Ordinance No. 533

AN ORDINANCE to repeal Sub-sections B, C, D, E, F, G, H, I, J, K, L, M, N as amended by Ordinance No. 445, and O, Section 49, Chapter VIII, of Ordinance No. 290, known as the Building Code of the City of Alexandria, adopted May 23, 1939 and made effective July 21, 1939, and to ordain new Sub-sections B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, and X of said Section 49, Chapter VIII, of said Building Code, which new Sub-sections relate to structural steel, cast steel and cast iron.

BE IT ORDAINED BY THE COUNCIL OF THE CITY OF ALEXANDRIA, VIRGINIA:

Section 1. That Sub-sections B, C, D, E, F, G, H, I, J, K, L, M, N as amended by Ordinance No. 445, and O, Section 49, Chapter VIII, of Ordinance No. 290, known as the Building Code of the City of Alexandria, adopted May 23, 1939 and made effective July 21, 1939, be and the same hereby are repealed.

Section 2. That Section 49, Chapter VIII, of Ordinance No. 290, known as the Building Code of the City of Alexandria, adopted May 23, 1939 and made effective July 21, 1939, be and the same hereby is amended by adding Sub-sections B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W and X following Sub-section A, which new sub-sections read as follows:

B. Materials

1. Structural steel shall conform to the Standard Specifications of the American Society for Testing Materials for steel for Buildings, Serial Designation A7-39.

2. Rivet steel shall conform to the Standard Specifications of the American Society for Testing Materials for Structural Rivet Steel, Serial Designation A141-39.

3. Cast steel shall conform to the Standard Specifications of the American Society for Testing Materials for Carbon-Steel, for Miscellaneous Industrial Uses, Serial Designation A27-39.

4. Cast iron shall conform to the Standard Specifications of the American Society for Testing Materials for Gray-Iron Castings, Serial Designation A48-36.

5. Stock material shall be of a quality substantially equal to that called for by the specifications of the American Society for Testing Materials for the classifications covering its intended use; and mill test reports may constitute sufficient record as to the quality of material carried in stock.

6. All structural steel sections shall be straight and true and any section so damaged as to affect its proper carrying capacity shall not be used in the construction of any building or structure

C. Allowable Unit Stresses

1. Structural and rivet steel—All parts of the structure shall be so proportioned that the unit stress in pounds per square inch shall not exceed the following values:

Tension

Structural steel, net section .. 20,000

Rivets, on area based on nominal diameter ... 15,000
(where combined stresses occur)

Compression

Columns, gross section

For axially loaded columns with values of l/r not greater than 120 ... $17{,}000-0.485\frac{l^2}{r^2}$

For axially loaded columns with values of l/r greater than 120 ... $\frac{18{,}000}{1+\frac{l^2}{18{,}000\ r^2}}$

in which l is the unbraced length of the column, and r is the corresponding radius of gyration of the section, both in inches.

The ratio of unbraced length to least radius of gyration l/r for compression members shall not exceed.

For main compression members ... 120

For bracing and other secondary members in compression ... 200

Plate Girder Stiffeners, gross section ... 20,000

Webs of Rolled Sections at toe of fillet ... 24,000
(Crippling, see Plate girders and rolled beams (h)

Bending

Tension on extreme fibers of rolled sections, plate girders, and built-up members. (see Plate girders and rolled beams (a) ... 20,000

Compression extreme fibers of rolled sections, plate girders, and built-up members, for values of l/b not greater than 40 ... $\frac{22{,}500}{1+\frac{l^2}{1800\ l^2}}$

with a maximum of 20,000 in which l is the laterally unsupported length of the member, and b is the width of the compression flange, both in inches.

The ratio of unbraced length to width of flange l/b for compression flanges of rolled sections, plate girders, and built-up members subject to bending shall not exceed 40.

Stress on extreme fibers of pins ... 30,000

Shearing

Rivets ... 15,000

Pins, rib bolts, and turned bolts in reamed or drilled holes ... 15,000

Unfinished bolts ... 10,000

Webs of beams and plate girders, gross section ... 13,000

Bearing	Double Shear	Single Shear
Rivets and rib bolts	40,000	32,000
Turned bolts in reamed or drilled holes	40,000	32,000
Unfinished bolts	25,000	20,000
Pins	32,000	
Contact Area		
Milled Stiffeners and other Milled Surfaces		30,000
Fitted Stiffeners		27,000
Expansion rollers and rockers (pounds per linear inch)		600d

in which d is diameter of roller or rocker in inches.

