

Allocation of Design Responsibilities in Constructional Steelwork



BCSA

FOR BUILDINGS

BCSA Publication No. 45/07

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Acknowledgements

This publication has been prepared under the guidance of a steering committee composed of the representatives and organisations listed below:

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Care has been taken to obtain the views and comments of all sections of the industry including architects, consulting engineers, main contractors and steelwork contractors. The steering group acknowledges with thanks the helpful contributions made.



ACA is the national professional body representing architects in private practice throughout the UK representing some of the country's leading practices.



ACE represents some 45,000 technical and fee earning staff in the consultancy and engineering sector working in the built and natural environment.



BCSA is the national organisation for the steel construction industry: its Members undertake design, fabrication and erection for all forms of construction.



CONSTRUCTION CONFEDERATION

The Construction Confederation is the main representative organisation for building and civil engineering contractors within the UK construction industry.

Griffiths & Armour

Griffiths and Armour are insurance advisers to the construction industry with a specialisation in Professional Indemnity Insurance.



The Institution of Structural Engineers is the world's leading professional body for structural engineering in the built environment



SCI develops and promotes the effective use of steel in construction. It is an independent membership based organisation.



HSE is pleased to support this publication which addresses how the design of structural steelwork can be better coordinated by the effective supply of information to all those parties involved in the design and delivery of projects

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1. Introduction

Accurate, timely and comprehensive information, especially design information, is essential to all parties involved in a construction Project. To achieve this, everyone throughout the supply chain needs to understand exactly what they have to do, the level of detail required and the dates by which information is to be provided. Unfortunately, on many Projects these procedures are either not properly established or are poorly managed. Both production of information and its exchange need to be improved in order to reduce wastage and overruns and to enable the Project team to deliver improving services to Clients. This applies just as much to Projects incorporating Steelwork as to any other.

Usually, the process of establishing production and exchange of information will be one of dialogue between the various Project participants involved in the design and delivery of the Project - a process made easier when Project teams are assembled in a collaborative way but possible and indeed common in traditionally procured Projects.

The early identification of design requirements is the easiest way of avoiding late variations, which are always expensive. Steelwork is produced by a factory based manufacturing process that is highly mechanised and increasingly automated. Consequently, Steelwork manufactured in the factory tends to be made very efficiently, a process that is difficult to reproduce on site. For instance, it is estimated that a hole drilled in the factory costs a few pence yet the same hole drilled on site once the steel is erected can cost several hundred pounds, the reason being that work on site often requires work to be carried out at height, requiring different equipment and more personnel, and representing an increased safety risk. Much wastage can be cut out of the system if there is good information available from the start, allowing as much fabrication as possible to be completed in the factory. If this is not possible, the design team must make a clear decision that site works will be needed and the steelwork contractor informed early in the project.

Additionally, the CDM Regulations provide the following:

'Every designer shall in preparing or modifying a design which may be used in construction work in Great Britain avoid foreseeable risks to the health and safety of any person -

(a) carrying out construction work;

(b) liable to be affected by such construction work...'
(paragraph 11(3))

This publication will therefore be a useful tool for the CDM co-ordinator to ensure compliance with the CDM Regulations.

Exchange of information can take place by many different methods - extranet, CD, e-mail or hard copy. Only one method should be used on any given Project and the agreement of all the parties should be reached at the beginning of the Project as to the methods which will be used and the status of information exchange by such methods. One efficient way to do this is by use of a collaborative controlled electronic publication management environment such as a Project wide shared server, a Project extranet or a web-based Electronic Publication Management System, such as the Avanti SMP.

Whatever methods are chosen, proper exchange of information at the right time also aids proper planning leading to safer work on site by minimising out of sequence working and the modification works that will often need to be carried out whilst working at height.

The purpose of this publication is to provide guidance for identifying the requirements for the production and exchange of accurate, timely and detailed information for Projects involving Steelwork. It includes a comprehensive list of design activities and design information requirements in the form of Checklists to assist in the procurement of Steelwork prior to and following the appointment of a Steelwork Contractor.

2. Definitions and References

2.1 Definitions

In this publication, the following terms are used with the following meanings (any reference to documents or drawings includes documents or drawings in any format, electronic or paper including Computer Aided Design format).

