

Concrete: A Western Australian tradition

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Abstract

In 1961, The Hale School Memorial Hall was completed in Perth, Western Australia. While Jennifer Taylor credits the building with the introduction of béton brut into Australia she also described the building as a “strangely isolated example”, not joined by a similar work until the completion of the Social Sciences Building at Flinders University, Adelaide in 1969. Yet in the period between these two buildings Australia saw a wide range of béton brut experiments carried out which laid the ground work for the materials widespread acceptance in the 1970s. This paper contends that rather than being an isolated example the Hale School Memorial Hall spurred on a wave of béton brut buildings in Western Australia throughout the 1960s, constituting what could be considered a regional tradition. Ian Molyneux has previously identified the key role that concrete played in Western Australia during this period, suggesting that it is the use of concrete, particularly off-form concrete, which constitutes the most visible and significant contribution that Western Australia made to contemporary Australian architecture. However, to date this contribution has received little scholarly attention. This paper then sets out to chart a nascent history of béton brut buildings in the 1960s in Western Australia. It examines a decade of material and formal experimentation looking particularly at the key role that recent graduates, publications, and the construction industry played in the formation of this tradition.

Introduction

Jennifer Taylor wrote in *Australian Architecture since 1960* on the introduction of *béton brut* concrete into Australia.

The first of the 'beton brut' concrete buildings was the Hale School Memorial Hall in Perth by Marshall Clifton in association with Anthony Brand... At the time of its completion in 1961 it was greeted with mixed cries of outrage and applause. The crudeness and uneven forms of some of the concrete work point to its experimental nature and the immaturity of the concrete industry at the time... [it was] a strangely isolated example and it was not until the completion in 1969 of the Social Sciences Building at Flinders University that it was joined by a work with similar, formalist pretensions.¹

With this statement, Taylor glossed over an entire decade of concrete experiments in Australia and this narrative sequence remains largely unchallenged. This paper seeks to redress this view, demonstrating that the 1960s in fact saw the widespread development of *béton brut* buildings across the country; a series of buildings that would mount a significant challenge to the orthodox modern movement. Particularly, this paper looks at the Western Australian contribution demonstrating that rather than being a "strangely isolated example", the Hale School Memorial Hall instead acted as a catalyst for a series of experimental *béton brut* buildings carried out in the early 1960s by a small group of closely connected young architects. Architectural historian Ian Molyneux has suggested that it was the use of concrete, particularly off-form concrete, that is the most visible and significant contribution that Western Australia has made to contemporary Australian architecture² and this paper sets out to chart the extent of this contribution. This paper aims to not only record this series of buildings, but importantly to ask why they happened, when they happened.

The 1960s was a formative decade in the rebuilding of Australia driven by the relaxing of wartime rationing coupled with a series of economic growths. The arrival of new technologies, changing consumer tastes and unrivalled economic prosperity led to a period characterised by a variety of architectural expressions and ideological debates. One of the most visible of these new expressions was an increasing use of exposed concrete across a range of institutional and civic buildings. Widely used in major projects by architects like James Birrell, Daryl Jackson and John Andrews, concrete became closely linked to ideas of postwar progress and what has come to be known as Brutalism, which, as Philip Goad describes, was an idiom that was "a key partner in the rediscovery of the Australian landscape... and the Australian city."³ However, as illustrated by the coverage in Taylor's

book, the increasing use of concrete during this period has received little scholarly attention. Miles Lewis' book *200 Years of Concrete in Australia* remains the most comprehensive text on the material generally, however the postwar contribution is almost entirely overlooked. A handful of examples are illustrated, but the use of *béton brut* is mentioned only twice - in reference to the undercroft at the UWA Winthrop hall, completed in 1927 as the first, and the completion of Stanhill apartments by Frederick Romberg in 1950.⁴

