INQUIRY INTO APARTMENT DESIGN STANDARDS

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Submission to the Inquiry into Apartment Design Standards

This submission is tendered by Dr Paulo Vaz Serra, Mr Steven Richardson, and Dr Andrew Martel, from the Construction Program of the Faculty of Architecture, Building, and Planning at the University of Melbourne. The authors have a background in research and teaching in Construction Management, and extensive industry experience as licensed builders in Australia and New Zealand, and the European Union. The authors are pleased to submit to the committee the following remarks and recommendations for consideration.

Introduction: Design quality in apartments

The introduction to the current Apartment Design Guidelines Draft (2021) notes that “(Victorians) want diverse, affordable housing options now and a legacy of quality housing stock for future generations.” While the notion of quality can be contested - it is a relative term - what can be stated is that quality in apartments is a combination of quality of design and quality of construction. This submission seeks to make the case that;

a) there is not a clean delineation between the two, and
b) under current procurement processes in Victoria it is quality in construction that determines the quality in design.

Good apartment design standards that support functionality, livability, security and create a sense of community are realized (brought into existence) by the performance and quality of the on-site construction stages. In Australia, there has been an increasing gap between good design and the quality of the on-site build forms, fit-out and finishing trades, notwithstanding the technical advancement and performance of off-site manufacturing that service many trades. This gap has increased over the past ten years, in our opinion, more than in any other time in the construction industry, with failure rates high, and the standard of on-site works at the lowest level in decades.

Building regulations in Australia are performance-based not prescriptive. However, satisfactory performance can be assumed by meeting requirements set out in the National Construction Code (NCC) and related Australian Standards, with the expectation that the industry will continue to innovate and improve performance. In practice, these minimum requirements are often the sole requirements, and compliance becomes compliance with the minimums, rather than compliance with performance. In this scenario, it is difficult to obtain a high level of commitment from contractors to achieve performance levels above these minimums. Several factors are involved, including the maintenance of profit margins for contractors (and sub-contractors), client’s reluctance to pay more and accept more risk, and regulators and authorities not demanding more than meeting requirements. Under Victorian building regulations, building surveyors are not permitted to demand anything more of contractors than meeting the minimum requirements under the NCC and Australian Standards (S. 24(2) amended by No. 66/2004 s. 5(1) - Building Act 1993).

All buildings are built under the auspices of a legally binding contract between the building owner (the client) and the head contractor (the builder), and a series of sub-contracts between the head contractor and sub-contractors that carry out the work. This submission will argue that the form of contract currently used in the Victorian construction industry to produce apartment buildings (and many other types) has a significant impact on the delivery of quality in construction projects, and of where the final responsibility for quality ultimately resides in practice.

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Understanding the current design process for apartments in Victoria

The dominant procurement method for apartment developments above four storeys in Victoria is via a contract type known as a Design, Novate, and Construct contract (DNC). Typically, under a DNC, the head contractor (the builder) is contracted with only partial design documentation complete (usually between 20 and 80%). Upon awarding of the contract, the design team and consultants are transferred (novated) to the head contractor, who is then responsible for completing the design as construction is underway. This submission highlights several consequences of this method that directly impact on the quality of built outcomes and the impact on apartment living standards.

The ongoing development of the DNC procurement process for constructing apartments began in earnest in the early 2000s. Developers began contracting and novating design at the concept stages supported with bills of sale, marketing documentation, display suites and selecting a head contractor under an Early Contractors Involvement (ECI) agreement. The ECI involvement would ultimately be focused on the contract conditions, the cost and time to achieve a fixed price (Guaranteed Maximum Price, GMP) and then rolled over into a DNC Contract Construction Agreement.

The head contractor will then adjust their sub-contract conditions to enable them to transfer a number of their obligations and risk profiles through a reciprocal (or ‘back-to-back’) subcontract agreement to almost all trades packages. The construction documentation that would initially form part of the head contract and sub-contract agreements, after the ECI process, would be made up of limited design drawings, reports and the project/industry trades standard specifications covering the trades scope. Typically, the contract will state the design is considered to be 70% complete, and this may be correct with regards to the architectural drawings, trade specification and the Principal Project Requirements (PPR) brief.

However, the engineering design scopes - that makes up 50% of the projects cost, including Structural Engineering, all Services and Façade Engineering works - documentation would still be at a developed design stage (i.e. not finalized), and qualified as being;

- Performance based design,
- Engineering intent,
- Comprised of standard details and profiles.

