

**STEELDOC**  
**Code of Practice**  
**for**  
**Structural Steelwork Documentation**

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Steel Construction New Zealand Inc.(SCNZ) has three basic objectives:

- To promote awareness of the advantages of steel construction
- To promote excellence in the delivery of steel construction solutions
- To encourage training and career development within the steel construction sector

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# 1 Preface

The use of structural steelwork in construction in New Zealand is rapidly increasing. Successful steel construction is an exercise in teamwork. Effective and clear communication is the foundation of confidence and achievement. In steel construction the Contract Drawings and the Specifications are the primary medium of project communication. Therefore the quality of their definition, clarity of their presentation and the conciseness of their content will largely determine the economic and technical success of the steel construction project.

The purpose of *Steeldoc: Code of Practice for Structural Steelwork Documentation* is therefore to clearly identify what Contract Documents, in particular the Drawings, should contain to get good value out of steel construction in New Zealand. As with any Code of Practice, the aim is to set minimum performance criteria, that are readily achievable and reflect common practice in the industry. The hope is that practitioners will quickly exceed these criteria and set their own levels of best practice for others to aspire to.

This second edition of the Code of Practice is reissued as report SCNZ 12:2006 following incorporation of Steel Construction New Zealand. This second edition includes the software programme SteelDoc. The original Code of Practice featured various checklists in hardcopy format. SteelDoc has been developed to streamline drawing office documentation Quality Control by presenting these checklists in an easy to use format.

General requirements and checklists are given for the Drawings and Specification content that can be used by the Principal's Representative as part of the contract documentation and quality assurance system. Typical documentation responsibilities and practice of the Principal's Representative under three commonly used General Conditions of Contract are set out. These are the *Conditions of Contract for Building and Civil Engineering Construction, NZS3910:1998*; *New Zealand Institute of Architects Standard Conditions of Contract, SCC1:2000* and *National Building Contract (General), NBC-G1: 1998*.

All of the above are used in the common building contract arrangement in which the Principal supplies the design of the Contract Works in the form of unambiguous Contract Documents of sufficient clarity and definition, that the Contract Works may be fairly measured, valued and constructed. Design responsibility rests with the Principal. The Contract Drawings and Specifications are incorporated directly into subcontract agreements with subcontractors.

Subcontract documentation responsibilities under design-build general conditions of contract, such as the FIDIC Conditions of Contract for Plant and Design-Build, 1999, are not covered directly by this document. However this *Code of Practice for Structural Steelwork Documentation*, while not directly written in the terminology of design-build contracts, may be made sufficiently informative by substituting the term, Principal's Representative, with the term, Contractor's Representative. In the design-build contract the Contractor supplies the design of the Subcontract Works in the form of unambiguous Subcontract Documents of sufficient clarity and definition, that the Subcontract Works may be fairly measured, valued and constructed.

The role of the Principal's Representative in the documentation process for design-build contracts is different to that in the above contract. The responsibility for the design and the adequacy of the Subcontract Documents for the Contract Works lies largely with the Contractor. The contractual relationship between the Contractor, the Contractor's Representative and the Subcontractors is also different. While the Contractor may take on design responsibility its Subcontractors, in many instances, will not be required to. The Subcontractor's contractual relationship with the design-build Contractor may therefore not be much different from that of the Contractor with the Principal in the more traditional construction contract in which the Principal takes design responsibility.

The recommendations and checklists contained in the *Code of Practice for Structural Steelwork Documentation*, have been put together as the result of wide consultation with and feedback from New Zealand steel fabricators, and detailers in particular. Valuable input from consulting engineers and construction companies has also been appreciated. Steel Construction Industry-New Zealand, (SCI-NZ), representing many companies involved in steel construction, and HERA have made the writing of this document possible through funding and support of the Steel Structures Analysis Service. The function of the Steel Structures Analysis Service has now been taken over by Steel Construction New Zealand which was formerly known as Steel Construction Industry New Zealand.

Steel construction is fundamentally about turning the dreams and visions of others into reality. The Contract Drawings and Specifications in particular are the written expression of those dreams and visions. By encouraging the improvement of Contract Documentation we believe that the confidence, necessary to allow those dreams to grow and to be run with by New Zealand's steel construction industry, will be fostered.

Getting the dream to reality has always required clarity in documentation: In the words of Habbakuk, "Record the vision and inscribe it on tablets, that the one who reads it may run!"

In this amendment to SCNZ 12, the companion software (SteelDoc 1.0b) has been revised to make data entry easier.

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## 2 Introduction

Fabricated structural steelwork is a value added product. It requires skilled design, management, labour and machine time to be added to the raw material of steel plate and sections, to produce a highly versatile, customised building product. A small number of generic connection types are used for the vast majority of steelwork fabrication. By using pre-specified industry normal connections, the structural engineer can minimise design time and optimise fabrication cost. Design expertise can be devoted to solving the non-standard connection configurations. The Contractor can develop efficient practices for manufacturing connections based on industry norms.

The last two decades have seen the rise of new and varying forms of construction contract agreements and design and construction arrangements. The aim of such change may have been to improve the delivery of construction solutions. However, unless well managed and communicated, change simply results in loss of confidence and confusion.

Clarity of communication and responsibility fosters confidence and success. Clarity, consistency and completeness of documentation are the key issues for design consultants to focus on in preparing drawings and specifications that will form the backbone of the Contract Documents. It is a fact the architectural and engineering design consultants with reputations for excellence in design documentation attract better tender prices to projects for their clients.

The Contract Documents are the only formal basis of what happens on a construction project. They are the primary method of communication of construction performance requirements. Where Contract Documents are difficult and time consuming to interpret due to being incomplete, ambiguous or poorly presented, additional cost, re-work and delay is added to the project.

There is a quantifiable amount of detail and work required between conceptual design and the completion of shop drawings involving architects, engineers, project managers, the fabricator and the shop detailer. It is in everyone's interest that tasks and responsibilities in the documentation process are clearly defined early in the project. Where possible these should follow commonly held conventions so as to minimise confusion and maximise efficiency. Oversights will occur even with the best intentions and efforts, however good documentation practice will minimise the number and their effects on the Contract Works.

Presentation styles and extent of contract documentation varies from consultant to consultant and around the country. It also varies with the size and complexity of the project. There is no universally recognised right or wrong style or layout of drawings. However there is a minimum amount of information that must be present on the Drawings and in the Specification for the Contract to run smoothly.

- Clear, complete and unambiguous Contract Documents encourage:
- Achievement of construction programmes.
- Minimisation of errors and omissions.
- More knowledgeable and competitive bids.
- Avoidance of duplication of effort.
- Lower material supply costs.
- Clearly defined responsibilities.
- Minimisation of field errors.
- Reduction in revision costs and delays.
- Elimination of costly start-ups, Requests For Information (RFI's), clarification and verification.
- Reduction in demobilisation and remobilization.
- Increased morale among suppliers.

Steel construction requires good up front planning as most of the steelwork is prefabricated quickly off-site.

The issue of increasingly incomplete design documentation is not just one that occurs in the New Zealand construction industry. The following are a few quotes from New Zealand and overseas:

“Due to ...design professionals not having enough time to complete preparation of contract documents the contractor bidding process, including steel detailing, deteriorates into one of speculation rather than a meticulous estimate of work to be done.”

“...If certain elements cannot be finalised, the *Principal's Representative* at least should inform the Contractor as to what has or has not been completed on the *contract drawings*” . In any event, those portions of design information, which are released, *For Construction*, should be checked and co-ordinated.”

“If design is not complete...owners, design professionals and general contractors should anticipate that omission or ambiguity of information at the bid stage may produce justifiable change orders, claims for “extras”, disputes, cost escalations and delays. The end result of all these escalating adjustments to fees and schedule (programme) is often higher final cost for the project than would have been achieved had the design followed a more conventional course.”

“...Ultimately, one way or the other, the *Principal* should understand that there is a premium to be paid for short-circuiting the design process.”

“Generally when pricing contracts without clear and obvious details, an allowance is made in the quote on the basis of the worst case scenario. This obviously adds cost to the project.”

## 3 Definitions of Terms

### 3.1 GENERAL

Terms used in the Code of Practice for Structural Steelwork Documentation are generally as defined in the New Zealand Standard, Conditions of Contract for Building and Civil Engineering Construction, NZS3910:1998; New Zealand Institute of Architects, Standard Conditions of Contract, SCC1:2000; National Building Contract (General), NBC-G1:1998.

In these General Conditions of Contract there are two parties to the building contract, the Principal and the Contractor. In addition the Principal's Representative is defined with specific responsibilities and is the only person through whom documentation and instructions may be issued to the Contractor. All other persons involved within the contract are referred to as being represented by one of these persons.

Each of the commonly used General Conditions of Contract define the Principal's Representative with different titles, such as the "Engineer", "Architect" or "Principal". However the duties and responsibilities of the Principal's Representative vary only slightly, if at all. Therefore within this document the term, Principal's Representative, is used exclusively.

### 3.2 PERSONS TO THE CONTRACT

#### 3.2.1 PRINCIPAL

The Person named as such in the Special Conditions and includes its executors, administrators and successors.

#### 3.2.2 PRINCIPAL'S REPRESENTATIVE

The professional engineer, architect, surveyor or other person named or identified in the Special Conditions or such other person as may be subsequently appointed by the Principal to act as Principal's Representative. This person has dual roles in the administration of the Contract. One being as expert adviser to and representative of the Principal, giving directions to the Contractor on behalf of the Principal. In the other role the Principal's Representative has fiduciary responsibilities. These include acting independently of either contracting party to make the decisions required under the Contract Documents.

In terms of NZS3910:1998, Conditions of Contract for Building and Civil Engineering Construction, the Principal's Representative is called the Engineer. In terms of NZIA SCC1:2000, the New Zealand Institute of Architects Standard Conditions of Contract, the Principal's Representative is called the Architect. Under NBC-G1:1998, the National Building Contract (General), the Principal's Representative is termed the Principal.

#### 3.2.3 CONTRACTOR

The Person whose tender has been accepted by the Principal or the Person who has been so named in the Contract Documents, and includes its executors, administrators, and successors of the Contractor.

#### 3.2.4 SUBCONTRACTOR

Any Person who contracts with the Contractor to carry out or supply part of the Contract Works on behalf of the Contractor.

### 3.3 OTHER TERMS

#### 3.3.1 CONTRACT AGREEMENT

The written agreement for the fulfilment of the contract signed by the Principal and the Contractor.

#### 3.3.2 CONTRACT DOCUMENTS

The Contract Agreement and the documents referred to in and forming part of the Contract Agreement.

#### 3.3.3 CONTRACT WORKS

The works including temporary works to be executed in accordance with the contract.

#### 3.3.4 GENERAL CONDITIONS

The Conditions of Contract for Building and Civil Engineering Construction, NZS3910:1998  
New Zealand Institute of Architects, Standard Conditions of Contract, SCC1:2000  
National Building Contract (General), NBC-G1:1998.

#### 3.3.5 DRAWINGS

The drawings included in the Contract Documents together with any modifications of such Drawings approved and notified to the Contractor and such other Drawings as may from time to time be supplied by the Principal's Representative to the Contractor for the purpose of the contract.

