

PERFORMANCE-BASED SPECIFICATIONS AND DESIGN INTENTION DRAWINGS

New Zealand has a building regime that is performance based rather than prescriptive. An adjunct to this regime, most successfully used for complex buildings, is a 'performance' specification – where performance requirements are written into the specifications rather than details. The more prescriptive details come later in the process.

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For complex buildings it is not always possible or desirable to fully detail every aspect of the building before applying for building consent or commencing construction. The design of a particular building element or system might require the input of a manufacturer's technical expertise along with some experimentation and testing of prototypes to ensure the design intention and intended performance of the designer are achieved.

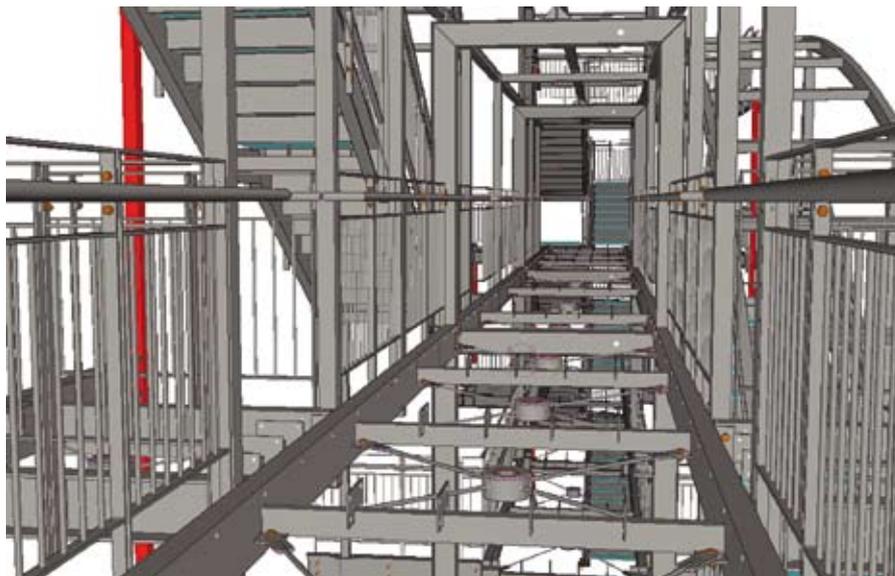
The architect, in association with any consultants, will need to first determine the performance requirements a particular element needs to meet, and then identify them for tendering, construction and consent purposes. A common example of this is the steelwork design provided by the project structural engineer. The building consented drawings will often need to be supplemented with further detail drawings, such as shop drawings that the steel fabricators will actually build to.

Building officials are able to compare specified performances and design intention drawings with those required by the various sections of the Building Code. For example to provide an innovative design for an external glazed wall (single storey) to an apartment block, including sliding doors opening onto balconies, openable windows, mechanical louvers and glazing, the following sections of the Code would need to be considered:

- B1 *Structure* – gravity, seismic, thermal expansion and wind loading on glass and frames
- B2 *Durability* – material of frames, flashings and fixings
- C1 *Fire safety* – inter-tenancy separations and fire resistances
- E2 *External moisture* – weatherproofing, junctions to adjacent resolved materials and trades work
- F2 *Hazardous building materials* – NZS 4223.3: 1999 *Human impact safety requirements*
- F4 *Safety from falling* – transom heights and window restrictors
- G4 *Ventilation* – opening sashes, doors and mechanical louvers
- G5 *Interior environment*
- G6 *Airborne and impact sound*
- G7 *Natural light*
- H1 *Energy efficiency* – double/single glazing.

Also consider Resource Consent requirements such as internal/external noise and mechanical ventilation.

If the architect identifies the performances to be achieved in the specification and supplies a design producer statement (form PS1), a building consent may be granted on the basis that these performances satisfy the requirements of the Building Code and the designer has the competence or experience to make the statement.



Typical structural steel shop drawing model image showing the complexity that makes a performance specification with design intention drawings a logical option. (Image courtesy of www.steelpencil.com.)

Subsequent detailed drawings and specifications supplied by the manufacturer and all test results supporting these performances are submitted to the BCA to satisfy the consented documentation as they become available. On completion of the construction, a construction producer statement (form PS3) stating that all work has been constructed and installed to these details should be supplied by the contractor. Finally, a construction review producer statement (form PS4) should be provided certifying that the completed installation meets the performance specified in the consent documents, which should allow the Code Compliance Certificate to be issued.