Architectural Design	The architectural design of the Project indicating the arrangement of the spaces and facilities and the materials and finishes of the Project for which the Steelwork is required.
Base Plan Drawings	Drawings indicating location of column bases and details of Steelwork connections to the foundation.
<i>BSRIA</i>	Research organisation which publishes 'A Design Framework for Building Services'.
CDM Co-ordinator	Person appointed as the CDM co-ordinator under the CDM Regulations.
CDM Regulations	The Construction (Design and Management) Regulations 2007.
<i>CIC</i>	Construction Industry Council, which publishes the <i>CIC Scope of Services</i> .
Client	The organisation for whom a Project is carried out.
Contractor	A person appointed to manage and/or implement the design (if required) and manage or carry out the construction of the whole or part of the Project.
Design Co-ordination	The gathering, co-ordination and communication of design information to the Project team.
Erection Drawings	Drawings, which may be derived from the Steelwork General Arrangement Drawings, showing details amplifying the information given in the erection method statement prepared in accordance with the <i>CDM Regulations</i> and showing details of any temporary Steelwork.
Fabrication Drawings	Drawings showing all necessary information required for the Steelwork fabrication element of the Project.
NSSS	The National Structural Steelwork Specification for Building Construction 5 th Edition.
Project	The proposed development procured or to be procured by the Client as described in the Architectural Design.
Project Specification	The specification prepared for the Project.
Project Team	The team procured or to be procured by or on behalf of the Client, to design procure and implement the Project.

<i>RIBA</i>	Royal Institute of British Architects, which publishes the Outline Plan of Work.
Safe Site Handover Certificate	The Safe Site Handover Certificate indicating that site conditions are suitable and adequate for the erection of Steelwork.
SMP	Avanti Standard Method and Procedure.
Steelwork Contractor	The organisation appointed to undertake any or all of the design, detailing, fabrication and erection of the Steelwork as required by the Project Specification.
Steelwork General Arrangement Drawings	Fully dimensioned drawings showing the location of all members together with their size and material grades, the forces to be developed in their connections, any cambers and eccentricities and other information necessary for the design of the connections and completion of Fabrication and Erection Drawings.
Structural Engineering Drawings	Drawings indicating the outline structural requirements for the Project.
Steelwork	Those parts of the Project described in the Project Specification as constructional steelwork

2.2 References

- A Design Framework for Building Services. Published by *BSRIA* publication No. BG 6/2006; ISBN 0 86022 656 5
- SMP Avanti Standard Method and Procedure. Published by Constructing Excellence available on www.constructingexcellence.org.uk/resources/az/view.jsp?id=841
- NSSS National Structural Steelwork Specification for Building Construction 5th Edition. Published by BCSA and Steel Construction Institute publication No. 203/07; ISBN 0 85073 052 X
- RIBA* Outline Plan of Work published by *RIBA* available on www.architecture.com
- The *CIC* Scope of Services. Published by *CIC*; ISBN 978 1 8594 6 258 4 available on www.cicservices.org.uk
- The Construction (Design and Management) Regulations 2007 SI 2007 No. 320
- Safe Site Handover Certificate. Published by BCSA available on www.steelconstruction.org

3. Using this Publication

3.1 Background

This publication is intended for anyone involved in a Project that may have an input into the exchange of information for the design and/or fabrication and/or erection of Steelwork. It is designed to assist in defining and managing the interfaces that exist in all construction Projects and in particular to minimising the potential gaps and overlaps that may occur in the information supplied by the parties involved in the procurement of Steelwork.

The following points are important to note:

1. This publication does not attempt to deal with liability for design work, simply the practicalities of who does what design, when it is carried out and how information is distributed throughout the Project team.
2. This publication is intended to be used no matter what procurement route is chosen and therefore references to forms of contract and procurement routes have been avoided.
3. This publication is not a mandatory requirement on designers and Contractors. It needs to be specified as a requirement in the Project by the Client and advisers for all participants in a Steelwork contract.

This publication is primarily designed as a supplement to or detailed explanation of Tables 1.1 and 1.2 of the NSSS but can equally be used independently. Also, as far as possible, it has been designed to be compatible with the CIC Scope of Services and the RIBA Outline Plan of Work. With regard to the CIC Scope of Services, it provides a further level of detail, amplifying the Specific Scope Schedule (which sets out primary design responsibility for certain elements at various stages). This publication also fits in with BSRIA's 'A Design Framework for Building Services'.

