IMPROVING NEW ZEALAND CONSTRUCTION INDUSTRY PRODUCTIVITY: AN OVERVIEW

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The New Zealand construction industry has a long-standing problem of poor productivity, even after a decade of a strong market with years of committed forward workload. The industry's defining characteristics range from project delays and cost over-runs to company collapses, construction quality deficiencies (graphically illustrated by the 'leaky building' phenomenon), skills shortages, technological illiteracy and the adversarial nature of project relationships. Transferring risk and apportioning blame are prioritised above efficiency — one of the industry's few growth areas is dispute resolution services.

The responsibility for the state of the industry is shared all by of those within it — clients, including central and local government, contractors and subcontractors, architects, engineers, project managers, quantity surveyors and building owners — and all have responsibility for fixing it. The industry's constituent sectors must work together to construct better infrastructure and better buildings, and do so more efficiently. The dislocations caused by the Covid pandemic and the existential challenge of climate change make this imperative even more urgent.

Previous attempts at construction industry reform have been piecemeal and narrowly focussed. Unsurprisingly, they have been largely unsuccessful. The industry must rethink how projects are delivered. This reappraisal must comprehend the entire design and construction process and the roles and responsibilities of the industry's participants.

A group of experienced cross-discipline practitioners came together as the Construction Productivity Group (CPG) to develop practical solutions to the industry's productivity problems. The CPG focussed primarily on the vertical construction sector, with its larger-scale and more complex projects, but the group's recommendations apply generally to the industry, including infrastructure projects.

These recommendations are in six inter-related areas:

- Construction Procurement
- Regulatory Process
- Project Management
- Design Documentation
- Technology and BIM
- Training and Education

This paper is a summary overview of a document that goes into greater depth in evaluating the challenges facing the industry and defining pragmatic steps to significantly lift performance. To obtain a copy of the full paper, or to discuss its contents, contact a member of the CPG. (*A list of contact email addresses is at the foot of this document*).

Construction Procurement

The project procurement process starts when a client decides to proceed with a project and engages professional advisors to assist with the client brief and budget. It continues through the design process, the

engagement of a contractor and the appointment of subcontractors. Implementing the appropriate procurement process for all construction projects is critical, especially as most of them are, necessarily, bespoke.

Consultant Team

The success of a construction project critically requires not only engaging experienced and competent practitioners across each aspect of the building's design, but also ensuring that there is good synergy between designers and all other project participants. Effective teamwork is of paramount importance. Consultant selection based on low price can be counter-productive; consultant engagement needs to take into account relevant experience and the ability to work in collaboration. The type of project delivery method, whether full or novated consultant design-then-build, or partial or full contractor design and build, will be a key determinant in the allocation of responsibilities and risks between the client, consultants, contractor, and subcontractors.

Particular attention must be paid to deciding and agreeing which party is responsible for completing the design, recognising that most projects will incorporate some elements of contractor or subcontractor design, including by that by façade, mechanical and piling subcontract trades. These responsibilities must be clearly stated in the various parties' contracts. Design errors or omissions requiring rectification lead inevitably to expensive and time-consuming disputes.

A common construction industry problem is the failure to provide for adequate design time, including the time required to integrate and coordinate contractor and subcontractor designs. The construction industry seems stubbornly resistant to learning the lesson that it is less costly to get things right in the first place than have to fix them up later. On larger and/or complex projects the engagement of a competent cost consultant and project manager for the lifespan of the project is recommended, as is the retention of the same consultant team throughout the design and construction phases.

Project Challenges and Risks

The failure to fairly allocate contractual risks among the parties in a construction project is not uncommon and causes many disputes. A typical risk during construction is incomplete design and/or ill-defined handover points of design responsibilities from the client to the contractor in the tender documents and detailed design drawings. Detailed design failure is a major cause of time-consuming and expensive contract variations and ongoing quality issues. Prompt client and consultant decisions where required are essential to a project's successful progress. Effective design coordination demands that all design consultants have access to the same digital platform.

The identification and allocation of key project challenges and risks should be closely evaluated across the entire project. The alignment of project risks, including client, design, documentation, pricing and construction risks, with the project delivery method is critical to a project's success.

Design Brief

A client's signed-off project objectives and consequent high-quality design brief are the foundations for a successful project. Establishing a knowledgeable client team capable of working effectively with the

consultants in the briefing process and allowing sufficient time to get the brief right are critical. Where the client intends to move immediately into project design phases, it is strongly recommended that the briefing team becomes part of the design team.

