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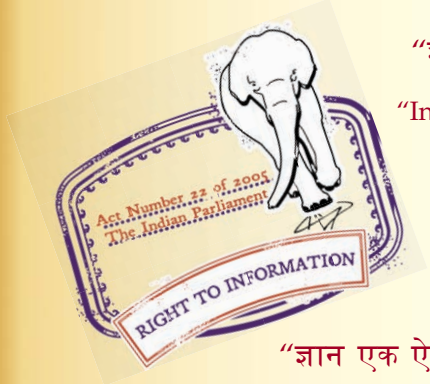

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RECOMMENDATIONS FOR DIMENSIONAL PARAMETERS FOR INDUSTRIAL BUILDINGS

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RECOMMENDATIONS FOR DIMENSIONAL PARAMETERS FOR INDUSTRIAL BUILDINGS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 28 December 1977, after the draft finalized by the Structural Engineering Sectional Committee had been approved by the Structural and Metals Division Council and the Civil Engineering Division Council.

0.2 In a developing country like India the capital outlay under each Five Year Plan towards setting up of industries and consequently construction of industrial buildings is very high. In addition the quantity of steel produced in the country is not sufficient to meet the requirement of the industry. It is, therefore, necessary that the parameters of the industries have to be standardized on broad based norms so that it will be feasible to easily adopt pre-fabricated concrete members and to minimize the extent of steel members for such industries.

0.3 The standardization of parameters for industries by itself will be a very difficult task, as it will not be possible to specify the requirement for each industry and the layout including the heights will vary from industry to industry, for it depends on the process of the end products. However, if a little more detailed analysis of the requirement is made, it will be obvious that it will not be that difficult as it looks. It will not be possible to specify any particular constraint on the parameters but a broad norm can be given within which any industry could be accommodated. All that is necessary is to have a national standard and faithfully follow it in the spirit in which the same is worked out.

0.4 It will, therefore, be necessary to classify the industries so that a further classification of the industrial structures could be made and, based on these a recommended norm for the parameters could be worked out.

0.5 The industrial buildings will be the starting point for the engineering profession for planning, designing and construction. Therefore, it shall have meaningful parameters by specifying the loading conditions and minimum required safety considerations. In addition, even if an industrial complex may be classified as heavy industry, it need not necessarily mean that all the industrial structures coming within this complex should be

heavy industrial structure and the structures could be of all the types. Similar reasoning applies for various classifications made in this standard.

0.6 It is, therefore, suggested that the classification shall be based primarily on the number of cycles of specific loading case anticipated for the portions of the structure. On the basis of estimated life span and rate of load repetitions, the classification of the structure for the whole or part of the building can be made. The maximum life span of 50 years is generally recommended and based on the above, the classifications are suggested.

0.7 There are buildings without crane facility and also of special requirement to meet the process and utility industries for which the above classification based on cycles of loads due to cranes will not be applicable. Therefore a separate classification is made for them.

0.8 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard specifies the important dimensional parameters for normal industrial buildings classified according to the service requirements (*see* **4**).