The Checklists in Section 4 are intended to encourage discussion between those procuring and those supplying the Steelwork in order to seek general agreement on the respective roles and responsibilities of those engaged. This will include clear agreement on who will provide the information necessary to enable the design, detailing, manufacture, supply and erection of the Steelwork and the timescales within which it should be provided.

The Checklists may be used as the basis for a set of agreements between the Client and other parties as appropriate regarding the production and exchange of information for procuring the Steelwork, which should be reflected in each Project team member's contract.

Appointments are not always made at the same time and so completing the Checklists early in the procurement process may well require allocating certain activities to as-yet unknown parties. These can simply be marked 'to be confirmed', and refined later as appointments are made. However, it is essential that all appointments making a contribution to the Steelwork are made within the timescales required by the Project. Depending on the nature of any later appointments, certain activities may have to be done by parties that have already been appointed; in this case, roles and responsibilities may need to be re-defined.

The Checklists can also be used to identify activities which have not yet been allocated to any Project team member. Here, they become part of the Project risk management process.

3.2 Design Co-ordination

It is important that the interfaces between different members of the Project team are clear with appropriate roles and responsibilities defined and allocated. In particular, there is design code requirement for one party to be clearly responsible for overseeing that overall structural stability is achieved even though the Steelwork may only be a part of an overall structural system supplied by a range of contractors. In addition, the organisation taking the lead on co-ordination between design and manufacture should be clearly identified so that every member of the Project team can make informed decisions about its own role and costs.

Problems may also arise where there is a spatial conflict between the Steelwork and other elements of the Project including building services. These can be avoided by ensuring responsibility is allocated for the checking of spatial co-ordination. This is dealt with in the Checklists.

3.3 Design Stages

This publication uses two design stages relating to the Steelwork: preliminary design and detailed design; these are called Design Stage 1 and Design Stage 2. The more detailed design stages used in other publications - for instance the RIBA Outline Plan of Work and the CIC Scope of Services are included here for the sake of comparison.

Design Stage 1 is equivalent to RIBA Stage D - Design Development, Stage E - Technical Design and Stages G & H - Tender Documentation and Action or CIC Stage 3D Design Development.

Design Stage 2 is equivalent to RIBA Stage F - Production Information or CIC Stage 4D - Production Information.

By the end of Design Stage 2 all the information necessary to finalise the Fabrication Drawings should be available and fixed. This includes any minor adjustments to dimensions around openings for doors, windows etc. and addition of any required secondary Steelwork members. Major additions or changes should not be carried out during the period leading up to the information exchange date.

Any alterations in the design should be discussed and resolved before the end of Design Stage 2, to enable the person undertaking the design of the Steelwork to finalise the Steelwork General Arrangement Drawings. Required information exchange dates should be highlighted in the Steelwork Contractor's construction programme and should be set to meet the requirements for the start date for the design, fabrication and/or erection of the Steelwork as required. On large Projects or on Projects where phasing is required, multiple exchange dates may be appropriate.

The end of Design Stage 2 should be clearly shown on the Project programme so that all parties are aware of the information exchange dates that have been agreed.

Table 1 gives a description of the two Design Stages 1 and 2, together with the outputs expected at the end of each stage.

Table 1 Design Stages

Design Stage	Summary of the main deliverables	RIBA Outline Plan of Work/CIC Services Stage
Design Stage 1	Sufficient information, including initial design work and the identification of any significant risks associated with the design to enable the Steelwork Contractor to cost the Steelwork.	RIBA Stages D, E and G & H CIC Stages 3D
Design Stage 2	Sufficient information to allow finalisation of the complete design of the Steelwork. The output is a set of finalised agreed Steelwork General Arrangement Drawings.	RIBA Stage F CIC Stage 4D

3.4 Drawings, dimensions and activities

The scope and detail of documentation required for the Steelwork will vary widely from project to project depending on such parameters as size, complexity, location and the project delivery system. However, in general, complete information should include:

- A clear description of the structural elements and the orientation and overall stability of the structural system, including necessary schedules, sections and details
- A clear specification for materials and workmanship specific to the Project
- Co-ordination within the Steelwork documentation and with other Project documentation
- Dimensions for structural elements and for their location
- The relationship of the structure with adjacent non-structural elements and finishes
- Governing codes, design loads and design criteria for various structural elements and materials as required by the codes and/or needed for flexibility in future use
- Identification of parts of the structure designed by others (that is, not the Steelwork Contractor) and the clear design and performance requirements for these parts
- Clearly defined quality assurance measures required for the structure including Contractor quality control and independent inspection and testing (e.g. welding).

