

Modern working practices, with ever decreasing timescales, have affected the transfer of information between the structural designer and steelwork contractor. The use of CAD as part of a factory production system means that the fabricator can rapidly build-up a model of the frame, *but* he requires complete information before he can start. Steel must be ordered early, and connection information can no longer be considered as secondary. Connection design and detailing may take place in the first two weeks of the steelwork contractor's programme.

In Section 1 of the *National Structural Steelwork Specification* (NSSS)⁽⁶⁾ details are given of information which should be supplied to the steelwork contractor for different contract scenarios. Similar recommendations can be found in Appendix C of ENV 1090-1⁽⁸⁸⁾. This information will be required early in the project because the steelwork is an early trade on site. As an example, consider the typical case when design and detailing of the connections is to be carried out by the steelwork contractor after member design has been performed by the consulting engineer. The NSSS states that information concerning the following 15 points must be supplied in such a case:

1. A statement describing the design concept
2. Design drawings
3. Environmental conditions which may affect detailing
4. The design standards to be used for connection design
5. Any part of the steelwork where the manufacturing processes must be restricted, for example plastic hinge locations
6. Details of any dynamic or vibrating forces, and members subject to fatigue
7. The forces and moments to be transmitted by each connection
8. In the case of limit state design, whether loads shown are factored or unfactored as defined by BS 5950⁽⁸⁵⁾
9. Positions on the structure where additions and stiffeners are required to develop the combination of local and primary stresses, and where notching may affect member stability
10. Any grades of bolt assemblies and their coatings which are specifically required
11. Details of fixings of bolts to the foundations for which the consultant is responsible, or a statement indicating that the steelwork contractor has to design these items and prepare a foundation plan drawing
12. Requirements for any particular types of fabrication details and/or restrictions on types of connection to be used
13. Details of cutouts, holes or fittings required for use by others
14. Cambers and presets which have to be provided in fabrication so that continuous frames and other steelwork can be erected to the required geometry
15. Connections where holes cannot be punched

It is interesting to note that recent and future developments, for example the use of semi-rigid or composite connections, will have implications on this traditional procedure. It may no longer be possible to divorce member and connection design, because of their interdependence.

2.3.4 Coordination

Contributions to the design are frequently drawn from a wide variety of sources within many organisations. Different contractual arrangements may be adopted, as discussed above. Each organisation will have its own objectives which, although sympathetic to the project as a whole, will often override it. This problem may be especially pronounced with specialist designers, who are only concerned with one small part of the project.

When a ‘construction led’ approach is adopted, consideration of the construction programme should reveal the principal designers for each stage of the project. Formal start-up meetings at key stages can be used to agree programmes, details etc. During these meetings critical tasks must be identified, and communication can be fostered and encouraged. Because the contributions of different organisations may run in parallel careful planning is needed, with substantial cross-referencing between individual designers to ensure compatibility.

2.3.5 Interfaces

Physical interfaces relate to the features of the building, and may occur between components, systems, or zones. If maximum benefit is to be derived from a construction strategy based on zones (see Section 4.3), a clear separation of systems crossing the zones must be made. Lead designers of adjacent zones should negotiate with one another to establish:

- the line of an interface
- who has primacy in coordinating the design
- information requirements for both parties
- the policy on tolerances.

Sections 6 and 7 of these guidelines give detailed information concerning interfaces with both structural and non-structural components. The extensive information given reflects the importance that the interfaces may have in dictating the overall building cost.

2.3.6 Design development

Design development must be carefully controlled because primary designers require large amounts of information from various sources. *Communication of structural design*⁽⁴⁾ identifies possible key stages of Scheme Design and Detail Design. Information required at each of these stages, according to that particular document, comprises:

Scheme Design information : ‘Investigate alternative detail solutions to the basic structural problems (including alternative design by the contractor). On basis of foregoing, refine and develop outline proposals and produce all structural information leading to cost check of the scheme design.’

Detail Design information : ‘Develop proposals from Scheme design information and produce necessary detail information.’

Agreements and approvals required during these two stages are also given⁽⁴⁾ . Similar requirements are identified in other documents⁽⁷⁾ . The Institution of Structural Engineers recommend that the brief should not be modified after the