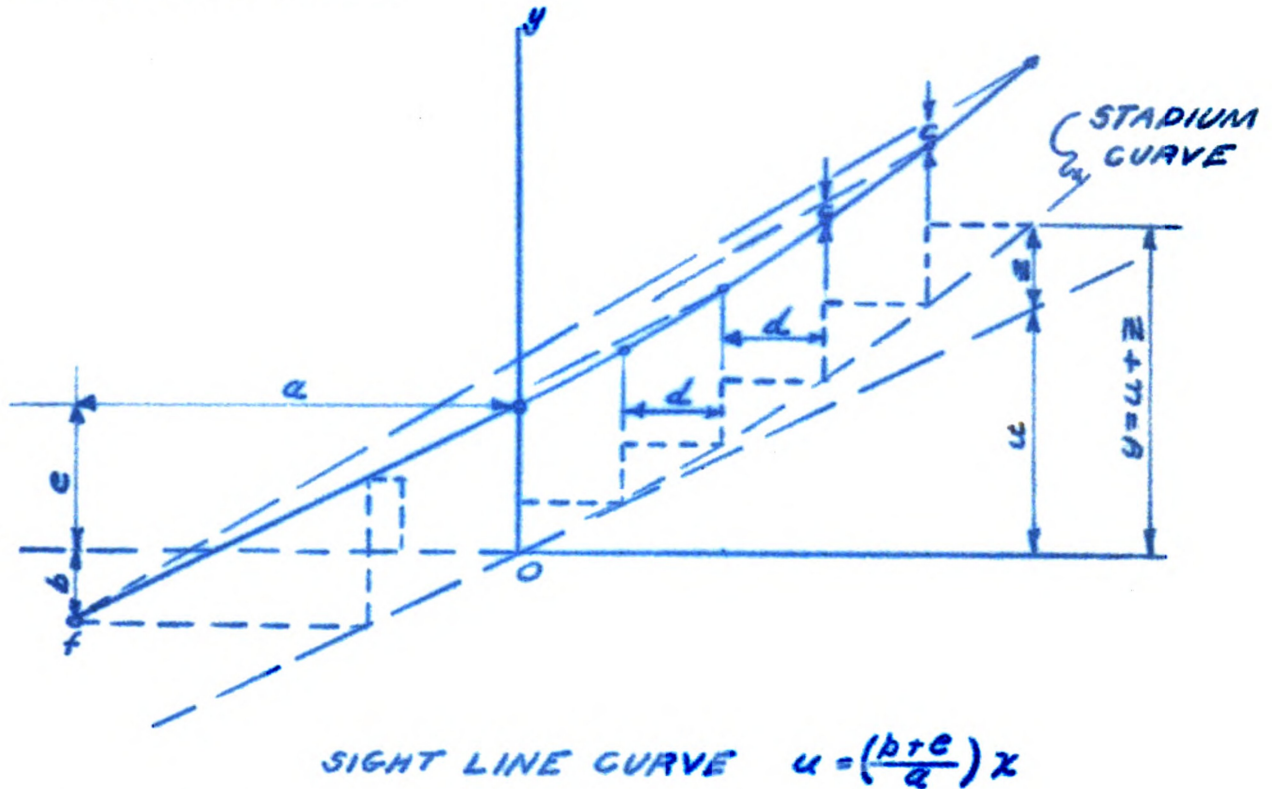
$$20.8 \times 440 = 9,152 \text{ seats for the new end}$$

This leaves 18,000 seats, or 9000 seats per side. Now by double decking these sides it will be seen that I can get every spectator to within 315' of the center of the field, also I will obtain a well elevated viewpoint. Closing in of the south end puts the sun at the spectators backs and eliminates that low afternoon sun in the eyes of a large portion of the east stands. Another advantage of double decking is a narrow building thus eliminating a large amount of inside room space for the dormitory. This will be taken up in elevations.

*Actual figure slightly under 7,000.

Visability

The existing stadium is designed on a good sight curve. See sketch SK-1. Calculations for a continuance of this practice follow:



Nomenclature

- a horizontal distance from assumed sight point to spectator in first row of seats.
- b vertical distance from assumed sight point to lowest floor elevation of stadium at feet of 1st spectator.
- c assumed vertical measurement from spectator's eyes to top of head. Also the vertical clearance from his focal ray to the eyes of the preceding spectator.
- d width of treads or back to back distance of seats.
- e assumed vertical measurement from floor to eyes of seated spectator. Equal to sitting height less c.
- f assumed vocal or sight point taken as original of the sight line curve.

- o origin of stadium section curve at base of first riser
- xy co-ordinates of stadium section curve with o as origin.
- z vertical distance from tangent to curve (values interpolated from Table III page 26 of "The Stadium")
- u $\frac{b - e}{a} x$ Constants Assumed: $c=0.5'$
 $a=112'$ $e=4'$ $b=52'$ $d=2.17'$

Due to the distance to the field and the small increment of change between rows for the purpose of design the girders will be assumed as straight; however the construction should meet the following:

<u>x</u>	<u>u</u>	<u>z</u>	<u>y</u>	<u>use</u>
2.17	1.08	0.43	1.51	1.50
4.34	2.17	0.86	3.03	3.03
6.51	3.25	1.29	4.54	same
8.68	4.34	1.72	6.06	"
10.85	5.42	2.15	7.57	
13.00	6.50	2.65	9.15	
15.17	7.58	3.15	10.73	
17.34	8.67	3.65	12.32	
19.51	9.75	4.15	13.90	
21.68	10.84	4.68	15.52	
23.85	11.92	5.21	17.13	
26.00	13.00	5.74	18.74	
28.17	14.08	6.27	20.32	
30.34	15.17	6.80	21.97	
32.51	16.25	7.36	23.61	
34.68	17.34	7.92	25.26	
36.85	18.42	8.48	26.90	
39.00	19.50	9.04	28.54	
41.17	20.58	9.63	30.21	
43.34	21.67	10.22	31.89	
45.51	22.75	10.81	33.56	
47.68	23.84	11.40	35.24	35.25
49.85	24.92	11.99	36.91	36.93
52.00	26.00	12.61	38.61	38.64
54.17	27.08	13.23	40.31	40.35
56.34	28.17	13.85	42.02	42.07
58.51	29.25	14.47	43.72	43.78
60.68	30.34	15.09	45.43	45.50

Building Plan for Maximum Dormitory Space

The problem of a dormitory in a stadium is one of light and ventilation. Air conditioning will make inner rooms liveable but not desireable and also such mechanical fixtures are subject to failure at times. Discomfort or sickness, even a few days may toll heavily on a students grades and progress.

After a series of arrangements I hit upon a solution that will provide light and ventilation to all of the student rooms. Of course the problem could have been solved readily in a manner similar to the Ohio State Stadium (inner ward sleeping rooms, six per room, and outer group study rooms). A more desireable arrangement is two men per room and the room large enough to permit study. This plan has been accepted and adopted throughout the nation.

Now if I have an eight story building (see sketch SK-1) the sixth and seventh floors can have windows sheltered by the stands slab. The fourth and fifth floors will have their windows behind steel bleachers, but a good percentage of light will come through and their function as ventilators will be as good as any windows. The third floor will be lighted and ventilated by skylights under the steel bleachers. The first and second floors will be necessary for lounges, reading and recreation rooms, and can therefore be well served by artificial light and air

conditioning. This plan should make all student rooms suitable and utilize all available space to advantage.

PROBABILITY OF FILLING THE DORMITORY

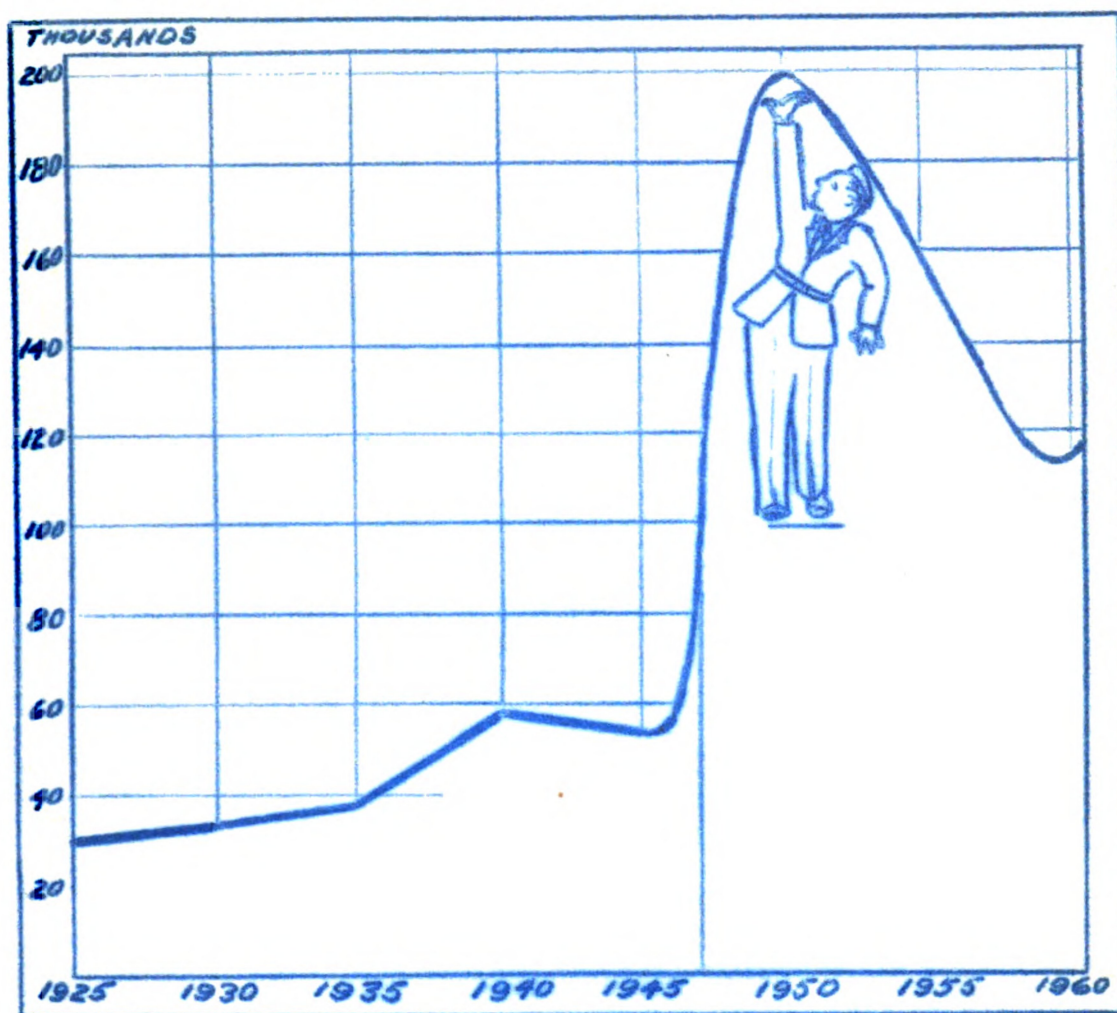
Enrollment and Available Space

The following are the enrollment statistics for Michigan State College from 1926, as secured from the finance department. The war years were purposely omitted.

<u>Year</u>	<u>No. of Students</u>
1926	3192
1927	3503
1928	3816
1929	4367
1930	4436
1931	4516
1932	4175
1933	3538
1934	3745
1935	4843
1936	5610
1937	6351
1938	7506
1939	8345
1940	8410
1946	Post-war 13500

The above would indicate a trend of normal growth and dormitory facilities have always lagged far behind enrollment. There has never been a time in the history of the school when its living quarters have not been filled to capacity. The present building program for permanent quarters will only facilitate 7500 students. It would seem a safe assumption that the addition of a dormitory for 880 will be very necessary for years to come. And that revenue therefrom could be figured on capacity. To back up this contention is a graph taken from a report to the Michigan Legislature by seven Michigan college presidents.

Enrollment Predictions for Michigan Colleges



While the influx of veterans has created a "bulge" in college enrollments, our colleges would be overcrowded without them, now and in the future.

*The above taken from "Status of Higher Education in Michigan"

LAYOUTS AND GENERAL PLANS

Floor Plans See sketches SK-2 and SK-3

General Features 1

Fire resistant construction, with respect to both framework and interior finish.

Sound deadened floors and principal partitions.

Dining room located in new south end with kitchens.

Reading and Recreation rooms.

Social hall or lounge.

Separate sleeping rooms with not more than two persons per room.

Large windows fitted with screens.

Good system of ventilation.

Data on Student Rooms 2

The "typical" double room for dormitories as given by Klauder and Wise measures 12 x 18 feet. The minimum area for double rooms suggested by the Institute of Economics Section -- 140 to 168 square feet. The height of ceilings in student rooms should be not less than 8½ feet or 9 feet for double rooms. Bath and toilet facilities should always be sufficient to encourage hygienic habits of living. In no case should there be more than 6 students assigned to one fixture.