2. Cast steel—Compression and bearing same as for structural steel. Other unit stresses, 75 per cent of those for structural steel. All steel castings shall be annealed.

D. Reversal of Stress

Members subject to live loads producing alternate tensile and compressive stresses shall be proportioned as follows:

To the net total compressive and tensile stresses add 50 per cent of the smaller of the two and proportion the member to resist either of the increased stresses resulting therefrom. Connections shall be proportioned to resist the larger of the two increased stresses.

E. Combined Stresses

Members subject to both direct and bending stresses shall be so proportioned that the greatest combined stresses shall not exceed the maximum allowed limits.

Members subject to stresses produced by a combination of wind and other loads, the permissible working stress may be increased 33 1/3 per cent, provided the section thus found is not less than that required by the dead and live loads alone.

F. Members Carrying Wind Only

Members carrying wind stresses only, the permissible working stresses may be increased 33 1/3 per cent.

G. Effective Span Length

1. Simple spans—Beams, girders and trusses shall ordinarily be designed on the basis of simple spans whose effective length is equal to the distance between centers of gravity of the members to which they deliver their end reactions.

2. End restraint—When designed on the assumption of end restraint, full or partial, based on continuous or cantilever action, beams, girders and trusses, as well as the sections of the members to which they connect, shall be designed to carry the shears and moments so introduced, in addition to all other forces, without exceeding at any point the unit stresses prescribed in Allowable Unit Stresses.

H. Minimum Thickness of Material

1. Main material—The minimum thickness of steel except for linings, fillers, and the webs of rolled beams and channels, shall be: for exterior construction 5/16 inch; for interior construction ¼ inch. (These provisions do not apply to light structures such as skylights, light one-story buildings, or light miscellaneous steelwork.) Steel studs which are spaced not over 24 inches on centers may be of material having a thickness of not less than 16 gage but such studs shall be limited to use in buildings not over 3 stories in height.

2. Gusset plates—Gusset plates for trusses with end reactions greater than 35,000 pounds shall be not less than 3/8 inch thick.

3. Angles—The widths of the outstanding legs of angles in compression (except where reinforced by plates) shall not exceed 12 times the thickness for girder flanges and 16 times the thickness for other members.

4. Compression members—In compression members consisting of segments connected by cover plates or lacing, or segments connected by webs, the thickness of the webs of the segments shall be not less than 1/32 of the unsupported distance between the nearest rivet lines, or the roots of the flanges in case of rolled sections. The thickness of the cover plates or webs connecting the segments shall be not less than 1/40 of the unsupported distance between the nearest lines of their connecting rivets, or the roots of their flanges in case of rolled sections.

5. Corrosion—Provision shall be made for parts subject to corrosive agents, either by increasing the thickness of material or by effective protection.

In areas classified "E" Industrial Zone by Chapter 28 of the City Code, buildings not exceeding one story or 15 feet in height may be constructed of cold formed pressed steel units not less than No. 16 United States Standard Gage, contingent upon adherence to the following limitations.

The steel used shall have the properties corresponding to the American Society of Testing Materials Specification A245-T for Grade "C" Material.

All members used as beams or girders which are spaced more than four feet on centers shall be not less than No. 8 United States Standard Gage and shall be of the type formed with stiffened flanges.

All members used as posts or columns and which are spaced more than four feet on centers shall be not less than No. 6 United States Standard Gage and shall be of the type with the stiffened flange; and it is further provided that such posts or columns shall be protected from the effect of impact for a distance of five feet above the floor level with not less than two inches of class "D" concrete poured in place at the site. Flange Stiffeners.

Stiffeners of Flange

(a) Minimum Dimensions of Stiffeners

The minimum dimensions of longitudinal stiffening lips, necessary in order to stiffen compression flanges with full effectiveness at the edges, shall be obtained from the table below:

Minimum Properties of Stiffener Lips

w/t	I	d	w/t	I	d
Less than					
10	0	0	20	35.2t4	7.[illegible]t
10	0	0	25	46.2t4	8.2t
12	8.2t4	4.6t	30	54.8t4	8.7t
14	16.2t4	5.8t	40	73.7t4	9.6t
16	23.7t4	6.6t	50	92.7t4	10.4t
18	30.2t4	7.1t	60	110.8t4	11.0t

where w=flange projection beyond web, in inches.

t=thickness of flange, in inches.

