

Design Documentation Guidelines

Structural

Concept Design Phase

Design Process	Deliverables	Commentary
<p>Inputs:</p> <ul style="list-style-type: none"> • Client briefing, including budget and time schedule. <input type="checkbox"/> • Geotechnical information on types of foundation systems. <input type="checkbox"/> • Survey information, including legal and physical. <input type="checkbox"/> • Architectural sketch concept drawings (e.g., bulk and location). <input type="checkbox"/> • Site constraints, including planning and fire issues. <input type="checkbox"/> • Conditions of consents. <input type="checkbox"/> • Existing building and site information/records. <input type="checkbox"/> <p>Design:</p> <ul style="list-style-type: none"> • Structural type and form. <input type="checkbox"/> • Main gravity and lateral load resisting systems. <input type="checkbox"/> • Floor system. <input type="checkbox"/> • Ground retention systems. <input type="checkbox"/> • Foundation system. <input type="checkbox"/> • Façade support systems. <input type="checkbox"/> • Roof support systems. <input type="checkbox"/> • Identify structural scheme options. <input type="checkbox"/> • Special project features concepts, (e.g., large canopies). <input type="checkbox"/> • Design co-ordination of key elements with other disciplines. <input type="checkbox"/> • Identify responsibility for control and set-out of dimensions. <input type="checkbox"/> • Identify responsibility for design co-ordination and management. <input type="checkbox"/> 	<p>Drawings:</p> <ul style="list-style-type: none"> • Sketch drawings. <input type="checkbox"/> <p>Reports:</p> <ul style="list-style-type: none"> • Sketch drawings where necessary within report. <input type="checkbox"/> • Structural concept design brief, including floor loadings. <input type="checkbox"/> • Key risks and assumptions. <input type="checkbox"/> • Concept report outlines key issues and options considered. <input type="checkbox"/> 	<ol style="list-style-type: none"> 1. Costing only on square metre rate basis. 2. Concept and preliminary design phases are often combined on smaller projects. 3. Agree roles and responsibilities for all participants in project procurement process. 4. Discuss with client the requirements and programme for client information and approvals. 5. Establish project procedures for communication, document issue, approvals, etc. Note: larger projects may have a project procedure manual or web-based document control systems. 6. Establish a design programme for key milestones and deliverables including design team co-ordination.

Design Documentation Guidelines

Structural

Preliminary Design Phase

Design Process	Deliverables	Commentary
<p>Inputs:</p> <ul style="list-style-type: none"> • Client approval of concept design, including ratification of cost estimate. <input type="checkbox"/> • Preliminary fire engineering (where appropriate). <input type="checkbox"/> • Preliminary wind studies (where appropriate). <input type="checkbox"/> • Preliminary acoustic advice (where appropriate). <input type="checkbox"/> • Preliminary geotechnical report, including preliminary design parameters. <input type="checkbox"/> • Design programme. <input type="checkbox"/> <p>Design:</p> <ul style="list-style-type: none"> • Evaluate and select primary structural systems. <input type="checkbox"/> • Define grid layout (with architect). <input type="checkbox"/> • Preliminary analysis to establish critical member sizes for primary elements. <input type="checkbox"/> • Define key serviceability criteria. <input type="checkbox"/> • Design co-ordination of key elements with other disciplines. <input type="checkbox"/> • Define floor to floor heights. <input type="checkbox"/> • Preliminary assessment of floor vibration and building movement. <input type="checkbox"/> • Preliminary assessment of primary members of existing buildings (where appropriate). <input type="checkbox"/> • Address durability requirements. <input type="checkbox"/> • Preliminary input to Architect on 'architectural' elements. <input type="checkbox"/> • Identify high risk and/or high cost elements in structure. <input type="checkbox"/> 	<p>Drawings:</p> <ul style="list-style-type: none"> • Drawings outline primary members as mark-ups of architectural drawings (1:200). <input type="checkbox"/> • Proposed primary framing. <input type="checkbox"/> • Prelim. sizes of primary members only with reinforcing as kg/m³ and steel as kg/m. <input type="checkbox"/> • Preliminary foundation layout. <input type="checkbox"/> • Indicative structural connection types. <input type="checkbox"/> • Outline system for secondary elements. <input type="checkbox"/> • Outline durability/coating systems. <input type="checkbox"/> • Indicative surface finish for exposed concrete. <input type="checkbox"/> • Critical details that may have significant cost implication. <input type="checkbox"/> • Proposed primary elements of strengthening for existing buildings (where appropriate). <input type="checkbox"/> <p>Specifications:</p> <ul style="list-style-type: none"> • Outline specification of key structural elements. <input type="checkbox"/> <p>Reports:</p> <ul style="list-style-type: none"> • Design brief, including fire protection requirements for structural members. <input type="checkbox"/> • Design features (options) report, with recommended option to take to developed design. <input type="checkbox"/> 	<ol style="list-style-type: none"> 1. Where appropriate carry out discussion with a 'preferred' contractor on construction methodology. 2.* Consultation with Building Consent Authority is recommended on key aspects of the design that may be considered outside the 'Acceptable Solution', and unusual/contentious issues. 3. Cost estimates at this stage generally cannot be on full elemental basis, as secondary elements are not well defined. 4. Contribute to value management session, if required. 5. Agree the scale of drawing deliverables for each phase according to project type. 6. A specialist façade design consultant may need to be engaged, if the façade system is particularly complex or demanding.