1. "The Design of a College Dormitory for Men" by W.A. Howmaster

2. "Planning Residence Halls" by Harriet Hayes

Tabulated below are the lavatory computations on the basis of: toilets - 3' x 4'; shower and towelng space - 6' x 8'; tubs - 6 x 6'; lavatories - 3' x 4'

Floor	8th	5th 6th & 7th	4th	3rd	2nd	1st
Students	17*	21	17	16	use Stadium	23
Toilets	36**	48	36	36	Men's Room	48
Showers	72	96	72	72	& 1st Floor	192
Tubs	0	36	108	0	Paths	36
Lavs	<u>36</u>	<u>48</u>	<u>36</u>	<u>36</u>		<u>48</u>
Total	144	228	252	144		324
Avail	176	264	340	160		480 (must carry lounge load)

* No units

**Square feet

2nd Floor Stadium Lavs: basis 7 fixtures / 1000

Toilets - 7 x 4.5 equals 32 toilets x 12 sq ft is 384

Lavs - 7 x 4.5 32 12 384
756 sq ft

Men's space required 384 available 414 sq ft

Women's 384 414

Elevations

Due to limited time very little was done on appearance. Plate 2A was completed far enough to get the picture in mind then Plate 2 was substituted for better design. The false columns were subsequently added to give the building strength appearance over the blank elevator shafts. However, the main purpose of Plate 2 is to fix the abstract shape. All details are beyond the scope of this problem.

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Ramps and Elevators

See sketches SK-1, SK-2, and SK-4. The plan of six sections per side has been carried on from the existing stadium. This means each exit from the upper stands must pass 910 spectators and each exit from the steel bleachers must pass 638. Assuming 1 person per 2' width per second, a 6' exit will pass 180 people per minute, or clear the stands in 5 minutes. The two exits meet on the 4th floor and the ramp becomes 8' wide. These people from the bleachers have a start on the people from the upper stands of 150' of travel or $2\frac{1}{2}$ min. So that the 8' ramp moves 240' people per minute or 600 of the 638 out before the upper stands people reach them.

The ramps have a 1 to 4 slope recommended in the book "The Stadium" by Lyron Serby. The elevators as an auxiliary aide can be employed and will facilitate those who are unable to climb or willing to wait.

The elevators have 7' x 7' cabs and can carry 20 people. It must serve 65 students. This should be adequate but could be reduced or enlarged very easily upon more study of the problem.

DESIGN TEST

The purpose of this test is to go through and make a quick check to the footings to find out how large the columns and footings will need to be. This can be used as a basis for determining the feasibility of constructing with reinforced concrete and at the same give the writer some design practice.

Seating Slab

See SK-5, SK-2, and SK-6.

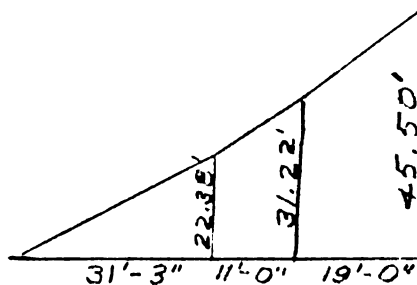
For the purpose of design assume straight sections between girders.

Y height from good sight formula $y \approx u + z$

$$\frac{56}{112} \times 30.68 = 15.34 + 7.04 = 22.38'$$

$$\frac{56}{112} \times 41.68 = 20.84 + 9.38 = 31.22'$$

$$\frac{56}{112} \times 60.68 = 30.34 + 15.09 = 45.43 \text{ corr'd to } 45.50'$$



Dead load

weight of steps

Ht of A risers	$\frac{22.68}{14}$	=	1.59'	or	1'- 7"
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Ht of B risers	$\frac{31.22}{14}$	=	1.77'	or	1'- 9"
----------------	--------------------	---	-------	----	--------

Ht of C risers	$\frac{45.50}{14}$	=	1.91'	or	1'-11"
----------------	--------------------	---	-------	----	--------

Design of Seating Slab Continued

Girders to be $56 - 18.67' \text{ c-c}$
 $\frac{3}{3}$
 Beams to be horizontal dist apart

A - $30 - 6'$
 $\frac{5}{5}$

B - $11 - 5.5'$
 $\frac{2}{2}$

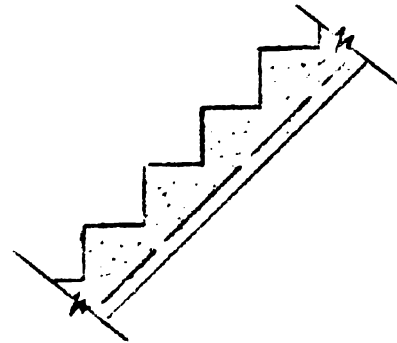
C - $18 - 6'$
 $\frac{3}{3}$

Assumptions:

$f'_c - 3000 \text{ psi}$
 $f_c - 1350$
 $f_s - 20,000$
 $n - 10$
 $v_c - 150$
 L.L. - $100\#/'$
 I.L. - 100%
 cover - $1.5''$
 BM - $1 \frac{w l^2}{12}$

For design use $6' \text{ c-c}$
 clear span $5'$

Live Load - 100
 Impact - 100
 Step Load - 85
 Slab Load - 50
 $1/3 \times 150 \quad 335\#/'$



BM - $1 \frac{335(5)^2}{12} \times 12 - 8370\#'$

BM - $cjd - \frac{1350}{2} \times 12 \times .403 \times .867d$

$d^2 - 4.0 \quad d - 2'' \quad h - 2 \frac{1}{2} \times 1.5 - 3.5''$

$A_s - \frac{M}{f_s jd} - \frac{8370}{20000 \times .867 \times 2} - .242 \text{ sq } ''$

Try $3/8 \phi$ bars @ $5'' \text{ c-c}$

Bond - $u - \frac{V}{\Sigma o jd} - \frac{335/2 (5)}{2.36 \times .867 \times 2} - 205 \text{ allow } 150$

$205:150-5:x \quad x - 3.66 \text{ or } 3\frac{1}{2}'' \text{ spacing}$

Shear - $v - \frac{V}{b jd} - \frac{335/2 (5)}{12 \times .867 \times 2} - 40.2 \text{ allow } 60 \text{ OK}$

USE Positive Steel $3/8 \phi$ rods @ $3\frac{1}{2}'' \text{ c-c}$, 1.5 from bottom

Negative Steel $3/8 \phi$ rods @ $3\frac{1}{2}'' \text{ c-c}$, 1.5 from top

*Σ means Sigma
 - means equals

Design of Guard Wall

Wind Load - 20#/'
 Thrust - 75#/'
 95#/'

Assumptions

Detroit Code 1936

f'_c - 3000
 f_c^c - 1350
 n^c - 10
 v_c - 60
 u - 150
 M - $wl^2/2$

BM - $1/2 (95)4^2$ - 760 x 12 - 9120#

A_s - $\frac{9120}{20000 \times .867 \times 2.5}$ - .210 sq "

Try 3/8 ϕ rods @ 6" c-c

Bond - u - $\frac{380}{2.4 \times .867 \times 2.5}$ - 73 allow 150 OK

Shear - v - $\frac{380}{12 \times .867 \times 2.5}$ - 14.6 allow 60 OK

USE 3/8 ϕ rods @ 6" c-c, on centerline 5" wall.
 Extend steel 15" into E1

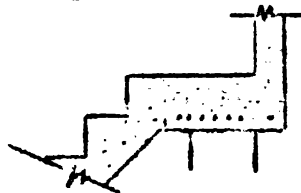


Design of E1

BM - $\frac{1(w)l^2}{12}$

Clear Span 17.5'

Slab Load - 335 x 3 - 1005
 Guard Wall - 150 x 4 x $\frac{1}{2}$ - 300
 Beam Load - 150 x 3 x 5/6 - 375
 1680#



Assumptions

f'_c - 3000
 f_c^c - 1350
 n - 10
 f_s - 20000
 v_c - 60
 u - 150
 M - $\frac{1}{12} wl^2$

cover - 2"

M - $\frac{1}{12} (1680)(17.5)^2$ - 514,000#

M - $\frac{1350(36)(.403d)(.867d)}{2}$

d^2 - 60.6 d - 7.8 or 8" h - 8 plus 2 - 10"

A_s - $\frac{514,000}{20000 \times .867 \times 10}$ - 3.7 sq" Try 8, $\frac{3}{4}$ " ϕ rods

Bond - u - $\frac{1680/2(17.5)}{8 \times 2.4 \times .867 \times 8}$ - 111 allow 150 OK

Shear - v - $\frac{1680/2(17.5)}{36 \times .867 \times 8}$ - 59 allow 60 OK

E1 Continued

B1 Continued

USE Positive Steel 8 $\frac{3}{4}$ " ϕ rods @ 4" c-c 2" from bottom

Negative Steel 8 $\frac{3}{4}$ " ϕ rods @ 4" c-c 2" from top and extend to inflexion points.

Design or B2

Span Length - 18.67'

Clear Span - 17.5'

Consider beam of rectangular cross-section and continuous.

Slab load - 335 x 6 - 2010

Beam load - 150 x $1\frac{1}{4}$ - 188
 $\frac{(17.5" \text{ plus } 11.5")}{2}$ 2198#/'

Assumptions

f'_c - 3000
 f_c - 1350
 f_s - 20000
 n - 10
 v_c - 60
 u - 150
cover - 2"
 b - 12

$$M - \frac{1}{12} (2198)(17.5)^2 12 - 673,000 \text{ \#}$$

$$M - \frac{1350(12)(.403d)(.867d)}{2}$$

$$d^2 - 238 \quad d - 15.4 \text{ or } 15.5"$$

$$h - 15.5 \text{ plus } 2 - 17.5$$

$$A_s - \frac{673,000}{20000 \times .867 \times 15.5} - 2.51 \text{ sq"}$$

Try 5, 7/8" ϕ bars

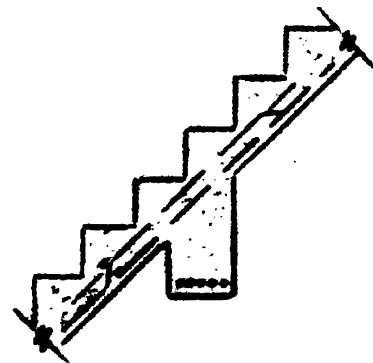
$$\text{Bond} - u - \frac{2198/2(17.5)}{5 \times 2.8 \times .867 \times 15.5} - 102 \text{ allow } 150 \text{ OK}$$

$$\text{Shear} - v - \frac{2198/2(17.5)}{12 \times .867 \times 15.5} - 119$$

$$2198 \times 8\frac{1}{4} - 19250$$

$$R_L - 19250 \times \frac{2}{3} - 14,400$$

$$V_{\text{mid}} - 1/3 \times 14,400 - 4800 \quad v_c - \frac{4800}{12 \times .867 \times 15.5} - 29.8 \text{ or } 30$$



B2 Continued

B2 Continued

$$x = \frac{59 \times 105}{80} \quad x = 69.5$$

$$\text{Load} = \frac{1}{2} \times 59 \times 69.5 \times 12 = 24,600$$

One stirrup carries $2 \times .11 \times 16000 = 3500 \#$

$$\frac{24600}{3500} = 7 \frac{3}{8} \phi \text{ stirrups}$$

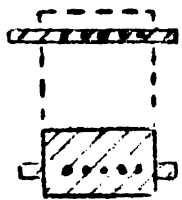
Bend up 3 bars then 2 bars and extend to inflex points

Effective bent up bar spacing 11.6"

Supplement with 5 stirrups spaced 6", 7", 8", 8", 10"

Negative steel

To find the neutral axis



$$\begin{aligned} & T x / 2 (12x) \text{ plus } 30(x \text{ minus } 2) - \\ & \quad 27(15.5 \text{ minus } x) \\ & 6x^2 \text{ plus } 30x \text{ minus } 60 - 418 \text{ minus } 27x \\ & 6x^2 \text{ plus } 57x - 478 \\ & x^2 \text{ plus } 9.5x \text{ plus } 18 = 97.5 \\ & x \text{ plus } 4.25 = 9.9 \\ & x = 5.65 \end{aligned}$$

$$\begin{array}{rcl} C_s x 13.5 - 30 x .66 f_c x 13.5 & - & 267.0 f_c \\ C_c x 15.5 \text{ minus } 5.65 - \frac{1}{2} f_c x 12(5.65) 13.5 & - & 460.0 f_c \\ \hline & & 53.7 f_c \qquad \qquad \qquad 727.0 f_c \end{array}$$

$$a = 13.55"$$

$$M = 673,000 \#$$

$$T = C = \frac{673,000}{13.55} = 49,800$$

$$f_c = \frac{49,000}{53.5} = 925 \text{ psi allow } 1350 \text{ OK}$$

$$f_s = \frac{49800}{2.51} = 19,900 \text{ psi allow } 20,000 \text{ OK}$$

therefore 3 sq" steel used on top and bottom is OK

USE bent up bars

Positive steel 5, 7/8" ϕ bars 2" from bottom

Negative steel effective from bent up bars.