I=Minimum moment of inertia of stiffener (of any shape*) about centroidal axis parallel to flange.

d=minimum total depth (out to out) of lip, in inches, where stiffener consists of a simple lip of thickness t, bent at right angles to the flange.

(b) Maximum Depth of Stiffening Lip*

To prevent buckling of the stiffening lip, the maximum clear projection from flange to edge of lip shall not exceed 12 times its thickness if the lip is part of a compression member carrying the full, allowable design stress fb (Section 2.2*.) If the maximum compression stress f in the lip if less than fb, the maximum clear projection, d, of the lip may be increased before the critical point of buckling is reached, and shall be determined from the following formula, for all grades of steel.

$$*d = \frac{1.667fb - (f \div 5430)}{0.0555\ (fb - 8150)} t$$

For flanges with lips of depths exceeding d=12t, the maximum allowable compression stress that will avoid buckling of the lip, is determined from the formula:

$$*f = (1.667fb - 5430) - 0.0555\ (fb - 8150)\ d/t$$

Note: The two equations above are identical, except that the first is solved for d for a given f, (for use in design) while the second is solved for f for a given d (for checking the critical stress of a given member*.)

Tests

The Building Inspector shall have the right to collect samples of material from the site and have them tested in a laboratory of his selection, at the expense of the owner.

Footnote: *The provisions of this section apply only to stiffening lips that are located entirely on the compression side of the neutral axis of the member. Where the extremity of the projecting lip extends beyond the neutral axis, into the tension zone, stresses become effective that tend to prevent buckling of the lip

I. Gross and Net Sections

1. Definitions—The gross section of a member at any point shall be determined by summing the products of the thickness and the gross width of each element as measured normal to the axis of the member. The net section shall be determined by substituting for the gross width the net width computed in accordance with paragraphs (c) to (g) of this Article.

2. Application Unless otherwise specified, tension members shall be designed on the basis of net section. Columns shall be designed on the basis of gross section. Beams and girders shall be designed in accordance with Plate Girders and Rolled Beams (a).

3. Net width—In the case of a chain of holes extending across a part in any diagonal or zigzag line, the net width of the part shall be obtained by deducting from the gross width the sum of the diameters of all the holes in the chain, and adding, for each gage space in the chain, the quantity $\frac{S2}{4g}$, where

S = longitudinal spacing (pitch) in inches of any two successive holes.

g = transverse spacing (gage) in inches of the same two holes.

The critical net section of the part is obtained from that chain which gives the least net width.

4. Angles- For angles, the gross width shall be the sum of the widths of the legs less the thickness. The gage for holes in opposite legs shall be the sum of the gages from back of angle less the thickness.

5. Splice members—For splice members, the thickness considered shall be only that part of the thickness of the member which has been developed by rivets beyond the section considered.

6. Size of holes -In computing net area the diameter of a rivet hole shall be taken as 1/8 inch greater than the nominal diameter of the rivet.

7. Pin Holes--In pin connected tension members, the net section across the pin hole, transverse to the axis of the member, shall be not less than 140 per cent, and the net section beyond the pin hole, parallel with the axis of the member, not less than 100 per cent, of the net section of the body of the member.

In all pin-connected riveted members the net width across the pin hole, transverse to the axis of the member, shall preferably not exceed 12 times the thickness of the member at the pin.

J. Expansion

Proper provision shall be made for expansion and contraction.

K. Connections

1. Minimum connections--Connections carrying calculated stresses, except for lacing sag bars, and girts, shall have not fewer than 2 rivets.

2. Eccentric connections—Members meeting at a point shall have their gravity axis meet at a point if practicable; if not, provision shall be made for their eccentricity.

3. Rivets—The rivets at the ends of any member transmitting stresses into that member should preferably have their centers of gravity on the gravity axis of the member; otherwise, provision shall be made for the effect of the resulting eccentricity. Pins may be so placed as to counteract the effect of bending due to dead load.

4. Unrestrained members--When beams, girders or trusses are designed on the basis of simple spans in accordance with Effective Span Length (a), their end connections may ordinarily be designed for the reaction shears only. If, however, the eccentricity of the connection is excessive, provision shall be made for the resulting moment.

