THE APPLICATION OF IRON AND STEEL TO BUILDING PURPOSES.*

The results of many experiments show that two tons load per superficial foot of foundation is a safe limit to assume for ordinary clay, gravel, etc. Having settled on a limit of pressure on the earth, we will now consider the question of an isolated column as being the simplest case, and will assume that it carries a not unusual load of 50 tons; such a column would weigh about 15 cwt., say one ton; thus 51 tons will be discharged on its bed-stone. This bed-stone may be taken as ordinary sandstone, which would carry with safety a load of 25 tons per foot; this determines the size of base flange of column, which in this case should have an area of two feet at least. In a building where the ground floor supports are principally columns, and especially for a corner shop where there is only a party and back wall, it is advisable to make the column or stanchion bases larger than given by above rule to give lateral steadiness to the building. The concrete block under the bed-stone or base-plate or brick pier should always be mixed with Portland cement, for the ordinary lime concrete is long in setting, and in large masses it will take years before the centre of block becomes hard. One of Portland cement to eight of other ingredients, if carefully ane well mixed, will safely bear a load of 5 tons per superficial foot. These other ingredients should be *hard* materials, as gravel, broken stone and bricks, or bats of hard quality.

Cast-Iron Columns and Stanchions.—A cast-iron hollow column to carry 50 tons should have a ratio of about fifteen to twenty times its diameter for its length; this might safely be loaded to 2½ tons per square inch of sectional area; and, if we assume a diameter of 9 inches and a thickness of metal of 1 inch, we get an area of 25 inches, 20 per cent. in excess of our requirements; but for hollow columns it is always advisable to have a liberal margin of safety, as, unless great care is taken in the molding, the shifting of the cone may cause an unequal thickness of metal in the casting. The hollow column is, theoretically, the strongest form of section, but the probability of an unequal thickness of metal is an objection to its use. Another objection is that it does not lend itself very readily to being cased in a fireproof material. Its base flange should have a bold rounding at its junction with the shaft, and bracketed in four directions; the thickness of the base flange should be from one-eighth to one-quarter more than the thickness of the shaft—in this case 1¼ inch. It will often be found that stanchions of the + or H section are preferable.

They have this great advantage, that the whole surface of the metal can be seen and any imperfections detected; also, the absence of the central core greatly reduces the risk of an unsound casting, while in tiers or stacks of stanchions such sections give great facilities for making simple junctions of girders and iron joists at the various floor levels. In designing a stanchion of H section to be placed flat against the wall, it must be remembered that the least width of its section, viz., the width of the flange of the H section, is the measure of its strength, and it will be seen at once that an H section 12″×6″ is not so strong as one 12″×9′, even though it contained the same sectional area. The commonly employed ⊓ or ⊓⊓ section is not to be recommended, on account of the very unequal distribution of compressive stress over its section, and also on account of its liability to become bowed in cooling—a risk which, more or less, attends all very non-symmetrical sections. These channel sections are generally fixed with the web or back placed against the wall, but the stanchion is under better conditions if the web is placed outward towards the centre of span. Whatever form of section of column or stanchion is decided on, it is important that the cap plate on which the girder rests should be well chamfered back from the front to prevent the girder from bearing on the extreme front edge of the cap plate, and, in the case of very narrow stanchions, the cap plate should also be narrow, to prevent as far as possible the deflection of the girder tending to bend the stanchion.

All bed-stones for ends of girders in walls should have their front edges chamfered in same manner, and for a distance of 3 inches from the face.

Wrought-Iron and Steel Stanchions.—It is not now uncommon to use stanchions made of rolled joists, the cap and base-plate being fixed to the joists by angle-irons or gusset-plates, or both combined. As the ends of joists cannot be considered as bearing accurately on the end plates, without special care in the workmanship, such gussets and angles must be designed so that the shearing or bearing resistance of the riveting alone is sufficient to transmit the load to the base-flange. For very heavy loads, say 150 to 300 tons, it is usual to make stanchions of wrought-iron, of tubular section, with web plates and angle-iron, or with webs made of rolled joists or channel irons. The construction of such stanchions presents many special difficulties of design in the cap and base junctions; and as such loads rarely occur in ordinary practice, it is advisable, whenever they do occur, that an engineer should be employed to design them.

Cast-iron base-plates direct on concrete are rarely used, unless the load on column exceeds 100 tons. It is not possible to give a rule for their depth in center, or the thickness of metal, as this will be influenced by the number of the radiating arms and their thickness; but a rough approximation would be 2½ inches in depth for every foot in diameter, and a nearly uniform thickness to that of the column or stanchion on it. Thus, a base-plate 6 feet diameter would be about 15 inches deep in the centre, and as the stanchion on it would have to carry a load of 130 tons, it would be found to work out to about 1¼″ metal, and base-plate should have the same thickness. Such a base should have some holes about 3″ diameter cast in the spaces between each pair of radiating arms, so that when base-plate is wedged up and cement is run under same, it can be seen to flow at these holes, and thus make certain that whole area of plate is covered by cement.

* From a paper read before the Royal Institute of British Architects, by F. T. Reade, Hon. Assoc., R.I.B.A.

Prices of Building Materials.

LUMBER.

CAR OR CARGO LOTS.

