Design of Columns.— The columns that supported the roof were to be braced laterally and were to be designed to take dead load and wind load. The columns supporting dead load, wind load, and crane load, were to be designed as cantilevers or columns of type 1.

The columns on the windward side were to be designed to carry the entire wind load on this wall and the estimated reaction of the roof. The leeward columns took the leeward reaction of the roof.

Many designers assumed that the windward and leeward columns shared the load. This assumption, though it might suit some designers on account of the reduction produced in the column sections, was not to be made. It was neither based on scientific reasoning, nor was it found to be true by experiment. The amount that could be transmitted by means of the truss would vary from nothing in some cases to an appreciable amount in others, but the amount transmitted could not be possibly calculated with any degree of accuracy. It seemed that some designers ignored deformation in structures. It was possible for elastic deformation to be the cause of failure of a structure.

Knee Braces.— Knee braces were not to be used. Knee braces were estimated to reduce the moment in the columns. If strain meters were applied to the columns at the base, it would be found that in most cases the value of the knee brace was small. Elastic deformation which was not allowed for in the trusses was the cause of the small value of the knee brace.

Bearing Power of Piles.— The maximum load carried by any pile was not to exceed 25 tons or ¼ ton to the square inch of its average cross section. Piles driven through loose wet soil to solid rock or equivalent bearing figured as columns with a maximum unit strain of ¼ ton per sq. in. properly reduced. The maximum distance between centres of piles was 2½ feet.

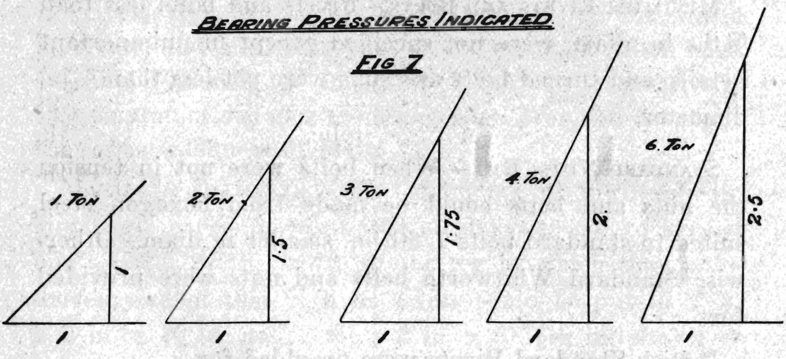
The bearing power of piles was deduced by the following formula $P = \frac{2Wh}{S+1}$ where—

P = safe load on pile in tons
W = weight of hammer in tons
h = distance of free fall of hammer in feet
S = penetration of the pile for the last blow in inches.

This gave about a factor of safety of 6. Several hundred 12″ piles were recently driven at Cockatoo Island. These were all driven to the rock. Where rock was within reasonable distance from the surface it was always advisable to drive to same.

FOUNDATIONS.— Foundations were either stepped or sloped and the projections were as follows:—(Fig. 7).

PROJECTIONS PERMITTED IN CONCRETE
WITH NO REINFORCEMENT
AND
BEARING PRESSURES INDICATED.
FIG 7



The resultant of all forces was to fall within the centre third of the foundation, and the average pressure was not to exceed half the maximum bearing pressure allowed.

The following formula assisted in estimation:—

$$P = P_1 \times P_2$$

P = total stress permitted.

P_1 = stress due to vert. load.

P_2 = stress due to moment.

$$\text{i.e. } P = \frac{\text{direct load}}{\text{base area}} + \text{ or } - \frac{\text{Overturning mom.}}{\text{Mod. of base area.}}$$

DETAILS.

MINIMUM THICKNESS OF MATERIAL. No steel of less than ¼″ in thickness was allowed for except for lining or filling vacant places.

MINIMUM ANGLE.– No angles less than 2″ x 2″ x ¼″ were allowed for.

MINIMUM RODS.—No upset rods were less than 5/8ths in. in diameter. Sag rods may be as small as 3/8ths in. in diameter. Rods less than 1 in. diam. 12′ — 0″ long or 2½in. diam. 6′ 0″ long should not be upset, as the cost of upsetting would exceed the value of material saved.

MINIMUM RIVETS AND BOLTS.—Rivets and bolts less than ⅝ths in. diam. were not specified except in unimportant details, and turned bolts and pins were not less than ¾in. diameter.

STANDARD NUTS, ETC.—When bolts were not in tension the nuts and bolts could be made from hexagon steel suited to standard bolts 1/8th in. smaller in diam. Otherwise Standard Whitworth bolts and nuts were provided for.

British Standard Rivets were provided for.

ALLOWANCE FOR CLINCHING RIVETS.– A liberal allowance for forming heads and filling holes was allowed for.

POSITION OF HOLES IN SECTIONS.—The standard position of holes was adopted. When two joists of different flange widths were riveted or bolted flange to flange, the difference between the distances given for hole centres should be shared, provided that the edge distance was within limits to be mentioned. When 5/8th rivets are used in 2″ x 2″ L's the dimension 'A' was given as 1″.