* Amended August 2008

Design Documentation Guidelines

Structural

Preliminary Design Phase continued

Design Process continued	Deliverables continued	Commentary
<ul style="list-style-type: none"> • Define key elements of ground retention system (if required). <input type="checkbox"/> • Define design parameters for façade systems. <input type="checkbox"/> • Incorporate additional structural implication of fire and acoustic requirements. <input type="checkbox"/> • Assess implication of dynamic motion of building services equipment. <input type="checkbox"/> • Consider buildability of primary structural system, including significant health and safety issues during construction. <input type="checkbox"/> • For unusual structures or existing structures where stability may be affected by the sequence of construction, consider significant health and safety issues. <input type="checkbox"/> • Assess maintenance requirements of structural components, including health and safety issues. <input type="checkbox"/> • Coordinate relevant design information between disciplines. <input type="checkbox"/> 	<ul style="list-style-type: none"> • Outline of elements not covered in preliminary design drawings or design features report. <input type="checkbox"/> • Define assumed construction methodology governing design (where appropriate). <input type="checkbox"/> • Highlight 'significant' buildability issues and significant/unusual health and safety issues arising from the structure. <input type="checkbox"/> 	

Design Documentation Guidelines

Structural

Developed Design Phase

Design Process	Deliverables	Commentary
<p>Inputs:</p> <ul style="list-style-type: none"> • Client approval of preliminary design, including ratification of the cost estimate. <input type="checkbox"/> • Final geotechnical report. <input type="checkbox"/> • Final wind report (if required). <input type="checkbox"/> • Final fire report. <input type="checkbox"/> <p>Design:</p> <ul style="list-style-type: none"> • Determine sizes of all primary and most secondary structural members; however, there may be some architectural and services secondary support members not defined at this stage. <input type="checkbox"/> • Generic connection details. <input type="checkbox"/> • Agree serviceability performance criteria with client (e.g., floor vibration, interstorey drifts, etc). <input type="checkbox"/> • Structural input to architectural elements. <input type="checkbox"/> • Confirm building movements with the design team. <input type="checkbox"/> • Incorporate likely erection/construction requirements (where appropriate), including consideration of significant/unusual health and safety issues arising from the structure. <input type="checkbox"/> • Key support details for façade elements. <input type="checkbox"/> • Structural support requirements for building maintenance systems (e.g., BMU and abseil anchor points). <input type="checkbox"/> • Coordinate relevant information with other disciplines. <input type="checkbox"/> 	<p>Drawings:</p> <ul style="list-style-type: none"> • Drawings (1:100 plans) defining all primary framing members, with reinforcing as kg/m². <input type="checkbox"/> • Layout and size of secondary framing members (e.g., lift, stairs, canopies, and platforms). <input type="checkbox"/> • Generic reinforcing details for typical primary elements. <input type="checkbox"/> • Typical connection details for primary elements. <input type="checkbox"/> • Define elements covered by proprietary design (e.g., precast floor and piling). <input type="checkbox"/> <p>Specifications:</p> <ul style="list-style-type: none"> • Preliminary technical specifications, including durability and serviceability issues. <input type="checkbox"/> <p>Reports:</p> <ul style="list-style-type: none"> • Updated design brief, including fire protection requirements for structural members. <input type="checkbox"/> • Updated design features report, including serviceability and maintenance issues. <input type="checkbox"/> • Define key risks and assumptions, including erection/buildability and significant/unusual health and safety issues arising from the structure. <input type="checkbox"/> • List elements where the scope has not been fully defined elsewhere in the documents. <input type="checkbox"/> • Highlight significant health and safety issues. <input type="checkbox"/> 	<ol style="list-style-type: none"> 1. Separate primary reinforcement from secondary stirrup or ties in quantity estimates. 2. Cost estimates at this stage can be produced by quantity surveyor on elemental basis, with secondary elements estimated on typical details. 3.* Developed design generally provides the level of documentation to define the scope of all building elements. 4.* Where appropriate carry out discussions with a 'preferred' contractor on construction methodology. 5.* Consultation with Building Consent Authority may be helpful on key aspects of the design that may be considered outside the 'Acceptable Solution', and unusual/contentious issues.