Clear design intentions needed

In following the path of a performance-based specification for any aspect of a project, it is important that the design intentions of the architect are clear and the performances to be met are clearly stated. With a clear performance specification a subcontract for the work can often be let and the selected subcontractor can contract directly with the client or become a nominated supplier under the main contract. These responsibilities will need to be clearly spelt out in the main contract documentation so parties know their responsibilities and risk.

Good performance specifications and design intention drawings:

- indicate the performance level to be met in clear project specific quantities
- allow contractors to propose innovative cost-competitive responses, thus securing their involvement in the project
- indicate how different proposals will be assessed before selection
- require verification that the constructed elements will perform as intended.

Contractors must verify performance

To achieve specified performances, which may be in excess of those required by the Building Code, the architect must select and work with manufacturers, suppliers and consultants who can design to these performances, and use a contractor who will

follow the design. Mechanical installations may also include a commissioning period, when the installation can be observed meeting the specified performance in normal use. This is common with air-conditioning plants and certain fire systems that are also checked under the 'specified systems' regime for building warrants of fitness.

A clear line responsibility is important for this to work. Some clear guidelines may be needed on the drawings, i.e. submitted tenders that break the work into component parts (e.g. fabrication, installation, and glazing) with separate responsibility for each will not be accepted. Contractors will need to take responsibility for the detailed design, procurement, fabrication and installation of their part of the project, and ensure the elements satisfy the performance requirements and design intention drawings. This can also include a maintenance schedule to ensure continued performance.

Intention sketches inform fabrication

Take a case study of an external glazing system, typical of a high-rise commercial building. The tender submission and shop drawing process can be used to finalise the

fabrication details based on design intention sketches (see Figure 1) and limit states from the architect.

With the intention drawings at hand, the contractor can develop working drawings for proposed sections that can include:

- maximum wind loading
- provision for structural ductility and/or seismic loading
- provision for acoustic and/or fire-rating requirements if the system runs across the face of inter-tenancy walls or floors
- thermal movement of the frame based on the proposed section
- nominated air leakage
- appropriate louvers to use and coordinated weathertight and airtight connections to ducts on the internal faces of these louvers
- allowance for an appropriate glazing schedule.

Once an appropriate section is selected the working details can be assessed for compliance with the design intention drawings. Then each extrusion length, frame area, aspect ratio or span between supports and coupling mullions can be calculated as required to achieve the required conditions. ■

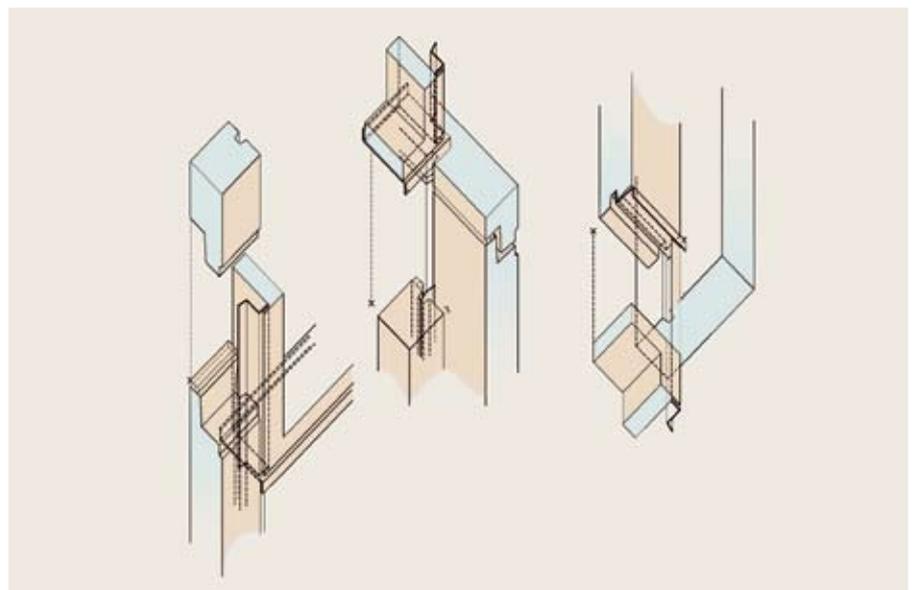


Figure 1: An example of design intention sketches for the 3D interface between two building elements. One is detailed (precast panels) and the other is performance specified (a simplified window profile is shown based on a preferred proprietary system).