#### 3.3.6 FOB ITEMS

Free on board items are items which can be fabricated separately to the primary structure. They don't support or prevent the structural erection of the primary structure, but are usually attached to it. Allowance should be made within the primary structure to accommodate and provide attachments for FOB items.

Some FOB items such as some stairs may be critical path items that need to be fabricated and erected concurrent with the erection of the primary structure, to facilitate construction access. Therefore "For Construction" authorisation may be required for some FOB items at the same time as the "For Construction" authorisation of the primary structural elements they attach to.

#### 3.3.7 "FOR CONSTRUCTION"

The Contract Documents are considered to fully describe the Contract Works. It is common practice however for the Principal's Representative to reissue all the Contract Drawings, "For Construction", upon execution of the Contract Agreement. This authorises the Contractor to commence the relevant parts of the Contract Works. Where portions of the Documents lack sufficient definition, are ambiguous or lack sufficient clarity for construction to commence, the Principal's Representative should not knowingly authorise construction of that work to commence without identifying the limitations of the Documents. The additional information necessary to adequately define the relevant portion of the Works should then be issued in due course to the Contractor in the form of instructions, drawings and specifications.

### 3.3.8 PERSON

Includes a natural person and a partnership, body of Persons, firm, company or organisation whether corporate or not. In NZS 3910:1998 and SCC1:2000, the Principal's Representative shall be a natural person.

### 3.3.9 PRIMARY STRUCTURE

The steelwork necessary to allow the erection of the structure and the installation of floor decking, roof and wall cladding elements.

### 3.3.10 SHOP DRAWINGS

Detailed drawings prepared by the Contractor suitable for construction trades personnel. These drawings do not form part of the Contract Documents.

### 3.3.11 SHOP DRAWING INSPECTION OR REVIEW

The Principal's Representative may require Shop Drawings prepared by the Contractor, to be inspected or reviewed prior to fabrication commencing. The purpose of this inspection is to assure the Principal's Representative that the Contract Documents have been correctly interpreted by the Contractor. Inspection or review of the Contractor's shop drawings does not relieve the Contractor of responsibility of correctly interpreting the Contract Drawings and Specification. Neither may the Principal's Representative unnecessarily disrupt the Contractor's Contract Programme. An allowance of seven (7) calendar days is made in the Special Conditions of Contract for shop drawing review or inspection by the Principal's Representative.

### 3.3.12 SPECIAL CONDITIONS

The First Schedule and such other documents as are included in the Contract Documents which add to or delete from or modify the General Conditions.

### 3.3.13 SPECIFICATIONS

Documents included in the Contract Documents containing descriptions of materials and workmanship and other details of the Contract Works, together with any additions to, or modifications of, such documents approved in writing by the Principal's Representative and notified to the Contractor, and other additions or modifications supplied by the Principal's Representative to the Contractor for the purpose of the contract.

### 3.3.14 TENDER DOCUMENTS

Documents which are distributed to prospective tenderers.

### 3.3.15 VARIATION

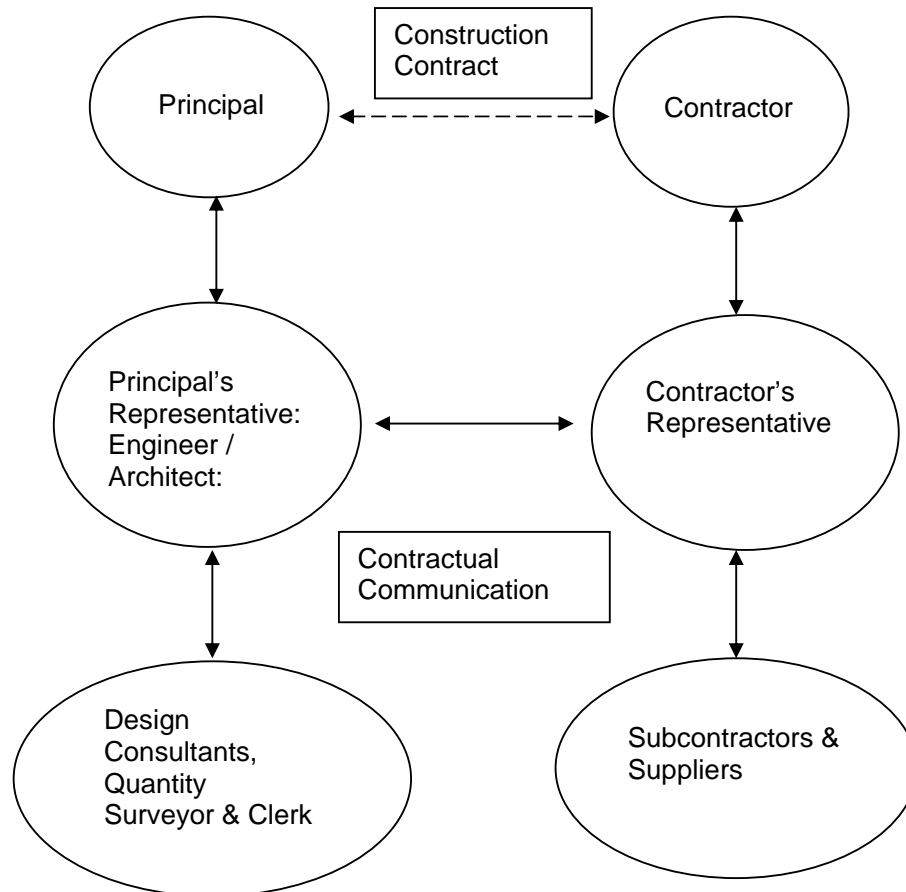
A variation to the Contract Works.



## 4 Contractual Relationships and Communication

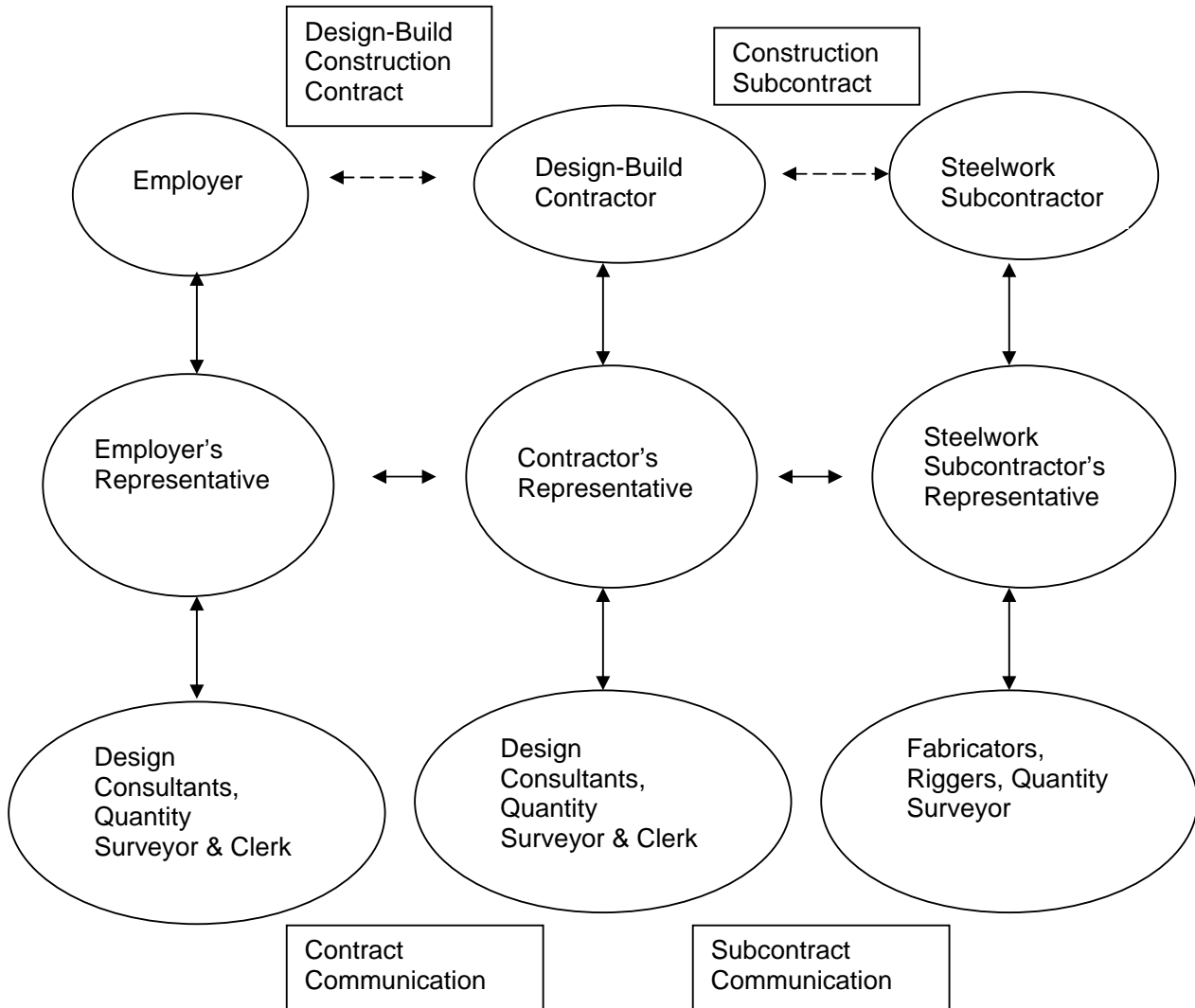
### 4.1 PRINCIPAL RESPONSIBLE FOR DESIGN

NZS3910:1998 / NZIA SCC1: 2000 / NBC-G1: 1998



4.2 CONTRACTOR RESPONSIBLE FOR DESIGN

FIDIC Conditions of Contract for Plant and Design-Build: 1999



## 5 Steel Construction Complexity Categories

Six categories of common building steel construction of varying complexity are identified below . Common steelwork components typically specified in each category are shown.

### 5.1 LOW RISE RESIDENTIAL HOUSING

Light beams and lintels <40 kg/m.  
Posts  
Fixing plates, HD bolts and attachments.  
Bracing portal frames.

### 5.2 FOUNDATION STRUCTURES

Bearing piles  
Sheet piles  
Soldier piles.

### 5.3 MULTI-LEVEL STRUCTURES

Beams  
Columns  
K and X-bracing  
Lift framing  
Floor decking systems  
Embedded items and HD bolt assemblies.

Trusses  
Architectural steelwork: Exposed for aesthetic  
Service penetrations  
Stairs and landings  
Cladding panel attachments

### 5.4 SINGLE LEVEL & ROOF STRUCTURES

Portal frames and rafters  
Gutter layouts and supports  
Doors, windows and lintels  
Overhead crane gantry girders  
Pre-cast panel attachments  
HD bolt assemblies.

Purlins, girts and bridging  
Light gauge X-bracing and fly bracing  
Roller shutter door assemblies  
HVAC support platforms  
Walkways

### 5.5 CANOPIES, CLADDING AND FEATURE STRUCTURES

Street front canopies  
Glazing and cladding components and attachments  
Pre-cast panel attachments and embedded items  
Specialist coatings.