Project Delivery Methods

Common project failures are providing too short a tender period, and issuing tenders that do not reflect the state of the design documentation. The effect of these practices and behaviours is to underestimate or disregard the extent of contractor/subcontractor design required to be completed with the tender. Awarding contracts solely on the basis of low price usually jeopardises a project from the start, especially when awarded to a contractor lacking the necessary experience or sufficient resources. The type of delivery method should dictate the selection of an appropriate contract type and should also be reflected in the subcontractor contracts.

The procurement of the head contractor under an equitable contract is critical to a project's success. Such a contract must include the allocation of project risks to the party best able to manage each risk, particularly when a contractor is not in control of the design process. The addition to the contract document of special conditions which unfairly favour one or other party must be avoided. Contracts should allow for a reasonable contractor's margin which allows for off-site expenses, including the profit required for the general running of the contractor's business.

Early engagement of subcontractors in critical trades such as piling, structure, façades and mechanical services is becoming more common and needs to be reflected in the head contract and subcontract conditions, together with explicit reference to the subcontractors' design responsibilities and contract risks. In almost all projects design is incomplete at the start of construction. It is therefore important that the nature and extent of design documentation is aligned with the project delivery method and the type of contract being used. Compliance with the New Zealand Construction Industry Council (NZCIC) Design Documentation Guidelines is encouraged.

Successful projects rely on teamwork and a strong "best for project" culture, as exemplified in some alliancing contracts. These projects achieve a balance between satisfying probity requirements and promoting team compatibility.

Head Contractor Management Responsibilities

Between 80%–85% of the physical work on larger New Zealand construction projects is generally delivered by subcontractors. It is important that the following areas of responsibility are correctly assigned when procuring projects:

- Design management across all disciplines, including integration of subcontractors' design
- Contractor management and support for the whole team
- Head office offsite and onsite management and supervision
- Relationship management

Key construction procurement considerations

- Tender and contract documents should be carefully tailored to the contract delivery method selected and should provide a clear outline of the project risks attributed to those parties best able to manage them
- The selection of a procurement method should take into account the nature of each individual contract type and market conditions at the time
- The appropriate standard contract documents should be used for the particular contract type, with minimal special conditions
- Contract documents should recognise the design responsibilities of all parties and allocate contract responsibilities accordingly
- Subcontractor selection and integration should be closely aligned with the overall contract delivery method
- A fixed-price, lump-sum contract may result in significant contract variations, increased costs, and delay
- Clients should accept that the contractor's price must include a realistic margin covering overheads and profit
- Contractors should be responsible for the extent of design clearly defined in the contract; however, contractors should not be responsible for errors, omissions, or incomplete client design
- Selection of tenderers should take into account experience and track record
- Tenderers should be allowed adequate time to prepare their tenders
- The contract time allowances should fairly reflect the nature of all parts of the work.

Regulatory Process

The processes put in place to meet the requirements of the 1991 Building Act have proven woefully inadequate to deal with the issues enshrined in its related performance-based Building Code. The Building Consenting process has not kept pace with changes to the Building Act, and the introduction of new building products and materials and new ways of designing and constructing buildings over the last three decades have rendered the consenting process no longer fit for purpose. Systemic failure in recent years has resulted in Territorial Authorities (TAs) becoming the pockets of last resort for claims related to defective buildings.

Online consenting processes

A recent Te Kāhui Whaihanga Institute of Architects (NZIA) survey indicated a lack of consistency in the interpretation of the Building Code by TAs across the country. Online consenting processes adopted by some TAs have the potential to produce consistency and improve productivity across the country but as yet have not achieved other needed improvements; of themselves, they cannot do so.

Reliance on Producer Statements

Requests for Producer Statements by TAs have increased, but a recent review of the settlement of leaky building disputes indicates that Producer Statements often have failed to shield TAs from responsibility. Producer Statements provided by design and construction reviewers selected by the building owner, frequently on the basis of low fees, may not be sufficient in either a construction or a legal sense.

Key Reasons to Change the **Building Consent process**

- Contemporary buildings are technically much more complex
- The building design process is more complex and involves a greater number of specialists
- The construction procurement process is now also more complex and usually requires the contractor to take more design responsibility, particularly for specialist trades
- TAs generally lack appropriate technical expertise and have proven unable to keep pace with increases in the complexity of buildings, hence their reliance on Producer Statements
- The quantum of design documentation required by TAs in building consent submissions is inconsistent across the country and sometimes across different projects
- The statutory timeframe for TA assessment of the documentation for building consents is not realistic for complex buildings and is rarely met.

Recommendations for Changes to the Building Consent Process

Key Principles

- Align the consent process with the design and construction processes for delivering building projects
- Identify potential problems at the outset and adopt appropriate risk mitigation strategies
- Define appropriate levels of documentation and technical support in support of Building Consent submissions, and identify appropriate time frames
- Source appropriate technical support for territorial authorities through MBIE, NZIA and Engineering New Zealand (EngNZ).

