FURSMAN

Design of a Foundry Building

Civil Engineering
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DESIGN

OF A

FOUNDRY BUILDING

...BY...

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THIS IS TO CERTIFY THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

WILLIAM HIRAM FURSMAN

ENTITLED DESIGN OF A FOUNDRY BUILDING

IS APPROVED BY ME AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE DEGREE

OF Bachelor of Science in Civil Engineering

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DESIGN OF A FOUNDRY BUILDING

Introduction

In January, 1902, the city of Aurora, Illinois, gave to the Doyle Air Burner Co. twenty-eight acres of land on condition that they should erect their plant in that city. It was the intention of the company to erect a million dollar plant for the purpose of manufacturing their improved furnaces, which they claimed insured the perfect combustion of fuel. The writer was at the time in the employment of that company and assisted in the general lay-out of the buildings. None of the buildings were designed; only their location appeared in the prospectus which the company published.

I have taken for the subject of this thesis the design of the foundry as located by the company's engineer. It is not the intention to deal with the foundry equipment, but to design the building so that it may be equipped economically.

Principles of Foundry Design

The first and foremost object in foundry design is to obtain unobstructed floor space. In a large foundry, provision should be made for a traveling crane, which may be used in pouring large castings and in removing them to the chipping room. The position of the cupola should be such that the molten metal can easily be transferred from it to the large ladle operated by the crane. As nearly as practicable the pig iron and fuel should be unloaded and stored on a level with the charging platform.

The Location

The site of the foundry is on a hillside. The floor level is at such a height that the material excavated will approximately make the fill. With the exception of a few inches of loam, the soil is a compact mixture of gravel and clay, which will stand with an almost vertical face.

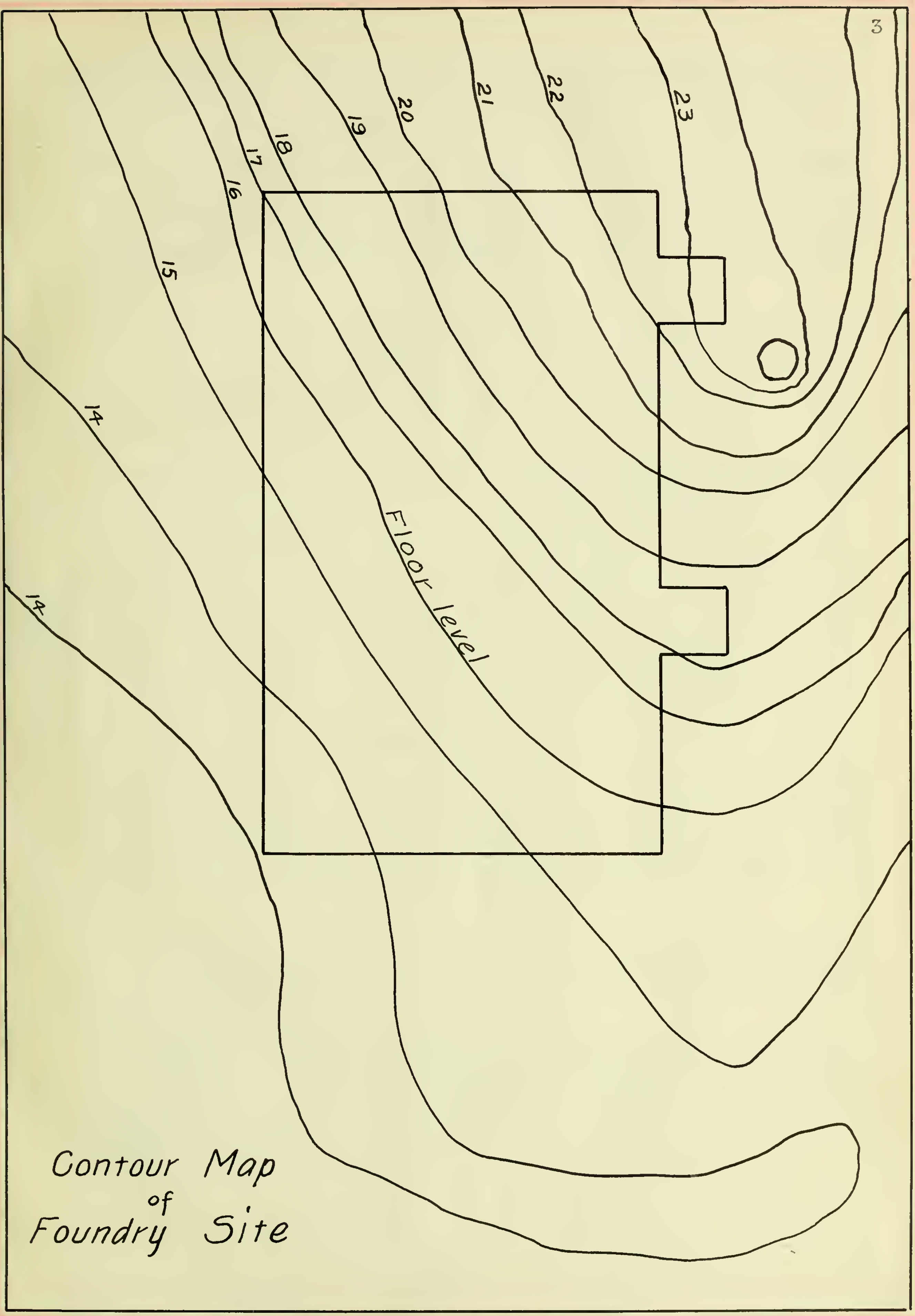
On the following page is a map showing the position of the building and also the contours of the original surface.