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Design Documentation Guidelines

Structural

Detailed Design Phase

Design Process	Deliverables	Commentary
<p>Inputs:</p> <ul style="list-style-type: none"> • Client approval of completed developed design, including ratification of the cost estimate. <input type="checkbox"/> <p>Design:</p> <ul style="list-style-type: none"> • Complete the design and coordination of all structural elements, including connection details, except for elements that can be adequately covered by non-specific design codes. <input type="checkbox"/> • Address serviceability and maintenance criteria in the design. <input type="checkbox"/> • Highlight significant/unusual health and safety risks arising from the structure that were identified through the design process (if any). <input type="checkbox"/> • Co-ordinate relevant information with other disciplines. <input type="checkbox"/> 	<p>Drawings:</p> <ul style="list-style-type: none"> • Drawings defining all structural elements, including plans, elevations, sections and details, with adequate cross-referencing. <input type="checkbox"/> • Define all connections by either defining specific connection details or referencing to industry standard connection details (e.g., HERA connection details) or specifying forces for a propriety connection system. <input type="checkbox"/> • Construction sequences and positions of control/construction joints. <input type="checkbox"/> • Includes stairs, plant platforms and façade system support. <input type="checkbox"/> • Reinforcing details defined (see commentary). <input type="checkbox"/> • Precamber/set established for members. <input type="checkbox"/> • Include seismic and gravity support of ceiling/partition systems (optional). <input type="checkbox"/> <p>Specifications:</p> <ul style="list-style-type: none"> • Detailed specifications for each structural trade. <input type="checkbox"/> • Performance specifications where appropriate, including performance criteria for proprietary design. <input type="checkbox"/> • Method statements for critical construction processes governing design. <input type="checkbox"/> • Design loadings for design of proprietary non-structural elements e.g., glazing, seismic bracing of services. <input type="checkbox"/> • Define deliverables from contractor e.g., producer statements, shop drawings, and testing requirements. <input type="checkbox"/> 	<ol style="list-style-type: none"> 1. Detailed design generally provides a level of documentation to clearly define the design of all structural elements. Design details should be coordinated with other disciplines. However, the documents produced in this phase may not directly be able to be 'built' from. 2. Structural drawings should dimension the main building grids, critical structural elements, and other elements that are the direct responsibility of the structural engineer. 3. Reference the architectural plans or other disciplines for other dimensions (unless agreed otherwise). 4. HERA report DR4-106, <i>Structural Steelwork</i> documentation 'Specification', sections vi, vii, and ix outline documentation details that need to be addressed in the working drawings and specifications. 5. Design and documentation of secondary architectural elements are generally shown on the architect's drawings; the structural engineer will have input where requested by the architect. 6. Reinforcing details defined means that all reinforcing required to construct the project is defined on the drawings, in quantum and size, such that shop drawings and/or bar bending schedule can be produced by others without further additional information.