Within the novation and contact conditions the designers are released from post contract design briefings, meetings and design information requests (from sub-contractors) that stem from incomplete drawing sets that form the contract, including;

- Ambiguity,
- Inadequacy,
- Inconsistency,
- Discrepancy,
- Omission,
- Incompleteness, and
- Lack of co-ordination or integration.

These and other contract clauses are considered to be buildability related issues and therefore the responsibility of the head contractor. Under this process there are a number of steps that must be taken to achieve a standard design for constructing, typically through Request for Information (RFI), or shop drawing submission for approval, that maybe requested to be resubmitted for approval against mark-up or notes placed on the first submission. They could also be approved subject to comments, along with a testing information, or sample for approval, with a process similar to the shop drawings. Design changes are typically required to be approved (signed-off) by the client, but resolution of uncertainty in, or lack of, design clarity is now driven by head contractor considerations that include program (time) and cost, in addition to quality.
Scenario 1: Incomplete documentation of Façade at novation

An example of the effects of incomplete documentation can be demonstrated with respect to façade elements. Heavy weight elements, such as a façades curtain wall system have been developed and designed to be totally manufactured off site and installed off bracketry that has a maximum vertical and horizontal structural load capacity that is based on movement tolerances and a cladding zone from 20mm to 75mm from a primary or secondary structures. These cladding zone tolerances are well understood by engineers and architects but are generally not co-ordinated or considered in the engineering documentation regarding the primary edge profiles design and by default any gab or cladding zones increase become the responsibility of others. This responsibility will normally form part of the façade contractors scope to engineer and resolve the extent and type of support required manage the cladding zone increases.

A secondary structure is normally introduced to support and standardise the cladding zones. As these cladding zones can vary from 75mm to over 1m, in most cases structural steel elements or framing will be designed as the secondary structure. This is not included in the initial design drawings novated across to the head contractor, due to the initially perceived up front design cost and the risk to the engineering standard details and the design intent reports.

So this critical design element will fall to the façade sub-contractor to design and develop, with an increase in risk to project co-ordination, structural integrity of the fixing and connection types, shop drawing consistency with design drawings, and the level of experience required to conduct the various approval processes.

One of the critical issues under this type of contracting, is that the final drawings, the issue for construction set (IFC), are not finalized or submitted until the on-site build form, services and installation fit-out, finishing trades and commissioning documentation are completed. Put simply, final documentation on how to build is not complete until the building is finished.

Cracks in the Compact City: Tackling defects in multi-unit strata housing

The UNSW City Futures Research Centre report ‘Cracks in the Compact City’ (Crommelin et al, 2021, p.i) notes that:

“Whereas in other construction contexts, such as a commercial building, the client has oversight as the project proceeds, in the MUST sector, individual purchasers have little involvement until after completion. This means only public agencies provide independent oversight of these developments. If these agencies are not closely enforcing quality standards, developers are incentivised to complete quickly and cheaply (often resulting in lower quality), contrary to the purchasers’ interest in receiving a high-quality building (‘split incentives’). This market model also gives rise to ‘information asymmetries’, where one party is better informed than the other – in this case, developers are more informed about building quality than buyers. Buyers are not well-placed to identify poor quality work, distorting the market and undermining its performance.”

When the design team and consultants of the client (the developer) are novated across to the head contractor, who is responsible for the finalisation of design drawings and the resolution of ambiguity, omission etc., then the developer also faces the issues of split incentives and information asymmetries in regards to the builder, and so responsibility for quality moves even further from the intended occupant of the building.
The risk to quality and drivers of failure

The intent of DNC agreements and the transfer of risk is workable, provided it is controlled by experienced and properly trained people. From a quality process and level of design information point of view, it is predominantly dependent on the trades self-certifying that the quality and standards are achieved. A process that is not necessarily in full accordance with the head contractors Quality Control and Assurance plans, notwithstanding that processes are followed and that all the standard forms and submissions are signed off by employees of the builder. With the documentation tabled stating that inspections have taken place, including having a project management representative along with a building surveyor inspection where required. To recap, the trades certify that they have completed work to the required standard, while the builder’s representative and building surveyor assess the legitimacy of that certification and sign-off in agreement. The extent of failure and poor quality outcomes in contemporary apartment construction suggests that this oversite is often not being provided by people with the necessary experience levels or training proficiency.