J.M. Freeland's *Architecture in Australia* makes mention of the material, positioning the increased use of off-form concrete, along with other "warmer" and "textured" materials as central to the development of an architectural approach more "thoroughly and distinctly Australian."⁵ Freeland illustrates this approach with the Hale School Memorial Hall, alongside Goldstein Hall, designed by the New South Wales Government Architect Branch (1964) but does not elaborate much beyond the images. Jennifer Taylor's *Australian Architecture since 1960* – despite its side-stepping of the 1960s – provides the broadest survey of postwar concrete buildings in Australia to date. She devotes a chapter to those buildings which exploit the rich possibilities and sculptural qualities of the material, described as "Rational and Robust."⁶ These are predominantly projects from the 1970s, and she describes the use of concrete in the 1960s as "commonly used... but its prosaic treatment in general commercial and industrial buildings... was quite distinct from the heroic plastic use that had characterised Japanese, European and American architecture of the previous decade."⁷

The 1970s certainly saw the widespread use of expressed concrete around Australia, however, there was a range of "heroic" concrete buildings completed throughout the 1960s that have not been accounted for – buildings which laid the foundation for the materials success in the later decades and played an important part in the early rebuilding of postwar Australia. Early examples were often found in educational settings, praised for its hard wearing, low maintenance qualities.⁸ Christ College, Hobart (1960), the Highways Department Offices, Adelaide (1964), Union College at The University of Queensland (1964-65), Goldstein Hall, The University of Sydney (1964), and the considerable output of the NSW Government Architects Branch from 1964 onwards represent key moments in the early use of off-form concrete.

The heroic use of concrete in the 1960s has been the subject of much recent scholarship internationally, particularly surrounding its role in the formation of Brutalism. The recognition and excavation of buildings from this period is exemplified in the recent campaign *SOS Brutalism*, an initiative of the Deutsches Architekturmuseum to complete a

global survey of significant brutalist buildings in order to raise awareness of their increasingly threatened status.⁹ EPFL in Switzerland have released a series of books which look at the central role that concrete played in the work of Louis Kahn, Le Corbusier, Nervi and German architecture.¹⁰ In Australia, Philip Goad has produced the most comprehensive update to Taylor's "Rational and Robust" grouping, in his recent *Fabrications* article "Bringing it all Home: Robin Boyd and Australia's Embrace of Brutalism, 1955-71".¹¹ Here, Goad highlights a range of key buildings overlooked in Taylor's survey, including Seidler's 1967 Killara House, Bogle & Banfield's Total Car Park (1965), and the work of Dirk Bolt in Hobart. Other seminal concrete buildings from the 1960s have been featured in a range of recent texts, including *Hot Modernism* which includes the work of James Birrell at the University of Queensland and Glenn Harper's "The Brutalist Project Sydney" which comprehensively maps brutalist projects throughout New South Wales.¹² This paper aims to build on these recent revisions, further illustrating the particularly strong and cohesive body of work produced in this period.

It is important at this point to define the parameters of terms and be clear in the papers intention. This paper specifically seeks to address the use of *béton brut*, concrete which is left untreated after the formwork is removed, or "a concrete whose surface bore the traces of the grain of the wooden moulds, the imprint of the building process."¹³ It looks specifically at those buildings in Western Australia that use this process as the generator of design, or as Miles Lewis describes, in "architecturally conspicuous locations."¹⁴ This is important to distinguish as *béton brut*, or off-form board marked concrete, had been used extensively since the early 20th century for engineering and other structures. This paper uses Western Australian as a case study with the intention of charting a geographically specific group of concrete buildings and the situation in which they were produced, by way of highlighting the diversity present in postwar architectural practice in Australia.

The Hale School Memorial Hall

The first of the major *béton brut* building completed in Western Australia was the 1961 Hale School Memorial Hall, designed by Marshall Clifton and Anthony Brand, architects in Association, with R.J. Ferguson as the design architect. The Hall was to be the centre piece of the new Hale School campus, an elite private boys school located in the garden suburb of Wembley Downs. Brand and Clifton were tasked with designing the new school, but given the demands of designing an entire campus they were unable to complete the Hall in time. Instead, in 1960 Brand sought help to finish the Hall from fellow Perth Technical College (PTC) graduate, R.J. Ferguson, the two having just commenced a private practice together, Brand and Ferguson.



Figure 1: Hale School Memorial Hall, Wembley Downs, 1961.

Source: *Cross-Section* Archive, Melbourne University.