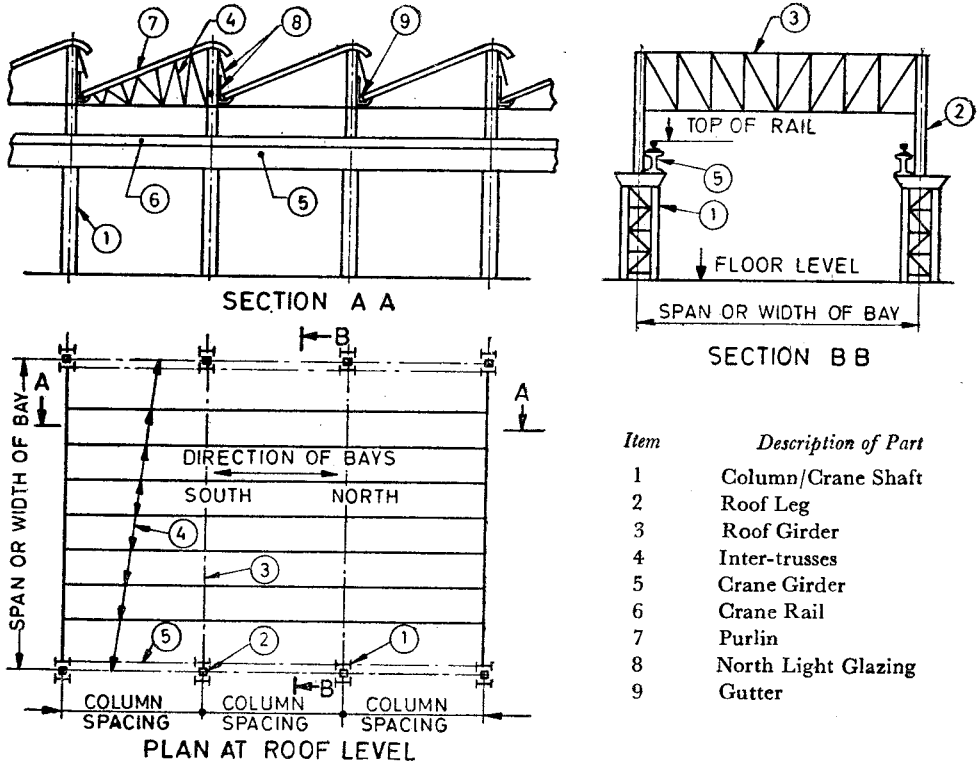
2. STATUTORY REGULATIONS

2.1 Statutory regulations relating to dimensions of industrial building and components wherever applicable shall be adhered to.

3. LAYOUT

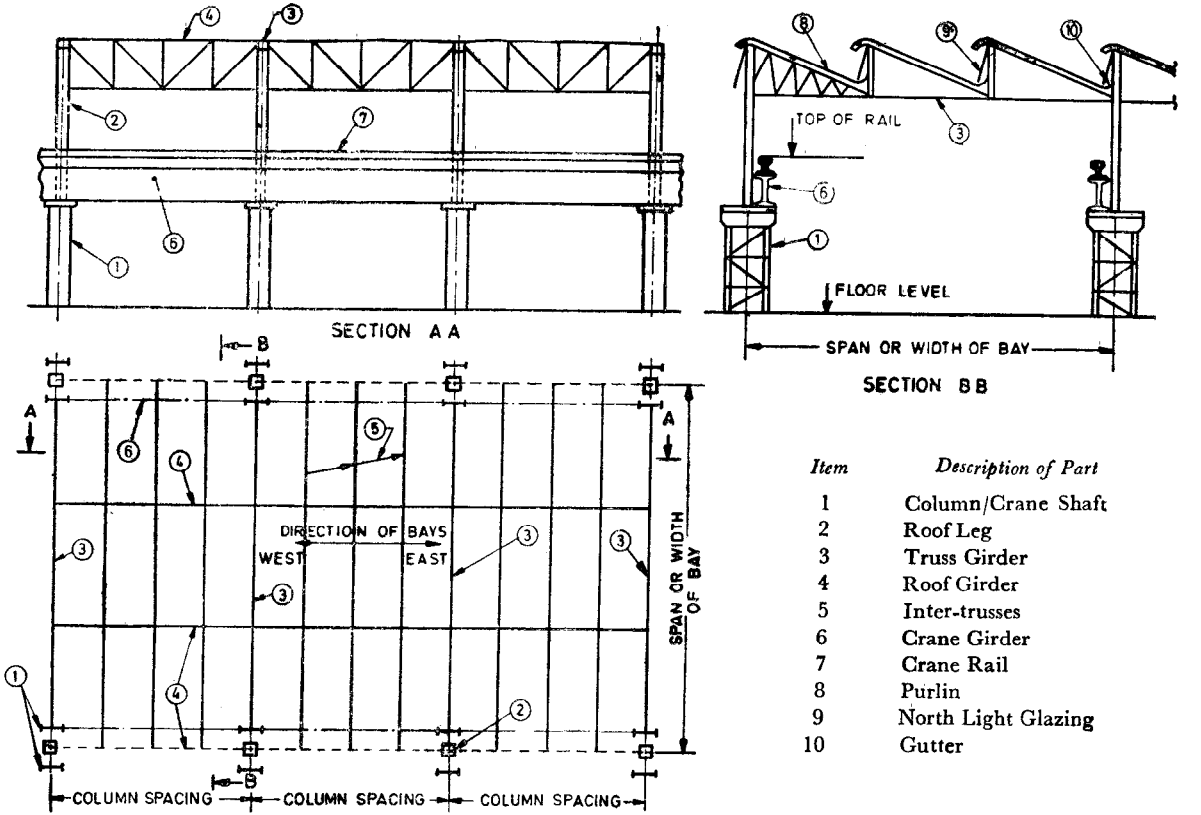
3.1 The layout of building depends on various factors such as functional requirements and local conditions. When the bays are arranged east to west or north to south, it may be advantageous to adopt northlight roof structures. Need for further extension and increase in crane capacity shall also be kept in view before planning the layout of the building (*see* Fig. 1 and 2).