5. Restrained members--When beams, girders or trusses are subject both to reaction shear and end moment, due to the restraint specified in Effective Span Length (b), their connections shall be specially designed to carry both shear and moment without exceeding at any point the unit stresses prescribed in Allowable Unit Stresses. Ordinary end connections comprising only a pair of web angles, with not more than a nominal seat and top angle, shall not be assumed to provide for this kind of end moment.

6. Fillers—In truss construction when rivets carrying computed stress pass through fillers, the fillers shall be extended beyond the connected member and the extension secured by sufficient rivets to develop the stress in the filler.

Fillers under plate girder stiffeners at end bearing or points of concentrated loads shall be secured by sufficient rivets to prevent excessive bending and bearing stresses.

7. Splices--Compression members wnen faced for bearing shall be spliced sufficiently to hold the connecting members accurately in place. Other joints in riveted work, whether in tension or compression shall be spliced so as to transfer the stress to which the member is subject.

L. Rivets and Bolts

1. Use of bolts--All shop and field connections shall be riveted, except where in the opinion of the inspector of buildings, it is impossible to obtain satisfactory power-driven rivets, approved rib bolts to a driving fit may be used; or turned bolts may be

used in reamed holes, with a clearance not over one-fifieth inch, and the threads shall be entirely outside the holes. Washers not less than ¼ inch thick shall be used under the nuts, and threads shall be burred.

In buildings of wall-bearing design not more than three stories or 40 feet in height, field connections may be bolted with unfinished bolts, except that connections of all trusses and riveted girders and of all rolled beams over 16 inches in depth or over 25 feet in length shall be riveted, except when seat angles properly designed and securely riveted to the columns are provided to carry the entire end reaction of such trusses, girders or beams. Connection of, or to cast iron shall be bolted. Bolts shall be long enough to extend entirely through the nuts, which shall be screwed up tightly, and the threads burred.

Unfinished bolts may be used in field connections of frame work for small metal-covered buildings and for such members as girts, door, and window framing in all buildings.

In all cases where direct tensile stresses are to be resisted, turn bolts with washers shall be used instead of rivets.

2. Diameter—In proportioning and spacing rivets and bolts the nominal diameter of the bolt or undriven rivet shall be used.

3. Effective bearing area—The effective bearing area of pins, bolts, and rivets shall be the diameter multiplied by the length in bearing; except, that for countersunk rivets, half the depth of the countersink shall be deducted.

4. Long grips—Rivets carrying calculated stress, and whose grip exceeds five diameters, shall have their number increased 1 per cent for each additional 1/16 inch in the rivet grip.

Special care shall be used in heating and driving such rivets.

5. Main members—The end reaction stresses of trusses, girders, or beams, and the axial stresses of tension of compression members which are carried on rivets or bolts, shall have such stresses developed by the shearing and bearing values of the rivets or bolts.

M. Rivet Spacing

1. Minimum pitch—The preferable minimum distance between centers of rivet holes shall be not less than 4½ inches for 1¼ inch rivets, 4 inches for 1⅛ inch rivets, 3½ inches for 1 inch rivets, 3 inches for ⅞ inch rivets, 2½ inches for ¾ inch rivets, 2 inches for ⅝ inch rivets, and 1¾ inches for ½ inch rivets, but in no case shall it be less than three times the diameter of the rivet.

2. Maximum pitch compression members—The maximum pitch in the line of stress of compression members composed of plates and shapes shall not exceed 16 times the thickness of the thinnest outside plate or shape, nor 20 times the thinnest enclosed plate or shape with a maximum of 12 inches, and at right angles to the direction of stress the distance between lines of rivets

shall not exceed 30 times the thickness of the thinnest plate or shape. For angles in built sections with two gage lines, with rivets staggered, the maximum pitch in the line of stress in each gage line shall not exceed 24 times the thickness of the thinnest plate with a maximum of 18 inches.

3. End pitch compression members—The pitch of rivets at the ends of built compression members shall not exceed four diameters of the rivets for a length equal to 1½ times the maximum width of the member.

4. Two-angle members—In tension members composed of two angles, a pitch of 3 feet 6 inches will be allowed, and in compression members, 2 feet 0 inches, but the ratio l/r for each angle between rivets shall be not more than ¾ of that for the whole member.

5. Minimum edge distance—The minimum distance from the center of any punched rivet hole to any edge shall be that given in Table 1.