Ferguson, then 28, had recently returned from a formative three-year trip abroad, working for a year and a half with Chamberlin Powell and Bon (CPB) on the Barbican redevelopment, and later driving across Europe and Asia visiting many of Le Corbusier's buildings along with a range of vernacular architecture. Working on the Barbican project, which was then designed with a highly polished smooth concrete finish, does not appear to have had any significant formal influence on Ferguson's practice. Instead he suggests that the major lesson he took from his time at CPB was confidence – losing any fear of big jobs.¹⁵ Rather it was an interest in architectural traditions and the finely textured board marked concrete surfaces he saw in the buildings of Le Corbusier, and a series of houses in Switzerland during this trip which would most directly influence the first years of his practice.

Upon his return, Ferguson was keen to put into practice the exciting new concrete processes he had seen on his travels, and the dramatic, monumental presence implied by a memorial project provided the ideal application. Ferguson had never built with concrete before, and in 1960 he used another project which the practice Brand and Ferguson had just been awarded, the Fremantle South Terrace Primary School, as a kind of testing ground for the Hall. A modest two-storey state primary school, the soffit of the first-floor balcony provided the opportunity for Ferguson to experiment with the material. Despite the diminutive scale, the project clearly illustrates Ferguson's enthusiasm for *béton brut* and was constructed within months of returning from his study trip. Ferguson specifically chose

jarrah boards for the formwork which were sawn in different thicknesses and arranged to emphasise the surface texture, which was later scaled up for use in the Memorial Hall.

The beginnings of a tradition

The Hale School Memorial Hall was a dramatic building, and had an immediate impact on the local profession, particularly after it was awarded the RIBA Bronze Medal for 1959-1961 and the *Architecture and Arts* Australian building of the year in 1962, the journal calling it “one of Australia’s most significant buildings.”¹⁶ *Cross-Section* described it as “courageous” suggesting “this architecture, may serve as a touchstone of taste and temperament for many years to come.”¹⁷ The infamous local architectural commentator Caliban, pseudonym of architect Peter Parkinson, noted shortly after its completion, “Hale School Hall is a sophisticated exercise in surface texture and abstract balance, and as such is a building with which to be extremely pleased.”¹⁸ While the profession generally admired it, it was a shock to the school and the general public. An opinion piece in *The Architect WA*, describes this tension, “The Hale School Hall used a form of construction which was not only totally untried in WA, but also uncommon elsewhere...and it was only the medal which saved the building from being rendered and the architects from being sued.”¹⁹

Despite the divisive reception from the public, the young architectural profession took up the material with gusto and the Hale School Memorial Hall can be seen as the starting point for a series of experimental works carried out in the state over the next several years. From 1960-1965 a small but confident brace of buildings were completed in almost total *béton brut*, mostly carried out by a small group of well-connected and adventurous young architects. These buildings quickly caught the attention of the *Cross-Section* editors and in 1965 they noted, “Western Australia has set the pace for the rest of Australia in off-form concrete buildings.”²⁰ The first to follow from the Memorial Hall was the 1962 Celtic Club designed by Silver and Goldberg, notable for its large scale brise soleil stretched across the front facade. Hawkins and Sands built a series of buildings on Cottesloe Beach including an enormous boardwalk, kiosk, and change rooms, followed in 1963 by the Mosman Park School for Deaf Children which was a bold white concrete building set just back from the beach. A block of flats designed by Brand, Ferguson and Solarski in 1963 also on Cottesloe Beach mixed *béton brut* with concrete blocks. These were followed by the completion of the first stage of Western Australian Institute of Technology (WAIT) in 1964, designed by the Public Works Department (PWD) headed by Vin Davies, and stage 1 of St Mary’s Anglican Girls School designed by Margaret Feilman.