*Rules for rounding off numerical values (*revised*).



Item	*Description of Part*
1	Column/Crane Shaft
2	Roof Leg
3	Roof Girder
4	Inter-trusses
5	Crane Girder
6	Crane Rail
7	Purlin
8	North Light Glazing
9	Gutter

FIG. 1 TYPICAL FACTORY BUILDING — DIRECTION OF BAY, NORTH-SOUTH



Item	*Description of Part*
1	Column/Crane Shaft
2	Roof Leg
3	Truss Girder
4	Roof Girder
5	Inter-trusses
6	Crane Girder
7	Crane Rail
8	Purlin
9	North Light Glazing
10	Gutter

FIG. 2 TYPICAL FACTORY BUILDING — DIRECTION OF BAY, EAST-WEST

4. CLASSIFICATION OF INDUSTRIAL BUILDINGS

4.1 General — regarding the details of loading conditions and method of calculating the cycles as mentioned hereinunder for classifying an industrial building, reference shall be made to IS : 807-1976*.

4.2 Group A — covers the industrial buildings where certain members may experience 500 000 to 2 million repetitions of loading condition 3, or 2 million and above repetitions of loading condition 4 in the estimated life span of building of 50 years. After considering the service, determination of the loading conditions shall be decided.

4.2.1 The main industries that will fall under this category will be batch annealing buildings; billet yard, continuous casting buildings; foundries, mixer buildings; mould conditioning buildings; scraping yards, scrap yards, skull breakers, slab yards, soaking pit buildings; steel making buildings; stripper buildings and other buildings based on predicted operational requirements.

4.3 Group B — covers the industrial buildings where certain members may experience a repetition of 100 000 to 600 000 cycles of specified loading condition in the estimated life span of about 50 years.

4.3.1 The following industries may be considered under this group:

Metal (Aluminium, zinc, copper, etc) industries for manufacturing equipment like heavy machinery, boiler, ships, locomotives, aircrafts and other buildings based on predicted operational requirements.

4.4 Group C — covers the industrial buildings where certain members may experience a repetition of 20 000 to 100 000 cycles of specified loading condition in the estimated life span of about 50 years.

4.4.1 The following industries may be considered under this group:

Industries for manufacturing cars, scooters, earth-moving equipment, machine shops and other buildings based on predicted operational requirements.

4.5 Group D — covers the industrial buildings where certain members may experience below 20 000 repetitions of specified loading condition in one estimated life span of about 50 years.

4.5.1 The following buildings may be considered under this group:

Generally all the light, utility and process industries.

*Code of practice for design, manufacture, erection and testing (structural portion) of cranes and hoists.

4.6 Group E — covers industrial structures that require special consideration based on the process or utility and which may not be provided with cranes or if provided with cranes, they may be used only for maintenance. In such cases in addition to the dead loads, wind/seismic forces, live loads/superimposed loads as required for each individual situation shall be considered. In addition, stresses due to temperature caused by the process, air borne vibration, special needs of height, etc, may have to be considered.

4.6.1 Typical structures that come under this group are as follows:

Thermal power stations, fertilizer units, petrochemical units, transformer test stations, compressor house, textile mills, paper mills, etc.

4.7 Group F — structures which are not provided with cranes and that which do not come under Group E. These structures generally are of simplest type involving normal live, dead and wind/seismic loads.

4.7.1 Typical structures that come under this group are as follows:

Storage building (godowns) garages, repair shop without cranes, consumer goods manufacturing units, small scale industries where use of crane is not required.