The Design

The foundry will be 120 feet wide and 200 feet long. The side walls are to be of brick, 8 inches thick, with 16 inch pilasters under the truss. In the front end-wall, pilasters will be built under every other purlin. The rear end-wall will have no pilasters; but a truss will be built into it, so that in case of an addition to the building the thin wall may be torn down and the building extended. On the up hill side, the wall to the height of the charging platform will be made of concrete, partly because pockets of gravel on the building site will furnish suitable aggregate, and partly because the heavy wall which is required can be more economically built of concrete than of brick.

Sections of the concrete retaining wall and of the footings are shown on Plate I.

The earth on the outside of the retaining wall will be subjected to heavy loads, as on it will be stored pig iron and fuel, and as on it also will be built a railroad track for transport-



Contour Map
of
Foundry Site

ing this material. These loads will be carried by piles driven as shown on Plate I. After the heads of the piles are sawed off, a layer of concrete about 1 foot thick will be deposited around and over them, and about 18 inches of clay will be placed on top of the concrete, the latter to deaden the blows of falling pig iron.

The roof truss is a combination of the Howe and the modified Fink type. The general dimensions, the loadings and the stress sheet are given on Plate III.

In determining the stresses in the truss and the posts, the following assumptions were made: The posts are fixed at both ends, the reactions on the walls are vertical, the horizontal reactions of the posts are equal, and the condition for maximum stress occurs when the dead and wind load or dead and snow load act together, as it is not probable that the maximum wind and snow load will ever come at the same time.

To resist the wind against the gable end, sway bracing will be placed in the second panel from each end, as shown on Plate I. The purlins will act as struts to transmit the wind stress to the sway rods.

For details of the truss, the sway bracing and purlin connections see Plate II.

The tension members are designed to carry 15,000 lbs. per sq. in., net section; and the compression members are designed in accordance with the following formula:

$$P = 16000 - 70 \frac{l}{r}$$

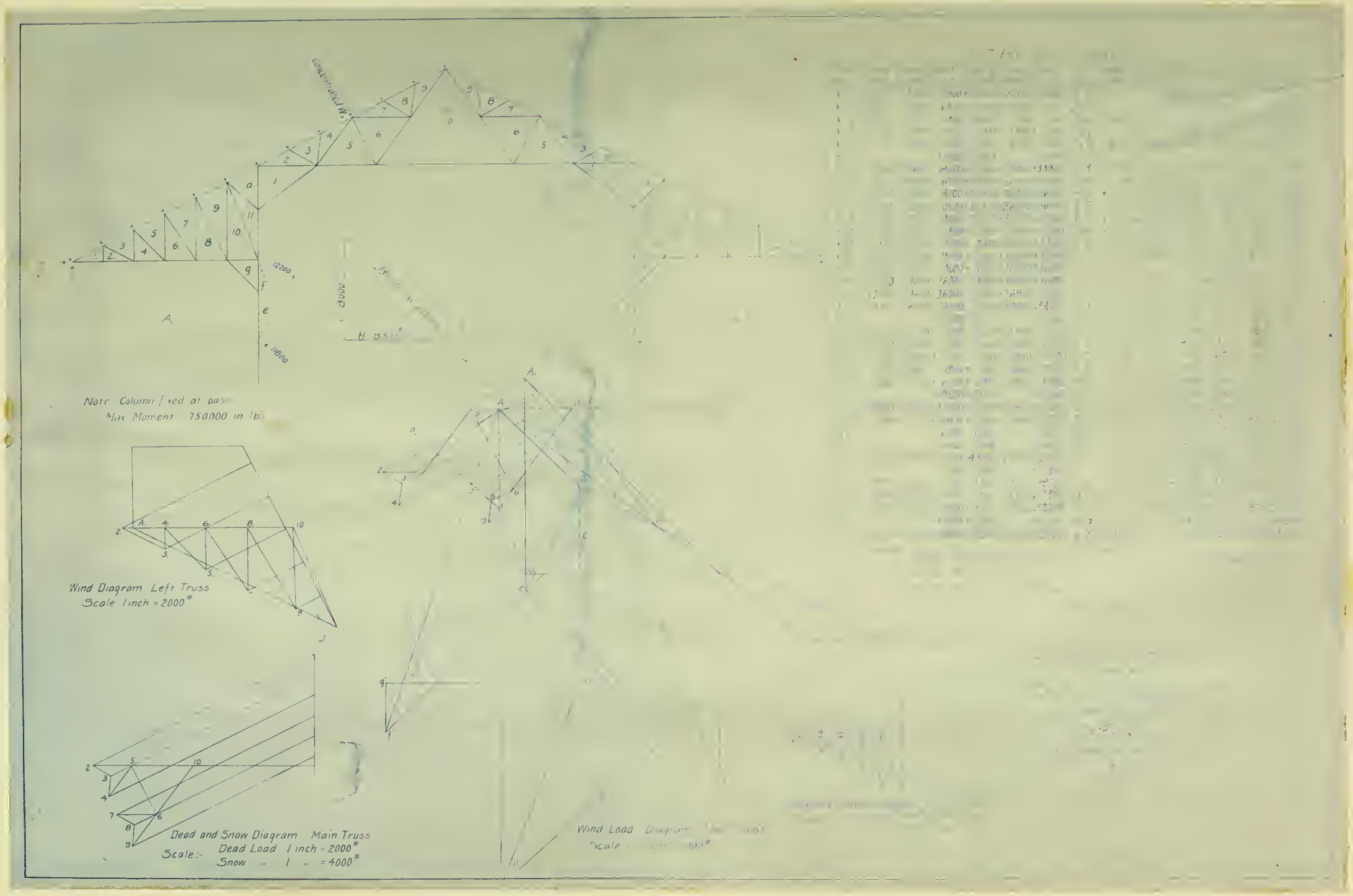
in which