In a highly competitive market, it is understood the primary obligations of all apartment construction contract agreements are driven by time and cost considerations, with quality deemed to comply in line with the contract documentation. The nature of the contract conditions (as written into contracts) is designed to be administered with aggression by all sides, taking pro-active action to protect their rights. This creates conditions of confrontation across all the stake-holders that are a signed to the contract. Recent history has showed that this confrontational approach is having a direct impact on cash flow within the sub-contracting market, impacting their current and future works. It is very difficult for the sub-contractor to follow the ‘back-to-back’ contract conditions, primarily due to their dependence of other trades completing their obligations and the coordination of the works before or after theirs. So the contract risk (in time and cost terms) is transferred from the head contractor to the sub-contractor, but it is the head contractor that controls the sequencing of works (the before and after trades) that are critical to the sub-contractor’s ability to perform work to the required quality.

Scenario 2: Construction of a bathroom wall

*Initial defects occurring within sequencing and construction of a internal bathroom dry plastered tiled wall can create a domino effect around compliance to design obligations and quality. The trades are working in accordance to the recommendations of the manufacturers and trade specifications, but without themselves controlling the tolerances of preceeding trades, and so defects occur.*

The following six points approximate the steps required in constructing a single wall:

- **Set-out the wall lines at top and bottom tracks** (this is the most critical step in the whole construction process of the wall). It is always possible the lines will not be transferred vertically 100% therefore encroaching into the allowable design tolerances
- **Place the top and bottom tracks**
- **Place the studs, noggens and structure support systems**
- **Place all services and equipment within the wall as required**
- **Place the approved plaster board system to the wall, including all water proofing requirements**
- **Place the tiles including making provision for all penetrations for fixings and fit-off.**

These six steps could involve up to 20 people to construct and inspect a 2.4m x 2.4m tiled internal bathroom wall.

*If the vertical tolerances of the wall are not consistently reviewed and control checked by all trades involved at each step and the alinement does fall outside of the vertical allowances, the problems with the alinement may only be realised when the placement of the tiles are occurring and the verticality can be seen clearly at the corner junctions of the walls. If this does occur, it is offen made good by building up off the substrate. This decision can be made by many different people at any time, by the trades themselves or the project team inspecting. Walls can fall out of the vertical allowances by up to 20 to 25mm due to site conditions, creep in tolerances, and different groups of workers doing different steps of the installation within each trade.*
If the building up of the substrate is not carried out in accordance to an approved material which is fit for purpose (and the contract process in getting approval to use an undocumented non-specified material will take approximately 7 days), the short cut build up is to apply additional glues or adhesives that have been specified for the normal tiling process. However, this will not perform in accordance with the manufacture requirements and it will fail over time. Subject to the extent of the alignment being outside of allowable tolerances, this also has a direct impact on the plumbing fixings and connections needing to be extended or reduced. If the tolerances are managed on site, the thread length will be reduced in both cases, and this can create plumbing integrity issues and ongoing maintenance.

However if the instruction is given to re-align the wall to the correct allowable tolerances to make good, this could take 2 to 3 weeks to rectify, with knock-on effects to all following trades and the overall project program. The critical issue then becomes the quality and integrity of making good of water proofing membranes and how that process is managed on the floors, and floor-to-wall junctions, to prevent water damage and ongoing maintenance.

Complicating the above scenario, the sub-contractors are essentially entering into a dispute amongst themselves, however, the sub-contract is structured so the dispute comes under the direction of the head contractor who is controlling the time and cost parameters of the project. So maintenance of quality (re-building the wall correctly) come into direct conflict with time and cost considerations – ultimately arbitrated by the head contractor.

**Recommendation 1: Increase understanding of Construction Contract types impact on quality**

The Victorian Government should develop plain language information (across a variety of mediums) that clearly explains Construction Contract processes, risks, and consequences for quality in building, for all parties involved in a building project. Industry peak bodies in development, building, and trades should be encouraged to promote the material.

**The on-site industry in Melbourne**

In today’s construction industry the head contractor is primarily a manager of the construction contract processes that sub-contract out the work to stated conditions. Direct responsibilities include the project preliminaries (site establishment, the project management team, etc.), and taking overall responsibility for the projects health and safety (OHS) obligations. These typically range between 16% to 20% of the total project cost, with an approximate margin allowance of 4% to 5%. The sub-contractors are working to a modified ‘back-to-back’ head contractor agreement which is without fully coordinated documentation, and where the workplace is driven by time and cost considerations. Sub-contractors often work within an environment that they themselves do not coordinate, with certain trades controlling the overall outcome.

