Steelwork Systems and Structural Design Scope

STRUCTURE / MATERIALS / CONNECTIONS / APPLICATIONS

PRACTICAL KNOWLEDGE
FOR BETTER STRUCTURES

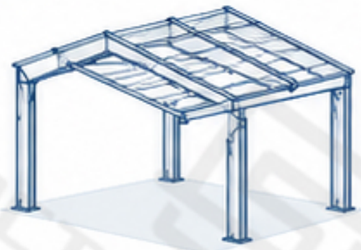
1. OVERVIEW AND PURPOSE

Steelwork is **not** an isolated member or a single steel item. It is formed by structural steel members, fabricated assemblies, **connection** systems, and complete load-bearing arrangements.
Structure selection begins with structural function, load path, and project configuration.

2. COMMON STEELWORK SYSTEMS

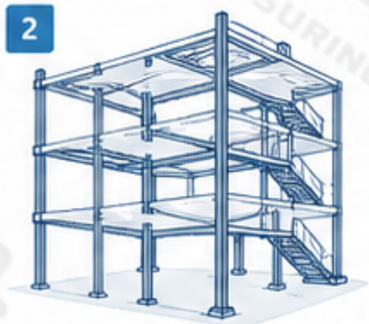
TYPICAL SYSTEM TYPES (INDICATIVE)

1



Portal Frame Structure

2

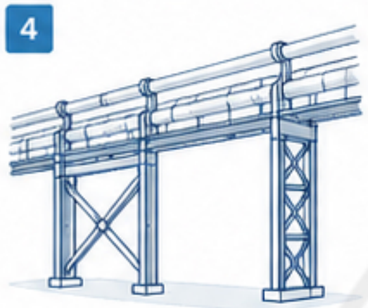


Multi-Storey Steel Frame

3

Steel Truss Structure

4

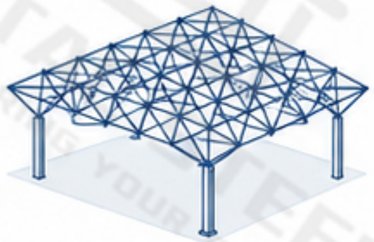


Pipe Rack / Support Structure

5

Steel Platform / Walkway

6



Space Frame Structure

3. WHAT STEELWORK COVERS

- Structural steel members
- Fabricated assemblies
- Connection systems
- Load-bearing structural arrangements

4. MAIN DESIGN INPUTS

- Load requirements
- Span and layout
- Stability needs
- Service environment
- Fabrication and erection conditions

5. CORE ENGINEERING PRINCIPLE

Steelwork selection begins with structural function, load path and project configuration rather than with an isolated member.

KEY TAKEAWAY

Steelwork is selected as a structural system. Members, connections and fabrication methods are then defined according to the required engineering function.

Selection Logic for Steelwork Structures

SELECTION / SYSTEMS / MEMBERS / CONNECTIONS / CONSTRUCTABILITY

PRACTICAL KNOWLEDGE
FOR BETTER STRUCTURES

1. SELECTION LOGIC FLOWCHART

FROM REQUIREMENT TO IMPLEMENTATION

1

Define Structural Requirement

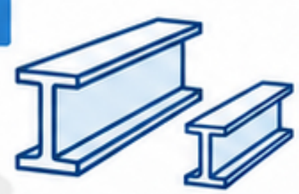
- required function
- project type
- load condition

2

Identify Structural System

- frame
- truss
- platform/support
- space frame

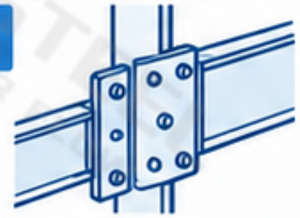
3



Select Main Members

- beams
- columns
- bracing
- truss members
- platforms

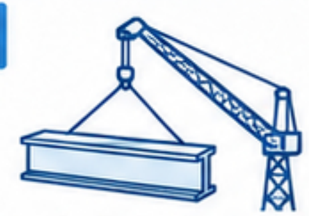
4



Determine Connection Strategy

- welded
- bolted
- moment
- simple/pinned
- project-specific connection

5



Verify Fabrication and Erection Feasibility

- shop fabrication
- transportation
- site assembly
- installation sequence
- inspection

2. DESIGN FACTOR MATRIX

KEY CONSIDERATIONS FOR SELECTION

Key Factors Affecting Steelwork Selection

Design Factor	Engineering Meaning	Influence on Selection
Span requirement	Defines bending demand and structural depth	Influences frame, truss or space-frame choice
Vertical load	Determines member sizing and support arrangement	Affects columns, beams and load path
Lateral load	Controls stability and bracing demand	Influences frame stiffness and bracing layout
Functional layout	Reflects access, equipment and space use	Affects structural arrangement and member spacing
Service environment	Includes corrosion, temperature and exposure	Influences material and protection system
Fabrication and erection condition	Considers shop capability and site assembly	Affects member segmentation and connection choice
Future modification requirement	Considers expansion or additional loads	Influences structural flexibility and reserve capacity

KEY TAKEAWAY

A suitable steelwork system is determined by structural demand, constructability and service condition working together, not by geometry alone.