### 5.6 INDUSTRIAL SUPPORT STRUCTURES

Beams  
K and X-brace  
Access ladders  
Composite flooring  
Crane fixings

Columns  
Walkways  
Steel plate and mesh decking  
Embedded items and attachments  
Machine plinth HD Bolts.

## 6 Contract Documentation Responsibilities

### 6.1 RESPONSIBILITIES OF THE PRINCIPAL'S REPRESENTATIVE

The Principal's Representative has roles defined in terms of the contract documents. The Principal's Representative is responsible for issuing contract documents and is the only person in terms of the contract who can issue clarifications or variations to the contract documents. The Principal's Representative is therefore the only person under the contract, to be fully responsible for the completeness and co-ordination of the Contract Drawings and Specifications.

A person accepting the role as Principal's Representative should therefore be competent in managing the process of contract documentation development, co-ordination and administration. The Principal's Representative has a fiduciary duty of care to both the Principal and the Contractor to facilitate the administration of the Contract. Therefore care should be taken to ensure that the reliability or completeness of Contract Documents issued is not misrepresented.

The Principal's Representative often relies on design consultants to prepare Drawings and Specifications for the Contract. The Principal's Representative should therefore ensure that the design consultants have adequate documentation quality assurance systems in place and that co-ordination between design consultants is satisfactorily completed before Drawings and Specifications are issued to the Contractor.

### 6.2 IDENTIFICATION OF DOCUMENTS

Steelwork drawings, specifications and addenda should be clearly and completely identifiable as a work package. Drawings should be numbered and dated for purposes of identification. All Drawings that need to be used to set out, measure quantities, detail and fabricate the structural steelwork need to be identified in a structural steelwork document schedule. These may include drawings prepared by the architect, the structural engineer and mechanical services engineer, among others.

Maintaining a common convention for the identification of drawing revisions assists in tracking down the current construction document. The preferred convention for numbering drawing revisions is to use numbers from 1 to x for pre-construction issue drawings. At, "For Construction", issue the revision number is then made, 0. Further revisions during construction should be identified with alphabetic characters, A, B,....

### 6.3 SUFFICIENCY OF DOCUMENTS

The Contract Documents are assumed to provide complete structural steel design drawings clearly defining the work to be performed and giving the size, section, material grade and the location of all members, connection types, floor levels, column centres and offsets, and camber of members. There should be sufficient dimensions or references to common project grids to convey accurately the quantity and nature of the structural steel to be furnished. Structural steel specifications should include any special requirements regulating the fabrication and erection of the structural steel.

### 6.4 LIMITATIONS OF TENDER DOCUMENTS

When it is required that a project be tendered using Documents that are sufficient for Tender purposes only, the Principal's Representative should clearly and completely identify the limitations of the Tender Documents.

Sufficient information should be provided covering the steelwork portion of the works, in the form of scope, drawings, section sizes, connection types, coatings, outline specifications, and other

descriptive data to enable the Contractor to assess the proposed Contract Works and prepare a knowledgeable bid. The Principal's Representative should make the Contractor aware of the limitations of the Tender Documentation and be able to identify the risks associated with the contract works that have not been fully defined.

## 6.5 DIMENSIONS

The set out and dimensioning of the structural skeleton of the building is one of the primary architectural design tasks. Responsibility for this important task is often shared by the architect with structural and building services engineering designers. The Principal's Representative should ensure that dimensioning responsibilities are clearly defined for their particular project. Typically the architectural consultant will locate grids, finished floor levels, slab penetrations and building envelope dimensions, within which the structural consultant sets out the structural elements. The building services consultant will then refer to both the architectural and the structural consultants drawings for setting out services. Co-ordination checks between the architect, structural and building services engineer prior to drawings being issued for construction is therefore essential to ensure that all dimensioning information is consistent.

The structural skeleton should be fully and clearly defined to ensure that the finished surfaces, features and amenities of the building can be properly accommodated. Accurate set out and dimensioning of the structural elements is also necessary to ensure that the strength and in-service performance of the structure is in accordance with the regulatory requirements of the Building Code and any special requirements of the Principal.

In cases of discrepancies or ambiguities, between the structural steelwork drawings and the architectural drawings or drawings for other trades, the Contractor shall assume that the structural steelwork drawings govern for the following information:

- Steel member sizes, grades, cambers and connection details.
- Set out of all main members in plan.
- Set out of all main members in elevation.
- Set out geometry for working points.

When issued "For Construction", the structural drawings are assumed to be complete and adequately accommodate the regulatory aspects of the design in terms of set out and structural performance. Once issued "For Construction", any changes to architectural or building services requirements should therefore be made to accommodate the structure, already authorised to be built. Where changes are made that have structural implications in terms of set out or structural performance then the structural drawings should be appropriately amended and reissued.

To ensure that the regulatory and performance aspects of the structural design are not compromised by other trades, it is recommended that any information or dimensions that may affect the regulatory and structural performance of the steelwork structure should be found on the structural steelwork drawings. Once these are issued "For Construction", the information found on the structural steelwork drawings should take precedence over information found on drawings of other trades.

In addition, construction of the Works described in the structural drawings will be commenced ahead of the installation of building services and architectural finishes. In many cases architectural detailing and specific building services equipment types may not be finalised before the structure is under construction. As a result, the issuing of structural steelwork drawings should be the focus of efforts to co-ordinate architectural and building services setting out information.

## 6.6 CO-ORDINATION OF DOCUMENTS

The Contractor is not responsible for ensuring that the Drawings are fully co-ordinated and without discrepancy.

The Principal's Representative should ensure that all information necessary for the construction of the structural steelwork is fully and correctly documented. Any conflicts between architectural, building services and structural drawings should be resolved prior to being issued "For Construction".

Where drawings other than the structural steelwork drawings are to be referred to by the Contractor for setting out the structural steelwork, these should be specifically identified within the structural steelwork drawings. If it is difficult and time consuming for the Contractor to find the relevant design and setting out information then there will inevitably be increased costs associated in constructing the steelwork.

Any portions of a drawing that have not been fully designed or co-ordinated by the Principal's Representative at the time of being issued "For Construction", should be clearly identified.

## 6.7 "FOR CONSTRUCTION" AUTHORISATION

The Contractor usually cannot proceed with the Contract Works, until the Drawings are released "For Construction". "For Construction" issue drawings are assumed to fully and clearly define the Contract Works without ambiguity. "For Construction" drawings and specifications are required by the Contractor for authority to order material, prepare shop and erection drawings and commence fabrication of the Contract Works.

## 6.8 DEVELOPMENT OF SHOP DRAWINGS

Structural steelwork shop drawings are often prepared in three stages. The first stage is to confirm quantities of steel sections and fittings so that an accurate order may be placed with suppliers. This involves setting an accurate wire frame model of the structure. The second stage involves detailing the connections between the members. The third stage is to detail any service penetrations that may be required.

Where the Principal's Representative wishes to fast track issuing of "For Construction" steelwork drawings and this has been communicated to the Contractor during the Tender process, it is possible to stage the "For Construction" issue into three successive stages. These are: Material Order, Connections and Services. The documents issued at each of these stages describe completed information that is not changed at the issue of drawings at each subsequent stage. Shop drawing preparation will be commenced at the issue of drawings for material order. However these will not typically be issued to the Principal's Representative for review until "For Construction" drawings have been issued confirming connection and services accommodation requirements.

### 6.8.1 For Construction: Material Order

Confirmed member sizes and setting out information in plan and elevation are required.

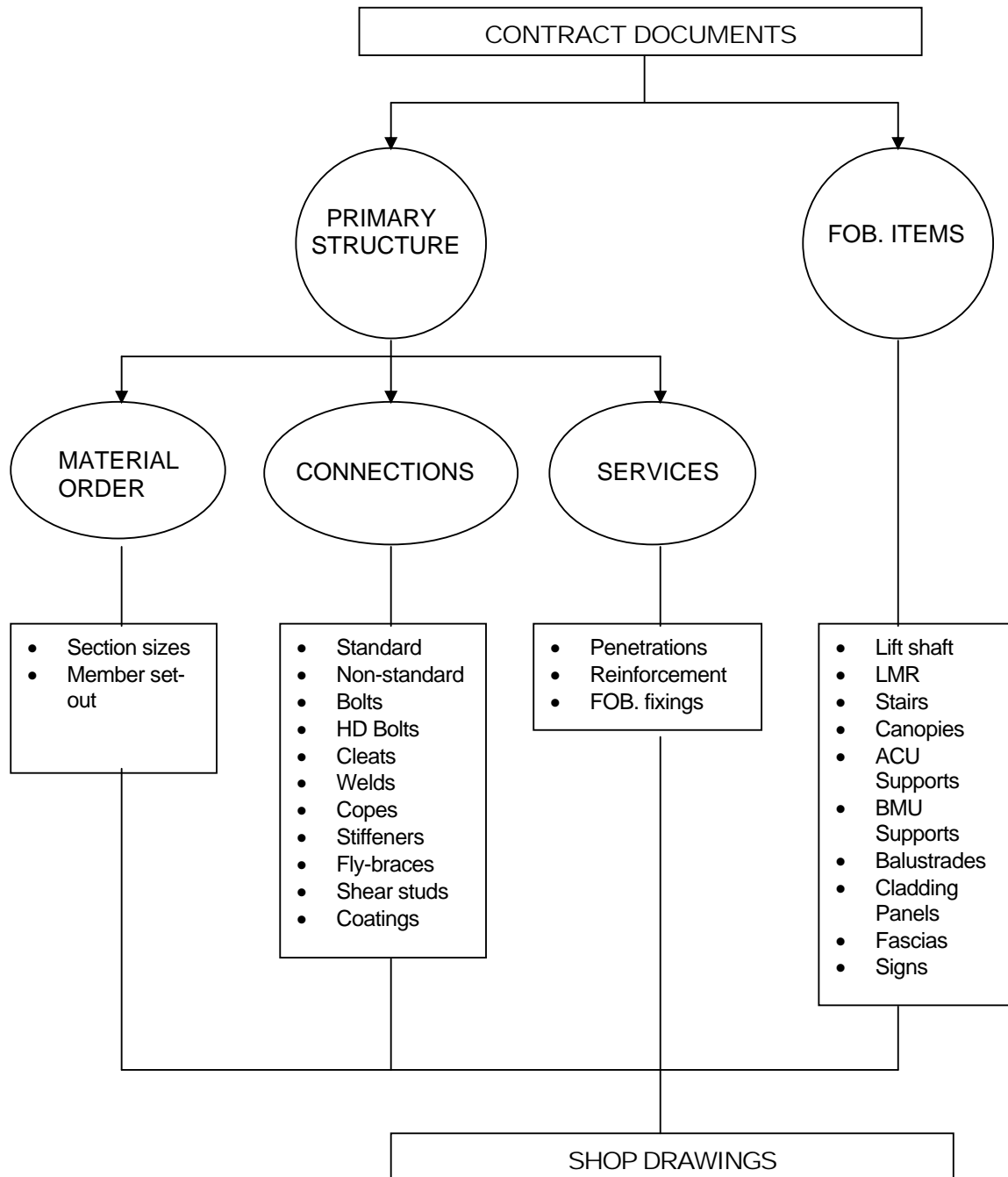
This allows a shop drawing wire frame model to be developed by the Contractor, setting out the steel members relative to grids and floor levels. From these drawings accurate steel section quantities can be determined and orders placed with steel stockists.