TABLE NO. 1

Rivet Diameter, Inches	Minimum Edge Distance (Inches) for Punched Holes		
	In Sheared Edge	In Rolled Edge of Plates and Sections with Parallel Flanges	In Rolled Edge Of Sections With Sloping Flanges
½	1	⅞	¾*
⅝	1⅛	1	⅞*
¾	1¼	1⅛	1 *
⅞	1½	1¼	1⅛*
1	1¾	1½	1¼*
1⅛	2	1¾	1½*
1¼	2¼	2	1¾*

*May be decreased ⅛ inch between holes or near end of beam.

6. Minimum edge distance in line of stress—The distance from the center of any rivet under computed stress, and that end or other boundary of the connected member toward which the pressure of the rivet is directed, shall be not less than the shearing area of the rivet shank (single or double shear respectively) divided by the plate thickness.

7. Maximum edge distance—The maximum distance from the center of any rivet to the near edge shall be 12 times the thickness of the plate, but shall not exceed 6 inches.

N. Plate Girders and Rolled Beams

1. Proportioning—Riveted plate girders, cover-plated beams, and rolled beams shall in general be proportioned by the moment of inertia of the gross section. No deduction shall be made for standard shop or field rivet holes in either flange; except that in special cases where the reduction of the area of either

flange by such rivet holes, calculated in accordance with the provisions of Gross and Net Sections, exceeds 15 per cent of the gross flange area, the excess shall be deducted. If such members contain other holes, as for bolts, pins, or countersunk rivets, the full deduction for such holes shall be made. The deductions thus applicable to either flange shall be made also for the opposite flange if the corresponding holes are there present

2. Plate girder webs shall have a thickness of not less than 1/170 of the unsupported distance between flanges, but in no case less than 5/16 inch in thickness.

3. Flanges Cover plates, when required, shall be equal in thickness or shall diminish in thickness from the flange angles outward. No plate shall be thicker than the flange angles.

Unstiffened cover plates shall not extend more than 6 inches nor more than 12 times the thickness of the thinnest plate beyond the outer row of rivets connecting them to the angles.

The total cross-sectional area of cover plates shall not exceed 70 per cent of the total flange area.

4. Rivets—Rivets connecting the flanges to the web shall be proportioned to resist the horizontal shear due to bending as well as any loads applied directly to the flange.

5. Stiffeners—Stiffeners shall be placed on the webs of plate girders at the ends and at points of concentrated loads. Such stiffeners shall have a close bearing against the flanges, shall extend as closely as possible to the edge of the flange angles, and shall not be crimped. They shall be connected to the web by enough rivets to transmit the stress. Only that portion of the outstanding legs outside of the fillets of the flange angles shall be considered effective in bearing.

If h/t is equal to or greater than 70, intermediate stiffeners shall be required at—

all points where h/t exceeds $\frac{8{,}000}{\sqrt{v}}$ in which

h = the clear depth between flanges, in inches.
t = the thickness of the web in inches.
v = greatest unit shear in panel, in pounds per square inch under any condition of complete or partial loading.

The clear distance between intermediate stiffeners, when stiffeners are required by the foregoing, shall not exceed 84 inches or that given by the formula—

$$d = \frac{270{,}000t}{v}\sqrt[4]{\frac{vt}{h}}$$

d = the clear distance between stiffeners, in inches.

Intermediate stiffeners may be crimped over the flange angles.

Plate girder stiffeners shall be in pairs, one on each side of the web, and shall be connected to the web by rivets spaced not more than 8 times their nominal diameter.

6. Splices—Web splices in plate girders shall be proportioned to transmit the full shearing and bending stresses in the web at the point of splice.

Flange splices shall be proportioned to develop the full stress of the members cut.

7. Lateral forces—The flanges of plate girders supporting cranes or other moving loads shall be proportioned to resist any lateral forces produced by such loads.

8. Web crippling of beams—Rolled beams shall be so proportioned that the compression stress at the web toe of the fillets resulting from concentrated loads, shall not exceed the value of 24,000 pounds per square inch allowed in Allowable Unit Stresses. The governing formulas shall be:

For interior loads $\frac{R}{t\,(N + 2\,k)}$ = not over 24,000

For end reaction $\frac{R}{t\,(N + k)}$ = not over 24,000

R=concentrated interior load or end reactions, in pounds.
t=thickness of web, in inches.
N=length of bearing, in inches.
k=distance from outer face of flange to web toe of fillet, in inches.

When two or more rolled steel beams are used as a girder they shall be connected together by bolts and separators at intervals of not more than 5 feet. All beams 12 inches and over in depth shall have at least two bolts to each separator.