Proposed Changes

Step 1: Develop Building Consent framework

MBIE, TAs and industry professional organisations/bodies must collectively develop a framework which aligns the Building Consent approval process with the processes by which buildings are produced.

Step 2: Develop Staged Building Consent process

i) *Preliminary design features review*

A clear process developed with the TA at completion of preliminary design: identification of key risks; definition of mitigation steps; and validation of the proposed design and construction details required to meet Building Code requirements.

ii) *Building Consent Review*

Achieve consistency in the design documentation required for the Building Consent Review. Consent documentation should define the generic design details and the procurement of 'design-build' elements. The documentation should include the designers' key requirements.

iii) *Construction inspections and design through construction*

Provide and agree, prior to construction, a detailed construction inspection plan, defining the extent of inspections by TA staff, project designers and industry specialists. Systems and procedures must be in place to ensure that additional design documentation meets project team design and Building Consent requirements. An industry understanding and definition of '"design change" is needed.

iv) *Code Compliance Certificates*

Prior to and throughout construction, the supplementary and revised detailed design documentation should be compiled, along with inspection records and requisite Producer Statements.

Step 3: Define Building Consent design documentation

Common definitions of the extent of design documentation required for each step of the Building Consent process are needed across the industry, aligned with Building Consent processes and NZCIC Design Documentation Guidelines.

Step 4: Design knowledge and expertise through the construction phase

Designers must be involved in monitoring construction to ensure design and Building Consent requirements are met. Where design continuity cannot be achieved, the realisation of key design assumptions must be ensured.

Step 5: Capture and disseminate lessons learned

The lessons from building failures are not readily available to the industry. A system that captures and disseminates learnings across the industry is vital to improving the regulatory process and buildings as a whole.

Project Management

Effective project management is pivotal to the delivery of construction projects, especially major vertical projects and complex buildings. Effective project management gives structure and direction to a project: problems are solved; options analysed; recommendations agreed; and approvals signed off. The project manager links the design team and the building contractors; identifies risks and advises on risk mitigation

and management; sets target dates for the design, tendering and construction phases; establishes the construction procurement methodology; manages the tendering process; administers contracts and contract changes; and manages the relationships between all parties through to project completion.

New Zealand has a history of over-budget and delayed construction industry projects, and significant levels of re-work reflecting poor internal and external project management. The project management sector in New Zealand is unregulated; there is no clear definition of project management services and no minimum qualifications requirement. There are few skilled practitioners capable of managing the design process on complex building projects.

Recommendations

Step 1: Establish project management services guidelines

> Develop an industry guideline defining standard full-project management services for buildings projects using the current NZCIC Guidelines as a starting point. Leading industry project managers could create an outline of standard project management, then work with wider industry and MBIE/government representatives to finalise guidelines. Project Management Guidelines should be developed in concert with the proposed revisions of the NZCIC Design Documentation Guidelines and education programmes should be established.

Step 2: Establish an accreditation structure for project management services

> We recommend that project management services in the construction industry are regulated or licensed. In the longer term, it may be that a Project Management Association is established to set and update standards and issue best practice guidelines.

Design Documentation

The NZCIC 2003 and 2016 Guidelines were formulated to establish a consistent industry standard defining the roles and responsibilities of the team engaged to create design documentation. These guidelines now need revision so they align with the changes to and increased complexity of the building industry. There is a great opportunity for the construction industry to revise and develop new guidelines using a common format that enables electronic interlinking for easy revision and updating.

The 2016 update of the NZCIC Guidelines included some, but not all, project management and procurement tasks. As already noted, projects will be significantly benefitted by the provision of separate guidelines defining the complete project management services, and advice on the merits of different procurement strategies. Project management services directly related to the preparation of design documentation should be highlighted and aligned with the Design Documentation Guidelines.

It envisaged that this suite of guidelines will be structured as follows:

1. Procurement Guidelines
   Options: descriptions, risks, benefits; the selected procurement option will impact the output from subsequent sections.

2. Project Management Guidelines
   Description and 'pick list' of complete project management scope. Design-related project management tasks should also appear in the Design Documentation Guidelines.

3. Design Documentation Guidelines
   Update of current NZCIC Guidelines.

Building Consent Guidelines
Schedule of documentation required at each stage of the consent process from project inception to final sign off; specific tasks will be linked back to the Design Documentation Guidelines.

Each guideline should be able to be read either in isolation or as a consistent part of the wider suite. Other industry documents, e.g., the BIM Handbook, will in time be linked with and aligned with this suite of documents.