17

Design of G1

Consider G1 as a T girder with
2 concentrated loads and its own
distributed weight

Span length 18'

Clear Span 16'

$\frac{1}{4} \times 18 = 4.5'$ or 54"

$3.5 \times 8 = 28''$ overhang

For b' use 54"

$$M = \frac{1}{10} (1.5)(26)(150)(16)^2 12 = 2,920,000 \text{ in}^2$$

To get an estimate of steel $A_s = 2920000 / 20000 \times 0.867 \times 23 = 7.45$
 $(54 \times 3.5)(x \text{ minus } 1.75) = 74.5(23 \text{ minus } x)$

$$263.5x = 2046$$

$$x = 7.8''$$

$$\frac{4.3(1350)}{7.8} = 742 \text{ psi}$$

Comp C

Arm

L about top

$$\begin{array}{rcl} 3.5 \times 742 = 2605 & 3.5 \times \frac{1}{2} = 1.75 & 4550 \\ \frac{1}{2} \times 3.5 \times 608 = 1062 & 3.5 \times \frac{1}{3} = 1.16 & 1232 \\ \hline & & 5782 \end{array}$$

Dist from C to top of girder 1.57

Lever arm of resisting couple

$$23 \text{ minus } 1.57 = 21.43$$

$$C = \frac{2920000}{21.43} = 136,000$$

$$C = \frac{1}{2}(1350 \text{ plus } 742) \times 3b = 136000$$

$$b = \frac{136000}{1043 \times 3} = 43.3 \quad \text{OK}$$

$$T = C = 136000$$

$$A_s = \frac{136000}{20000} = 6.82$$

Going back and substituting 6.82 for 7.45 sq" try again

G1 continued

Assumptions

$$f'_c = 3000$$

$$f_c = 1350$$

$$f_s = 20000$$

$$v_c = 60$$

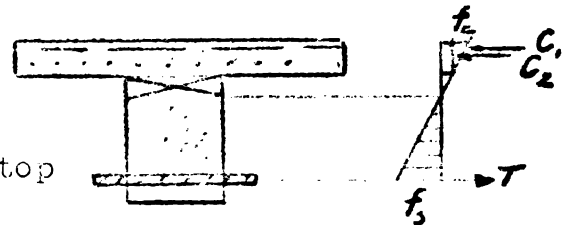
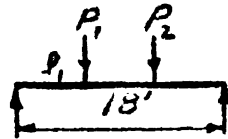
$$u = 150$$

$$M = \frac{1}{10} w l^2 \text{ plus } P_1 l_1$$

$$b = 18''$$

$$d = 23$$

$$\text{cover} = 3$$



G1 Continued

$$n \times 6.82 = 68.2$$

$$\begin{aligned} 54 \times 3.5(x \text{ minus } 1.75) &= 68.2(23 \text{ minus } x) \\ 189x \text{ minus } 331 &= 1570 \text{ minus } 68.2x \\ 257.0x &= 1901 \\ x &= 7.4 \end{aligned}$$

$$\frac{3.5(1350)}{7.4} = 712 \text{ psi}$$

Comp C	Arm	M about top
$3.5 \times 712 = 2495$	$x \frac{1}{2}(3.5)$	$= 4360$
$\frac{1}{2}(3.5)638 = \frac{1118}{3613}$	$x \frac{1}{3}(3.5)$	$= \frac{1295}{5655}$

Dist from c to top of beam 1.57

Lever arm - 23 minus 1.57 = 21.43 OK

USE two rows of tension steel
12 bent up bars $7/8"$ ϕ

$$\text{Bond} - u = \frac{43,450}{12 \times 2.8 \times .867 \times 23} = 64.6 \text{ allow } 150 \text{ OK}$$

$$\text{Shear} - v_c = \frac{43,450}{18 \times .867 \times 23} = 121 \text{ psi}$$

$$\text{at the first conc. load } v_c = \frac{38,983}{18 \times .867 \times 23} = 108 \text{ psi}$$

Inflexion point is $2/3$ dist to first concentrated load - 4' run 17 bar dia. past - 5'3"

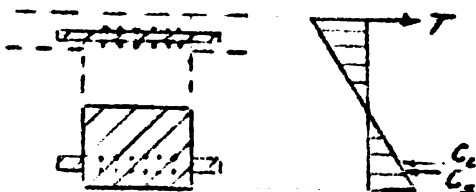
$$\text{JC Report 819 b } s = \frac{1.20(16000)(.867)(23)(1.414)}{43450} = 16.6 \text{ or say } 16"$$

The bent up bars will then take up 40" leaving 32"

$$\frac{61 \text{ plus } 47}{2} (72) = 3898 \times 18 = \frac{69884}{3500} = 20 \text{ stirrups (Don't use)}$$

$$\frac{53 \text{ plus } 47}{2} (32) = 1600 \times 18 = \frac{28800}{3500} = 8 \text{ stirrups @ } 4" \text{ c-c } 3/8" \phi$$

Negative Steel



$$\begin{aligned} \text{To find the neutral axis} \\ x/2(18x) \text{ plus } 72(x \text{ minus } 3) &= \\ 64.8(23 \text{ minus } x) &= \\ 9x^2 \text{ plus } 72x \text{ minus } 216 &= 1490 \\ \text{plus } 64.8x &= \\ x^2 \text{ plus } 15.2x &= 190 \\ x \text{ plus } 7.1 &= 16.1 \\ x &= 9" \end{aligned}$$

G1 Continued

$$\text{Arm for } C_s - 23 \text{ minus } 3 - 20"$$

$$C_s - 72 \times .67f_c - 48f_c$$

$$\text{Arm for } C_c - 23 \text{ minus } \frac{9}{3} - 20"$$

$$C_c - \frac{1}{2}f_c \times 18 \times 9 - \frac{81f_c}{129f_c}$$

$$C - T - \frac{2920000}{20} - 146,000$$

$$f_c - \frac{146000}{129} - 1130 \text{ psi allow } 1350 \quad \text{OK}$$

$$f_s - \frac{146000}{7.20} - 20,300 \text{ but with slab steel the stress would go well under } 20,000 \text{ allowable}$$

Since the slab reinforcement is parallel with the girder, a transverse reinforcing must be in the slab over the

area used for the T which is 54".

Assumptions

$$M - \frac{wl^2}{2} - \frac{335 \times 1.5^2(12)}{2} - 4520 \text{ #}$$

$$w - 335$$

$$d - 2$$

$$A_s - \frac{4520}{20000 \times .867 \times 2} - .13 \text{ sq "}$$

Use $\frac{1}{2}$ " ϕ bars @ 18" c-c OK ACI spec min $\frac{3}{8}$ " ϕ bars @ 18"

$$\text{Bond} - u - \frac{492}{1.1 \times .867 \times 2} - 258 \quad \text{Use special anchorage}$$

$$L - \frac{16000}{4 \times 150} \left(\frac{1}{2}\right) - 13.3 \text{ or } 14" \quad \text{The girder being 18" will supply 9" so the bar should be 64" long.}$$

$$\text{Shear} - v_c - \frac{492}{12 \times .867 \times 2} - 23.7 \text{ allow } 60 \quad \text{OK}$$

Design of Room Slab - 2 way

Dimensions 18 x 18.67 L.L. - 40#/'

Assumptions

Live load - 40

$$f'_c - 3000$$

Plaster - 5

$$f_c - 1350$$

Linoleum - 6

$$f_s - 20000$$

4" Slab - 56

$$n - 10$$

$$\frac{107 \# / '}{}$$

$$v_c - 60$$

$$u - 150$$

$$b - 12"$$

$$t - \frac{18 \times 18.67 \text{ minus } .10(73.33)}{72} - 4.08$$

$$t - 4\frac{1}{2}"$$

Room slab 2 way Continued

Use $t = 4\frac{1}{2}"$

Table 5 JC Code 811

Pos M - .025x107x18x18.67x12

Pos M - .025WAB

Pos M - 10,750#

Neg M - .033WAB

$$R = \frac{10750}{12 \times 32} = 88.5 \text{ psi}$$

$$A_s = \frac{10750}{20000 \times .867 \times 3} = .21 \text{ sq"}$$

Use $3/8 \phi$ bars - $6\frac{1}{2}"$ c-c - .21sq" center half
 $3/8 \phi$ bars - 10" c-c - .13sq" outer quarters
 Bend alt bars for Neg M and stagger bends

$$\text{Neg M} = .033 \times 107 \times 18 \times 18.67 \times 12 = 14,200$$

$$R = \frac{14,200}{12 \times .32} = \text{XXXXX} 132 \text{ psi}$$

$$A_s = \frac{14,200}{20000 \times .867 \times 3} = .28 \text{ sq"}$$

$$\text{Truss rods} = .13$$

$$\text{Top rods } \frac{3}{8} \phi @ 9" \text{ c-c} = \frac{.15}{.28} \text{ sq"} = .28 \text{ sq"}$$

Use top rods $3/8 \phi$ rods @ 9" c-c 1.5" down extend to inflex.Pt.

$$v_c = \frac{107 \times 18 \times 18.67}{4 \times 12 \times 17 \times .867 \times 3} = 6 \text{ psi OK}$$

$$\text{Bond} - u = \frac{107 \times 18 \times 18.67}{4 \times 17 \times 2.4 \times .867 \times 3} = 85 \text{ allow 150 OK}$$

Design of G5

Clear Span - 17'

Assumptions

$$\frac{1}{4} \times 18 = 4.5' = 54"$$

$$\frac{3}{8} \times 8 = 24" \text{ overhang}$$

$$\text{Use } b' = 54"$$

$$f'_c = 3000$$

$$f'_c = 1350$$

$$f_s = 20000$$

$$n_s = 10$$

$$v_c = 60$$

$$u = 150$$

$$\text{cover} = 2$$

$$b = 7$$

$$R = 229$$

$$\text{From slab W} = \frac{2 \times 107 \times 18 \times 18.67}{4} = 17900\#$$

$$M = W14/3$$

$$M = \frac{4}{3} \times 17900 \times 17 = 405,000\#$$

$$t/d = 4\frac{1}{2}/12 = .375$$

$$d = \frac{405000}{229 \times 12} = 12"$$

G5 Continued

G5 Continued

$$A_s = \frac{405000}{20000 \times 12 \times .867} = 1.97 \text{ sq"}$$

$$\text{Try } 4 - \frac{1}{2}" \text{ sq bars} \quad V = \frac{17900}{2} = 8950$$

$$\text{Shear} - v_c = \frac{8950}{7 \times .867 \times 12} = 123$$

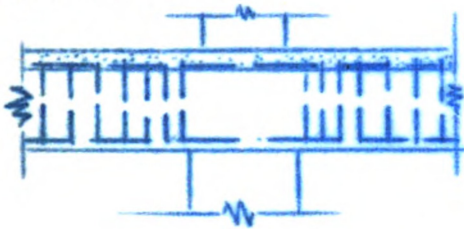
$$\text{Bond} - u = \frac{123 \times 7}{2 \times 4} = 108 \quad \text{allow } 150 \quad \text{OK}$$

$$a = \frac{63}{123} \times 102 = 52.3$$

$$A_v = \frac{7 \times 52.3 \times 63}{2 \times 16000} = 1.38 \text{ sq"}$$

$$\frac{1.38}{.22} = 7 \quad \text{use 8 stirrups spacing } 2, 4, 5, 5, 6, 6, 8, 10$$

Negative Steel



$$\begin{aligned} &\text{to find the neutral axis} \\ &x^2(7x) \text{ plus } 20(x \text{ minus } 2) - \\ &\quad 18(12 \text{ minus } x) \\ &3.5x^2 \text{ plus } 20x \text{ minus } 40 - \\ &\quad 216 \text{ minus } 18x \\ &x^2 \text{ plus } 10.75x - 73.2 \\ &\quad x \text{ plus } 5.4 = 10.1 \\ &\quad x = 4.7" \end{aligned}$$

$$\begin{aligned} C_s \times 10 - 20 \times 5.75 f_c \times 10 &= 115.0 f_c \\ C_c \times 12 \text{ minus } 4.7 - \frac{1}{2} f_c \times 7 \times 4.7 \times 10.4 &= 171.5 f_c \\ \hline &28 f_c \quad \quad \quad 286.5 f_c \\ a &= 10.22 \end{aligned}$$

$$T - C = \frac{405000}{10.22} = 39,500$$

$$f_c = \frac{39,500}{28} = 1315 \quad \text{allow } 1350 \quad \text{OK}$$

$$f_s = \frac{39,500}{2} = 19,750 \quad \text{allow } 20,000 \quad \text{OK}$$

Use $4, \frac{1}{2}" \phi$ bars 2" from top

Design of Corridor Slab

Live Load - 100
 Slab Load - 56
 Linoleum - 6
 Plaster - 8
 $\frac{170}{12} \text{ #/sq'}$

Assumptions

f'_c - 3000
 f'_s - 1350
 f_s - 20000
 n - 10
 v_c - 60
 u - 150
 t - 4 $\frac{1}{2}$
 L.L. - 100

Carry t - 4 $\frac{1}{2}$ " to match room floors

$$M = \frac{1}{12}(170)(10.25)^2 \cdot 12 = 17,450 \text{ #}$$

$$M = \frac{1350(12)(.403d)(.867d)}{2}$$

$$d^2 = 6.17 \quad d = 2.48 \quad \text{use } d = 3"$$

$$A_s = \frac{17,450}{20000 \times .867 \times 3} = .33 \text{ sq"}$$

$$\text{Bond} - u = \frac{170/2(10.25)}{3.5 \times .867 \times 3} = 96 \quad \text{allow 150 OK}$$

$$\text{Shear} - v_c = \frac{170/2(10.25)}{12 \times .867 \times 3} = 28 \quad \text{allow 60 OK}$$

Positive Steel Use 3/8" ϕ bars ϕ 4", 1.5" from bottom

Negative Steel Use 3/8" ϕ bars ϕ 4", 1.5" from top
 extend to inflexion point

Design of B5

Consider the moment as being made up of $\frac{1}{2}$ the corridor slab and $\frac{1}{4}$ of the room slab.