Structure, facades and primary engineering services are the key elements of any project, and so any program delay to them will likely have an impact on time and cost to all the following trades. With cost and time well understood across the industry (and typically very specifically set out in the contract), most programs can be restructured to manage time delays to a point. However, the responsibility in mitigating labour cost and time within the trade packages ultimately rely on the sub-contractor and direction given by the head contractor.

It is common that one or more of the key elements will be delayed at different stages during construction. With a combination of delays occurring over the life of the project the overall program tightens, forcing the trades, under instruction of their program obligation to the head contractor, to proceed with accelerating deadlines. This can result in the trades instituting time-shortening procedures, such as starting works before the preceding trade is fully completed or considered to be signed off. This has implications for the quality assurance policies implemented by the head contractor. Compounding this situation, the current construction industry in Victoria relies on disproportionately on younger, inexperienced members of the project management team on-site to manage and co-ordinate the trades to ensure the standard of works are delivered to the contractual obligations. Notwithstanding that the majority of young managers today are well educated, and well mentored in the management procedures involved, balancing the needs of head contractor and sub-contractor time and cost pressures against the maintenance of quality required in today’s building is a
difficult task while building up personal experience and knowledge. The (typically) more experienced role of site manager is mainly consumed by being responsible for the coordination of ongoing site management, crane co-ordination, delivery planning and placement, safety audits and site inspection, access within the site, short term programming, first line of on-site industrial relations issues and providing leadership to the site management team.

Opal Tower Investigation Final Report 2019 – Carter et al

In the Opal Tower report, the authors Carter, Hoffman, and Foster, state that “There are a number of points noted where construction differed from the design and/or Standards” (p. 8).

The six points identified included inadequate grouting between the hob and the pre-cast concrete panel that revealed a discrepancy between the design drawings and the shop drawings (the shop drawings were followed). Also included were inadequate concrete cover over the reinforcing bars in the hob, an incomplete (possibly cut after installation) dowel bar, a 20 mm overhang of the pre-cast panels on the hob due to the panels being manufactured to 200 mm not 180 mm as in the drawings (to match the hob width), and incorrectly sized reinforcement bars (20 mm not 28 mm) placed during the manufacture of the pre-cast panels. Finally, they noted a lack of reinforcement cross-ties to resist bursting forces in the hob.

These faults (at Opal) represent a mismatch between design drawings and shop drawings (grouting), inaccurate manufacture of prefabricated elements off-site (panel width and size of reinforcement bars), and poor workmanship by the trades (inadequate concrete coverage, cut dowel bars and missing cross-ties), all of which in theory should have been picked up using industry standard quality assurance procedures.

As the building was given a clearance at practical completion and subsequently occupied by residents, presumably all inspection points were conducted and signed-off (including photographs taken during construction). A lack of time to properly assess, and a lack of experience among the project team responsible for quality control are likely factors in the missed identification of materials and processes that contradicted requirements noted in contract specifications, design drawing, and Australian Standards.

Responsibility for the promotion, characterisation, and assessment of quality in building is shared between:

- the Education and Training sector – Tertiary Institutions responsible for teaching and learning in Architecture, Engineering, Construction, and the Trades,
- Victorian Building Authority – and also including Professional Bodies such as the Architects Institute of Australia (AIA), Engineers Australia (EA), and Australian Institute of Builders (AIB), and
- Private Industry and Business – including Peak bodies such as the Urban Development Institute of Australia (UDIA), the Housing Institute of Australia (HIA), and the Master Builders Association (MBA).

These organisations are responsible for academic qualifications, professional accreditation, and industry accreditation of personnel who work in design and construction, and ultimately control access to who is permitted to build in Victoria.

Recommendation 2: Coordination of Responsibility for Quality

The Victorian Government should take steps to coordinate an approach to quality that goes beyond the meeting of minimum standards and requirements and emphasises quality as a core value in each of the key institutions responsible for the education, regulation and accreditation of individuals who work in the built environment industry.
Conclusion: Understanding the limits of planning policy in driving quality

It is critical that the parameters of time, cost and quality in construction are considered equal across all trades. Quality by its nature operates at a different level of urgency for a head contractor than time and cost, and so it is assumed to be protected in contract documentation (drawings, specifications, PPRs) and monitored by a system of checks and balances. The extent and consistency of poor quality building in Australia suggests that there is a growing pattern of developer, head contractors and sub-contractors disregarding obligations under the contract (or at least passing them on downstream) under time and cost pressures, and a corresponding lack of expertise is detecting contract violations – among state-sanctioned inspectors and head contractor’s internal workforce.