6.8.2 For Construction: Connections

Confirmed member to member connection details are required so that shop drawings can be progressed to near completion. Plate, bolts and welding quantities can then be determined and orders placed.

6.8.3 For Construction: Services

Confirmed attachments and penetrations necessary to accommodate building services such as sprinkler pipes, electrical cable trays, HVAC ductwork and architectural fittings.



## 6.9 DESIGN RESPONSIBILITY

The Principal's Representative should provide the Contractor with complete and accurate contract documents that give thorough information, allowing the Contractor to correctly interpret the design intent and to produce quality shop drawings.

When the Principal's Representative provides the design, drawings and specifications, the Contractor is not responsible for the suitability, adequacy or legality of the design.

## 6.10 RESPONSIBILITY FOR DIMENSIONS

The Principal's Representative should provide sufficient and accurate dimensioning information on the Drawings for the Contractor to be able to correctly set out the structural steelwork.

The Contractor requires Contract Drawings describing the structural steelwork that include: Base plate and Grid set-out drawing; Floor plans with member set-out relative to grid and top of steel; Elevations of bracing frames and connection detail drawings. This information may be provided on a combination of cross-referenced and co-ordinated architectural, structural and building services drawings. However the structural engineering drawings are the natural focus of structural steelwork information. This is because the structural design and drawings should meet the requirements of the architectural and building services design for the building as well as satisfy the structural performance requirements of the Principal and the regulatory authorities. Any information, including member specification and set out, that affects the structural performance of the structure, in terms of regulatory and design brief, should therefore normally be found on the structural drawings.

Once issued "For Construction", any changes made to the architectural and building services design that affects the structural steelwork should typically be made in conjunction with the structural engineering drawings. This is to ensure that structural performance is not compromised by the changes.

Contract Drawings describing the structural steelwork are typically prepared as A1 drawings. However the use of A4 drawings for all non-standard connection details can be an effective approach. This allows the details to be kept in an A4 file and minimises the need for re-issues of A1 connection drawings when only one detail on a sheet may be affected.

## 6.11 SHOP DRAWING INSPECTION / REVIEW

Shop drawings prepared by the Contractor do not form part of the Contract Documents and therefore their review or inspection should not be regarded as part of the Principal's Representative's contract documentation quality assurance process. The purpose of the inspection of shop drawings is similar to the purpose of any inspections or reviews done by the Principal's Representative, that is to assure the Principal's Representative that the Contractor has correctly interpreted the Contract Documents.

The Principal's Representative may issue Contract Documents prepared to a level of detail such that the Contractor decides not to prepare additional shop drawings. However the Principal's Representative is responsible for the completeness and accuracy of all such drawings provided.

When the Contractor prepares shop drawings, prints may be submitted to the Principal's Representative for review and release for fabrication, if specifically required by the Contract Documents. Typically the Contract Documents will give an allowance of seven, (7), calendar days in the schedule, for the Principal's Representative to return the shop drawings to the Contractor. Where possible this review time should be reduced so as to minimise material order and fabrication delays. Typically the dimensional set out of members and items calculated by the

detailer are not checked by the Principal's Representative. Inspection and review of shop drawings by the Principal's Representative does not in any way relieve the responsibility of the Contractor to correctly interpret the Contract Documents. As with other inspections performed by the Principal's Representative, only portions of the Works may be selected for detailed review, so as to provide adequate assurance of the Contractor's interpretation and compliance with the requirements of the Documents.

Return of shop drawings is typically noted with the Principal's Representative's release for fabrication to continue on the reviewed portion, release subject to corrections as noted, or request to correct and resubmit. The Contractor makes any corrections and furnishes corrected prints to the Principal's Representative. Where, following the review of the shop drawings, the Principal's Representative wishes to make changes to the steelwork Drawings or Specifications, then a Variation should be ordered in accordance with the terms of the contract and may be subject to a claim. Variations made at the shop drawing review stage are likely to have contract programme and cost implications for the Principal. Any Variation that compromises the Contractor's right and flexibility to determine the fabrication schedule necessary to meet the project's requirements, is likely to have cost and contract programme implications.

The role of the Detailer is to interpret the Contract Documents and prepare shop drawings for each item of steelwork suitable for construction tradespeople to fabricate and erect the items. The Contractor is not required to verify the accuracy of or co-ordinate Contract Drawings and Specifications. Where the Principal's Representative wishes to use a shop detailer to assist in co-ordination of Contract Drawings then the detailer should be engaged as part of the Principal's Representative's contract documentation development team.

Where the Principal's Representative wishes the Contractor to co-ordinate design and specification activities of Subcontractors to the Contract Documents this should be clearly stated in the Contract Documents.

Where the Contractor finds that Contract Drawings and Specifications are incomplete, contain errors or are inadequately co-ordinated with other trades work, then the Contractor shall issue a formal Request For Information, (RFI), to the Principal's Representative. Where the Principal's Representative confirms that the Drawings or Specifications are incomplete or in error, then the Contractor's costs associated with preparing the RFI shall be considered as extra work for which the Contractor is entitled to compensation.



## 7 Steelwork Contract Documentation: General Requirements

Completed Contract Drawings should include the following:

### 7.1 ALL STRUCTURAL STEELWORK DRAWINGS IDENTIFIED

All structural steel items should be clearly located and identified on the Principal's Representative's structural steelwork Drawings. Where architectural, mechanical or electrical drawings contain structural requirements, these should be co-ordinated with the structural engineer's drawings and clearly cross-referenced.

### 7.2 PRINTED AT SCALE DRAWN

The Drawings should be issued at the scale in which they are drawn. Additional copies at a reduced scale may be supplied to the Contractor upon request.

### 7.3 CAD and 3D MODELLING FILES

Provide clear direction as to the software type, accuracy and completeness of CAD and 3D modelling files for direct use for member placement and other detailing requirements of the steel constructors shop drawings. If CAD or 3D files are issued for use by the Contractor they should be accompanied by configuration information to allow correct printing of the documents.

The requirements and preparation of steelwork shop drawings and the associated manufacturing information system data required by steel constructors is a very important and specialist area not covered by this document. In order to ensure best productivity is achieved in the steel construction process It is strongly recommended that the steel constructor engaged by the Contractor manage the development of any structural steelwork shop drawings and associated 3-D modelling.

### 7.4 COORDINATION WITH MECHANICAL, ELECTRICAL & ARCHITECTURAL

The structural Drawings should be co-ordinated with architectural and mechanical requirements.

### 7.5 SPECIFICATIONS

The Specifications should be customised to the particular project and be in agreement with the Drawings. The Specification for the Fabrication and Erection of Structural Steelwork, HERA Report R4-99, is a recommended base specification.

### 7.6 STANDARD STEELWORK NOTES

Depending on the particular job these generally should cover the following:

- General
- Abbreviations
- Steelwork including: Weld classes and grades, structural bolts, holes, purlins, grouting under base plates, painting, inspection and any other specific requirements
- Drill-in fixings
- Attachment to masonry
- Attachment of timber
- Special construction sequences required.

## 7.7 DIMENSIONS

Show setting out dimensions for all project grids and floor levels.

Show setting out dimensions for all items of structural steelwork relative to project grids and floor level datums.

## 7.8 MATERIALS

Provide sizes and material grade of all members, beams, columns, and bolts, etc. Simplicity and repetition result in cost savings. Standardise the use of AS 3679 G300 steel sections, AS 3679.1 G250 steel flat bar and AS/NZS 3678 G250 steel plate.

State whether section types may be substituted with welded or other similar hot rolled sections.

Where non-standard welded beams are specified, ensure that the relevant flange and web plate dimensions are in conjunction with flange to web welding requirements.

Specify not infer, special requirements such as fracture critical material, Charpy V-notch testing, etc., on all required members and pieces.

## 7.9 BRACING FRAME AND MEMBER SEISMIC CATEGORY

The seismic category and structural type of steel bracing frames shall be identified in terms of the *New Zealand Steel Structures Standard, NZS3404:1997*. This is particularly where Specification clauses for material, weld quality and inspection requirements may refer to frame or member seismic category.

## 7.10 MEMBER ORIENTATION

Verify orientation of columns on each plan.

## 7.11 PRE-CAMBER

Is the camber information complete?

## 7.12 SHEAR STUDS

Identify the size, number and spacing of shear studs.

## 7.13 SPLICE LOCATIONS

Provide specific column, truss, and girder splice details. Identify zones over which splice locations may be located to accommodate fabricators preferred locations for transport and section stock lengths.

## 7.14 BASEPLATES AND CAST-IN PLATES / ITEMS

Complete base plate and holding down requirements including base plate elevations for all columns, type of levelling system, material grade, diameter, embedment, hole pattern and size of holes, plate orientation, weld requirements.

Complete cast-in plates / items and attached studs or welded reinforcing bar requirements, including level and location, material grade, plate orientation and weld requirements.

## 7.15 PASSIVE FIRE PROTECTION

Clearly indicate location, type, and limits of members requiring passive fire protection.

## 7.16 PROTECTIVE COATINGS

Special cleaning, passive fire protection, galvanising and painting systems (type, colour, exposed, etc.) and locations should be clearly located and identified on design drawings.

## 7.17 SPECIAL ERECTION REQUIREMENTS

Clearly specify any special erection requirements.

## 7.18 FOUNDATION PLAN

- Clear and complete gridline set out
- Location and orientation of all columns
- Necessary dimensional information relating columns to ground beams, insitu concrete piles, footings, etc
- RL to TOC (Top of concrete)
- H.D (Holding down) bolt detail including size, grade, embedment, bolting arrangement, corrosion protection and any other specific detail
- Base plate thickness, size and orientation, offset (if any), bleed holes if necessary
- Grouting details
- Weld requirements

## 7.19 TYPICAL FLOOR PLAN

Complete plan of structural steel for every level, checked for erectability and fully dimensioned including:

- Clear grid layout
- Member locations dimensioned from grids
- Section, size and orientation of every member (particularly for non-symmetrical sections: PFC, Angles)
- RL TOS (Top Of Steel)
- Precamber
- Designation for standard connections/splices and reference detail for specifically designed connections/splices. Where possible use Industry Standard ref. *Structural Steelwork Connection Guide SCNZ-15: 2006*
- Specific details of any services requirements showing location, dimensions and any other requirements
- All relevant details interfacing other trades eg. pipe and underfloor penetrations
- Concrete Floor: RL's, thickness, steps, rebates, slopes, special reinforcement, shear studs, voids to be trimmed, ponding allowance assumed, etc
- Timber Framing: Reference to details showing, connections, timber sizes, location relative to steel member, any cleats or holes, etc
- Any other specific items requiring coordination and setting out eg voids for stairs, lifts, concrete panels, spandrels, parapets, glazing, louvres, timber walls and bracing.