Assumptions

f'_c - 3000
 f'_s - 1350
 f_s - 20000
 n - 10
 v_c - 60
 u - 150
 M - $\frac{1}{2} W_1 L + \frac{W_1}{6}$
 b - 9
 d - 10

Span length 18.67' Clear Span 18.09'

Corr. slab load W_1
 $4.125 \times 18.09 \times 4.5 \times 150 = 5170$

Wt of beam ext. $\frac{12}{144}$
 $\frac{9 \times 7 \frac{1}{2} \times 150}{144} = \frac{78}{5248 \#}$

B5 Continued

1000

1000

Design of B5 Continued

Partition load studs - 2
 plaster, lath $\frac{16}{18}$
 $18 \times 17.67 \times 9 = 2860\#$

Slab and beam load $\ast \frac{5248\#}{7108\#}$

$M = \frac{7108(18.09)}{12}$ plus $\frac{9000(18.09)}{6} = 37,900'\#$

$M = 37,900 \times 12 = 455,000''\#$

$T - C = \frac{455,000}{10 \times .867} = 52,500$

$t = \frac{1350(10)}{3350} = 4''$

$A_s = \frac{52,500}{20,000} = 2.63 \text{ sq}''$

Try 4, $1''\phi = 3.16 \text{ sq}''$

$C = \frac{1350(4b')}{2} = 52500$

$b' = 19.5''$ allow $54''$

Bond $= \frac{16108/2}{12.6 \times .867 \times 10} = 74$ allow 150 OK

Shear $= u = \frac{16108/2}{9 \times .867 \times 10} = 103$

$x = \frac{43(112)}{103} = 46.8$

$\frac{1}{2}(43)(46.8)(9) = 9080$

$2 \times .79 \times 16000 \sin 45^\circ = 17,800$

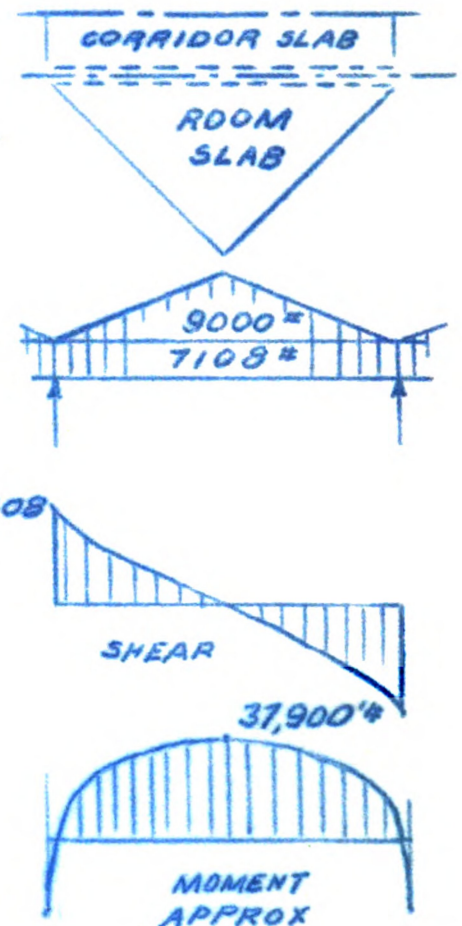
effective bar width $= 8''$ leaving 38.8

$x = \frac{103(38.8)}{112} = 34.9$

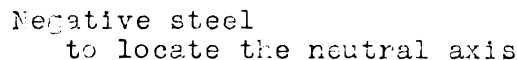
$A_v = \frac{9 \times 34.9 \times 38.8}{2 \times 16000} = .362$

$\frac{.362}{.22} = 1.6$ or 2 stirrups

USE 4, $3/8''\phi$ stirrups with bent up bars
 spaced from end 12, 6, 8, 8, 10



100



$$x^2/2 + 31.5x - 372.88$$

a - 8.15

$$f_c = \frac{55,900}{44.5} = 1250 \quad \text{allow } 1350 \quad \text{OK}$$

Negative Steel from bent up bars extended to inflex point.
4, 3/8" ϕ stirrups

Assumptions

ACI Code 1928

1' - 3000

p^c - .01 to .04

f. - 20,000

Ties - 2" dia.

spaced 16 bar dia

48 x dia

or least dia col

bearing - 750psi

C4 Continued

Design of Column C4 Continued

W_1 due to G1 - 42400

W_2 due to F2 - 38500

W_3 due to G2 - $\frac{21930}{102830}$

2' col. wt. $\frac{300}{103130\#}$

A - $\frac{103130}{675(1 \text{ plus } (10 \text{ minus } 1) \cdot 01)}$ - 141 sq"

Use 12 x 12 with 4, 5/8" ϕ bars in corners w/2" cover

Wt of floor system loaded

9TH FLOOR WT

slab 17350

$\frac{1}{2}$ G5 1470

F5 2040

seating slab

$\frac{102830}{1626}$

col wt $\frac{1626}{125316}$

9th floor for storage will not be reduced

A - $\frac{125316}{675(1.09)}$ - 170sq" 12 x 12 - 144
4, 7/8" ϕ - $\frac{24}{168}$
new p - .0167

A - $\frac{125316}{675(1.15)}$ - 162sq"

Use 12 x 12 with 4, 7/8" ϕ rods, 2" cover

8TH FLOOR WT reduced live load 10%

corr. slab - 10200

Room slab - 16750

G5 - 2030

F5 - 2040 31020

7to8 fl col - 1768

wt above 8th $\frac{125316}{158104}$

A - $\frac{158104}{675(1.09)}$ - 215sq" 12 x 16 - 192
4, 7/8" ϕ - $\frac{24}{216}$
new p - .0125

Use 12 x 16 with 4, 7/8" ϕ rods, 2" cover

C4 Continued

Design of Column C4 Continued

7TH FLOOR WT reduced live load 10%

31020
col wt 1990
wt above 7th fl $\frac{158104}{191114}$

A - $\frac{191114}{675(1.09)}$ - 260sq" 12 x 18 - 216
6, 7/8" $\frac{36}{252}$
new p - .0167

A - $\frac{191114}{675(1.137)}$ - 242sq"

Use 12 x 18 with 6, 7/8" ϕ bars, 2" cover

6TH FLOOR WT reduced live load 10%

31020
col wt 2580
wt above 6th fl $\frac{191114}{224714}$

A - $\frac{224714}{675(1.09)}$ - 306sq" 14 x 20 - 280
6, 7/8" $\frac{36}{316}$
new p - .0128

Use 14 x 22 with 6, 7/8" ϕ rods, 2" cover
to save on form work.

5TH FLOOR WT reduced live load 10%

31020
col wt 2740
increase in last col 160
wt above 5th fl $\frac{224714}{258634}$

A - $\frac{258634}{675(1.09)}$ - 352 14 x 22 - 308 14 x 22 - 308
6, 7/8" $\frac{36}{344}$ 6, 1" $\frac{47}{355}$
new p - .0154

A - $\frac{258634}{675(1.115)}$ - 346

Use 14 x 22 with 6, 1" ϕ rods, 2 " cover.

C4 Continued

Design of Column C4 Continued

4TH FLOOR WT reduced live load 10%

31020
col wt 3600
wt above 4th fl 258534
293254

A - $\frac{293254}{675(1.09)} - 398 \text{ sq"} \quad 14 \times 28 - 392$
 $6, 7/8 \phi - \frac{36}{428}$

Req'd for p -.01 360 plus 36 - 396 OK

Use 14 x 28 with 6, 7/8 ϕ rods, 2" cover

3RD FLOOR WT reduced live load 10%

31020
col wt 3600
wt above 3rd fl 293254
327874

A - $\frac{327874}{675(1.09)} - 447 \quad 14 \times 28 - 392$
 $6, 1 \phi - \frac{47.4}{439.4}$
new p - .0121

A - $\frac{327874}{675(1.09)} - 439 \quad \text{Use } 14 \times 28 \text{ w/6, } 1" \phi \text{ bars, 2" cover}$

2ND FLOOR WT reduced live load 20%

29850
col wt 3600
wt above 2nd fl 327874
361324

A - $\frac{361324}{675(1.09)} - 491 \text{ sq"} \quad 14 \times 28 - 392$
 $6, 1 \frac{1}{8} \phi - \frac{76.2}{458.2}$
new p - .0162

A - $\frac{361324}{675(1.146)} - 467 \text{ sq"} \quad 14 \times 28 - 392$
 $6, 1 \frac{1}{8} \phi - \frac{76.2}{458.2}$

Use 14 x 28 with 6, 1 $\frac{1}{8}$ "sq bars with 2 $\frac{1}{2}$ " cover

C4 Continued

Design of Column C4 Continued

1ST FLOOR WT reduced live load 30%

col wt 28890
wt above 1st fl 4420
351724
394634

$$A = \frac{394634}{575(1.09)} = 537$$

$$16 \times 30 = 480$$

$$6, 1\frac{1}{8} \text{ sq } \frac{75.2}{556.2}$$

new p - .0159

Use 16 x 30 with 6, 1 $\frac{1}{8}$ sq bars with 2 $\frac{1}{2}$ " cover

Design of Flat Slab Basement Floor

Assume Live Load - 100 psf

Assumptions

Dead wt and loads
1/32 x 18 - about $\frac{1}{2}$ or 6"

f' - 3000
f_c - 1350
f_s - 20000
n - 10
v_c - 90
u - 150

Live load - 100
1" brano - 13
6" slab - 75
188 psf

$$\min t = .026L \sqrt{\frac{2500}{3000}} = 5.27" \text{ Use } 5\frac{1}{2}"$$

$$W = 16 \times 18 @ 188 = 60,800\#$$

$$M_o = .09(L \text{ minus } 2/3 C)^2 W/L = .09(16.17)^2 12 \frac{(60800)}{18}$$

$$= 950,000\#$$

Column Strip Pos M - .20 M_o - 190000"

$$R = \frac{190000}{120(4\frac{1}{2})} = 78.5 \text{ allow } 236 \text{ OK}$$

$$A_s = \frac{190000}{(20000 \times .867 \times 4\frac{1}{2})} = 2.43 \text{ sq "}$$

Use $\frac{1}{2}$ " sq bars @ 5 $\frac{1}{2}$ "

Flat Slab Continued

Flat Slab Continued

Middle Strip Pos M - .15 M₀ - 142500"

$$A_s - \frac{142,500}{20,000 \times .867 \times 4} - 2.03 \text{sq"}$$

Use $\frac{1}{2}$ " sq bars @ 18"

$$V - 60800 \text{ minus } 4.5 \times 6 \times 188 - 55730$$

$$\text{Shear} - v - \frac{55730}{4 \times 54 \times .867 \times 4} - 66 \text{ allow } 90 \text{ OK}$$

$$\text{Bond} - u - \frac{55730}{21 \times 4.4 \times .867 \times 4} - 161 \text{ or } 160 \text{ allow } 150 \text{ OK}$$

Design of Footing F4

Since I have no soil data on the stadium site, data and recommendations have been secured from the new Power Plant borings located about 200 yds to the southeast. The following is an exact copy:

Recommendations

Although it is possible to use a spread footing foundation in this type of material, the risk involved is not justified in a structure of this type. The only feasible foundation is piling. The piles should be at least 25' long and will have an allowable bearing capacity of 20 tons per pile with only a slight settlement. If the final driving resistance is low and the capacity of the piling is doubted, the resistance to driving should again be measured after the piles have set without disturbance over night or longer. This may reveal a "setting up" of the soil around the

F4 Continued

Design of Footing F4 Continued

pile.

Difficulty will be experienced in any excavation carried below ground water.

E. J. Harly, Pres.

MICHIGAN DRILLING CO.

On the basis of this report a pile footing seems in order. Included also in this paper is a soil profile of one boring from the same report.

Load

col load - 394634
flat slab- 10100
439334

Assumptions

f'_c - 3000
 f_c - 1350
 f_s - 20000
 n - 10
 v_c - 60
 u - 150

Assume a pad 4.5' x 6' x 2.5'

Load 439334
F4 wt 10100
449434 or 450,000#

$\frac{450,000}{40000}$ - 12 piles

Assume load uniformly dist. see Par 15-10
"Reinforced Concrete" Sutherland & Reese

W - 102,500

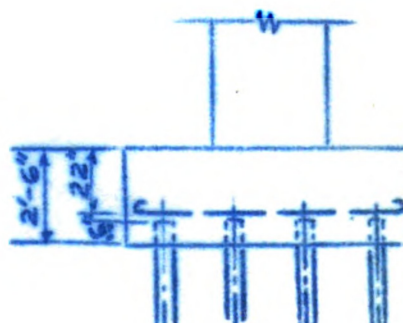
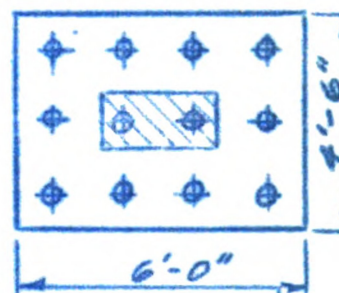
XX - 30x19x102500 - 60500 @ 9.5
51x19 42000 @ 12.67

BM - 40500x9.5 - 575000
42000x12.67-530000
1105000"#

$d = \sqrt{\frac{M}{R_b}} = \sqrt{\frac{1105000}{131x30}} = 16.7$

Par 1205 f ACI 60 minus 54 - 6
pile center is 3" from crit sec
use $\frac{1}{2}$ of pile loading