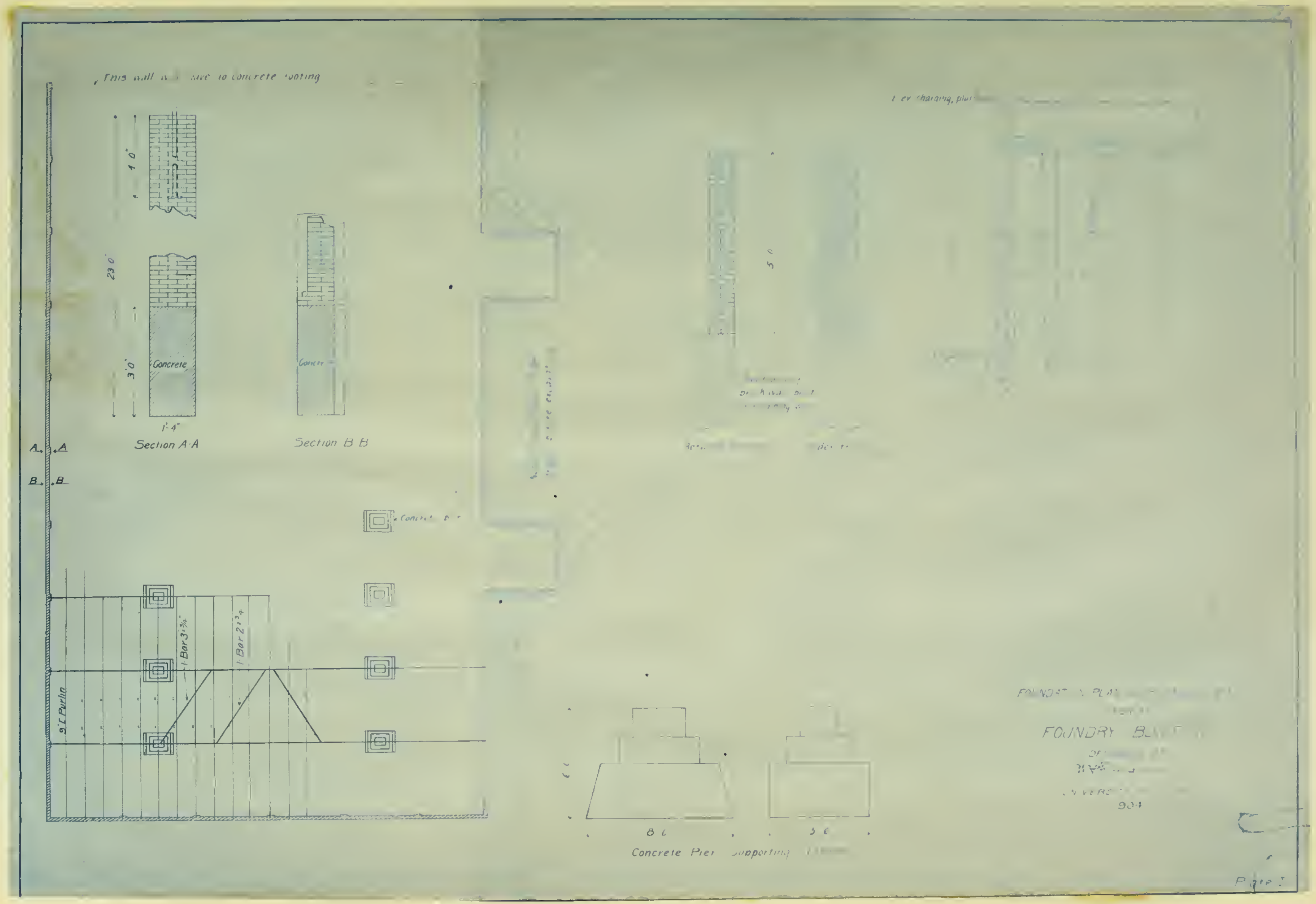
P = allowable stress lbs. per sq. in.