## 7.20 ROOF PLAN

Complete fully dimensioned plan showing all members, particularly rafters, ties, eave members, outriggers and any canopy framing, checked for erectability and dimensioned, including:

- Clear grid layout
- Where possible, members dimensioned from grids
- Accurate roof pitch
- Identify all ridge and/or valley lines and references to details

- Section, size and orientation every member (particularly for non-symmetrical sections- Purlins, PFCs, Angles)
- Purlin span details eg. simple, double, lapped and lap length
- No. of rows and types of bridging
- If applicable- Type and location of roof bracing and reference to connection details of same
- If applicable- Type and location of fly bracing and reference to connection details of same
- Type of purlin trimmers
- Dimensions from grids and any other relevant information relating to any openings eg skylights, access ladders, fans, walkways, etc
- All relevant details interfacing other trades eg Timber Framing for Gutters and soffits: Reference to details showing, connections, timber sizes, location relative to steel member, any cleats or holes, etc.
- Location and size of box gutters and supports
- Reference to any other sections or details required for further information.
- 

## 7.21 ELEVATIONS

Complete fully dimensioned elevation showing all members particularly “between floor” members such as stair supports, lift shaft steel, trusses, K-braces, hangers etc and all connections. Information on drawings should include:

- Clear grid layout
- Member locations dimensioned from grids
- Floor levels (RL's)
- Top of steel (TOS) that is not noted on plans
- Type of wall bracing and reference to connection details of same
- Dimensions from grids and any other relevant information relating to any door and/or window openings
- If applicable- Girt type, size, spacing and any other dimensional information required to place them on walls
- If applicable- roof slope, Apex RL, required purlin spacing
- All connections not shown on plans

## 7.22 CONNECTIONS

In the preparation of Contract Drawings, the Principal's Representative has two basic choices in the showing of connection details.

The Principal's Representative may specify standard connections from the *Structural Steelwork Connections Guide, SCNZ-15: 2006*. All the connections and connection types should be identified by the full description e.g. WP-70-NC, WP-30-SWC, BPP-80. All requirements for bracing details, stiffeners, doubler plates, web or cope reinforcement or similar items necessary for the completeness of the design should be sized and shown in complete detail.

The Principal's Representative may fully design and detail connections for all conditions and in this case the Principal's Representative has the obligation to show all fastener sizes, arrangement, quantities, grades and specify all connection material and weld types, sizes and lengths for each individual member or part to be joined. All requirements for bracing details, stiffeners, doubler plates, web or cope reinforcement or similar items necessary for the completeness of the design should be sized and shown in complete detail.

The Contractor may suggest alternative details to some connections based on their subcontractor's most efficient shop and erection processes. However, such changes should be forwarded to the Principal's Representative for review and approval.

In all cases, the release of the shop drawings by the Principal's Representative constitutes acceptance by the Principal's Representative of design responsibility for the structural adequacy of the connections shown on the shop drawings. Where design responsibility of some aspects of

the contract works is to be allocated to the Contractor this should be clearly stated in the Contract Documents.

Designation for standard connections/splices from *Structural Steelwork Connection Guide SCNZ - 15: 2006* should be shown on plans and elevations. Details relating to any specifically designed connections/splices should include:

- Bolt size and grade
- Number, gauge and spacing of bolts
- Plate thicknesses
- Stiffener requirements
- Weld details including category and inspection requirements
- Copes
- Packer plates
- Connection details of any other members not shown on plans or elevations eg bracing elements, purlins, girts, etc
- Any relevant details interfacing other trades not shown on plans or elevations
- Precast concrete panels or stairs: Fixing details.



## 8 Preliminary Steelwork Documentation: General Requirements

### 8.1 GENERAL

During the development of a project design, prior to building contract documentation being initiated, many options are considered by the Principal and his or her design and cost consultants. Preliminary design documents are often prepared for the purposes of quantifying a design and assessing its cost. In this case, where incomplete drawings and specifications are to be used for preliminary pricing, the following are some recommendations for preliminary documentation that will allow realistic preliminary pricing information to be prepared for structural steelwork. The documents prepared will also be in a position to be readily upgraded to Contract Documentation status with the minimum amount of effort.

Drawings and Specifications for preliminary pricing should include the following:

### 8.2 SCOPE OF PRELIMINARY STRUCTURAL STEELWORK DOCUMENTS IDENTIFIED

All structural steel items should be clearly located and identified on the preliminary structural steelwork Drawings. Exclusions should be clearly stated, such as stairs, handrails, embedded items, etc. The purpose of the preliminary drawing should be identified, ie. option selection purposes.

### 8.3 SPECIFICATION CLAUSES ON DRAWINGS

All specification clauses that may be expected to affect pricing should be noted on the preliminary drawings. eg. propping, precambering, surface treatment.

### 8.4 DIMENSIONS

Draw to scale and allow scaling for materials quantity measurement. Otherwise show setting out dimensions for all project grids, floor levels, all items of structural steelwork relative to project grids and floor level datums.

### 8.5 MATERIALS REQUIRED

Provide sizes and material grade of all members, beams, columns, and bolts, etc. Standardise the use of *AS 3679 G300 steel sections, AS3679.1 G250 steel flat bar and AS/NZS 3678 G250 steel plate*. Identify where special grades of steel are required, such as L0 and L15 steels. State whether section types may be substituted with welded or other similar hot rolled sections.

### 8.6 MATERIALS & WELD TESTING

Specify, not infer, special requirements such as through-thickness, Charpy V-notch and radiography / ultrasound weld testing, etc., on all required members and pieces.

### 8.7 BRACING FRAME SEISMIC CATEGORY

Identify the primary method of providing seismic lateral bracing to the structure. The seismic category and structural type of steel bracing frames should be identified in terms of the *New Zealand Steel Structures Standard, NZS3404:1997*.

## 8.8 PRE-CAMBER

Are the members requiring precamber identified?

## 8.9 SHEAR STUDS

Identify the diameter, typical welded height and number of shear studs per member or average spacing of shear studs.

## 8.10 CONNECTIONS & BASEPLATES

As structural steel fabrication is primarily involved with handling, cutting and joining steel members, it is important that the extent of connection work required is identified so that an accurate estimate of fabrication time and cost may be made. Indication of the intended connection type and relevant design load ratios significantly help estimators quantify that cost. A statement such as, "All secondary beam connections to be WP30, all primary beam to column connections to be FE 50, unless noted otherwise....", may cover much of the steelwork.

Standard details should preferably reference *Structural Steelwork Connection Guide SCNZ-15: 2006*. Non-standard details should be identified at least with the following identification system. Preferably use this identification system in conjunction with sketch details showing the typical arrangement of the connection. *Manual of Standard Connection Details for Structural Steelwork HERA Report R4-58*, has over 55 different connection configuration sketches that can be referenced or pasted into preliminary Drawings and Specifications. These are available as a CAD library.

### 8.10.1 Fixing System :

Identification should include the predominant fixing system of the member to the frame, eg. welding (W) or bolting (B).

### 8.10.2 Design Action Type :

The significant design action types that the connection should transfer should be identified, eg. tension (T), compression (C), moment (M) and shear (S).

For example a non-standard welded connection transferring tension moment and shear would be designated W-T/M/S. A bolted connection transferring moment and shear would be designated, B-M/S.

The connection details may then be fully developed, by the Principal's Representative, to coincide with the tendering process and commencement of detailing to ensure the detailing and fabricating processes will not be delayed. In addition, the Principal's Representative should consult with the Contractor regarding preferred practices for fabrication and erection. A pre-detailing meeting between the Principal's Representative and the Contractor may be appropriate to facilitate this exchange of information. In the event that design loads or other information necessary for selection of standard connections is not shown on the contract documents, this information should be furnished to the Contractor in a timely manner.

## 8.11 SPLICE LOCATIONS

Identify expected splice locations. Advise whether Contractor can adjust splice locations for standard section supply lengths.

#### 8.12 EMBEDDED ITEMS AND EDGE TRIMMERS

Identify embedded items and decking trimmers to concrete walls.

#### 8.13 MECHANICAL , ELECTRICAL PENETRATIONS & ARCHITECTURAL FIXINGS

Identify if penetrations to beams or additional fittings for architectural claddings are likely to be required.

#### 8.14 PASSIVE FIRE PROTECTION

Clearly indicate location, type, and limits of members requiring passive fire protection.

#### 8.15 PROTECTIVE COATINGS

Special cleaning, passive fire protection, galvanising and painting systems (type, colour, exposed, etc.) and locations should be clearly located and identified on design drawings.

#### 8.16 SPECIAL ERECTION REQUIREMENTS

Clearly specify any special erection requirements.

#### 8.17 TEMPORARY BRACING REQUIREMENTS

Temporary bracing requirements should be considered as part of the overall construction methodology. Consideration should be given as to how the structure will react in an unbraced state.



# 9 Documentation Contacts List

**DESIGN CONTACTS LIST** Page 1

Project Name: \_\_\_\_\_  
 Site Address: \_\_\_\_\_



*Details of the parties involved in the design of this project are as follows:*

	<u>Company</u>	<u>Contact Person</u>	<u>Phone</u>	<u>Fax</u>	<u>Email</u>
1	Structural				
2	Architect				
3	HVAC				
4	Mechanical				
5	Electrical				
6	Civil				
7	Sprinkler				
8	Main Contractor				
9	Steel Constructor				

Company: \_\_\_\_\_  
 Address: \_\_\_\_\_



# 10 Documentation Responsibility Checklist

## DOCUMENTATION RESPONSIBILITY CHECKLIST

This checklist identifies the agreed responsibilities for the design and documentation of all items of structural steelwork within this project.



Company:

Address:

### 1 GENERAL NOTES AND SPECIFICATIONS

Project:

Date:

### 2 PLANS

Item	Description	Responsibility	Date
1.1	Material grades specified for all structural items	Struct.	
1.2	Bolts completely specified (grade, installation, procedures)	Struct.	
1.3	Welding completely specified (weld type, grade, quality, sizes)	Struct.	
1.4	Oversize hole criteria given for the typical connection holes	Struct.	
1.5	Oversize hole criteria given for the anchor bolt/base plate holes	Struct.	
1.6	Paint, galvanising and metal spray requirements specified	Struct.	
1.7	Paint and no-paint areas completely specified.	Struct.	
1.8	Galvanized and metal spray areas completely specified.	Struct.	
1.9	Drill in or masonry anchors specified.	Struct.	
1.10	Standard notes complete.	Struct.	
1.11	Shop drawing review procedures specified.	Struct.	
1.12	All material, fabrication and coating inspection and testing requirements specified.	Struct.	
1.13	All fabrication and erection tolerances specified.	Struct.	
1.14	All special construction procedures and sequences specified.	Struct.	
1.15	Passive fire protection requirements noted	Struct.	
1.16	Member seismic categories specified for elements of lateral load resisting systems	Struct.	
1.17	Fixings to timber elements specified	Struct.	
1.18	Other(Specify)	Struct.	