F4 Continued



Design of Footing F4 Continued

$$\frac{454000}{4} \times \frac{1}{2} - 58,000$$

$$d = \frac{V}{b \cdot v} = \frac{58000}{60 \times 7/8 \times 60} = 18.4"$$

For the end section

$$W = 75,000$$

$$\frac{16 \times 21 \times 75,000}{35 \times 21} = 34300$$

$$BM = 34300 \times 10.5 = 360,000$$

$$40700 \times 14 = 570000$$

$$930,000 \text{ "#}$$

$$d = \sqrt{\frac{930000}{131 \times 16}} = 20.8"$$

To find the depth from shear

ACI spec Par 1205 f Use 7/12 pile load

$$\frac{450000}{12} = 37500$$

$$7/12 \times 8 \times 37500 = 175,000 \text{ #}$$

$$5/12 \times 2 \times 37500 = 31200$$

$$206,200 \text{ #}$$

$$d = \frac{V}{b \cdot v} = \frac{206200}{180 \times 7/8 \times 60} = 21.8 \text{ or } 22" \quad \text{Use } d = 22"$$

$$A_{s1} = \frac{1105000}{20000 \times .867 \times 22} = 2.89 \text{ sq"} \quad \frac{2.89}{2.5} = 1.54 \text{ sq"} \quad \text{Use } 1" \phi \text{ bars, } 6" \text{ c-c}$$

$$A_{s2} = \frac{930000}{20000 \times .867 \times 22} = 2.44 \text{ sq"} \quad \text{short bars}$$

$$\frac{2.44}{1.25} = 1.95 \text{ sq"} \quad \text{Use } 1" \phi \text{ bars, } 4 \frac{3}{4}" \text{ c-c}$$

$$1.25 \quad \text{long bars}$$

$$\text{Bond} - u_1 = \frac{102,500}{3.1 \times 12 \times .867 \times 22} = 145 \text{ psi} \quad \text{allow } 153.5 \quad \text{OK}$$

$$u_2 = \frac{175,000}{3.1 \times 11 \times .867 \times 22} = 116 \text{ psi} \quad \text{Use standard hooks}$$

Deformed bars .0375x3000-102.5
with end anchor 1.5x102.5-153.5

Job No. 4621 Project MICH STATE COLLEGE POWER PLANT

Location E. Lansing

DATE 4-20-46

SW. Cor. 161' N of & Road N of Judging
Pavillion, 71' E of & E of Railroad

Sample Number	Depth	DISCRIPTION	Consistency	Moisture	Shear LB3/FT	Penetration
	0	Slightly Moist Black Loam				
	2.0	Loose Dry Yellow Sand				
		Soft Moist Yellow Clay				
31	4.5	Loose Moist Yellow Sand coarse	120	20	450	
32	6	Soft Moist Brown Clay Sandy pebbly	135	17	250	
33	8					
	9.0	Compact Wet Grey Sand coarse		11		
34	10			19		
	12	Compact Wet Grey Sand medium				
35	14			20		
	16	Compact Wet Grey Sand fine		22		
36	18			25		
37	20					
	22					
	22.5	Compact Wet Grey Sand coarse with clay balls	120	15	275	
38	24					
	26					
	28					
	30					

Boring No. 5
Surface El. 849.6
Gd Water Table - 6'
Vol. - Saturated

MICH. DRILLING CO.

LOG OF SOIL BORING

True Copy

THE UNIVERSITY OF CHICAGO

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by Byron W. Serby

"Planning Residence Halls"

by Harriet Hayes

"The American School and University"

Yearbook 1945

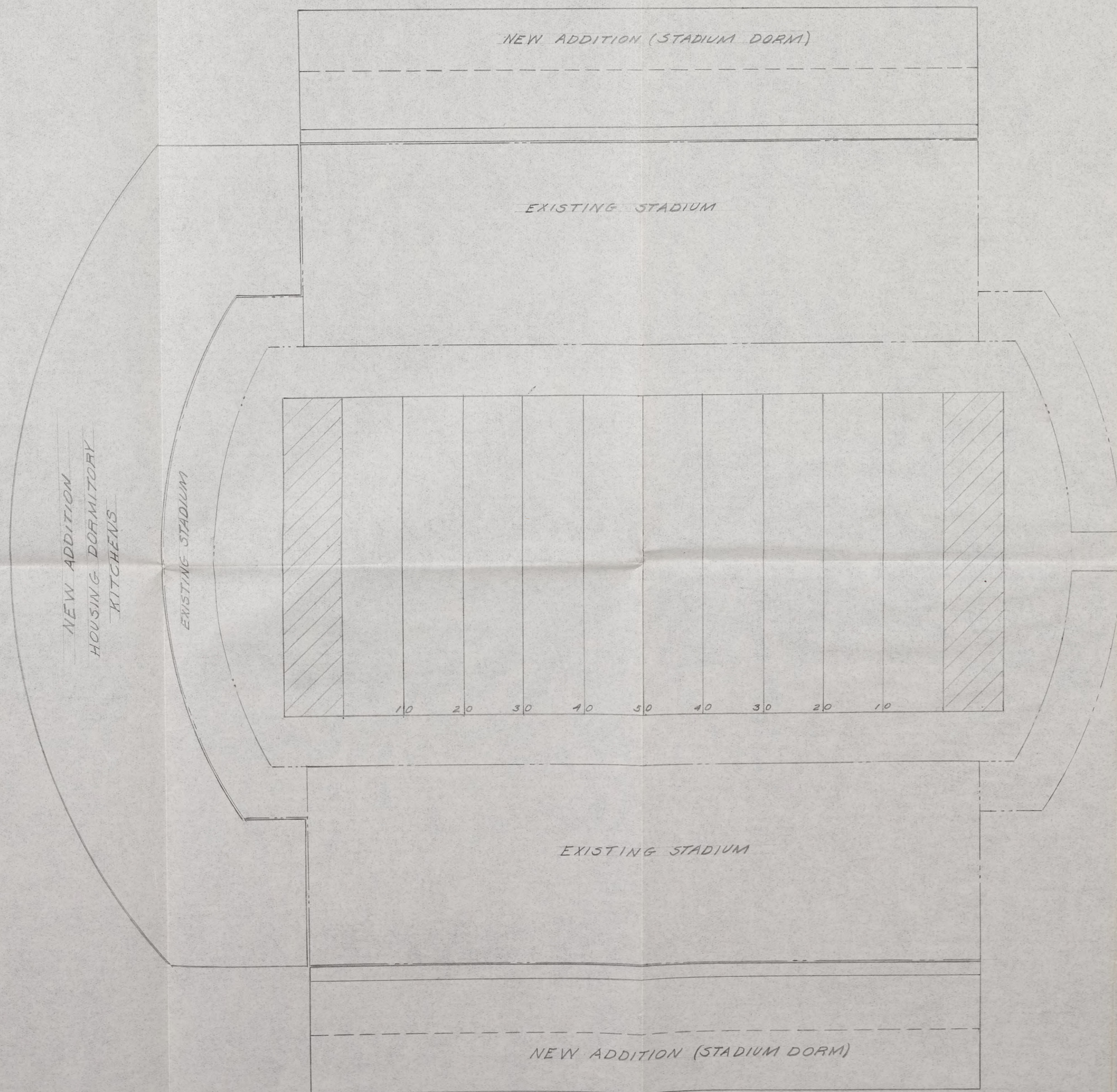
"Design of a College Dormitory for Men"

by W. A. Bowmaster

"A Report on the Progress of Higher

Education in Michigan"

by Association of
Michigan Colleges



SEATING CAPACITY - 50,000
STUDENT HOUSING - 8,800

PLATE No 1
PROPOSED MACKLIN FIELD
STADIUM DORMITORY
MICHIGAN STATE COLLEGE
SCALE - 1" = 40' APRIL 7, 1947
DESIGNED: A.W. SNOW
DRAWN: A.W. SNOW
CHECKED:



SUPPLEMENTARY
MATERIAL

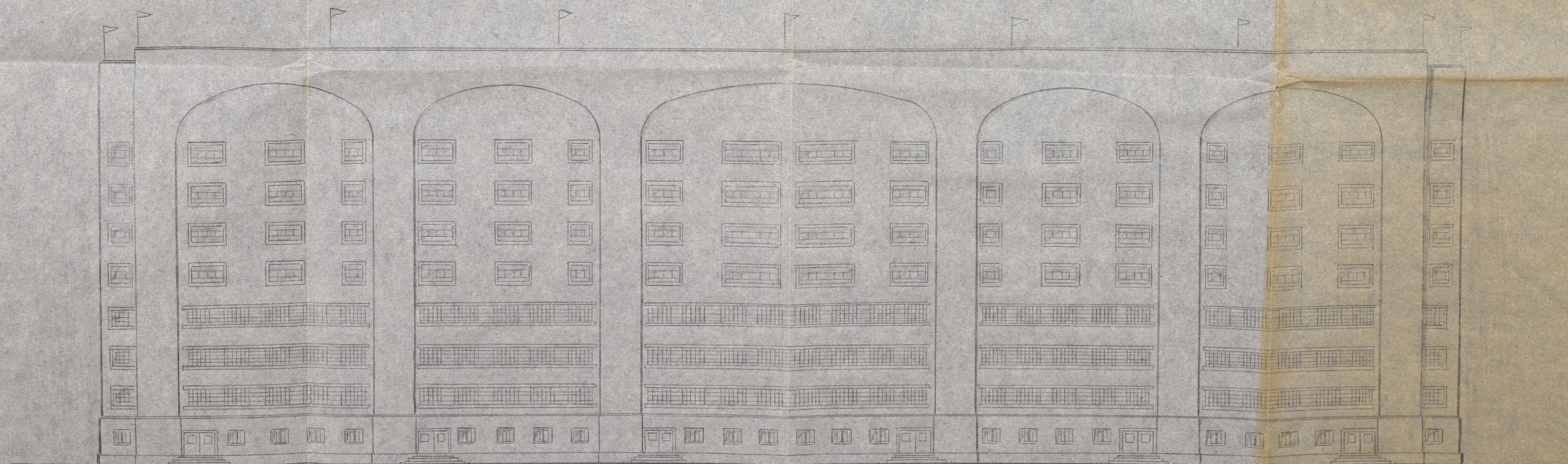


PLATE No 2
 SOUTH ELEVATION
 PROPOSED MACKLIN FIELD
 STADIUM DORMITORY
 MICHIGAN STATE COLLEGE
 SCALE ~ 1" = 20' APRIL 29, 1947
 DESIGNED: A.W. SNOW
 DRAWN: A.W. SNOW
 CHECKED:

126
 2/5
 745
 Draw
 no. 2



SUPPLEMENTARY
 MATERIAL



INCOMPLETE
NOT TO BE FINISHED!

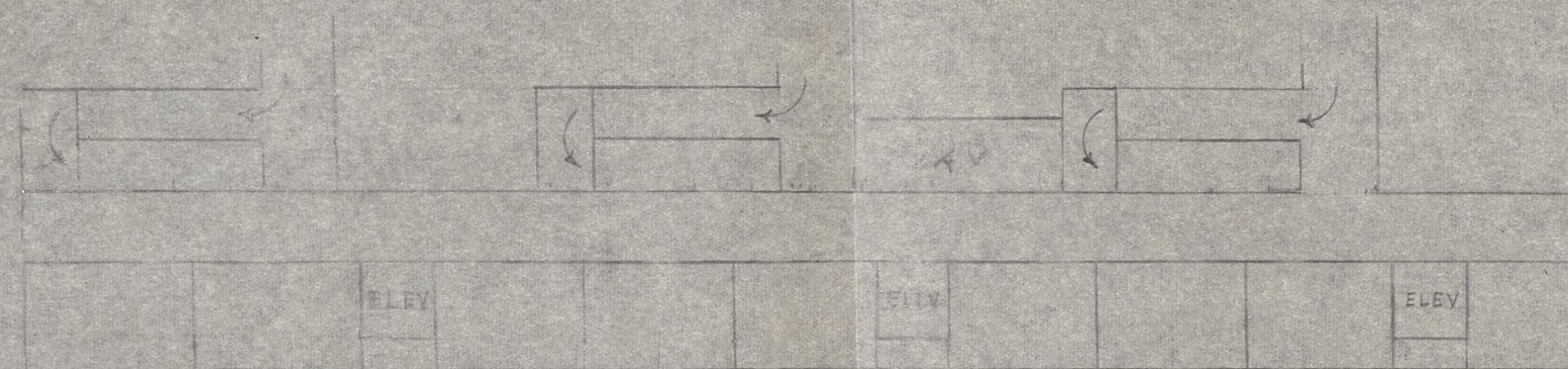
PLATE No. 2A
SOUTH ELEVATION
PROPOSED MACKLIN FIELD
STADIUM DORMITORY
MICHIGAN STATE COLLEGE
SCALE - 1" = 20' APRIL 29, 1947
DESIGNED: A.W. SNOW
DRAWN: A.W. SNOW
CHECKED:

MICHIGAN STATE UNIVERSITY LIBRARIES
3 1293 03150 3166

SUPPLEMENTARY
MATERIAL



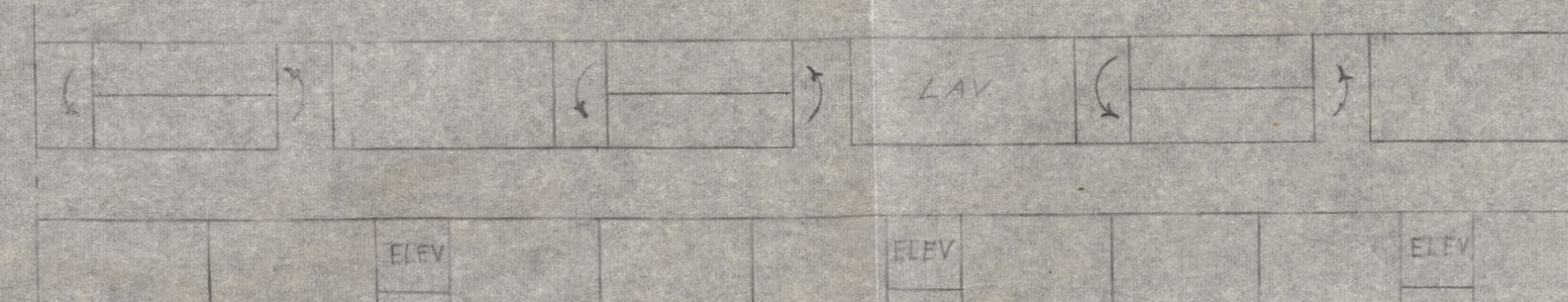
SK-1
SKETCH OF ELEV. SECTION
PROPOSED STADIUM DORM
MICHIGAN STATE COLLEGE
SCALE ~ $\frac{1}{8}$ " = 1'-0" APRIL 8, 1947
ARTHUR SNOW