5. COLUMNS SPACING AND WIDTH OF BAYS

5.1 A basic module of 3 m shall be adopted.

5.2 It is recommended that the column spacings shall be as follows:

a) Industrial structures covered under Groups C, D, E and F	3 — 6 m
b) Industrial structures covered under Groups A and B	6 — 12 m

5.3 The span (bay width) shall be standardized as:

a) Industrial structures covered under Groups D, E and F	6 — 12 m
b) Industrial structures covered under Group C	6 — 18 m
c) Industrial structures covered under Group B	12 — 30 m
d) Industrial structures covered under Group A	18/21/24/30/36/42 m

5.4 In the case of utility and process industries covered under Groups C, D, E and F, column spacing and the span (bay width) may be adopted from the range specified in **5.2** and **5.3** with due consideration to the actual requirements. Depending on the type of the roofing adopted, the inter-trusses may be spaced at 3 m spacing.

6. HEIGHT

6.1 It will be necessary to adopt certain standard heights for the columns so that it will be easy to standardize the components. The recommended heights to the top of crane rails are:

a) Industrial structures covered under Groups C, D, E and F	4 — 5 m
b) Industrial structures covered under Group B	6 — 9 m
c) Industrial structures covered under Group A	6 — 15 m

6.2 The heights shall be varied in modules of 0·5 m. In cases where cranes are not required for the light industries, the eaves heights may be standardized at 3·5 m.

NOTE — The recommended heights given above are generally applicable. However, for any specific requirements the heights shall be chosen as actually required.

7. CRANE CLEARANCES

7.0 Minimum top and side clearance where cranes are provided, are recommended as under (*see* Fig. 3).

7.1 Top Clearance — The provision of cranes has a bearing on the height of the building. It is therefore recommended that the following crane clearances between the top of crane rail to the underside of the roof or obstruction, as the case may be, shall be followed:

a) For cranes up to 50 tonnes capacity	3 m
b) For cranes above 50 tonnes up to 120 tonnes	3·6 m
c) For cranes higher than 120 tonnes capacity	4·2 m

NOTE — For special purposes like iron and steel making industries and similar other requirement, the actual required clearances based on crane manufacturing practice may be followed.

7.2 Side Clearance — The side clearances for the cranes should also be standardized in order to bring uniformity in space utilization. It is, therefore, recommended that the following side clearances shall be followed:

a) Where no access is provided for maintenance at crane level the minimum side clearance from the face of roof leg to the centre line of the rail shall be 500 mm. In addition it should be ensured that the clearance between the face of the roof leg and the crane structure (end carriage) shall be minimum 50 mm.

b) Where access for maintenance at crane level is provided, the above provision for side clearance shall be increased to meet relevant statutory requirements.

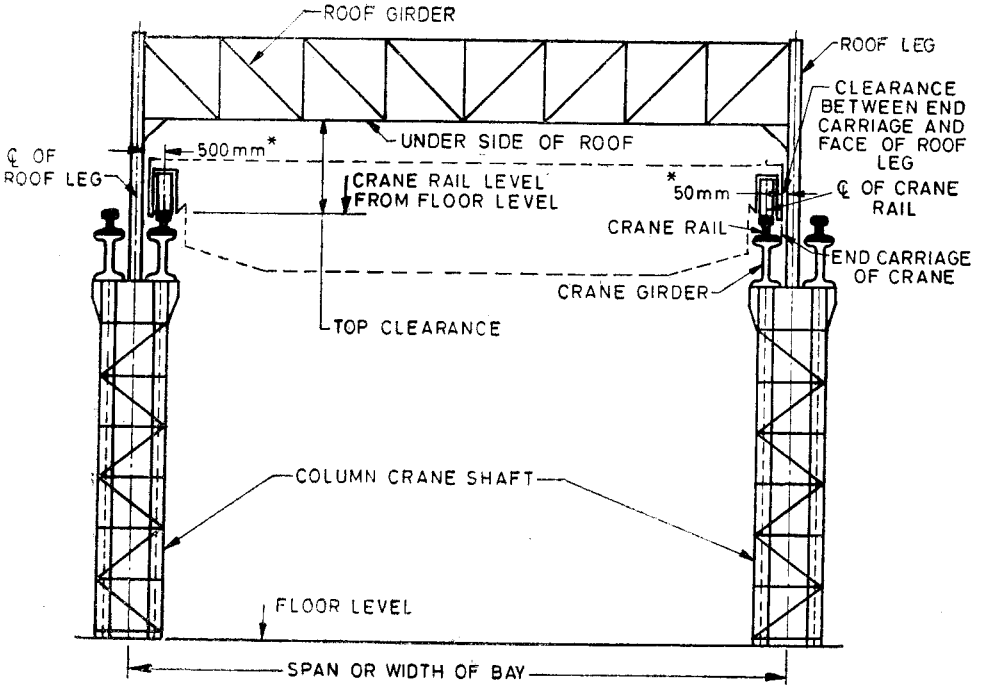
c) In the case of floor operated EOT cranes, the distance between the face of the roof leg and the centre line of the rails may be reduced to 300 mm.