Cracks in the Compact City 2

Although not the primary concern of their report, Crommelin et al (section 4.2.1), comment that:

“Lützkendorf and Speer (2005) and Forsythe (2007; 2015) argue that in addition to product quality, any definition of quality in construction should also encompass process and service quality – namely, the quality of the process through which the product is produced, and the degree to which delivery of the product meets customer expectations. The adoption of these ideas results in a shift in thinking away from merely a compliance-based approach to product quality, which tends to dominate quality debates in construction because prescriptive specifications, standards and codes are easy to implement, measure and monitor ... Instead, a process-focused approach requires adopting an outcomes-based ‘total quality’ perspective, which sees quality in three dimensions: that of the management systems and process of producing buildings; the object of the building itself; and the professionalism by which it is delivered to customers. Notably, this is similar to the outcomes-based approach advocated by Hackitt (2018) in her review of construction quality in the UK. Under this wider definition, a building has a satisfactory quality level when the building meets technical specifications, product standards, contractual agreements or regulatory requirements (in terms of asset performance, fitness for purpose and impact) but is also delivered through systems, processes and cultures which make that transparent to the customer and meet their expectations.”

We agree with the sentiment expressed here, although note that implementation is not always ‘easy’ as we have tried to demonstrate in this submission, and that systems, processes, and culture are people driven. Quality in construction must be the corner-stone that anchors expectations around time and cost, and this can only be introduced back into the industry by supporting the education, knowledge, and experience of the construction workforce, and a recognition of the role contracts play in determining quality through risk allocation.

This submission has argued that the form of contract currently used in the Victorian construction industry to produce apartment buildings pushes responsibility for design, and hence maintenance of design quality, down to the sub-contractor level where they have least control of the dynamics of the individual project, and current site practice by head contractors sees responsibility for inspection and control often delegated to inexperienced members of the project management team.

Increasingly sophisticated design guidelines that mandate adequate space standards, good ventilation, accessibility, and flexibility are important as these characteristics materially affect the quality of everyday life for people living in apartments. However, when it is only design intent, performance expectations, and dot-point principle project requirements that are handed to the builder – quality will always be in outside of the direct control of the buildings ultimate owner.

Recommendation 3: A Legislative framework for Quality

To ultimately drive change in the industry around quality, a legislative approach backed up by an independent Authority with powers of inspection, enforcement and penalty to individuals, similar to the current framework around workplace health and safety should be considered.
About the Authors

Dr Paulo Vaz Serra:

Paulo is a Senior Lecturer in Construction Management within the Faculty of Architecture, Building and Planning, Melbourne School of Design, at the University of Melbourne. Qualified in civil engineering, construction and management, Paulo joined the Faculty as an academic after more than twenty years’ experience in commercial, industrial, institutional and domestic construction as a senior construction manager and as a senior project manager, working with German, Italian, French, Spanish, English and Portuguese engineering and construction companies. Paulo has a Master’s degree in Construction and a PhD in Civil Engineering which focused on knowledge management in the construction company. He is the coordinator of several subjects within the Masters of Construction Management.

Mr Steven Richardson:

Steve has over 47 years of involvement in the construction industry where he has held various positions of responsibility including, Executive Project/Construction Manager, Project Manager, Site Manager, sub-contractor and consultant. He currently runs a consultancy practice that has been operating for seven years, that specialises in mentoring individuals, advising companies on construction means and methods, reviewing concept designs documentation on behalf of designers and developers, reporting on build-ability, constructability, including developing strategic planning and applying risk management strategies to troubled projects. While working as a project manager and executive project manager for Grocon, Steve worked on many iconic building projects in Melbourne including 120 Collin Street, ANZ Tower, Crown Casino, Melbourne University Grattan Street, QV, the MCC Northern Stand Redevelopment, and Melbourne Rectangular Stadium AMMI Park.

Dr Andrew Martel:

Andrew is a Lecturer who teaches into the Construction Management and Architecture programs in the faculty of Architecture, at the University of Melbourne. Andrew’s PhD investigated the nature of value in high-rise buildings in Melbourne. His research expertise is centred on housing, and has included high-density student housing, remote Indigenous housing, affordable family friendly housing and housing for people with disabilities. A particular focus of the research is on the complex nature of translating policy intentions of government entities into actual outcomes given the specific form and culture of the construction industry in Victoria and Australia. For the past few years Andrew has been investigating the potential of the NDIS to drive innovation in the production of accessible and adaptable domestic houses.