Item	Description	Responsibility	Date
2.1	All grids defined and dimensioned.	Architect	
2.2	All member sizes and orientations specified.	Struct.	
2.3	Plan location and orientation of each column specified.	Struct.	
2.4	Specific location of each beam dimensioned.	Struct.	
2.5	Sufficient reference dimensions given in non-rectangular areas.	Struct.	
2.6	Beams requiring pre-cambering clearly identified.	Struct.	
2.7	Shear studs specified.	Struct.	
2.8	Details provided for any other special reinforcing plates to be included.	Struct.	
2.9	The purlin span details provided. e.g. single, double, lapped and lap length.	Struct.	
2.10	Roof purlin bridging, fly bracing and light cross bracing clearly specified and located.	Struct.	
2.11	Specific dimensions provided for trimming out openings for other trades. e.g. Air conditions ducts, Stair/lift voids	Struct.	
2.12	Gutter slopes and fall directions clearly identified.	Struct.	
2.13	All relevant steelwork plans, elevations and connection drawings and Electrical, HVAC, Mechanical and Architectural Drawings referenced and co-ordinated.	Struct.	
2.14	Standard connection specified (eg. WP30 NC)	Struct.	
2.15	Correct detail referencing	Struct.	
2.16	Other(Specify)		

# DOCUMENTATION RESPONSIBILITY CHECKLIST

This checklist identifies the agreed responsibilities for the design and documentation of all items of structural steelwork within this project.

Company:  
Address:

## 3 ELEVATIONS AND SECTIONS

Project:  
Date:

Item	Description	Responsibility	Date
3.1	All grids defined and dimensioned.	Architect	
3.2	All member sizes and orientations specified.	Struct.	
3.3	All RL's of bottom of base plates shown.	Struct.	
3.4	All top of steel RL's (TOS) given.	Struct.	
3.5	All column, rafter and beam splice locations given.	Struct.	
3.6	"Between floor" member locations specifically dimensioned.	Struct.	
3.7	Sufficient reference dimensions given in sloping areas.	Struct.	
3.8	Specific dimensions provided for trimming out openings for other trades. e.g Window/door openings	Struct.	
3.9	Girts, hangers, fly braces and cross-bracing specifically dimensioned and located.	Struct.	
3.10	Supports for door opening machinery coordinated with door supplier.	Struct.	
3.11	Standard connections fully specified (eg. WP30 NC).	Struct.	
3.12	Correct detail referencing	Struct.	
3.13	Other(Specify)	Struct.	

## 4 CONNECTIONS

Item	Description	Responsibility	Date
4.1	Columns		
4.1.1	All base plates and hold down bolt connections designed, specified and sufficiently dimensioned.	Struct.	
4.1.2	Grout thickness sufficient to contain the jacking nuts.	Struct.	
4.1.3	The bottom ends of the hold down bolts sufficiently contained within the footings and sufficiently dimensioned.	Struct.	
4.1.4	Top ends of the hold down bolts sufficiently covered with the finish floor and sufficiently dimensioned.	Struct.	
4.1.5	All other construction items such as rebar unaffected by the hold down installation.	Struct.	
4.1.6	The hold down bolt patterns sufficiently contained within the footings and sufficiently dimensioned.	Struct.	
4.1.7	If the hold down bolts are detailed without special fabrication and erection approaches, i.e. within the allowances of Section 14 NZS 3404, will "plumb and level" of the structural frame be routine.	Struct.	
4.1.8	Column to column splice details and locations specified	Struct.	
4.1.9	If required, column caps specified	Struct.	
4.1.10	Other(Specify)	Struct.	
4.2	Beams		
4.2.1	Other cast-in or site drilled connections designed, specified and sufficiently dimensioned.	Struct.	
4.2.2	Cast-in's sufficiently contained in the walls and/or floor slabs.	Struct.	
4.2.3	All other construction items, such as rebar, unaffected by the cast-in or site drilled connection installation.	Struct.	
4.2.4	Beams to cast-ins or drilled on-site connections	Struct.	

**DOCUMENTATION RESPONSIBILITY CHECKLIST**

This checklist identifies the agreed responsibilities for the design and documentation of all items of structural steelwork within this project.

Company:  
Address:



**4 CONNECTIONS continued**

Item	Description	Responsibility	Date
4.2	Beams continued		
4.2.5	Beam to beam one-sided	Struct.	
4.2.6	Beam to beam two-sided	Struct.	
4.2.7	Beam to beam splice	Struct.	
4.3	Beam to Column		
4.3.1	Non-moment beam to column flange	Struct.	
4.3.2	Non-moment beam to column web	Struct.	
4.3.3	Moment beam to column flange	Struct.	
4.3.4	Moment beam to column web	Struct.	
4.3.5	Beam on supporting column	Struct.	
4.3.6	Column supporting beam	Struct.	
4.3.7	Other(Specify)	Struct.	
4.4	Bracing to beams or columns	Struct.	
4.5	Connections for FOB items	Struct.	

**5 STAIRS**

Item	Description	Responsibility	Date
5.1	All relevant grids defined and dimensioned.	Architect	
5.2	All member sizes and orientations specified.	Struct.	
5.3	Specific dimensioning given to locate the stairs in relation to the main structure.	Struct.	
5.4	All RL's of bottom of base plates shown.	Struct.	
5.5	All top of steel RL's (TOS) given and set downs noted.	Struct.	
5.6	All column splice elevations given.	Struct.	
5.7	"Between floor" members specifically dimensioned.	Struct.	
5.8	Sufficient reference dimensions given in sloping areas.	Struct.	
5.9	Cast-in fixings to concrete work coordinated with concrete drawings.	Struct.	
5.10	All relevant steelwork plans, elevations and connection Drawings and Architectural Drawings referenced and coordinated.	Struct.	
5.11	Connections fully specified	Struct.	
5.12	Correct detail referencing	Struct.	
5.13	Other(Specify)	Struct.	

**DOCUMENTATION RESPONSIBILITY CHECKLIST**

This checklist identifies the agreed responsibilities for the design and documentation of all items of structural steelwork within this project.

Company:

Address:

**6 LIFT FRAMING**

Project:

Date:

Item	Description	Responsibility	Date
6.1	All relevant grids defined and dimensioned.	Architect	
6.2	All member sizes and orientations specified.	Struct.	
6.3	Specific dimensions given to locate lift framing in relation to main structure.	Struct.	
6.4	All RL's of bottom of base plates shown.	Struct.	
6.5	All top of steel RL's (TOS) given and set downs noted.	Struct.	
6.6	All column splice elevations given.	Struct.	
6.7	"Between floor" members specifically dimensioned.	Struct.	
6.8	All relevant steelwork plans, elevations and connection Drawings and Electrical, Mechanical and Architectural Drawings referenced and coordinated.	Struct.	
6.9	Connections fully detailed	Struct.	
6.10	Correct details referencing	Struct.	
6.11	Other(Specify)	Struct.	

**7 WALKWAYS AND ACCESS LADDERS**

Item	Description	Responsibility	Date
7.1	All relevant grids defined and dimensioned.	Architect	
7.2	All member sizes and orientations specified.	Struct.	
7.3	Specific dimensioning given to locate all framing in relation to the main structure.	Struct.	
7.4	All RL's of bottom of base plates shown.	Struct.	
7.5	All top of steel RL's (TOS) given and set downs noted.	Struct.	
7.6	All member splices located.	Struct.	
7.7	"Between floor" members specifically dimensioned.	Struct.	
7.8	Hand and guard-rails specified and set out dimensions given.	Struct.	
7.9	Foot tread plate, foot mesh, ladder rungs and fixings specified and set out.	Struct.	
7.10	All relevant steelwork plans, elevations and connection Drawings and Electrical, HVAC, Sprinkler and Architectural Drawings referenced and co-ordinated.	Struct.	
7.11	Connections fully detailed	Struct.	
7.12	Correct detail referencing	Struct.	
7.13	Other(Specify)	Struct.	



**DOCUMENTATION RESPONSIBILITY CHECKLIST** Page 6

This checklist identifies the agreed responsibilities for the design and documentation of all items of structural steelwork within this project.



Company:

Address:

**10 CLADDING SYSTEMS**

Project:

Date:

Item	Description	Responsibility	Date
10.1	All relevant grids defined and dimensioned.	Architect	
10.2	All member sizes and orientations specified.	Struct.	
10.3	Specific dimensioning given to locate any framing for cladding panels in relation to the main structure.	Struct.	
10.4	All top of steel RL's (TOS) given and set downs noted.	Struct.	
10.5	"Between floor" members specifically dimensioned.	Struct.	
10.6	Relevant steelwork plans, elevations and connection Drawings, Architectural Drawings and any other proprietary drawings referenced and co-ordinated.	Struct.	
10.7	Connections fully detailed	Struct.	
10.8	Correct detail referencing	Struct.	
10.9	Other (Specify)	Struct.	

# 11 Structural Steelwork Drawings List



## Structural Steelwork Drawings List

List drawing numbers of all drawings necessary to prepare shop drawings, order materials, fabricate, coat and erect steelwork required as part of the contract works.

Project: \_\_\_\_\_ Date: \_\_\_\_\_ Company: \_\_\_\_\_ Address: \_\_\_\_\_

Drawing Category	Drawing Title	Drawing No.	Due date	Other Referenced Drawings										
				Architect	HVAC	Mechanical	Electrical	Civil	Sprinkler	Main Contractor	Other			
1	General Notes and Specifications													
2														
3														
4	Plans													
5														
6														
7														
8	Elevations and Sections													
9														
10														
11														
12														
13	Connections													
14														
15														
16														
17	Stairs													
18														
19														
20														
21														
22														
23	Lift Framing													
24														
25														
26														
27														
28	Walkways and Access Ladders													
29														
30														
31														
32	Overhead Crane Runway Girders													
33														
34														
35														
36	HVAC / Sprinkler / Electrical Supports													
37														
38														
39														
40	Cladding Systems													
41														
42														
43														
44														
45														
46														
47														
48														









**STEELWORK DRAWING COMPLETION CHECKLIST**



Project Name: \_\_\_\_\_ Company: \_\_\_\_\_  
 Address: \_\_\_\_\_

Drawing Type \_\_\_\_\_ Drawing Number: \_\_\_\_\_ Revision \_\_\_\_\_  
 Drawing Title \_\_\_\_\_ Issue Purpose \_\_\_\_\_ Issue Date \_\_\_\_\_

Issuing Company \_\_\_\_\_ Contact \_\_\_\_\_ Phone \_\_\_\_\_

Other Non-Steelwork Drawings Referenced \_\_\_\_\_  
 Drawing \_\_\_\_\_ Consultant \_\_\_\_\_ Aspect Governed \_\_\_\_\_  
 Architect \_\_\_\_\_ Civil \_\_\_\_\_  
 HVAC \_\_\_\_\_ Sprinkler \_\_\_\_\_  
 Mechanical \_\_\_\_\_ Main Contractor \_\_\_\_\_  
 Electrical \_\_\_\_\_ Other \_\_\_\_\_