8. ROOF WORK

8.1 General — Roof work standardization is comparatively easier to achieve than any other component of the industrial building. Following recommendations shall be followed in the standardization of roof work:

a) For latitudes higher than 23½° saw-tooth north light or its varients such as folded-plate or shell type roofs with clear glazing may be adopted. For lesser latitudes a monitor or pitched type or even saw-tooth type roof with adequate diffusive glazing could be adopted.

b) Roof components like truss girder, roof girder main truss and inter-truss shall be standardized for the spans for which the recommended parameters have been given earlier and for the loading conditions. With this standardization it will be easy to plan each component for a pre-fabrication either in concrete or in steel depending upon the economy and other constraints that may be expected.



*These clearances are required when no access is provided for maintenance at crane level.

FIG. 3 TYPICAL FACTORY BUILDING — CRANE CLEARANCE DIAGRAM

INDIAN STANDARDS

ON

STRUCTURAL ENGINEERING

Structural Sections

IS:

808-1964 Rolled steel beam channel and angle sections (*revised*)
808 (Part I)-1973 Dimensions for hot rolled steel beams; MB series (*second revision*)
811-1964 Cold formed light gauge structural steel sections (*revised*)
1252-1958 Rolled steel sections, bulb angles
1730 (Part I)-1974 Dimensions for steel plate, sheet and strip for structural and general engineering purposes: Part I Plate (*first revision*)
1730 (Part II)-1974 Dimensions for steel plate, sheet and strip for structural and general engineering purposes: Part II Sheet (*first revision*)
1730 (Part III)-1974 Dimensions for steel plate, sheet and strip for structural and general engineering purposes: Part III Strip (*first revision*)
1852-1973 Rolling and cutting tolerances for hot-rolled steel products (*second revision*)
2713-1969 Tubular steel poles for overhead power lines (*first revision*)
3908-1966 Aluminium equal leg angles
3909-1966 Aluminium unequal leg angles
3921-1966 Aluminium channels
3954-1966 Hot rolled steel channel sections for general engineering purposes
5384-1969 Aluminium I beam
6445-1971 Aluminium tee sections

Codes of Practice

800-1962 Use of structural steel in general building construction (*revised*)
801-1975 Use of cold formed light gauge steel structural members in general building construction
802 (Part I)-1977 Use of structural steel in overhead transmission-line towers: Part I Loads and permissible stresses (*second revision*)
803-1976 Design, fabrication and erection of vertical mild steel cylindrical welded oil storage tanks (*first revision*)
805-1968 Use of steel in gravity water tanks
806-1968 Use of steel tubes in general building construction (*revised*)
807-1976 Code of practice for design, manufacture, erection and testing (structural portion) of cranes and hoists (*first revision*)
3177-1977 Code of practice for design of overhead travelling cranes and gantry cranes other than steel works cranes (*first revision*)
4000-1967 Assembly of structural joints using high tensile friction grip fasteners
4014 (Part I)-1967 Steel tubular scaffoldings: Part I Definitions and materials
4014 (Part II)-1967 Steel tubular scaffoldings: Part II Safety regulations for scaffolding
4137-1967 Heavy duty electric overhead travelling cranes including special service machines for use in steel works
6533-1971 Design and construction of steel chimneys
7205-1974 Safety code for erection of structural steel work
8147-1976 Code of practice for use of aluminium alloys in structures

General

804-1967 Rectangular pressed steel tanks (*first revision*)
7215-1974 Tolerances for fabrication of steel structures
8081-1976 Slotted sections

Handbooks for Structural Engineering

No. 1 Structural steel sections
No. 2 Steel beams and plate girders
No. 3 Steel column and struts
No. 4 High tensile friction grip bolts
No. 5 Structural use of light gauge steel
No. 6 Application of plastic theory in design of steel structures
No. 7 Simple welded girders