Many of these were directly influenced by Ferguson’s Memorial Hall. Robert Hanlin, design architect for the deaf school and St Mary’s school had worked closely with Ferguson and

Anthony Brand on construction methods and mix colours, and Vin Davis has readily acknowledged his admiration for the “Corbian” nature of the Hall.²¹ The success of these early experiments led to a series of striking works in the late 1960s and into the 1970s. These include the Kings Park office buildings (Krantz and Sheldon, 1966), The UWA Law School and Sports Centre (R.J. Ferguson, 1967, 1970), Marine Research Laboratory (CCN, 1968), the second stage WAIT Campus (PWD 1965-68), CBH Office (Geoffrey Summerhayes, 1969) and Forbes and Fitzhardinge’s ANZ Bank (1966-67), Freemasons Hall (1967), and series of three City Beach Change Rooms (1970).



Figure 2: Western Australian Institute of Technology, Bentley. 1964.

Source: *Constructional Review*, February 1966.

The Influences

The network of architects and engineers involved in these buildings was deeply interconnected, individuals often assisting on other projects and providing help with construction details and finishes. The architectural community in Western Australia in the early 1960s was a tight knit group and this proved to be a fertile ground to share and disseminate architectural ideas. The recent arrival of significant émigré architects alongside a contingent of well-travelled students contributed to a healthy architectural discourse, bolstered by the local institute journal *The Architect WA*. But what led to the flourishing of this particular material? This is a task far beyond this brief paper, but a range of motivating factors can be identified, including: an emerging concrete industry, the support of local journals, and the experimental, practical qualities of the material.

By this time Ferguson was offered the Hale School Memorial Hall commission in 1960, there was a well-established local concrete industry, and large-scale testing of the material

was already occurring. The use of precast panels or frames and experiments with domes, folded plate and hyperbolic paraboloid structures were common, and precast concrete panels were being used to construct houses regularly through the WA State Housing Commission in the early 1950s.²² The use of reinforced concrete frames were common place in high rise developments and most large infrastructure projects were completed in concrete including dams, bridges and silos. Two notable concrete architectural experiments carried out during this period were the 1958 Display Pavilion at the Claremont Showgrounds, and the Tawarri Dome. Designed by the Architectural division of the PWD, with engineering carried out by Lew Harding, the Display Pavilion was a concrete hyperbolic paraboloid, inspired by the recent work of Candela.²³ The Tawarri Dome was designed by Tony Brand (before he joined with Ferguson) while at Forbes and Fitzhardinge in 1957, with the structure designed by William (Bill) Barton. While not a paraboloid, the building was a three-pointed concrete shell dome, with glazing slotted in between the large arched openings.

Experiments like these ensured local practices and engineers were familiar with the process and the potential limits of the material. The engineer for the Hale School Memorial Hall, Peter Bruechle, recalls this familiarity noting it was the board marked finish not the structure that was difficult:

The structure didn't bother me. I could design the structure in reinforced concrete, that wasn't the real problem, it was the finish... Fergy [R.J. Ferguson] made test panels, and he used sawn boards, and deliberately got them sawn so they had a pattern on them. It was all a bit experimental.²⁴

The use of concrete in Western Australia was supported and advocated by the building industry at an early stage, and the abundance of good local sand and aggregate made it a cost-effective and attractive option.²⁵ The Leederville Technical College began a course in concrete practice instigated in 1955 by the RAI, Master Builders' Federation, Department of Education and the Swan Portland Cement company to improve "the lamentably low standard of concrete construction in W.A." which architects and builders eagerly attended.²⁶ The course was so popular that a second was implemented to cope with demand. The "low standards" were clearly improved and a second national office of the Cement and Concrete Association of Australia (CCA) opened in Perth in 1962.²⁷ The CCA later organised the first off-form concrete conference in Australia, held in Perth in October 1964 titled "The Off-Form Concrete Surface Finishes Symposium."²⁸ Local hardware retailers got involved as well, and in 1964 Bunnings began advertising timbers specifically designed for use in off-form concrete formwork announcing "Timber gives

concrete new look”.²⁹ Local journal *The Architect WA* often published articles on the science of concrete and reported on symposiums held in Sydney, technical information on waterproofing, the use of timber formwork for surface finish, as well as republishing a lengthy article by Nervi from the 6th Congress of the International Union of Architects (UIA) on reinforced concrete in September 1961.³⁰ Weekly construction newsletter *Building and Construction* ran a special on concrete and its application across four issues in June 1962,³¹ and national journal *Constructional Review* often published WA work and technical information.