SPACING OF RIVETS.—The minimum distance allowed between centres of rivets was three diameters of the rivet, but the distance preferably should be not less than 3 in. for 7/8th inch rivets, 2½″ for ¾″ rivets, 2¼″ for 5/8th in. rivets, and 1¾″ for ½″ rivets. For angles with two gauge lines with rivets staggered, the maximum in each line was twice as great, and where two or more plates are used in contact rivets not more than 12″ apart in any direction should be used to hold the plates together. The pitch of the rivet in the direction of the strain was not to exceed 6 in. or 16 times the thinnest outside plate connected, and not more than 50 times that thickness at right angles to the strain.

EDGE DISTANCE.—The minimum distance from the centre of any rivet hole to a sheared edge was 1½ in. for 7/8th in. rivets, 1¼ in. for ¾ in. rivets, 1⅛ in. for 5/8th in. rivets, and 1 in. for ½ in. rivets, and to a rolled edge 1¼ in., 1⅛ inch, 1 in., and 7/8th in. respectively. The maximum distance from any edge provided for eight times the thickness of plate.

MAXIMUM DIAMETER.—The diameter of the rivets in any angle carrying calculated strains was not to exceed one quarter of the width of the leg in which they were driven, except that 5/8th in. rivets could be put in 2 in. x 2 in. x ¼ in. and 2 in. x 2 in. x 5/16th in. angles at 1 in. from the heel of angle. In minor parts rivets could be 1/8th in. greater in diameter but not greater than 5/8th in. in 2 in. angles.

Pitch at Ends.—The pitch at the ends of built compression members was not to exceed four diameters of the rivets for a length equal to one and a half times the maximum width of the member.

Pins.— Pins were to be long enough to insure a full bearing of all parts connected upon the turned-down body of the pin.

Pin Plates.—Pin holes were to be reinforced by plates where necessary; and at least one plate was to be as wide as the flange would allow; where angles were used this plate was to be on the same side as the angles. The plates were to contain sufficient rivets to distribute their portion of the pin pressure to the full cross-section of the member.

Tie Plates.—The open sides of compression members were to be provided with lattice having tie-plates at each end and at intermediate points where the lattice was interrupted. The tie plates were to be as near the ends as practicable. In main members carrying calculated strains the end tie plates were to have a length not less than the distance between the lines of rivets connecting them to the flanges and intermediate ones not less than half this distance.

Their thickness was to be not less than one-fiftieth of the same distance.

Lattice.—The thickness of lattice bars was to be not less than one-fortieth for single lattice and one-sixtieth for double lattice, of the distance between end rivets; their minimum width shall be as follows:—

For 15 in. channels or built sections with 3½ and 4 in. L's—2½ in. (7/8th inch rivets).

For 12 in., 10 in., and 9 in. channels, or built sections with 3 in. L's—2¼ (¾ in. rivets).

For 8 in. and 7 in. channels or built sections with 2½ in. L's—2 in. (5/8th in. rivets).

For 6 in. and 5 in. channels or built sections with 2 in. L's—1 and 3/8th inch (½ in. rivets).

LATTICE BARS.— Lattice bars with two rivets were to be generally used in flanges more than 5 in. wide.

ANGLE OF LATTICE.— The inclination of lattice bars with the axis of the member generally was to be not less than 45 degrees, and when the distance between the rivet lines in the flange was more than 15 in., if a single bar was used the lattice was to be double and riveted at the intersection.

SPACING OF LATTICE.—The pitch of lattice connections along the flange divided by the least radius of gyration of the member between connections, was to be less than the corresponding ratio of the member as a whole.

EYE BARS.—The eye-bars in pin-connected trusses composing a member were to be as nearly parallel to the axis of the truss as possible.

Members packed on pins were to be held against lateral movement.

JOINTS.— All joints in compression or tension were to be fully spliced. Covers on ¼ in. material shall be at least 5/16th in.; on 5/16th in., 3/8th in.; on 3/8th in., ½ in.; on ½ in., 5/8th in.; on ¾ in., 7/8th in.; on 7/8th in., 1 in.

FOUNDATION BOLTS.— Foundation bolts in tension when cemented in were to be at least twenty times the diameter of the bar in the concrete.

ADJUSTABLE MEMBERS.—Adjustable Members in any part of a structure were to be avoided.

SYMMETRICAL SECTIONS.— Sections were preferably to be made symmetrical.

Connections.—No connection except lattice bars was to have less than two rivets, and special care taken to ensure a good rivet.

Column Setting.—Columns with bases were to be set with half-and-half cement grouting.

Holes.—All holes were to be drilled. Holes through members to be connected were to be drilled with the members in position where possible. Holes for hot rivets were to be 1/16th in. larger than the nominal diameter of rivet. Pins in pin connected trusses of the style recommended were to be light driving fit.

Purlin Joints.—Joints in timber purlins and girts were to be scarfed at the junk piece and bolted to a junk piece with one 5/8th in. bolt when junk pieces were steel. They could be securely nailed to a junk block if wood is used.