The NSSS may be used to identify additional workmanship and material specific information.

The Steelwork General Arrangement Drawings should include:

- Details of assembly
- Material properties
- Sizes for all structural elements
- Dimensions required for the preparation of Fabrication Drawings and the fabrication and erection of the Steelwork.

The essential elements necessary to arrive at structural dimensions include:

- Overall building dimensions and gridlines
- Location of all structural elements with respect to gridlines
- Identification of position of edge of slab
- Structural floor elevations
- Top of steel levels
- Size of all framing members
- Adequate description of x-sections shapes
- Base level below finished floor level
- Setting out related to an agreed datum
- Camber requirements
- Structural wall thickness
- Services routing strategy including structural zone
- Required tolerances
- Cladding zones.

A reliable mechanism is needed for implementing and tracking any design changes. Drawing revisions should be clearly identified and fully and unambiguously described with dated revision number and 'clouding'. It is essential that all changes are promptly identified and clearly documented and issued to all parties to minimise their impact on both cost and programme.

4. The Checklists

4.1 Background

This Section contains Checklists to assist in the process of agreeing responsibility for the activities associated with the design, fabrication and erection of the Steelwork. They are intended to aid the communication, co-ordination and clarification of the scope and content of a Steelwork contract between the different disciplines involved and stages of the design process throughout the design, fabrication and erection of the Steelwork. It is intended that the Checklists should be used by the team participants when agreeing the scope and responsibilities within the Project team and in particular the responsibilities of the Steelwork Contractor.

4.2 Using the Checklists

The first Checklist is simply a list of the team members, that is, the Project Directory, and is the first publication that should be created. In general this publication should include the following for each Project team member:

- Name and address of company
- Contact person
- Telephone number
- Fax number
- Email address
- Role

The second and third Checklists break the two design stages into eight main areas: General, Design, Fabrication, Protective Treatment, Inspection and Testing, Erection, Output and Project Specific Requirements. The first seven areas are further subdivided in to detailed information required at that stage in the process. The Checklists also allow the responsibility to provide the information to be allocated to members of the Project Team and the date when the information is due to be clearly identified. The main deliverables from each of the stages are listed under the heading Output and again the Checklists allow the party responsible for provision of the information to be identified.

4.3 Project Directory

Project Name: _____

Site Address: _____

Details of the parties involved in the Project: Space is left for Project-specific requirements.

Role to be undertaken	Name and Address of Company	Contact Person	Phone	Fax	Email
Client					
Steelwork Contractor					

4.4 Design Stage 1: Checklist

It is the task of the person co-ordinating the design to identify agreed responsibilities of each party by ticking the boxes and adding dates by which the information needs to be provided.

Information Required or Activity	Relevant Party		Relevant Party		Relevant Party		Relevant Party	
	✓	Due Date	✓	Due Date	✓	Due Date	✓	Due Date
General A brief description of the structure including its arrangement, type, purpose, principal functions and use classification								
Architectural design								
Particulars of any aesthetic, structural or environmental or other conditions which may affect design								
Details of the site within which the Project will be constructed								
Description of any significant risks associated with the design; health and safety plan								
Any particular requirements of the Client regarding sustainability								
Detailed spatial co-ordination between Steelwork and other elements and systems								
Design Statement of design concept including function and proposals for the overall stability of the structure								
Design standards to be used								
Details of the main steel section sizes								
The loading data to be used including temporary construction loading								
The parameters to be considered in preparing the design layout								
The material grade and designation to be used, including all sub grades and required options								
The grades of bolt assemblies and any coatings specifically required								
Representative information necessary for the design of the connections. This should include factored connection forces for the following: <ul style="list-style-type: none"> • Base plates • Splices • Beams • Columns • Rafter • Bracing • Eaves cantilevers • Crane brackets • Tie force requirements 								
Details and specification of the fixings or bolts to walls or other concrete items								
Representative details of the bracing positions relative to the columns, beams and rafters and identification of the node points where critical								
Representative details and locations of any temporary works								