Aside from its cost-effectiveness, another major factor which may have contributed to the widespread uptake of the material was its weather resistant properties. West Australian architects were acutely aware of the need to protect against the difficult climate³² characterised by direct sun, driving rain, and specifically salt erosion from the coast, and the ability for concrete to resist these conditions was quickly seized upon. Desmond Sands, then President of the RAlA WA, espoused the benefits in a conference paper noting that the use of concrete is often necessitated in locations near the ocean which are affected by severe salt deterioration and the amount of costly maintenance which could be avoided by the use of concrete.³³ He echoed this sentiment when discussing one of his own projects several years later, the Cottesloe Boardwalk, noting that “The major design consideration was the need to withstand wear from coastal weather and public alike.”³⁴ Anthony Brand also highlighted the importance of this when designing a series of sculptural concrete beach kiosks in 1970, using a series of curved forms to keep the concrete in compression so that it wouldn’t crack, resisting the corrosive beach conditions.³⁵ Indeed many of the key off-form concrete buildings in the early years were located either on, or next to the beach, giving further credence to the idea that its early appearance in Perth was closely tied to its ability to resist salt erosion.

Almost all the examples described used a similar formwork technique and surface patterning despite the wide range of formwork process and finishes available at the time. The use of rough sawn, 15cm by 5cm (6 in. x 2 in.) timber formwork resulting in a deeply textured surface which was shared across a number of these projects. The use of timber formwork had many advantages for architects in Western Australia – it could be re-used and was relatively cost-effective compared to other treatments.³⁶ But the use of *béton brut* by this group of architects was largely ideologically motivated and was sought out for its aesthetic and textural capacity rather than any pragmatic qualities it possessed. Ferguson for example was interested the human scaled quality achieved by the finely board marked surface, something he saw lacking in the smooth finish that resulted from the use of large plywood sheets he observed in Le Corbusier’s work at Chandigarh.³⁷ Similarly Rob Hanlin’s

choice of material in the Mosman Park School for Deaf Children was aesthetically motivated, suggesting that the brilliant white of the concrete with rough board markings would enhance the sensorial experience for the students.³⁸

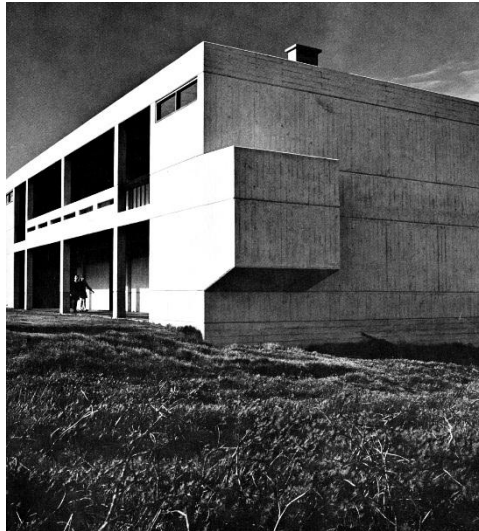


Figure 3: Mosman Park School for Deaf Children, Mosman Park. 1963.

Source: Sowden, *Towards an Australian Architecture*.

A practical tradition

An interest in the functional attributes of concrete and the ‘can-do’ attitude espoused by young engineers like Peter Bruechle draws upon a long-standing practical building tradition in WA. Ian Molyneux has described this tradition stating, “A belief in the principles of rational analysis of requirements and technological options has since remained the dominant ideological basis of architectural study in Western Australia.”³⁹ A practical building culture was deeply ingrained in the state, historically driven by a lack of materials, money, and skill.⁴⁰ The architectural course at PTC established by W.H. Robertson in 1946 continued this tradition, which Duncan Richards described as “far too practical in nature, trade based training rather than education.”⁴¹ Adrian Forty suggests that more so than other materials, concrete facilitates the ability to experiment, allowing the architect to be their “own alchemist”,⁴² and for young Western Australian architects and engineers, concrete clearly enabled exciting new formal opportunities. It possessed a satisfyingly functional, tectonic quality that aligned with local traditions, while allowing for self-expression. It was hard wearing and weather resistant, and the deeply textured, cragged surface produced a wonderfully pleasing aesthetic quality in the unrelenting sunshine.