O. Tie Plates

1. Compression members—The open sides of compression members shall be provided with lacing having tie plates at each end, and at intermediate points if the lacing is interrupted. Tie plates shall be as near the ends as practicable. In main members carrying calculated stresses the end tie plates shall have a length of not less than the distance between the lines of rivets connecting them to the segments of the member, the intermediate ones of not less than one-half of this distance. The thickness of tie plates shall be not less than one-fifieth of the distance between the lines of rivets connecting them to the segments of the members, and the rivet pitch shall be not more than four diameters. Tie plates shall be connected to each segment by at least three rivets

2. Tension members—Tie plates shall be used to secure the parts of tension members composed of shapes. They shall have a length not less than two-thirds of the length specified for tie plates in compression members. The thickness shall be not less than one-fifteth of the distance between the lines of rivets con-

necting them to the segments of the member and they shall be connected to each segment by at least three rivets.

P. Lacing

1. Spacing—Lacing bars of compression members shall be so spaced that the ratio l/r of the flange included between their connections shall be not over ¾ of that of the member as a whole.

2. Proportioning—Lacing bars shall be proportioned to resist a shearing stress normal to the axis of the member equal to two per cent of the total compressive stress in the member. In determining the section required the compression formula shall be used, l being taken as the length of the bar between the outside rivets connecting it to the segment for single lacing and 70 per cent of that distance for double lacing. The ratio l/r shall not exceed 140 for single lacing nor 200 for double lacing

3. Minimum proportions—The thickness of lacing bars shall be not less than one-fortieth for single lacing, and one-sixtieth for double lacing, of the distance between end rivets; their minimum width shall be three times the diameter of the rivets connecting them to the segments.

4. Inclination—The inclination of lacing bars to the axis of the members shall preferably be not less than 45 degrees for double lacing and 60 degrees for single lacing. When the distance between the rivet lines in the flanges is more than 15 inches, the lacing shall be double and riveted at the intersection if bars are used, or else shall be made of angles.

Q. Adjustable Members

1. Initial stress—The total initial stress in any adjustable member shall be assumed as not less than 5,000 pounds.

R. Base Plates

1. Loads—Beams, girders, and trusses shall be securely anchored to all supports, and where they are supported on masonry they shall be provided with bearing plates of such size and thickness that the allowable unit pressure on the masonry will not be exceeded.

Proper provision shall be made to transfer the column loads, and moments if any, to the footings and foundations.

2. Alignment—Column bases shall be set level and to correct elevation with full bearing on the masonry. Columns shall be connected to grillage beams and girders, with not less than four ¾ inch bolts. Columns, with built-up steel bases or rolled steel slab bases, shall be secured to the foundations with not less than two ⅞ inch bolts.

3. Finishing—Column bases shall be finished to accord with the following requirements:

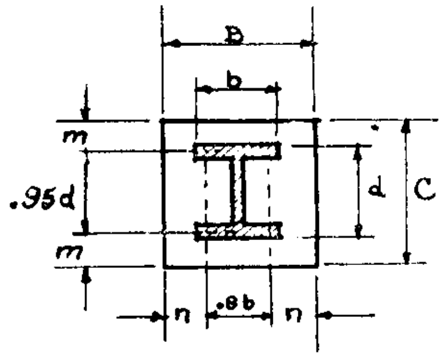
(1) Rolled steel bearing plates, 2 inches or less in thickness, may be used without planing, provided a satisfactory contact bearing is obtained; rolled steel bearing plates, over 2 inches,

but 4 inches or less in thickness, may be straightened by pressing (planed on all bearing surfaces if presses are not available) to obtain a satisfactory contact bearing; rolled steel bearing plates, over 4 inches in thickness, shall be planed on all bearing surfaces (except as noted under 3).

(2) Column bases other than rolled steel bearing plates shall be planed on all bearing surfaces (except as noted under 3).

(3) The bottom surfaces of bearing plates and column bases which rest on masonry foundations and are grouted to insure full bearing contact need not be planed.

4. Design—Rolled steel slabs shall have a thickness determined by the following method of design:



F.=total column load in kips.
A.=B x C=area of plate, in square inches.
T.=thickness of plate, in inches.
P.=bearing pressure on foundations, in kips per square inch.

The column load, F, is assumed to be uniformly distributed within a rectangle whose dimensions are .95d and .80b, and the base plate is assumed to have a uniform bearing pressure, P, on the foundation.