Comparison of Common Steelwork Structure Types

SYSTEMS / CONFIGURATION / APPLICATIONS / SELECTION

PRACTICAL KNOWLEDGE
FOR BETTER STRUCTURES

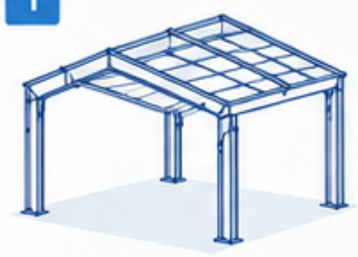
1. OVERVIEW

Steelwork is not a single form. Different steelwork systems correspond to different load paths, span demands and service functions.
System selection should be established before detailing members and connections.

2. COMMON STEELWORK SYSTEM TYPES

INDICATIVE SYSTEM TYPES

1



Portal Frame Structure

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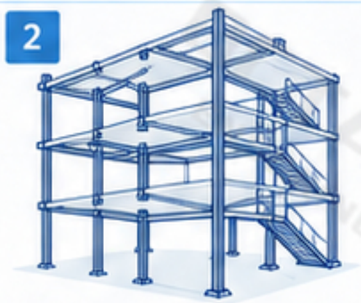

Multi-Storey Steel Frame

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Steel Truss Structure

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Pipe Rack / Support Structure

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Steel Platform and Walkway Structure

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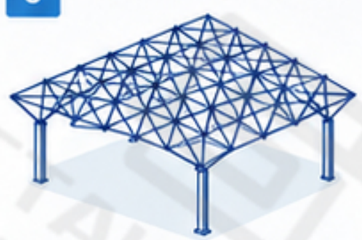


Space Frame Structure

3. TYPICAL STEELWORK SYSTEMS AND THEIR ENGINEERING CHARACTERISTICS

Steelwork Structure	Typical Configuration	Key Characteristics	Common Applications	Main Selection Point
Portal Frame Structure	Rigid columns, rafters, purlins and bracing	Efficient for medium-span enclosures with clear internal space	Workshops, warehouses, production buildings	Span, bay spacing, roof load, economy
Multi-Storey Steel Frame	Columns, primary beams, secondary beams and floor framing	Suitable for repeated floor levels and flexible internal layouts	Offices, industrial buildings, equipment buildings	Floor loading, storey height, frame continuity
Steel Truss Structure	Top chord, bottom chord, web members and nodes	High strength-to-weight efficiency for long spans	Roof systems, large-span industrial buildings, bridges	Span length, load distribution, fabrication complexity
Pipe Rack / Support Structure	Columns, transverse beams, bracing and pipe support members	Supports process piping, cable trays and equipment routing	Oil & gas plants, chemical plants, utility areas	Equipment layout, operational clearance, maintenance access
Steel Platform and Walkway Structure	Beams, columns, gratings, stairs and handrails	Provides access, operating floor and maintenance space	Plants, energy facilities, industrial access systems	Live load, access safety, integration with main structure
Space Frame Structure	Three-dimensional tubular members and nodes	Lightweight spatial system for large column-free areas	Terminals, exhibition halls, roof structures	Span, node design, erection sequence

KEY TAKEAWAY

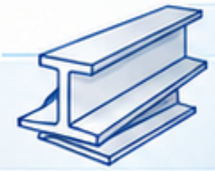
Steelwork systems should be compared by load behavior, span capability, functional layout and construction method rather than by member type alone.

Materials, Fabrication and Connection Design

MATERIALS / FABRICATION / CONNECTIONS / PERFORMANCE

PRACTICAL KNOWLEDGE
FOR BETTER STRUCTURES

1. MATERIAL SELECTION FOR STEELWORK

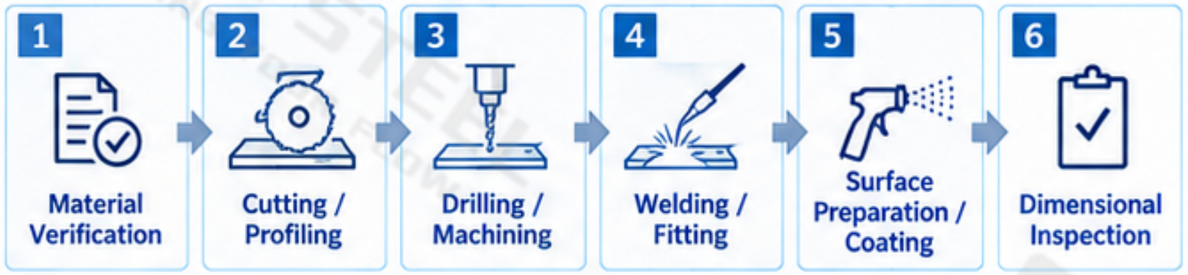


Material selection depends on load demand, exposure condition, fabrication method and service environment.