Item	Description	Aspect Governed	Consultant	Drawing	Aspect Governed	Issue Category	Completion Checked	Comments
4.1	Columns							
4.1.1	All base plates and hold down bolt connections designed, specified and sufficiently dimensioned.		*			M		
4.1.2	Grout thickness sufficient to contain the jacking nuts.					M		
4.1.3	The bottom ends of the hold down bolts sufficiently contained within the footings and sufficiently dimensioned.					M		
4.1.4	Top ends of the hold down bolts sufficiently covered with the finish floor and sufficiently dimensioned.					M		
4.1.5	All other construction items such as rebar unaffected by the hold down installation.					M		
4.1.6	The hold down bolt patterns sufficiently contained within the footings and sufficiently dimensioned.					M		
4.1.7	If the hold down bolts are detailed without special fabrication and erection approaches, i.e. within the allowances of Section 14 NZS 3404, will "plumb and					C		
4.1.8	Column to column splice details and locations					C		
4.1.9	If required, column caps specified					C		
4.2	Beams							
4.2.1	Other cast-in or site drilled connections designed, specified and sufficiently dimensioned.		*			C		
4.2.2	Cast-in's sufficiently contained in the walls and/or floor slabs.					C		
4.2.3	All other construction items, such as rebar, unaffected by the cast-in or site drilled connection installation.					C		
4.2.4	Beams to cast-ins or drilled on-site connections		*			C		
4.2.5	Beam to beam one-sided		*			C		
4.2.6	Beam to beam two-sided		*			C		
4.2.7	Beam to beam splice		*			C		
4.3	Beam to Column		*					
4.3.1	Non-moment beam to column flange		*			C		
4.3.2	Non-moment beam to column web		*			C		
4.3.3	Moment beam to column flange		*			C		
4.3.4	Moment beam to column web		*			C		
4.3.5	Beam to supporting column		*			C		
4.3.6	Column supporting beam		*			C		
4.4	Bracing to beams or Columns		*			C		
4.5	Connections for FOB items		*			C		
4.6	Other (specify)					C		

Note: For Material Order Issue, all category M items must be checked; For Construction Issue, all category M and C items must be checked.

\* Refer SCNZ-12 SteelDoc for minimum detailing information required.













## 13 SteelDoc Documentation Checklist Software

### 13.1 Introduction

STEELDOC is a Microsoft Windows based application developed with Microsoft Visual Basic 6.0 and Excel. The program has been developed to help streamline office quality control by quickly preparing checklists for each structural steelwork drawing in an easy to use format.

In addition to assisting in the process of ensuring completeness of drawings, the program also helps facilitates the coordination of all of the contract documentation that relate to the steelwork component of the project.

The program has been based around the commonly accepted practice of categorizing steelwork drawings in the following manner:

- **Primary Structure** (Floor structure, bracing elements, wall and roof structural elements)
  1. General notes and specifications
  2. Plans
  3. Elevations
  4. Connections
- **Free On Board Items** (canopies, stairs, lift assemblies, walkways, ladders, HVAC plant supports, gantry girders)

Provided the drawing set is prepared on this manner, a check list appropriate for each structural drawing will be prepared. The program will generate checklists for up to 100 drawings.

The file should be run on an IBM PC or compatible using Microsoft Windows XP and Excel XP or later versions.

### 13.2 Installation

Create a folder on the local drive of the users computer (e.g. C:\STEELDOC)  
Copy "SteelDoc.xls" into the SteelDoc folder. The program cannot be run directly from the CD Rom.

### 13.3 Input and Output Procedures

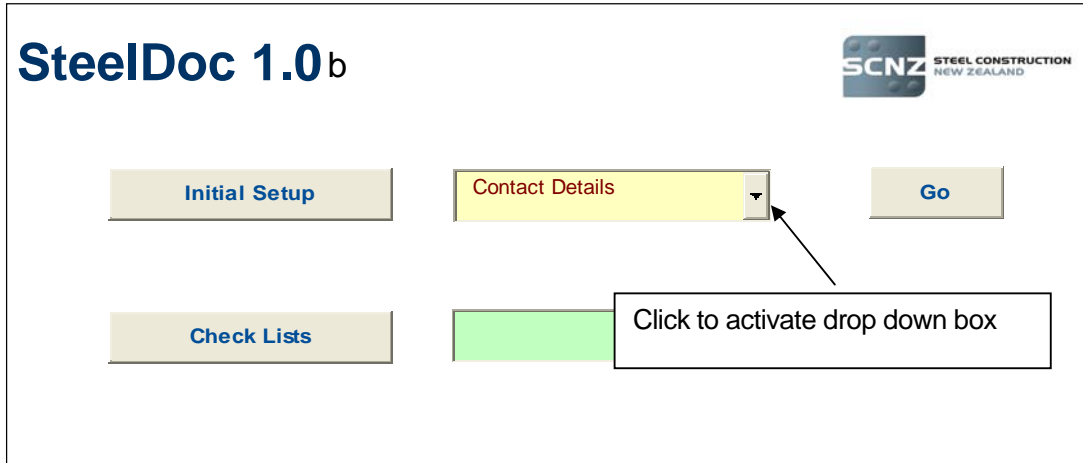
The various pages of the program are accessed from a single menu, see figure 1. To make the program easy to navigate the inputting functions have been separated into initial setup information and the checklists.

Each sheet of the program may be printed by clicking the print button on the spreadsheet tool bar.

#### 13.3.1 Step 1: Initial Setup – Design Consultants Contact Details Selection

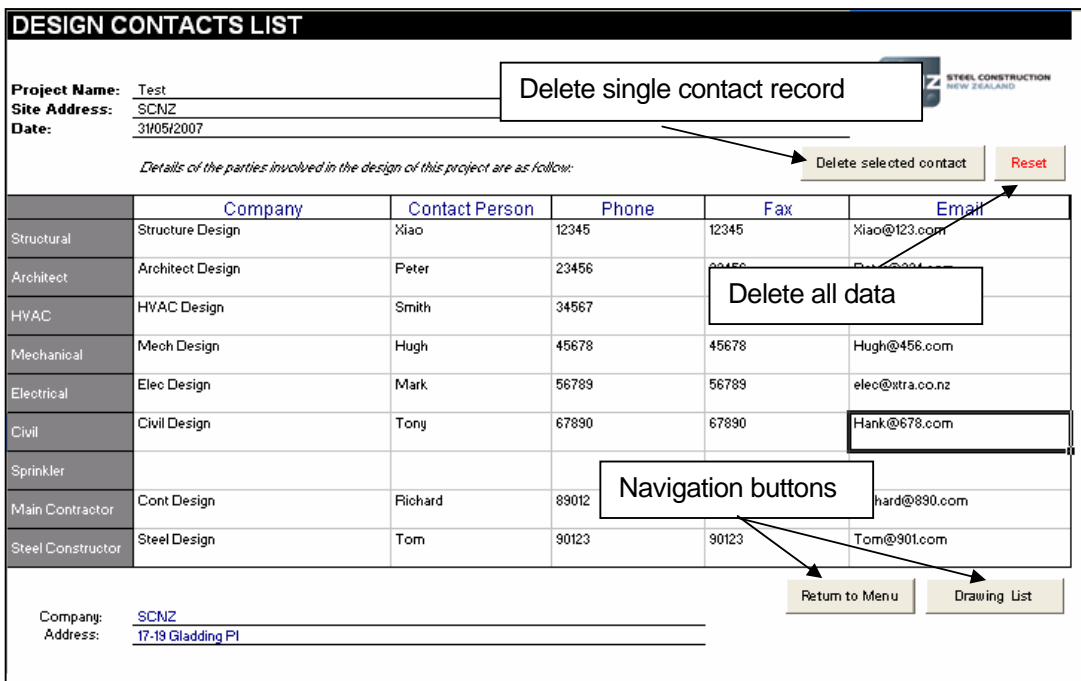
Select the initial setup box. A second box will appear to the right of the first. Click on the drop down box button. The user will be given the choice of three page options. Select **Contact Details** and then click the **Go** button, refer figure 1.

The project details, including contact details can be inputted into the programme by clicking on the appropriate cell and typing in the required information. Data from other Excel spreadsheets may also be input using the **Copy** and **Paste Special** functions or **control q**. When the Contact List sheet is opened a pop up box will remind users of the correct paste procedure to avoid formatting problems.



**Figure 1 Main menu - navigation features**

Information in the sheet may be amended by clicking on the required cell and using standard Excel spreadsheet editing procedures



**Figure 2 Contact List Page**

The user may either clear data one row at a time by clicking on any cell in the required row and selecting the **Delete selected contact** button or by using the **Reset** button to clear all the contact information, see figure 2. A pop up box will appear following activation of the **Reset** button to allow users the chance to confirm their intention to delete all contact details.

There is no requirement to save inputted data prior to exiting the page. To return to the main menu click the **Return to Menu** button located at the bottom of the page, see figure 2.

Alternatively the **Drawing List** page can be accessed by clicking the appropriate box at the bottom of the page, refer figure 2.

### 13.3.2 Step 2: Initial Setup – Contract Drawing List Selection

The contract drawing list page may be accessed either by activating the initial setup information button and selecting the drawing list option from the drop down box as per step 1 or from one of the other two initial setup information pages (Design Consultant's Contact List and Design Consultants Task Checklist). The minimum information required for SteelDoc is the structural drawing list with drawings categorized as previously discussed in the introduction section. To allow relevant information from other documents to be easily found for coordination and checking purposes, it is recommended that the appropriate other referenced documents boxes be filled in, see figure 3

The project details will automatically appear on the page if the Design Consultant Contacts List sheet has been completed. The user may add the date by clicking on the appropriate cell and typing the required information.

Drawing Category	Drawing Title	Drawing No.	Due date	Architect	HVAC	Mechanical
1 Plans	Foundation Plan	S1	8/05/2007			
2 Plans	Level 1 Floor Plan					
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

Figure 3 Contact drawing list page

Data entry can either be by clicking on the appropriate cell and typing the required information or by copying and pasting columns of data from other spreadsheets. If data is inputted from other spreadsheets it should be done so as single columns rather than as blocks. To avoid formatting problems, data should be pasted using either **control q** or the **paste special** function. The user must nominate for each drawing the appropriate drawing category. The drawing category box is activated by clicking on the right hand side of the drawing category cell.

To remove a single drawing entry, click on any cell on the line to be removed and select the **Delete selected drawing** button located on the top left hand side of the screen. To clear all data from the contract drawing list page, activate the **Reset** button also located on the top left hand side of the screen. To avoid erroneously deleting all the data, the program asks the user to confirm their intention to reset the page.

To edit data, click on the required cell and retype the correct data. To close line gaps caused by using the **Delete selected line** button or to rearrange the order of the drawing list, the copy and **control q** or **paste special** functions can be used. If during the course of editing information the

screen formatting is lost, it can be restored by using the reset function. The user should note that using this function will in addition to restoring lost formatting also remove all data from the page.

To save data, click on the **Update** button located top left side of the screen before exiting the screen.

The user can either return to the previous page by activating the **Contact List** button located at the top right hand side of the sheet or move to the next initial setup page via the **Task Checklist** button. A final option is to return to the main menu page via the **Return to Menu** button, see figure 3.