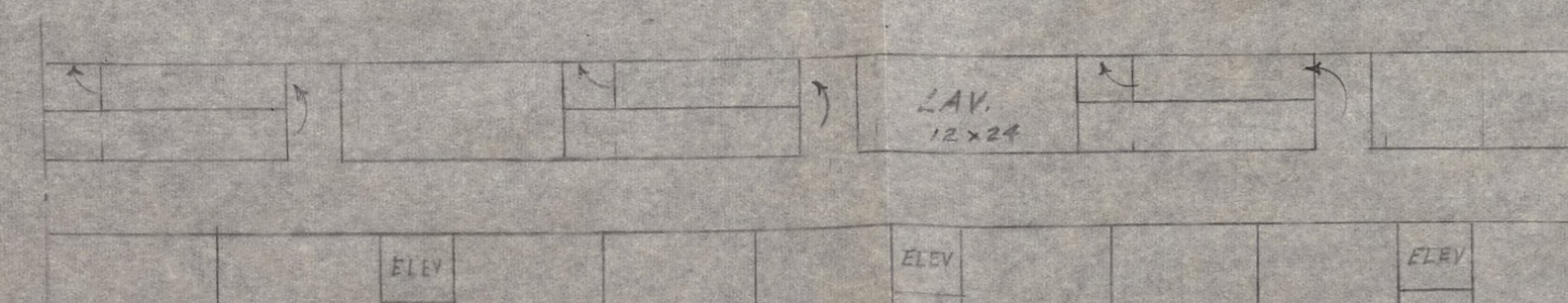
8TH FLOOR



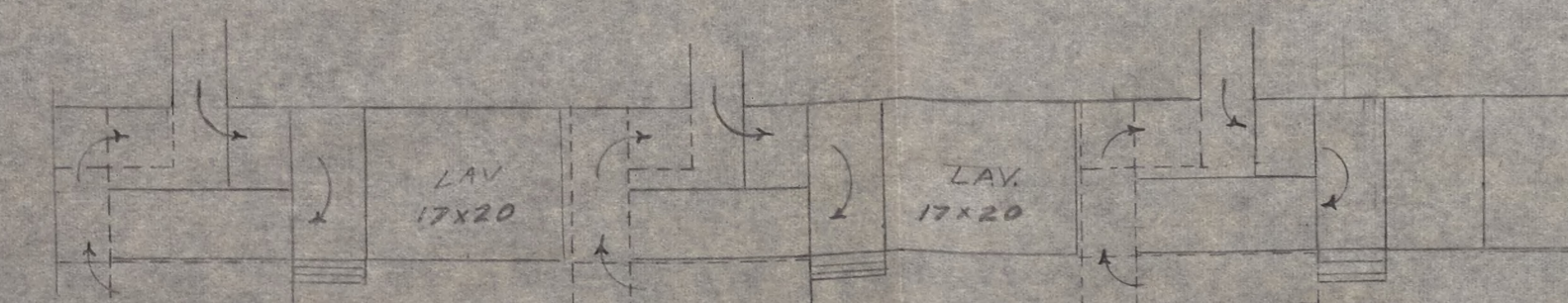
7TH FLOOR



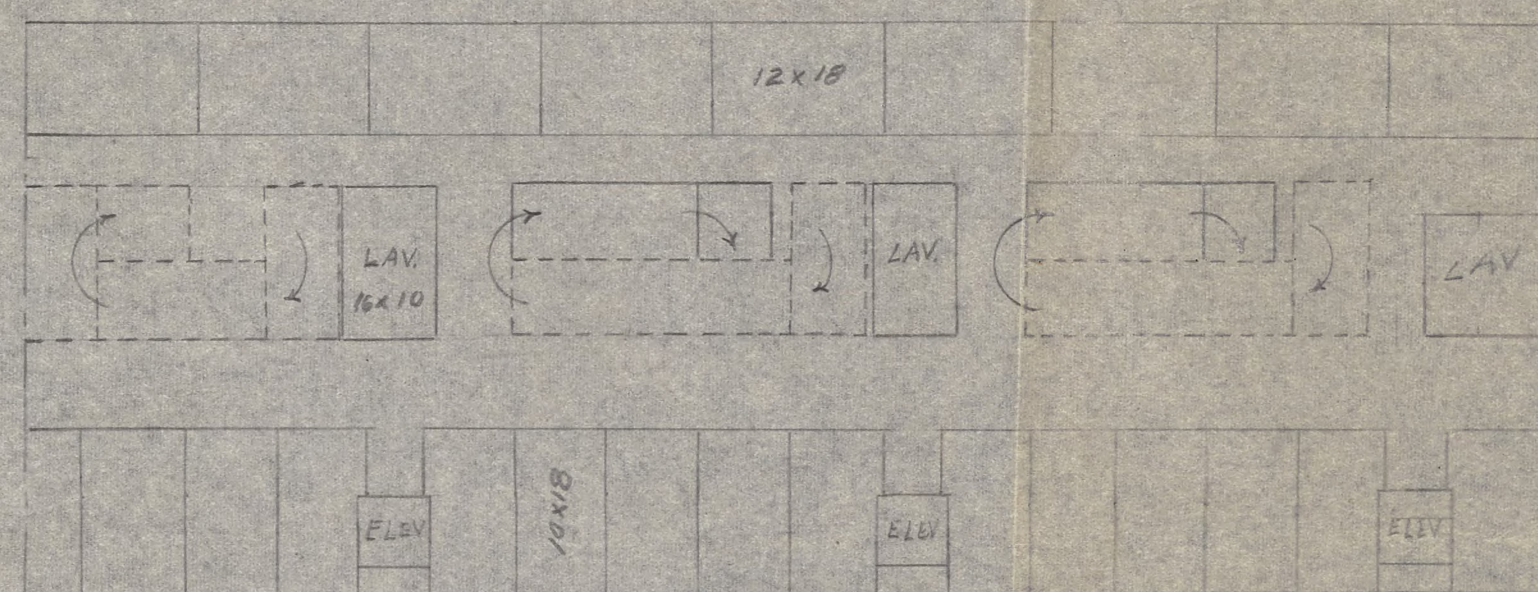
6TH FLOOR



5TH FLOOR



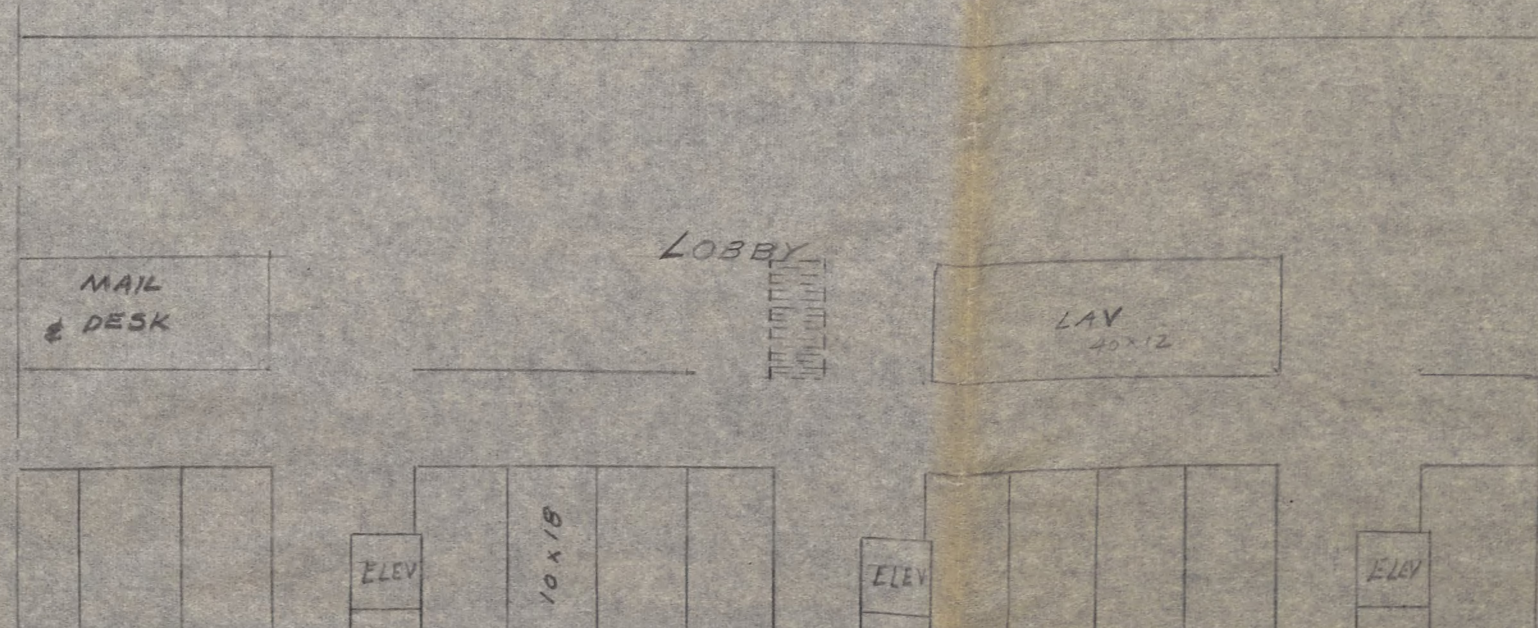
4TH FLOOR



3RD FLOOR



2ND FLOOR



MAIN

CAPACITY

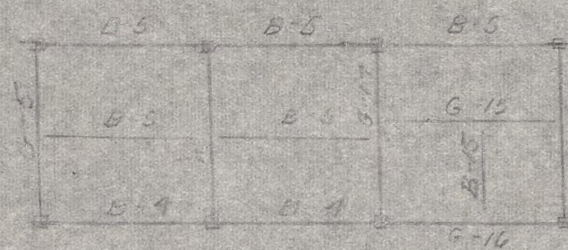
216 DOUBLE RMS
8 SINGLE RMS
440 STUDENTS
PER SIDE

Note:
BASEMENT TO HOUSE UTILITIES, STORAGE, etc.
NO ARRANGEMENT WILL BE SHOWN
→ ARROW INDICATES DESCENDING RAMPS

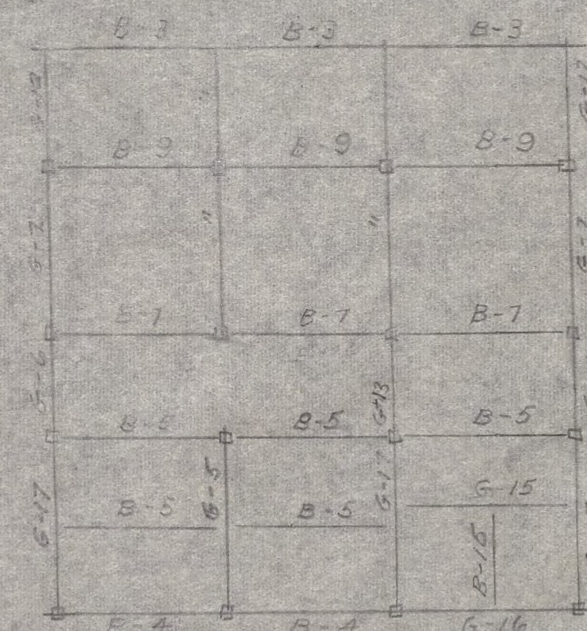
SK-2
FLOOR PLAN LAYOUT
PROPOSED STADIUM DORM
MICHIGAN STATE COLLEGE
SCALE - 1"=20' APRIL 14, 1947
ARTHUR SNOW