Significantly, it provided a way to continue the practical building tradition outside of the strong masonry tradition that had persisted in WA since the 19th century, in part due to the high quality of brick production in the city facilitated in part by the large numbers of clay pits.⁴³ This was a legacy developed through great historic civic works designed by government architects George Temple Poole and Hillson Beasley in the late 19th and very early 20th century, and which continued on into the 1950s. Major public buildings like the Agnes Walsh Nurses Home (1955) and the Sir Charles Gairdner Hospital (1958) were designed by the PWD in brick, as well as many significant government schools like Governor Stirling Senior High School (1956). Unlike brick, concrete did not hold any particular cultural significance to the state; it was a modern, introduced material. The enthusiastic embrace during the 1960s of concrete by young architects demonstrates the easy fit it achieved in Western Australia, and the opportunity it provided for the construction of a new tradition.

Conclusion

The late 1950s in Western Australia saw the arrival of émigré architects, a wealth of students returning from overseas travel, and a building rush triggered by a recent mineral boom which set the scene for an active start to the following decade. Building on a series of experimental concrete buildings from the 1950s along with increasing industry support, the 1960s bore witness to a range of *béton brut* buildings produced by a young, tight-knit group of architects and engineers excited by the possibilities of this new process, openly learning and sharing their experiences with each other.

Arguably triggered by the completion of the Hale School Memorial Hall, the widespread use of off-form concrete in Western Australia throughout the 1960s constituted what could be considered a new regional tradition. The plasticity of forms and the robust, economical nature of the material proved to be the ideal vehicle for a new generation of Western Australian architects. The use of heavily textured *béton brut* was a deliberate and considered decision and it symbolised a dynamic changing of the guard in the profession. For this group of architects, *béton brut* provided a medium to critique the orthodox modern movement while continuing a legacy of practical and robust solutions so deeply ingrained in local architectural practice. This paper has identified a brief but intense period of development in concrete expression which occurred in Western Australia, but one that was echoed around the country. These buildings provide an alternative perspective on the shift that occurred between the largely conservative public architecture of the immediate postwar period and the confident pluralism evident in the 1970s, of which the use of *béton brut* played a significant role.