Determine the required area A = F/P.

Determine B and C so that dimensions m and n are approximately equal.

Determine m and n, the projections of the plate beyond the assumed dotted rectangle, and use the larger value to solve for t by one of the following formulas:

$t^2 = .15\ Pm^2$ or $t^2 = .15\ Pn^2$

8. Metal Smoke Stacks

Metal smoke stacks for high pressure boilers and other appliances producing a corresponding temperature when isolated, shall have base plates of ample strength securely anchored to the foundations. If not designed to be free standing they shall be braced at least every 50 feet in height from at least 2 sides by means of stiff leg struts, or at least 3 sides by means of guys of rods or wire ropes. Stiff leg struts shall be designed as columns, the ratio l/r not exceeding 200. Guy rods shall be not less than ⅝ inch in diameter and guys of wire rope shall be galvanized and shall be not less than ½ inch in diameter. Where metal stacks are built in connection with buildings they shall be securely anchored or guyed to the frame work or walls and proper provision shall be made for expansion.

If the stack is constructed of rolled iron or steel, all joints shall be welded or securely riveted, and no rivet less than ½ inch in diameter shall be used; for stacks 900 square inches in cross-section and smaller, no plate less than ⅛ inch in thickness will be allowed; for stacks of greater cross-section no plate less than 3/16 inch shall be used.

If the stack is constructed of cast iron the section shall have tight flange joints and shall be securely bolted together.

T. Protection Against Corrosion

All structural metal work shall be cleaned of all scale, dirt, and rust and be thoroughly coated with one coat of approved paint before erection. After erection all such structural work, except steel joists, shall be painted with at least one additional coat of approved paint. All iron or steel used in damp locations or below water level shall be embedded in class C Portland cement concrete, not less than 3 inches thick, to exclude the air and water. Paint may be omitted from steel surfaces which are to be embedded in concrete.

U. Erection

1. Bracing—The frame of all steel skeleton buildings shall be carried up true and plumb, and temporary bracing shall be introduced wherever necessary to take care of all loads to which the structure may be subjected, including erection equipment, and the operation of same. Such bracing shall be left in place as long as may be required for safety.

2. Bolting up—As erection progresses the work shall be securely bolted up to take care of all dead load, wind and erection stresses.

3. Erection stresses—Wherever piles of material, erection equipment or other loads are carried during erection, proper provision shall be made to take care of stresses resulting from the same.

4. Alignment—No riveting shall be done until the structure has been properly aligned. Rivets driven in the field shall be heated and driven with the same care as those driven in the shop.

5. Burning holes—Burning holes for connections is positively prohibited.

6. See Chapter III, Section 303, for temporary floors during erection.

V. Fire-Resistive Protection

Where fire-resistive construction is required, see Chapter VII, Article 702-01; and where non-fire-resistive construction is permitted, see Chapter VII, Article 702-08; for fire-resistive protection of structural steel and cast iron.

W. Welding

Welding by the fusion method may be used in erection the metallic structural members of buildings or in shop assembly of parts, when done in accordance with the Code for Fusion Welding in Building Construction of the American Welding Society, edition 1938.

The permissible unit stresses in fusion welds shall be in pounds per square inch on section through throat of weld:

Shear	11,300
Tension	13,000
Compression	15,000

Maximum fiber stresses due to bending shall not exceed the values given above for tension and compression respectively. In designing welded joints subject to eccentricity the stresses due to eccentricity shall be added to the primary stresses in determining the total stress.

All field welding shall be performed by qualified operators who shall demonstrate their ability to perform such work by making a number of sample welds as directed by the inspector of buildings. Such welds submitted shall have been tested to destruction, to determine their soundness and adequacy of strength.

All shop welding for structural purposes shall be performed in shops approved by the inspector of buildings. Before giving his approval the inspector of buildings may require sample welds be made in his presence or that of his representative and tested to destruction. Such welds shall develop a factor of safety of not less than three in any case.

Structural plans submitted shall show in detail the types, sizes and lengths of all welds, and state the welding methods or processes to be used.

X. Steel-Pipe Columns

1. Steel-pipe columns shall conform to the requirements for structural steel. Details of the bases, caps, splices, and connections shall be subject to the approval of the building inspector.

Section 3. That this ordinance shall be published in the Alexandria Gazette and shall become effective the day after its publication.

WILLIAM T. WILKINS,
Mayor

March 29, 1948

1733—29c