Design Documentation Guidelines

Structural

Detailed Design Phase continued

Design Process	Deliverables continued	Commentary continued
	<ul style="list-style-type: none"> • Coating requirements for structural elements that are not addressed by the architect or other disciplines. <input type="checkbox"/> • Define required tolerances where different from industry standards. <input type="checkbox"/> <p>Reports: *</p> <ul style="list-style-type: none"> • Design Features Report including explanation of structural systems and load paths, design standards used, key design parameters and assumptions. <input type="checkbox"/> 	<p>7. The level of design detail shown on drawings in this phase, particularly for concrete and masonry elements, varies in the industry between regions, building types and procurement methodologies. A major factor is the capability of the local building industry to efficiently provide the construction phase documentation. The level of detail outlined in these guidelines is appropriate where the contractor has the skills and resources to efficiently provide construction phase documentation. For some projects, a greater level of detailing may need to be produced by the design consultant. The appropriate level of detailing required should be agreed with the client prior to the commencement of the project.</p> <p>8. Define in the appropriate specification the significant/unusual health and safety risks that arising from the structure were identified in the design.</p> <p>9. The contractor is responsible for managing health and safety risks during the construction phase.</p> <p>10.*Detailed design documentation is recommended for building consent submissions.</p>

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Construction Design Phase

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<p>Inputs:</p> <ul style="list-style-type: none"> • Construction programme and methodology, including craneage or access restrictions. <input type="checkbox"/> • Client approved ('for construction') drawings and specifications. <input type="checkbox"/> • Design and performance requirements for propriety elements. <input type="checkbox"/> <p>Design:</p> <ul style="list-style-type: none"> • Design of proprietary systems, e.g., flooring, glazing, plant support, etc. <input type="checkbox"/> • Detailed co-ordination required with other disciplines, site conditions, proprietary elements, erection requirements, and shop details. <input type="checkbox"/> • Prepare structural construction sequence, temporary erection and heath and safety plans. <input type="checkbox"/> • Determine the impact of temporary erection loads and construction sequence on structural members and connections. <input type="checkbox"/> • Check the design of structural members and connections for temporary construction conditions and loads, and redesign if required. <input type="checkbox"/> • Liaise with the design and construction teams to coordinate any revisions to the detailed design. <input type="checkbox"/> 	<p>Drawings:</p> <ul style="list-style-type: none"> • Drawings (incl. shop drawings and rebar schedules) on an elemental basis, including position, dimension, materials and finish of all details, including relevant material specifications (steel, timber, precast, etc.). <input type="checkbox"/> • Site management plans and/or method statements defining the construction sequencing and temporary erection requirements. <input type="checkbox"/> • Details of the temporary works. <input type="checkbox"/> • Revision of drawings, details and specifications arising from contract agreement, building consent, and construction requirements. <input type="checkbox"/> <p>Concrete:</p> <ul style="list-style-type: none"> •* Precast concrete shop drawings generally as defined in Precast NZ Code of Practice and AS/NZS1100. <input type="checkbox"/> •* Proprietary system layout drawings and connection details. <input type="checkbox"/> •* Embedded items and penetrations defined and located. <input type="checkbox"/> •* For non-standard conditions the following are to be provided where applicable. <input type="checkbox"/> <ul style="list-style-type: none"> • formwork <input type="checkbox"/> • propping and bracing <input type="checkbox"/> • scaffolding and access <input type="checkbox"/> <p>Steel:</p> <ul style="list-style-type: none"> • Shop drawings generally as defined in <i>Australian Detailer Handbook ASDH101</i> or the <i>American Institute of Steel Retailers Guidelines</i>. <input type="checkbox"/> <p>Review:</p> <ul style="list-style-type: none"> • Review shop drawings, technical specification, and construction method statement submissions for consistency with detailed design. <input type="checkbox"/> 	<ol style="list-style-type: none"> 1. Before the commencement of construction drawings the following need to be in place; contract details confirmed and tender accepted; sub-contract agreements confirmed; and owner supplied components available. 2. Deliverables contain sufficient details for elements to be manufactured/constructed without reference to other documents, i.e. , 'the details have co-ordinated the relevant design information across all disciplines and can be built from'. 3. Final determination of some dimensions may be dependent on proprietary design of non-structural elements (e.g., mechanical services duct sizes). Such proprietary design may need to be advanced to enable structural dimensions to be completed. 4. The constructor is responsible for managing health and safety risks during the construction phase. 5.* Significant changes or clarifications to the structural work in relation to the initial building consent documentation should be submitted to the Building Consent Authority and if necessary an amended building consent obtained to cover these changes

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