1¼ and thicker clear picks, Am. ins..	$30 00@	32 00
1¼ and thicker, three uppers, Am. ins.		37 00
1¼ and thicker, pickings, Am ins.....		27 00
1 x 10 and 12 dressing and better......	18 00	20 00
1 x 10 and 12 mill run................	13 00	14 00
1 x 10 and 12 dressing................	14 00	16 00
1 x 10 and 12 common..................	12 00	13 00
1 x 10 and 12 spruce culls............	10 00	11 00
1 x 10 and 12 maple culls.............		9 00
1 inch clear and picks................	28 00	30 00
1 inch dressing and better............	18 00	20 00
1 inch siding, mill run...............	14 00	16 00
1 inch siding, common	11 00	12 00
1 inch siding, ship culls.............	$10 00	$11 00
1 inch siding, mill culls.............	8 00	9 00
Cull scantling........................	8 00	9 00
1¼ and thicker cutting up plank.......	22 00	25 00
1 inch strips, 4 in. to 8 in. mill run. ..	14 00	15 00
1 inch strips, common.................	11 00	12 00

YARD QUOTATIONS.

Mill cull boards and scantling........		10 00
Shipping cull boards, promiscuous widths........		13 00
Shipping cull boards, stocks.......		14 00
Hemlock cantling and joist up to 16 ft.	11 00	12 00
" " " 18 "	12 00	13 00
" " " 20 "	13 00	14 00
Scantling and joist, up to 16 ft.......		14 00
" " 18 ft.......		15 00
" " 20 ft.......		17 00
" " 22 ft		19 00
" " 24 ft.......		21 00
" " 26 ft.......		23 00
" " 28 ft.......		25 00
" " 30 ft.......		27 00
" " 32 ft.......		27 00
" " 34 ft.......		29 50
" " 36 ft.		31 00
" " 38 ft.......		33 00
" " 40 to 44 ft..		36 00
Cutting up planks, 1¼ and thicker, dry	25 00	26 00
" " board,	18 00	22 00
Cedar for block paving, per cord......		5 00
Cedar for Kerbing, 4 x 14, per M....		14 00

B. M.

1¼ inch flooring, dressed, F. M.....	28 00	31 00
1½ inch flooring rough, B. M	18 00	22 00
1¼ " dressed, F. M.....	25 00	28 00
" undressed, B. M...	18 00	19 00
" dressed...........	18 00	22 00
" undressed	12 00	15 00
Beaded sheeting, dressed	22 00	35 00
Clapboarding, dressed................		12 00
XXX sawn shingles, per M, 16 in ...	2 65	2 75
Sawn lath............................	2 00	2 20
Red oak..............................	30 00	40 00
White................................	35 00	45 00
Basswood, No. 1 and 2	18 00	20 00
Cherry, No. 1 and 2..	70 00	70 00
White ash, No. 1 and 2..............	25 00	25 00
Black ash, No. 1 and 2...............	20 00	30 00
Dressing stocks.....................	16 00	22 00
Picks, American inspection..........		40 00
Three uppers, American inspection....		50 00

BRICK—℔ M

Common Walling......................		$7 50
Good Facing		9 00
Sewer	8 50	9 00

Pressed Brick:

Plain brick, f. o. b. at Milton, per M...		$17 00
" " 2nd quality, per M.......		13 00
" " 3rd " "		10 00
Hard Building.....................		8 00
Moulded and Ornamental, per 100.....	$3 to	10 00
First quality, f.o.b. at Campbellville, per M		18 00
2nd " " " "		13 00
3rd " " " "		10 00
Hard Building.......................		8 00
Ornamental, per 100.................	$3 to	10 00
Tiles...............................		24 00

Stone.

Common Rubble, Per Toise, delivered		14 00
Large flat " " "		18 00
Foundation Blocks, " Cubic Foot..		35

Slate: Roofing (℔ *square*).

" red...................		16 00
" purple................		9 00
" unfading green........		9 00
" black slate...........		7 50
Terra Cotta Tile, per sq............		25 00
Ornamental Black Slate Roofing..		8 00

Sand:

Per Load of 1½ Cubic Yards..........		1 25

PAINTS. (*In oil, ℔ lb.*)

White lead, Can......................	6 25	6 50
" zinc, Can.	6½	7 50
Red lead, Eng........................	5½	6½
" venetian........................	1 60	1 75
" vermillion......................	90	1 00
" Indian, Eng.....................	10	12
Yellow ochre.........................	5	10
Yellow chrome........................	15	20
Green, chrome........................	7	12
" Paris...........................	25	40
Black, lamp..........................	15	25
Blue, ultramarine....................	15	25
Oil, linseed, raw (℔ *Imp. gallon*).....	68	70
" " boiled "	72	75
" " refined, "	78	80
Putty................................	2¼	2½
Whiting, dry.........................	75	1 00
Paris white Eng., dry................	90	1 25
Litharge, Am.........................	6½	8
Sienna, burnt........................	15	20
Umber, "	8¼	12

CEMENT, LIME, etc.

Lime, Per Barrel of 2 bushels, Grey..		40
" " " White		55
Plaster, Calcined, New Brunswick..		2 00
" " Nova Scotia......		2 00
Hair, Plasterers', per bag ..		1 00
Cement, Portland, per bbl...........	2 80	3 00
" Thorold, "		1 50
" Queenston, "		1.50
" Napanee, "		1 50
" Hull, "		1 50

HARDWARE.

Cut Nails:

American Pattern, 1¼ inch, per keg....		4 15
" " 1½ to 1¾ inch, per keg		3 40
Canadian Pattern, 1¼ inch, per keg. .		3 65
" " 1½ to 1¾ inch, per keg		3 15
" " 2 to 2¼ inch, "		3 15
" " 2½ to 2¾ inch, "		2 90
" " 3 inch and larger......		2 65
Steel nails 10c. per keg extra.		
Finishing nails, 1 inch, per keg........		5 75
" " 1¼ inch, "		5 05
" " 1½ " "		4 50
" " 1¾ " "		4 25
" " " and larger....		3 10