Information Required or Activity	Relevant Party		Relevant Party		Relevant Party		Relevant Party	
	✓	Due Date	✓	Due Date	✓	Due Date	✓	Due Date
The type of column splice to be used e.g. external or internal flange plates, countersunk bolts etc.								
Representative length and frequency of shear studs								
Representative architectural requirements including: <ul style="list-style-type: none"> • Brickwork supports • Bracket for handrails etc • Balcony supports 								
Cold rolled members representative information: <ul style="list-style-type: none"> • Design assumptions e.g butt system, heavy end bay etc • Anti-sag and restraint systems • Fire wall requirements • Position of panel joints (in relation to horizontal cladding) • Detailed dimensions around gutters 								
Concrete planks/metal decking and/or depth of precast unit/metal floor								
Details of any dynamic or vibrating forces and where fatigue is to be considered								
Fabrication Requirements for any particular or special types of fabrication details and/or restriction on types of connections to be used								
Representative camber and presets								
Protective Treatment Representative Information on								
Requirements for surface preparation								
Thickness and composition of any sprayed metal coatings								
Requirements for galvanizing								
Requirements for paint treatment								
Fire resistance period and requirement for fire protective coatings								
Inspection and Testing Representative Information Requirements for non-destructive testing of materials								
Erection An outline method of erection giving the sequence for erecting the structure taking into account any phasing of the work								
Details of any underground services or other buried features, overhead power cables or site obstructions								
Details of the fixings or bolts to the foundations or walls								
Width and level of the prepared working area, for access of Site traffic and cranes and areas available for storage								

Information Required or Activity	Relevant Party		Relevant Party		Relevant Party		Relevant Party	
	✓	Due Date	✓	Due Date	✓	Due Date	✓	Due Date
Limitations on dimensions and weights of components to be delivered to the site and ground capacity requirements for heavy loads in accordance with the Safe Site Handover Certificate								
Erection sequences including requirements for phased construction that may affect the construction sequence or which may create an unusual constraint and/or hazard during construction.								
A description of any temporary works and any special requirements for temporary bracing required, the stage when it is no longer necessary, or whether it is to be left in position after completion of the Steelwork								
Output Specification for the Steelwork								
Structural Engineering Drawings								
Paint/galvanizing specification for individual members								
Base Plan drawings								
Any significant risks associated with the design and health and safety plan in compliance with CDM Regulations								
Project Specific Requirements								

4.5 Design Stage 2: Checklist

It is the task of the person co-ordinating the design to identify agreed responsibilities of each party by ticking the boxes and adding dates by which the action information needs to be provided. Stage 2 includes all information gathered under Stage 1 but with changes, qualifications and any additional detail clearly identified. Additional information required at Stage 2 is shown in italics.

Information Required or Activity	Relevant Party		Relevant Party		Relevant Party		Relevant Party	
	✓	Due Date	✓	Due Date	✓	Due Date	✓	Due Date
General A brief description of the structure including its arrangement, type, purpose, principal functions and use classification								
Architectural design								
Particulars of any aesthetic, structural or environmental or other conditions which may affect design								
Details of the site within which the Project will be constructed								
Description of any significant risks associated with the design; health and safety plan								
Any particular requirements of the Client regarding sustainability								
<i>The date(s) of issue of the Structural Engineering Drawings or data and other information</i>								
<i>Approval for acceptance of information submitted by the Steelwork Contractor</i>								
Detailed spatial co-ordination between Steelwork and other elements and systems								
Design Statement of design concept including function and proposals for the overall stability of the structure								
Design standards to be used								
Details of the main steel section sizes								
The loading data to be used including temporary construction loading								
The parameters to be considered in preparing the design layout								
The material grade and designation to be used, including all sub grades and required options								
The grades of bolt assemblies and any coatings specifically required								