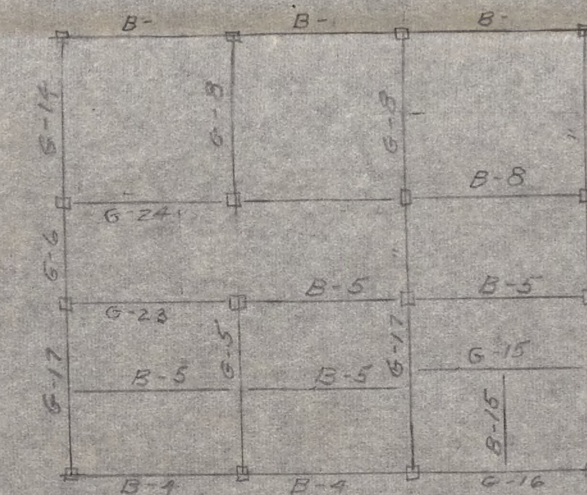
SUPPLEMENTARY MATERIAL



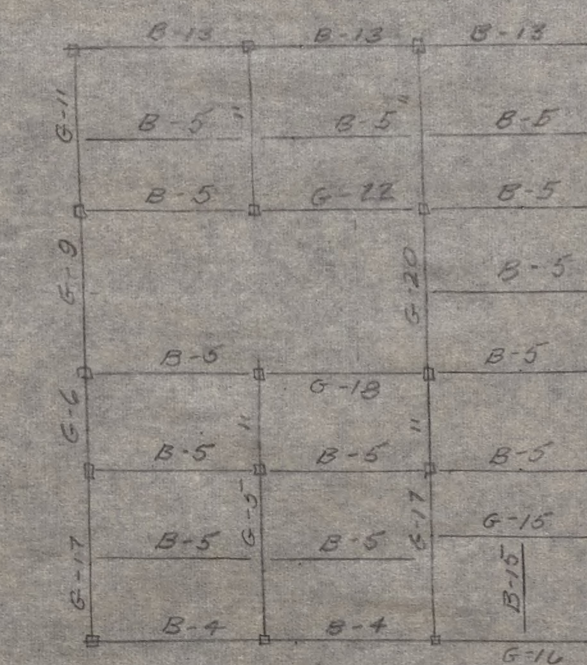
PLAN AT ELEV. 90



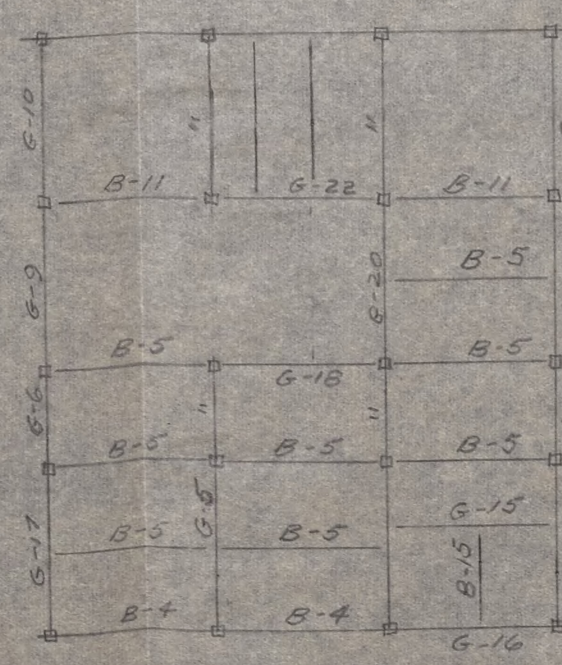
PLAN AT ELEV. 60



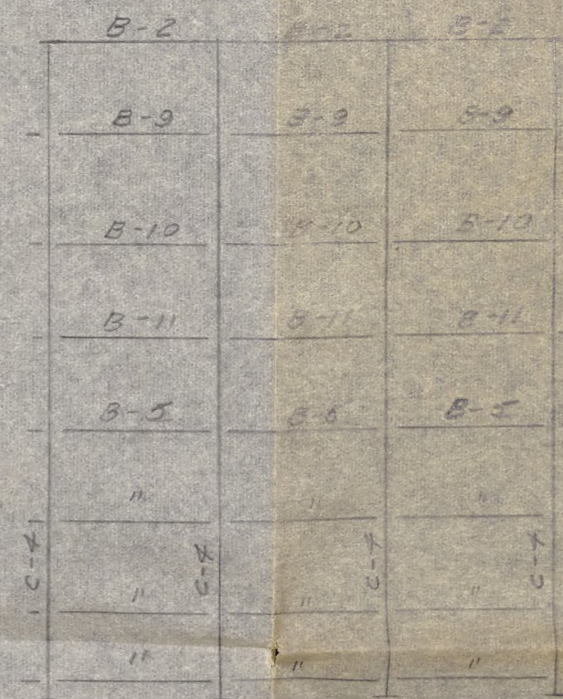
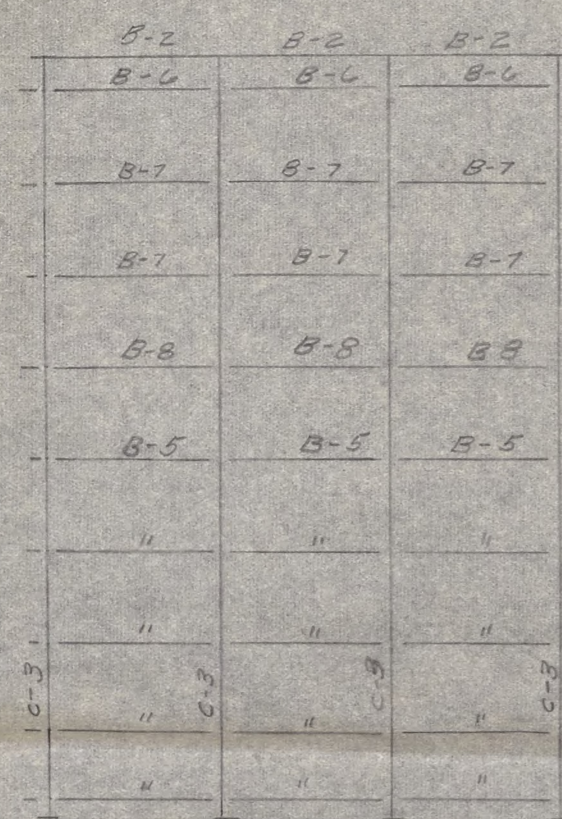
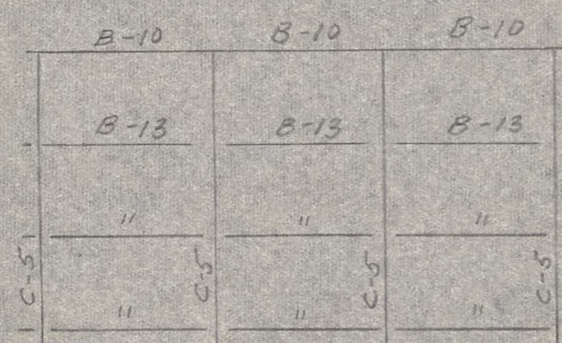
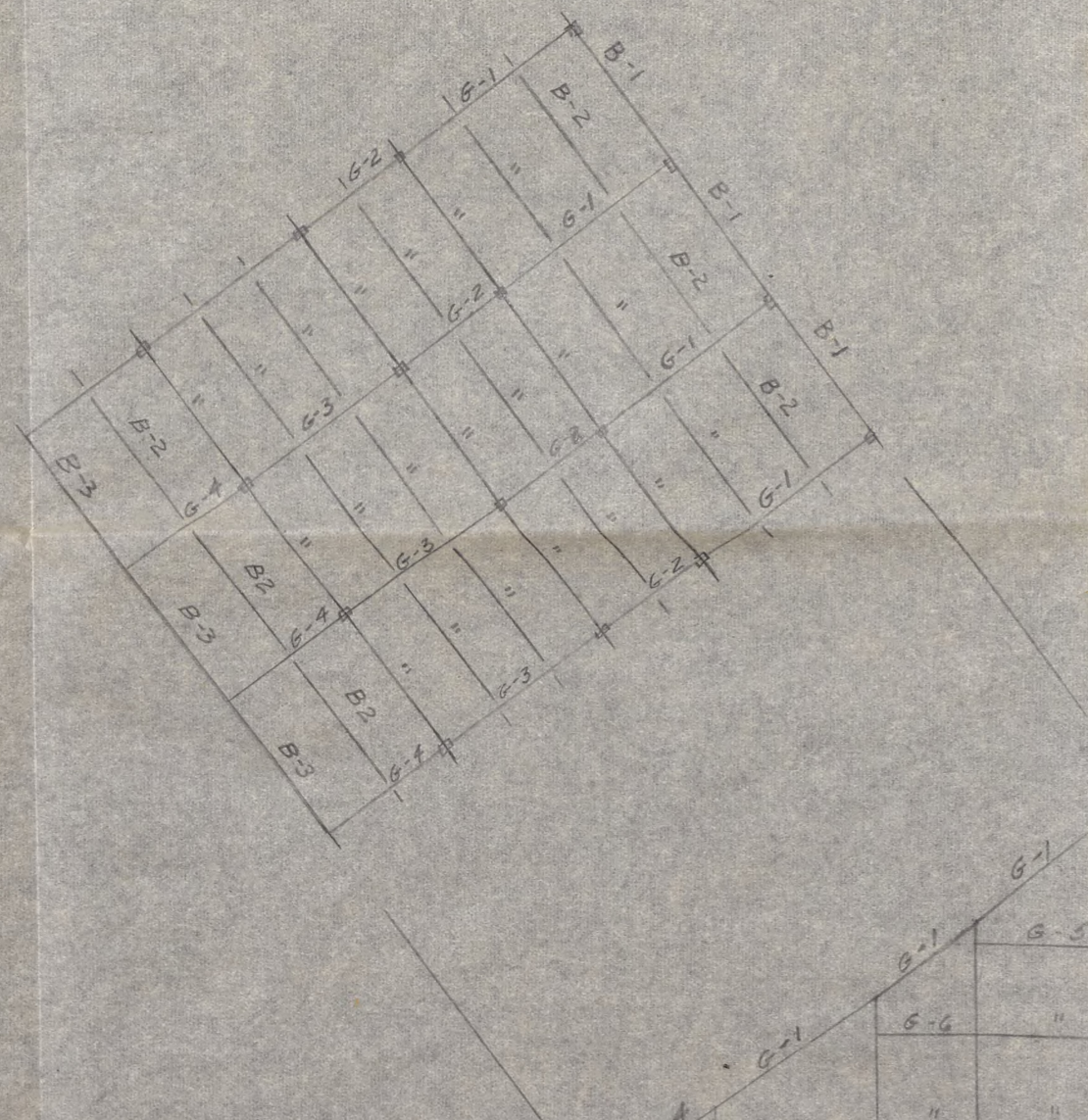
PLAN AT ELEV. 60



PLAN AT ELEV. 2, 30, 20, 4, 10



PLAN AT ELEV. 40

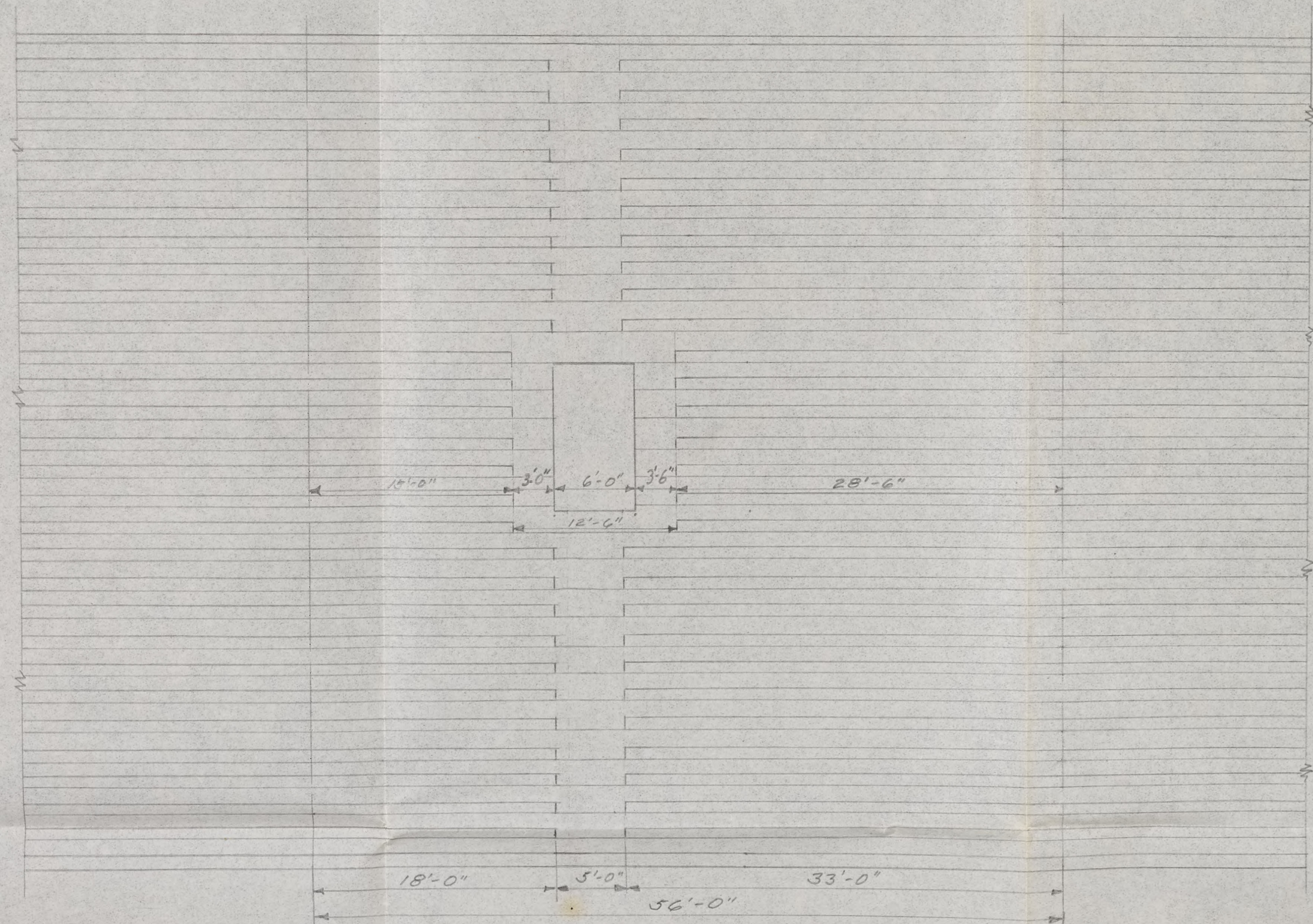


NOTE:-
ONE OF SIX INTEGRAL
SECTIONS PER SIDE.