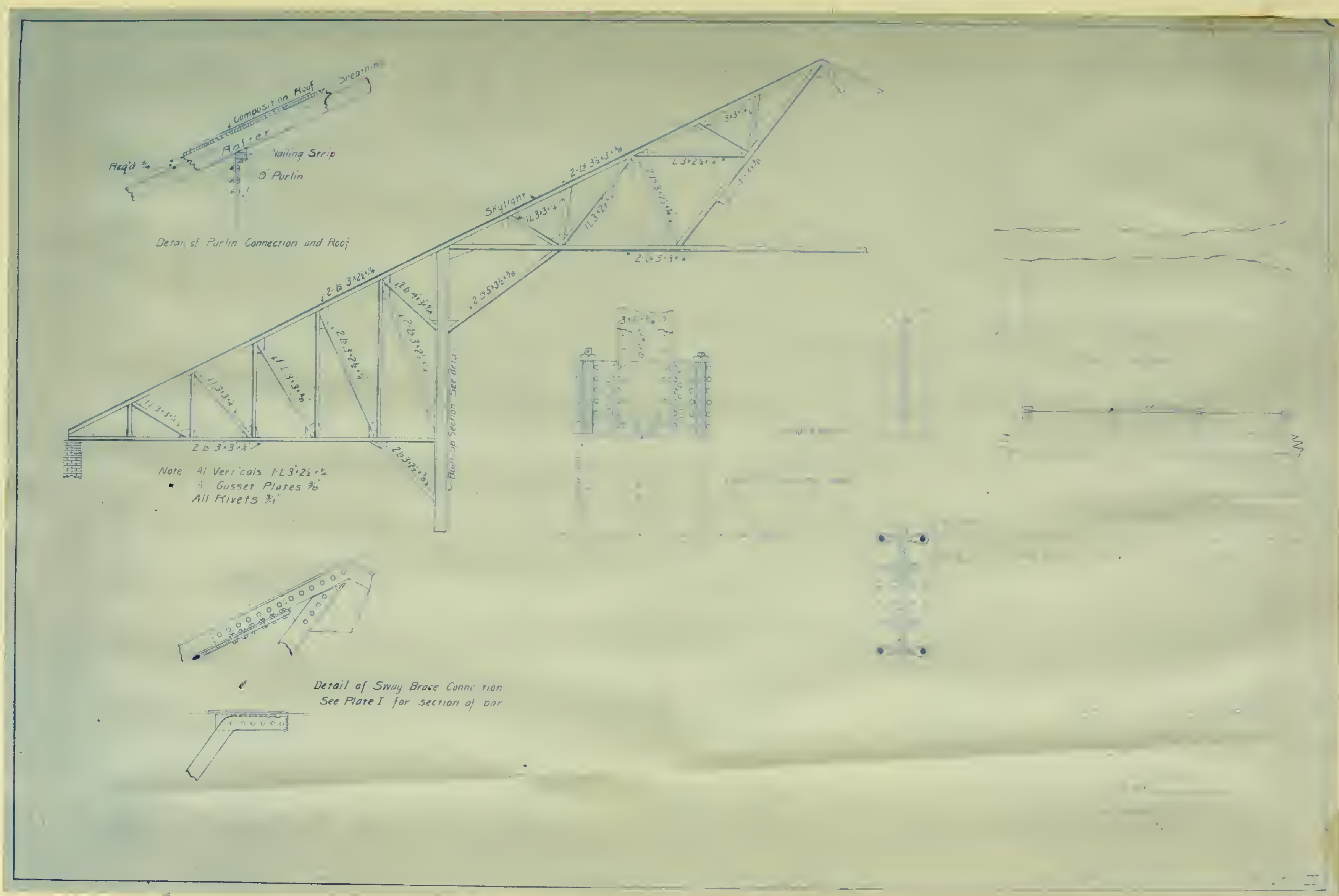
l = length of member in inches.

r = least radius of gyration of section.

No metal has been used less than 1/4 inch thick, and no angle smaller than a 3" x 2 1/2" x 1/4". These sections in some cases give an excess of metal, but lighter ones are inadvisable in such a large truss.


Concentrated W.
Note Column fixed at base
Max Moment 750000 in lb.
Wind Diagram Left Truss
Scale 1 inch = 2000#
Dead and Snow Diagram Main Truss
Scale:- Dead Load 1 inch = 2000#
Snow " 1 " = 4000#
Wind Load Diagram


This wall … to concrete footing
1' 0"
23' 0"
3' 0"
Concrete
1'-4"
Section A-A
Concrete
Section B B
A A
B B
9" I. Purlin
1-Bar 3×3/4
1-Bar 2×3/4
Concrete
5' 0"
8' 0"
5' 0"
Concrete Pier supporting
FOUNDRY BUILDING
1904
Plate


Composition Roof
Rafter
Nailing Strip
Purlin
Req'd
Detail of Purlin Connection and Roof
Skylight
Note All Verticals 1-L 3×2½×¼
Gusset Plates 3/8
All Rivets 3/4"
Detail of Sway Brace Connection
See Plate I for section of bar