Information Required or Activity	Relevant Party		Relevant Party		Relevant Party		Relevant Party	
	✓	Due Date	✓	Due Date	✓	Due Date	✓	Due Date
<p>Information necessary for the design of the connections. This should include factored connection forces for the following:</p> <ul style="list-style-type: none"> • Base plates • Splices • Beams • Columns • Rafters • Bracing • Eaves cantilevers • Crane brackets • Tie force requirements 								
<p>Details and specification of the fixings or bolts to walls or other concrete items</p>								
<p>Details of the bracing positions relative to the columns, beams and rafters and identification of the node points where critical</p>								
<p>Details and locations of any temporary works</p>								
<p>The type of column splice to be used e.g. external or internal flange plates, countersunk bolts etc.</p>								
<p>Length and frequency of shear studs</p>								
<p>Architectural requirements including:</p> <ul style="list-style-type: none"> • Brickwork supports • Brackets for handrails etc • Balcony supports 								
<p>Cold rolled members:</p> <ul style="list-style-type: none"> • Design assumptions e.g butt system, heavy end bay etc • Anti-sag and restraint systems • Detailed dimensions around doors, louvres, roof vents, rooflights etc • Fire wall requirements • Position of panel joints (in relation to horizontal cladding) • Detailed dimensions around gutters 								
<p>Concrete planks/metal decking and/or depth of precast unit/metal floor</p>								
<p>Stairs: Section and plan drawings showing all dimensions to allow detailing</p>								
<p>Eaves, verge, parapet, corner, re-entrant and any other special details</p> <ul style="list-style-type: none"> • Support members sizes and positions; • Sag/anti-sag and restraint system to members 								
<p>Details of any dynamic or vibrating forces and where fatigue is to be considered</p>								

Information Required or Activity	Relevant Party		Relevant Party		Relevant Party		Relevant Party	
	✓	Due Date	✓	Due Date	✓	Due Date	✓	Due Date
<i>Any part of the Steelwork where the manufacturing process must be restricted (eg, plastic hinge positions)</i>								
<i>Set out points for sloping members</i>								
<i>Set out points and radius for curved members</i>								
Fabrication Requirements for any particular or special types of fabrication details and/or restriction on types of connections to be used								
Camber and presets								
<i>Positions on the structure where additions and stiffeners are required to develop the strength of the members and where notching may affect members stability</i>								
<i>Details of cutouts, holes or fittings required for use by others</i>								
<i>Location of holes that cannot be punched</i>								
Protective Treatment Requirements for surface preparation								
Thickness and composition of any sprayed metal coatings								
Requirements for galvanizing								
Requirements for paint treatment								
Fire resistance period and requirement for fire protective coatings								
Inspection and Testing Requirements for non-destructive testing of materials								
Erection <i>Information required by CDM Regulations before site attendance by the Steelwork Contractor</i>								
An outline method of erection giving the sequence for erecting the structure taking into account any phasing of the work								
<i>A site plan showing position of datum level and setting out lines</i>								
<i>Requirements for the thickness and type of bedding material to be used under the column base plates</i>								
Details of any underground services or other buried features, overhead power cables or site obstructions								
Details of the fixings or bolts to the foundations or walls								

Information Required or Activity	Relevant Party		Relevant Party		Relevant Party		Relevant Party	
	✓	Due Date	✓	Due Date	✓	Due Date	✓	Due Date
Width and level of the prepared working area, for access of Site traffic and cranes and areas available for storage								
Limitations on dimensions and weights of components to be delivered to the site and ground capacity requirements for heavy loads in accordance with the Safe Site Handover Certificate								
Erection sequences including requirements for phased construction that may affect the construction sequence or which may create an unusual constraint and/or hazard during construction.								
A description of any temporary works and any special requirements for temporary bracing; the stage when it is no longer necessary or whether it is to be left in position after completion of the Steelwork								
<i>Responsibilities at the interface between the Steelwork and other trades</i>								
<i>A Safe Site Handover Certificate</i>								
Output Specification for the Steelwork								
<i>Steelwork General Arrangement Drawings</i>								
Paint/galvanizing specification for individual members								
Base Plan drawings								
Any significant risks associated with the design and health and safety plan in compliance with CDM Regulations								
Project Specific Requirements								