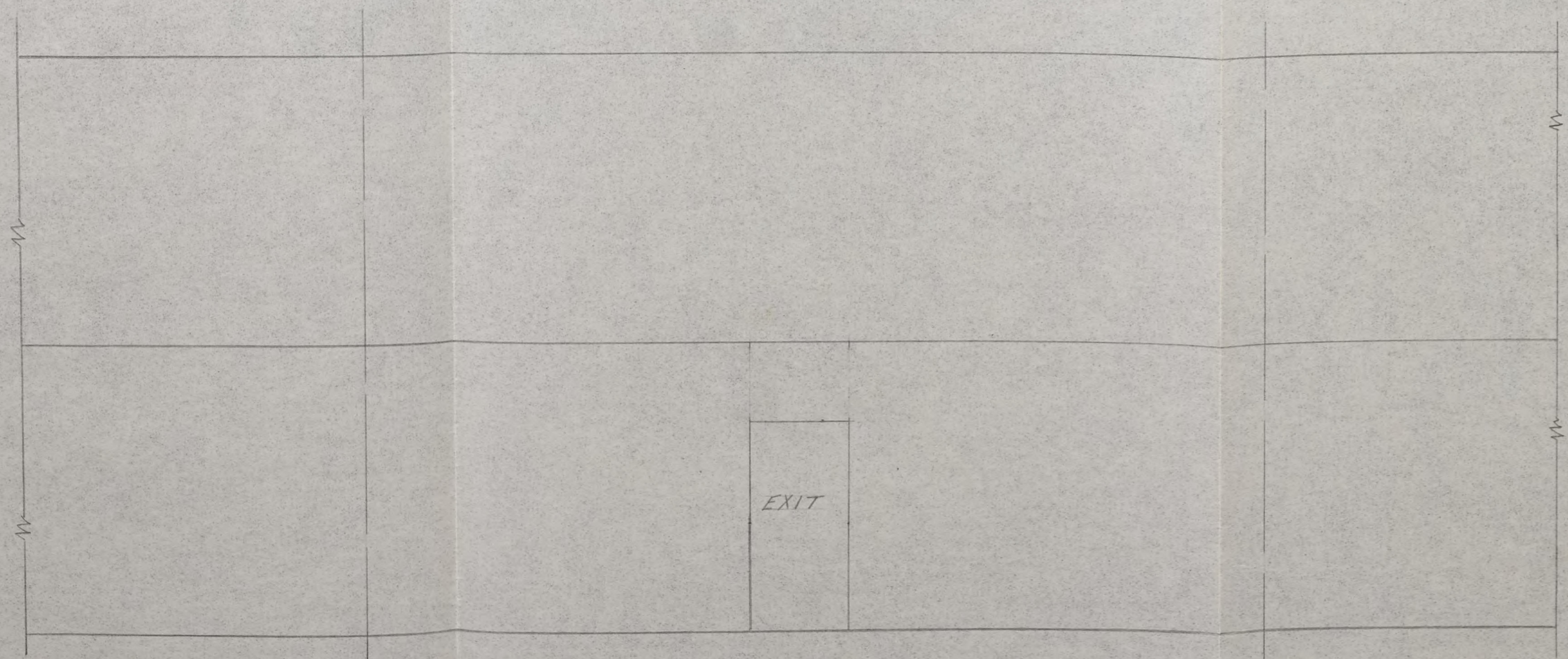
SK-3
FRAMING SKETCH
PROPOSED STADIUM DORMITORY
MICHIGAN STATE COLLEGE
SCALE-1"=20' APRIL 20, 1947
ARTHUR SNOW

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3 1293 03150 3190

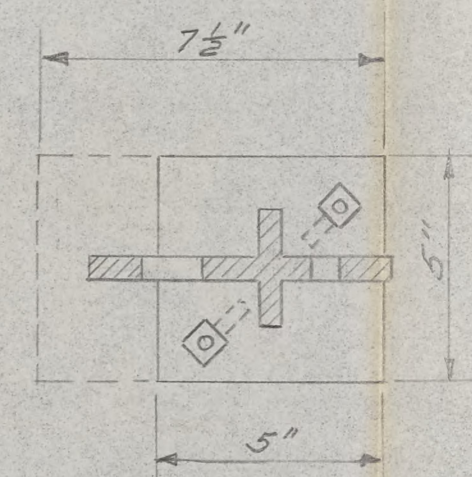
SUPPLEMENTARY
MATERIAL



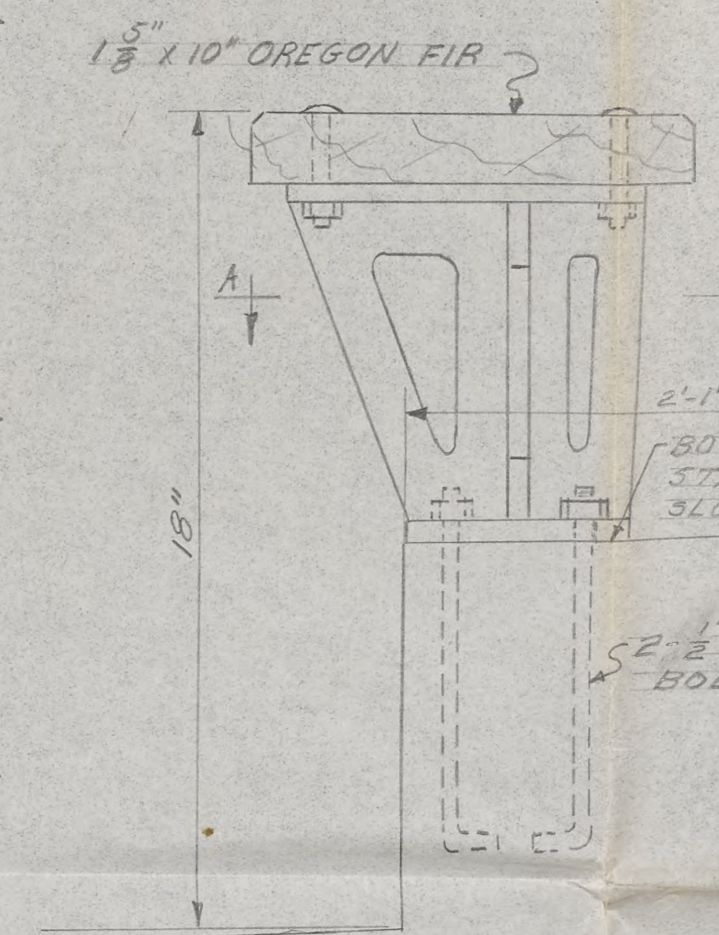
PLAN TYPICAL UPPER SEATING SECTION ~ 3 as shown & 3 opposite hand / DORM
28 ROWS



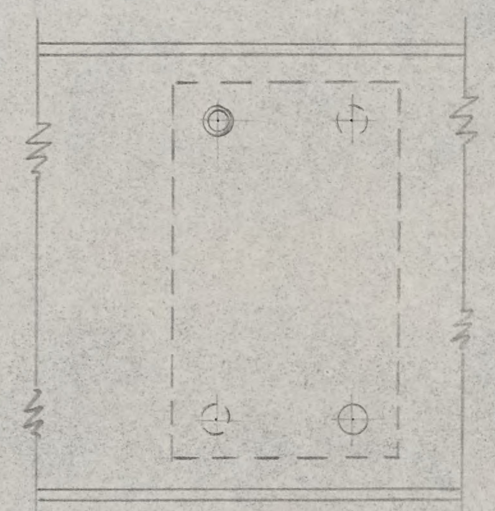
LOWER DECK STEEL BLEACHERS TO BE PURCHASED AND INSTALLED
20 ROWS



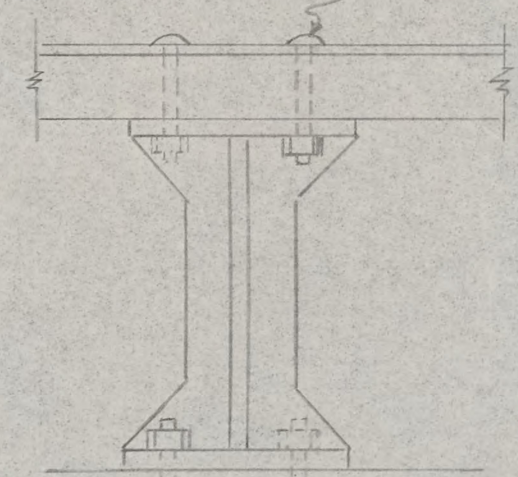
SECTION AA



SEAT DETAILS - UPPER SEATING SECTION
SCALE ~ 3" = 1'-0"



PLAN
WHERE JOINTS IN PLANKS OCCUR
PROVIDE FOUR BOLTS
2-1/2" CARRIAGE BOLTS

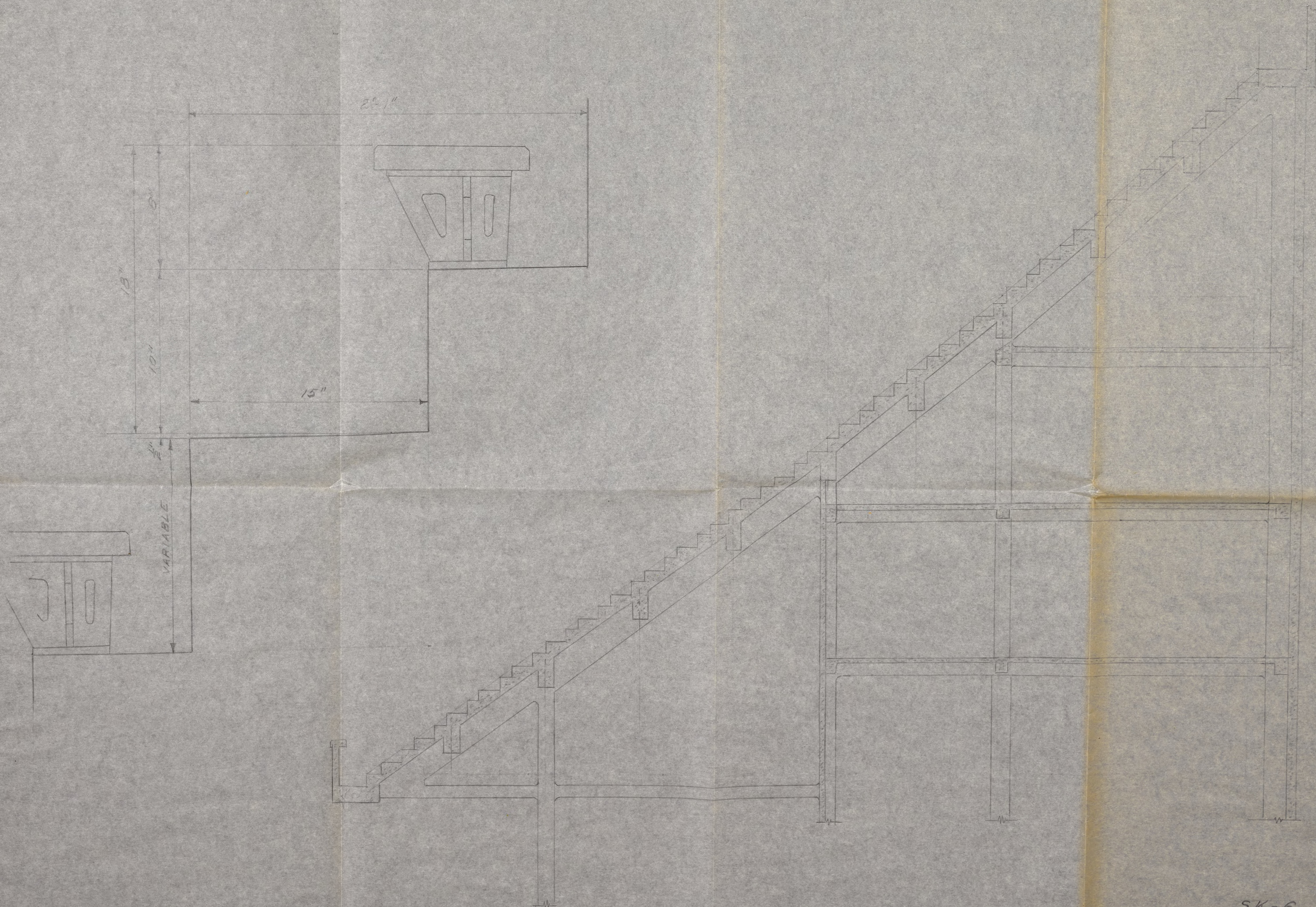


C.I. STANDARD DETAILS
NOT TO BE OVER 4'-0" APART
ONE EACH SIDE OF EXPANSION
JOINT

NOTE:-
CAPACITY UPPER SEC. - 910
LOWER DECK - 638
BASIS - 18" WIDE SEATS
TOTAL / SEC. 1548

SK-5
SKETCH OF SEATING PLANS
PROPOSED STADIUM DORM.
MICHIGAN STATE COLLEGE
SCALE ~ 1/8" = 1'-0" APRIL 8, 1947
ARTHUR SNOW

126
315
THS
SK-5
MICHIGAN STATE UNIVERSITY LIBRARIES
3 1293 03150 3216
SUPPLEMENTARY MATERIAL



SK-6
 SKETCH OF SEATING SLAB
 PROPOSED STADIUM DORM
 MICHIGAN STATE COLLEGE
 SCALE $\frac{1}{8}'' = 1'-0''$ APRIL 15, 1947
 ARTHUR SNOW

Pocket has.

Plate no.1

no.2

no.2A

SK-1

SK-2

SK-3

SK-4

SK-5

SK-6

PR

MIC

MICHIGAN STATE UNIVERSITY LIBRARIES



3 1293 03175 0601