### 13.3.3 Step 3: Initial Setup – Design Consultant Task Checklist Selection

The Task Allocation page can be accessed from either the Menu page as per step 1 or the Drawing List page.

The tasks listed itemize all the information required to be included in the structural steelwork design documentation. The majority of the information required will be provided by the Structural Engineer. In recognition of this fact, most of the tasks are allocated by default to the Structural Engineer. To reset to this default position, click the **Reset** button located at the top and bottom of the page, refer figure 4. However, there are tasks that will be the responsibility of other members of the design team ie specifying coating systems or coordinating drawings. To ensure tasks do not fall through the cracks so to speak, the Principal Consultant can use this page as a tool to ensure that all the tasks have been allocated to the design team and that everyone is aware of their responsibilities in this regard.

DESIGN CONSULTANT TASK CHECKLIST				Page 1			
The intent of this checklist is to identify all items that affect the Structural Steel elements within this project.							
Company: <a href="#">SCNZ</a> Address: <a href="#">17-19 Gladding Place, Manukau City</a>							
<b>1 GENERAL NOTES AND SPECIFICATIONS</b>				<b>2 PLANS</b>			
Project: Warehouse and Office				<div style="text-align: right;"> <span>Drawing List</span> <span>Reset</span> <span>Return to Menu</span> </div>			
Date: 1/01/2007							
Item	Description	Responsibility	Date	Item	Description	Responsibility	Date
1.1	Material grades specified for all structural items	Struct.		2.1	All grids defined and dimensioned.	Struct.	
1.2	Bolts completely specified (grade, installation, procedures)	Struct.		2.2	All member sizes and orientations specified.	Struct.	
1.3	Welding completely specified (weld type, grade, quality, sizes)	Struct.		2.3	Plan local specified	Struct.	
1.4	Oversize hold criteria given for the typical connection holes.	Struct.		2.4	Specific location of each beam dimensioned.	Struct.	
1.5	Oversize hole criteria given for the anchor bolt/base plate holes.	Struct.		2.5	Sufficient reference dimensions given in non-	Struct.	
1.6	Paint, galvanising and metal spray requirements specified.	Struct. Architect HVAC Mechanical Electrical Civil Main Contractor Other		2.6		Struct.	
1.7	Paint and no-paint areas completely specified.			2.7		Struct.	
1.8	Galvanized and metal spray areas completely specified.			2.8	Details provided for any other special reinforcing plates to be included.	Struct.	
1.9	Drill in or masonry anchors specified.	Struct.		2.9	The purlin span details provided. e.g. single, double, lapped and lap length.	Struct.	

**Figure 4 Consultant task checklist**

To change the task allocation to another party, click the tab on the appropriate responsibility column cell, this will activate a drop down box, see figure 4. Click on the required party to change to the task allocation.

The data will automatically be saved once the page is completed. To return to the main menu or the previous page, click on the appropriate navigation buttons located at the top and bottom right hand side of the page, refer figure 4.

13.3.4 Step 4: Check Lists Selection

The check list pages are accessed from the menu page, see figure 5. The program will generate a separate checklist for each drawing. The drawings are accessed by category type. Click the **check list** button on the menu page to activate a second box. Once the drop down button has been clicked, a list of the drawing categories is displayed from which the user may chose. Select the drawing category, in this instance Plans, see figure 5, followed by the **Go** button.

Once in the Steelwork Drawing Completion Check List page, the required drawing is found by clicking on the drawing list. A drop down box listing all the drawings under the chosen drawing category will appear, see figure 6. The sheet will now display the relevant drawing information previously inputted in steps 1 and 2. Users will note for each task there is an issue category designated M or C which refers to Material Order and Connections. This is discussed in section 6.8

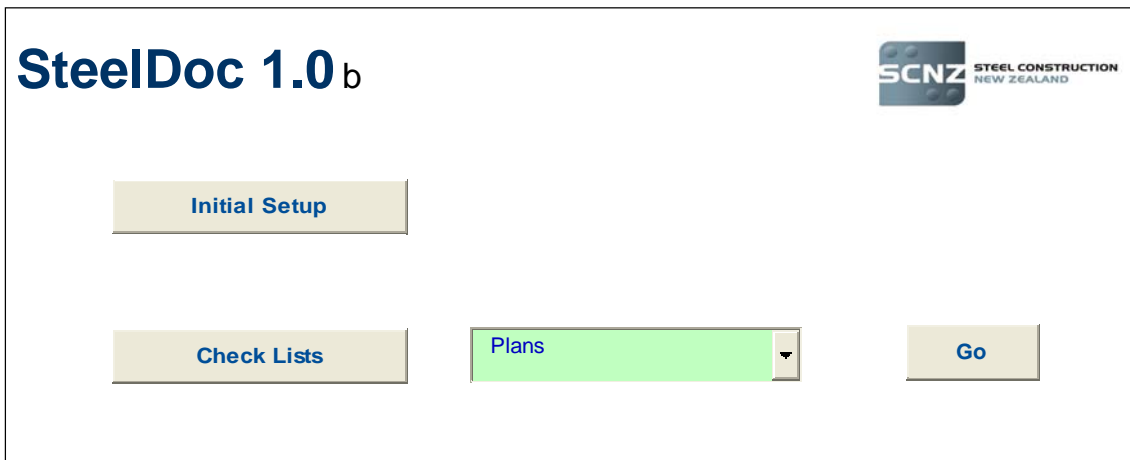


Figure 5 Checklist option selected from menu page

**STEELWORK DRAWING COMPLETION CHECKLIST**

Project Name: Warehouse and Office

Drawing Type: Plans

Drawing Title: First Floor Plan

Issuing Company: [ ]

Other Non-Steelwork Drawings Referenced

Consultant	Drawing	Aspect Governed
Architect	[ ]	[ ]
HVAC	[ ]	[ ]
Mechanical	[ ]	[ ]
Electrical	[ ]	[ ]

Plan drawings listed

Item	Description	Issue Category	Completion Checked
2.1	All grids defined and dimensioned.	M	<input checked="" type="checkbox"/>
2.2	All member sizes and orientations specified.	M	<input checked="" type="checkbox"/>
2.3	Plan location and orientation of each column specified.	M	<input checked="" type="checkbox"/>

Figure 6 Completion checklist page - drawing title drop down box activated

To access drawings with a different drawing category, click on the drawing type drop down button, see figure 7. This will activate a drop down box with a selection of categories the user may choose from. To pick the required drawing within the category, repeat the procedure discussed in the previous paragraph.

The input options for the checklist pages are as follows:

- Once a task is completed the appropriate box may be clicked to record a tick, see figure 7
- Comments may also be recorded for each task in the column located on the right hand side of the sheet. To input data click on the appropriate cell and begin typing
- Comments may also be added to the other non structural drawings referenced portion of the page. For example an architectural drawing referenced may contain set out information, the Aspect Governed column allows the user to record this was the reason for referencing this drawing. The intention is that this will make checking and coordinating the drawings easier in the future

**STEELWORK DRAWING COMPLETION CHECKLIST** Page 2

Project Name: Warehouse and Office

Drawing Type: Plans

Drawing Title: Plans

Issuing Company: [ ]

Other Non-Steelwork Consultant: [ ]

Architect: [ ]

HVAC: [ ]

Mechanical: [ ]

Electrical: E253

Drawing Number: [ ]

Issue Purpose: [ ]

Issue Date: [ ]

Contact: [ ]

Phone: [ ]

Consultant: [ ]

Drawing: [ ]

Aspect Governed: [ ]

Civil: [ ]

Sprinkler: [ ]

Main Contractor: sdf

Other: [ ]

Item	Description	Issue Category	Completion Checked	Comments
2.1	All grids defined and dimensioned.	M	<input checked="" type="checkbox"/>	
2.2	All member sizes and orientations specified.	M	<input checked="" type="checkbox"/>	
2.3	Plan location and orientation of each column specified.	M	<input checked="" type="checkbox"/>	
2.4	Specific location of each beam dimensioned.	M	<input checked="" type="checkbox"/>	

**Figure 7 Completion checklist page - drawing type drop down box activated**

To save the inputted information, the **Save** button located on the top right hand side of the page must be activated.

To clear all the user inputted data for the drawing type on the screen (this may involve several drawings), click the **Reset** button. Before the data is deleted the user will be asked to confirm this request. Activating the reset button will also remove all the drawing titles displayed in the drawing title box. The drawing titles can be reinstated using the following steps.

- Exit the completion check list page via the **Return to Menu** button
- Access the contract drawing list from the initial setup menu
- Once in the contract drawing list page click the **Update** button
- Return to the appropriate checklist page. The deleted drawing titles should now be displayed if the drawing title drop down box is activated.

If there is more than one drawing per drawing type and it is only required to delete checklist data for a single drawing, the user may undertake the following steps:

- Exit the Completion Checklist page and return to the Contract Drawing List input screen via the initial setup menu

- Delete the appropriate drawing using the **Delete selected drawing** button
- Click the update button
- Retype the deleted drawing title data
- Select the **Update** button
- Return to the original checklist page
- Activate the drawing title drop down box to select the required drawing title.

To save inputted or edited information, click the **Save** button located on the top right hand side of the page.

To return to the main menu, click the **Return to Menu** button located top hand corner of page, see figure 7.



## 14 Conclusion

The use of structural steelwork in construction in New Zealand is rapidly increasing. While the design and construction methods used is constantly changing the three fundamentals of good design documentation remain. They are clarity of presentation, lack of ambiguity and completeness in defining the Contract Works.

The Principal's Representative and the design consultants that prepare the Contract Documents that he or she issues on behalf of the Principal, have a pivotal role in facilitating the continuing development of a reliable and cost effective construction industry in New Zealand.

*SteelDoc: Code of Practice for Structural Steelwork Documentation* aims to clarify the issues that should be addressed to ensure the success of steel construction projects in New Zealand.



## 15 References

Some steel construction reference material useful in improving one's appreciation of the components of successful steel construction are as follows:

Carter, C., "Economical Design of Steel Structures", American Institute of Steel Construction.

Clifton, G.C., "HERA Specification for the Fabrication, Erection and Surface Treatment of Structural Steelwork", HERA Report R4-99:1998, New Zealand Heavy Engineering Research Association, Manukau City, 1998.

"Code of Practice for Steel Buildings and Bridges", American Institute of Steel Construction, Chicago, USA, 1992.

"Conditions of Contract for Building and Civil Engineering Construction", NZS 3910:1998, Standards New Zealand, Wellington, 1998.

"Design Guidelines for Successful Steel Detailing", National Institute of Steel Detailing, Inc., Oakland, USA, 1999.

"Steel Structures Standard", NZS 3404:1997, Standards New Zealand, 1997.

"Structural Steelwork Connections Guide", SCNZ-15:2006, Steel Construction New Zealand Inc., 2006 (Formerly HERA Report R4-100:1999, New Zealand Heavy Engineering Research Association, 1999.)

Troupe, E.W.J., "Effective Contract and Shop Drawings", Steel Construction, AISC, May 1999

"Working with Structural Steel in Schedule Driven Projects", American Institute of Steel Construction, March 1996.