Endnotes

- ¹ Jennifer Taylor, *Australian Architecture Since 1960*, (Sydney: Law Book Co., 1986), 79-80.
- ² Ian Molyneux, "Building in Western Australia 1940-1979," in *Western Towns and Buildings*, eds. Margaret Pitt Morison and John White (Nedlands: UWA Press, 1979), 153.
- ³ Philip Goad, "Bringing it all Home: Robin Boyd and Australia's Embrace of Brutalism, 1955-71," *Fabrications* 25, 2 (2015), 208.
- ⁴ Miles Lewis, *200 Years of Concrete in Australia* (North Sydney: Concrete Institute of Australia, 1988), 103.
- ⁵ J.M. Freeland, *Architecture in Australia: A History* (Melbourne: Cheshire, 1968), 305.
- ⁶ Taylor, *Australian Architecture Since 1960*, 78
- ⁷ Taylor, *Australian Architecture Since 1960*, 79.
- ⁸ "Technical College," *Constructional Review* 41, 3 (1968), 15.
- ⁹ Oliver Elser, Philip Kurz and Peter Cachola Schmal, *SOS Brutalism: A Global Survey* (Zurich: Park Books, 2017). See also: SOS Brutalism, <http://www.sosbrutalism.org>.
- ¹⁰ For example: Roberto Gargiani and Anna Rosellini, *Le Corbusier and Ineffable Space, 1940-1965: Surface Materials and Psychophysiology of Vision* (Lausanne: EPFL Press, 2011); Roberto Gargiana, Louis I. Kahn: Exposed Concrete and Hollow Stones, 1949-1959 (Lausanne: EPFL Press, 2014).
- ¹¹ Goad, "Bringing it all Home."
- ¹² J. Macarthur et al., eds. *Hot Modernism: Queensland Architecture, 1945-1975* (London: Artifice Books, 2015); Glenn Harper, "The Brutalist Project Sydney," see <https://www.architects.nsw.gov.au/public-resources/byera-hadley-travelling-scholarships1/33-past-reports/452-the-brutalist-project-sydney>
- ¹³ Rejean Legault, "The Idea of Brutalism in Canadian Architecture," in Rhodri Windsor Liscombe (ed.) *Architecture and the Canadian Fabric*, (Vancouver: UBC Press, 2011), 319.
- ¹⁴ Lewis, *200 Years of Concrete in Australia*, 103.
- ¹⁵ R.J. Ferguson, interviewed by author, December 2015.
- ¹⁶ "1962 Architecture and Arts Awards," *The Australian Journal of Architecture and Arts* 10, 12 (1962), 20.
- ¹⁷ *Cross-Section* 123 (January 1963).
- ¹⁸ Caliban, "Caliban," *The Architect WA* 6 (June 1963), 49.
- ¹⁹ "Opinion," *The Architect WA* 8 (December 1965), 39.
- ²⁰ *Cross-Section* 147 (January 1965).
- ²¹ Joseph Buch, "You May Seek Him in the Building: Interview with Vin Davies," *The Architect WA*, 34, 4 (1995), 29.
- ²² "University Has Its Own Housing Scheme" *The West Australian*, February 3, 1951, 5.
- ²³ *Constructional Review*, January (1959), 15-18.
- ²⁴ Peter Bruechle, interviewed by author, October 2016.
- ²⁵ Anthony Brand, interviewed by author, December 2017.
- ²⁶ "Syllabus of Lecture," *The Architect WA* 3 (March 1955), 12.
- ²⁷ "New Offices for Western Australian Division of Cement & Construction Association," *Constructional Review* 36, 6, (June 1962), 19.
- ²⁸ Speakers included C.F. Morrish, engineer, and R.W. Roberts on the cost of finishes, along with site visits including to the Deaf and Dumb school in Mosman Park. See *Constructional Review* 37, 12 (December 1964), 28.
- ²⁹ "Bunnings Advertisement," *The Architect WA*, 7, 3 (December 1964), n.p.
- ³⁰ P.I. Nervi, "The influence of reinforced concrete – technical and scientific progress on the architecture of today and tomorrow," *The Architect WA* 4 (September 1961), 46-54.
- ³¹ *Building and Construction*, June (1962). (No issue numbers)
- ³² "Talking Architecture," in Geoffrey London, Duncan Richards (eds.) *Modern Houses: Architect-Designed Houses in Western Australia from 1950-1960*, (Nedlands: School of Architecture and Fine Arts, The University of Western Australia, 1997), 31.
- ³³ "Our Cover Picture," *Constructional Review* 37, 12 (December 1964), 28.
- ³⁴ Harry Sowden, *Towards an Australian Architecture* (London: Lund Humphries, 1970), 137.
- ³⁵ Brand, interviewed by author, December 2017.
- ³⁶ R.W. Roberts, "Cost Comment on Off-Form Concrete Finishes," *Constructional Review* 37, 12 (1964), 24-28.

³⁷ Ferguson on Le Corbusier's concrete work: "Much of his work is brutal by intent stripped off ply sheets. The Swiss Pavilion at the Cite Universitaire, Paris has intimidating form but being stripped off timber boards produced a texture compatible with human scale." R.J. Ferguson, Personal communication with Andrew Murray, September, 2017.

³⁸ Robert Hanlin, Personal communication with author, November 2017.

³⁹ Molyneux, "Building in Western Australia 1940-1979," 140.

⁴⁰ Simon Anderson and Geoffrey London, "The Western Edge," *Architecture Australia* 79, 4 (1990), 48.

⁴¹ Duncan Richards, "With a Little Help From My Friends: Francis Senior Bolland at PTC." Unpublished essay, 2009.

⁴² Adrian Forty, *Concrete and Culture: A Material History* (London: Reaktion Books, 2012), 40.

Forty suggests the flexible and forgiving nature of the material, combined with the ability to experiment with additives and aggregates enables this 'alchemy.'

⁴³ Molyneux, "Building in Western Australia 1940-1979," 79.