Recommendations

- Current NZCIC Guidelines are reformatted and renamed in line with the structure described above; it will be necessary to move to a more data-driven, smart-forms-style document in which the same information can be displayed in a variety of formats.
- NZCIC suite of documents focuses on documentation that is pan-industry, but does not replace documentation currently developed and held by the various industry bodies, where such documentation is specific to that industry group.

Technology and BIM

Building Information Modelling (BIM) is the generic term for the design 'drawing' software packages, tools, and information sharing processes used to generate design and construction information. A BIM model is a 3D representation of a building. In addition to 3D models, digital information relating to the asset is available from a number of sources including laser scans of existing facilities, testing and commissioning data and 'live' operational information from Internet of Things (IoT) devices. All of this data and information can be embedded within the model and used in the design, construction, and ongoing operation and maintenance of the facility.

The BIM Acceleration Committee, which was set up in 2014, created the New Zealand BIM handbook and managed the BIMinNZ network. The group comprised design, construction and operations representatives with a desire to drive the uptake of BIM and create a level playing field and consistent language for the

industry. The Committee was dissolved in 2021; the BIMinNZ networks are now maintained under the custodianship of NZIOB.

BIM use in design

The use of 3D modelling in design has significantly increased and has progressed over the last decade to the point where most larger building projects are now fully modelled by the design teams. The main advance over the last several years is the level of collaboration between the various design parties. However, BIM has not yet delivered to its potential in realising improvements in construction industry productivity and building quality.

BIM use in construction

The gains in productivity that the construction industry needs can only be achieved through improving the transfer of BIM from the design process into the construction process and full-life building operation and maintenance. The significant project information contained within the BIM design model is, in general, not formally or contractually transferred through tender and procurement to construction contractors. Often, BIM deliverables are passed onto construction contractors on an 'information only' basis, with designers unwilling to extend their contractual responsibility within the transfer arrangement.

Recommendations

1. Establish industry guidelines and frameworks for transferring digital information between design consultants, construction contractors and other project participants, avoiding rework and the loss of information
2. Make BIM and other relevant digital information Contract Documents in all construction contracts
3. Set up targeted education and training programmes
4. Align the use of BIM through the construction industry to achieve better utilisation of technology.

Education and Training

The industry's overall skills shortage is well recognised. The status quo is the result of under-investment, over decades, in trade apprenticeships, tertiary courses and in-house training programmes. At present education institutions seem to be making considerable efforts to increase apprenticeship training and education in construction management. We support this greater focus on improving education and training, and note that the consolidation of the various Institutes of Technology and polytechnics across New Zealand into a single governance organisation (New Zealand Institute of Skills and Technology) provides an opportunity to focus a national effort into technology training.

Upskilling through contractors' in-house and on-the-job training is critical to accelerating full use of BIM in New Zealand construction. A particular area in which where upskilling is urgently required is in the use of BIM technology. The construction industry's failure to realise anything approaching the full potential of BIM technology and a general lack of digital competency are handbrakes on productivity. Other training

programmes specifically targeted at construction contractors should be developed to accelerate upskilling of the industry, as it would take decades to build upskills by relying largely on apprenticeships and tertiary education training programmes.

Many of the shortcomings of in-house training programmes are the direct result of 'race to the bottom' contractor tendering. Contractor margins should include a component that responds to the need for investment in training. To promote contractor in-house training we recommend government assistance for NZQA-accredited training modules. We recommend that such training includes a greater involvement of experienced practitioners.

The construction industry needs to come together to generate a suite of training seminars, webinars and education programmes to improve the industry. We see the NZCIC and NZIOB, supported by the Construction Sector Accord, as the best forums for developing a framework for training and education programmes. As the sector combines to produce in-houses programmes, it should liaise with the relevant tertiary education and training organisations across the country.

Conclusion

The CPG has examined the challenges facing the New Zealand construction industry afresh, unhindered by narrow sector pressures, and has proposed interlinked initiatives to improve construction productivity, especially in the vertical construction industry sector. Our goal is the better delivery of better buildings.

A constant theme of our discussions is that building projects are becoming increasingly complex, and that an integrated team approach is required to successfully deliver these projects. The entire ecosystem of building delivery needs to be considered and a game plan established to allow the multitude of industry players to effectively work together to create better buildings.

The initiatives we describe outline the direction of reform and provide a set of guidelines for the industry to follow. All parties in the construction industry have had a hand in creating the current dire state of the construction industry. Therefore, the entire industry must work together to fix the problems. We strongly recommend progress is made in developing the proposed initiatives in each of the defined areas because these areas are so strongly inter-related. The achievement of a substantial lift in industry performance will be realised by developing the proposed initiatives in parallel.

—Construction Productivity Group, November 2021

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