Material Type	Main Characteristics	Typical Use
Carbon Structural Steel	Balanced strength, weldability and fabrication efficiency for general structural use	Buildings, warehouses, industrial steel structures
High-Strength Structural Steel	Higher strength-to-weight ratio for reducing member size and structural weight	Long-span structures, heavy-duty applications
Weathering Steel	Improved atmospheric corrosion resistance in exposed service conditions	Outdoor structures, exposed steelwork
Stainless Steel	High corrosion resistance for aggressive or hygiene-sensitive environments	Chemical plants, coastal projects, special applications

2. FABRICATION PROCESS

FROM MATERIAL TO FINISHED COMPONENT



Fabrication Stage	Engineering Purpose
Material verification	Confirm steel grade, section type and traceability
Cutting and profiling	Produce required geometry according to drawings
Drilling and machining	Prepare holes and interfaces for assembly
Welding and fitting	Form structural assemblies with controlled accuracy
Surface preparation and coating	Improve corrosion protection and durability
Dimensional inspection	Verify geometry, alignment and fabrication accuracy

3. CONNECTION DESIGN REFERENCE

COMMON CONNECTION METHODS AND THEIR APPLICATION

Connection Type	Typical Applications	Installation Method	Engineering Considerations
Welded Steel Connections	Built-up beams, box columns, plate girders, permanent fabricated structures	Mainly shop welding, with field welding where required	Joint preparation, welding procedure, distortion control and inspection quality
High-Strength Bolted Connections	Beam splices, column joints, bridges, industrial structures	Site assembly with controlled tightening procedures	Bolt grade, preload/tightening method, contact surface condition
Moment Connections	Rigid frames, beam-to-column joints requiring moment transfer	Welded or bolted rigid connection arrangements	Rotational stiffness, force transfer, frame continuity
Simple or Pinned Connections	Secondary beams, platforms, support members	Usually bolted for convenient assembly	Shear transfer, erection tolerance, rotation allowance
Project-Specific Structural Connections	Space frames, complex industrial structures, custom assemblies	Installed according to project-specific procedures	Connection geometry, node design, assembly sequence

KEY TAKEAWAY

Reliable steelwork performance depends not only on the selected structural system, but also on correct material choice, controlled fabrication and appropriate connection design.

Typical Applications and Steelwork Design Checklist

APPLICATIONS / CHECKLIST / REVIEW / PERFORMANCE

PRACTICAL REFERENCE
FOR APPLICATION REVIEW

1. APPLICATION MAPPING

Steelwork application should be evaluated according to operating function, structural demand, access requirement and service environment rather than by member type alone.

COMMON APPLICATION AREAS AND THEIR STEELWORK USE

Application Area	Typical Steelwork Structures	Engineering Function
Industrial Plants	Process structures, equipment support frames, pipe racks, maintenance platforms	Support equipment, piping systems and industrial operations
Oil & Gas Facilities	Pipe rack structures, compressor shelters, equipment platforms, modular steel supports	Provide structural support for process systems and plant infrastructure
Warehouses and Logistics Buildings	Portal frames, steel columns, roof systems, large-span steel frames	Create wide internal spaces for storage and handling operations
Power and Energy Facilities	Turbine support structures, cable support systems, equipment platforms	Support energy equipment and maintenance access
Bridges and Transportation Infrastructure	Steel girders, trusses, pedestrian bridge systems, support frames	Transfer traffic loads and environmental actions
Industrial Access Systems	Stairs, platforms, handrails and maintenance steelwork	Provide safe access for operation and inspection

2. STEELWORK DESIGN REVIEW CHECKLIST

KEY CONSIDERATIONS FOR A COMPLETE DESIGN REVIEW

1 Structural Function

- What must the structure support?
- Primary load-bearing or access/support role?

2 Load and Span

- Vertical load
- Lateral load
- Span requirement
- Equipment load

3 System Selection

- Frame, truss, platform, rack or space frame?
- Is the load path efficient?

4 Connection Strategy

- Welded or bolted?
- Rigid or simple connection?
- Shop connection or site connection?

5 Fabrication and Erection

- Can members be transported and assembled efficiently?
- Are tolerances and sequence manageable?

6 Durability and Service

- Corrosion protection
- Maintenance access
- Future modification needs

KEY TAKEAWAY

Steelwork design should be reviewed as a complete engineering system that integrates structural behavior, fabrication control, connection detailing and service requirements.