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THE ROSE

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ABSTRACT: This paper describes the author's approach to the development of a Learn-by-Making unit for students of architecture. The design, construction and installation of two parkland seating structures located in the Nedlands Rose War Memorial Park, in an inner suburb or Perth, Western Australia is the primary case study provided as a successful example of Learn-by-Making in practice. Commissioned by The City of Nedlands, the project was undertaken by 4th and 5th year Master of Architecture students enrolled at the School of Architecture, Landscape and Visual Arts (ALVA) at the University of Western Australia (UWA) and supervised of the author, acting as both Project Architect and Unit Coordinator.

KEYWORDS: Timber design, public sculpture, Learn by Making, LbM, prefabrication, architecture students.

1 INTRODUCTION

Learn by Making (LbM) has the potential to be a rewarding process that can provide architecture students with an opportunity to develop an appreciation for design, documentation, construction, materiality and client/authority/consultant liaison in the context of a real project.

As a teaching methodology, it can be high risk. Short time frames, usually only one semester, inexperienced time-poor designers, full-scale construction requiring significant behind-the-scenes logistical organisation, infrastructure, transport and onsite based installation can make LbM a daunting proposition. This begs the question, why do it? In the author's opinion, LbM is undertaken for a variety of reasons, not the least, the positive feedback from the students who experience the satisfaction of having designed and built something of significance. But it is more than this. William J. Carpenter, in Learn by Building states that:

> 'The architect should not remain distant from the act of making … (he/she) ... should not simply observe … (but) … be immersed in the potential construction and its concept' [1].

The pragmatics of attempting to interpret the abstracted representations of a design to produce its literal realisation is a learnt art. A person who builds from plans must first be able to interpret and apply the design intent that the plans represent. This learnt art has value for architect and builder alike.

Architects rarely build the schemes that they create and a knowledge divide often exists between those who design and those who build. Neither participant exist in isolation and yet rarely do either experience each other's craft. The introduction of Learn-by-Making into architectural education represents one approach intended to increase an appreciation amongst architectural undergraduates of the difficulties that can be encountered in the realization of an idea or concept that, prior to its construction, only existed in abstracted form.

Figure 1: *The Roses. Designed by University of Western Australia's, Master of Architecture students, Soudabeh Alavi and Hamidreza Mahboudi Soufiani in 2014.*

Through the act of constructing one's own design, participants can develop an increased awareness of the need to understand sound construction techniques, the relationships between form and structure, and the fostering of a greater appreciation of materiality. Good design can benefit from an increased awareness of issues associated with producing that design. Traditional or theoretical architectural education does not always acknowledge this. In a forthright assessment of the state of architectural education and its shortcomings in the UK, Oliver Wainwright states that architectural education should be:

> '…a discussion of places and spaces, cities and landscapes, a discipline of engaging with the world around us', … but that with '…astronomical fees and paltry job prospects, it's time our professional architecture courses came back to the real world' [2].

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Wainwright's observations of architectural education speak of a rigid, out-of-touch and expensive course structures that lack a connection to the world as it is today.

Students of architecture are typically taught design, in the context of an architectural studio overseen by an experienced architect, by presenting theoretical solutions to a given brief. The designs are usually presented in drawn and virtual formats via two and three dimensional representations with supplementary scale models. The nature of building materials, architectural physics and the application of building standards are usually taught independently, and depending on the curriculum, a theoretical application of these aspects of construction will be applied to the projects undertaken in the studio.

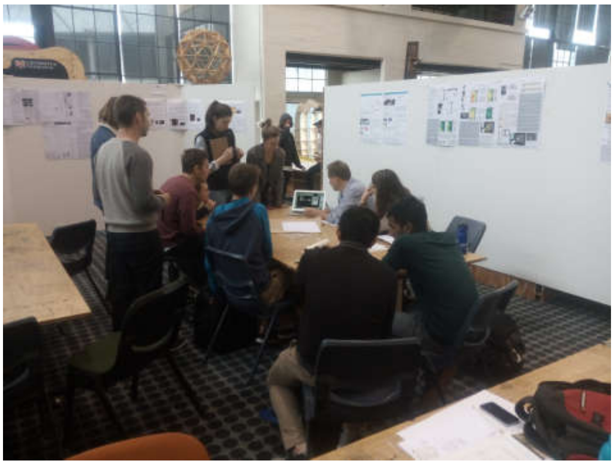

Figure 2: *A typical group of architecture students participating in an architectural studio.*

Dr Gary Stevens, another vocal critic of modern architectural education, points out that there should be a greater emphasis placed on architectural students understanding fundamentals, essentially teaching design based on first principles. He espouses that students be taught:

> '… how to draw … (gaining an) … understanding (of) building codes, the rudiments of structural analysis (and) the principles of construction…' [3].

These appear to be common sense aspirations, but in the author's experience, traditional theoretically based architectural education can benefit greatly from seeking experiences in the practical application of these fundamentals.

One way to address this is to introduce LbM into the curriculum and let the LbM process be a vehicle for such an ideal. Learn-by-Making does not propose supplanting the traditional model. Rather, it provides a practical method of supplementing theoretical design exercises with a manageable physical project designed specifically to compress normal design and construction processes and timelines. It should accommodate semester timetables, while still providing students with a valuable experience resulting in the realization of their design at full scale.

1.1 CONSIDERATIONS FOR THE DEVELOPMENT OF A LEARN-BY-MAKING PROGRAM

Learn-by-Making can be extremely rewarding for both the educator and the student, conversely, failure to successful complete a project can result in serious implications for the student's assessment and the requirements to deliver a completed project for the client. As with any building project, unforeseen difficulties can arise and these need to be managed to allow the students to maximize their learning opportunities and still ensure that sufficient work is completed to allow assessment.

When the inevitable difficulties do arise, such as delays in approvals, material supply issues and equipment failure, they can be leveraged to contribute to the learning outcomes. Students often have had little or no prior experience with workshop tools, handling building materials, and the many difficulties encountered in project coordination. Learn-by-Making must take these factors into consideration and the program should be structured to ensure that adequate technical staff are available to assist. Additional time should be included in the program to accommodate unforeseen delays. Because of its compressed time frame, it is essential to negotiate a prearranged fast-tracked approval process with consultants and local authorities if required.

Having a structural engineer as part of the educational team, even as an external consultant, is also key to a LbM project's success. Engaging periodically with an engineer will provide students with regular applied feedback on the structural imperatives they should consider with their design, provide a streamlined path to certification if required, and provide an additional layer of expertise throughout the construction process.

1.2 PROCCESSES, MATERIAL CHOICES AND CONSTRUCTION METHODS

The Learn-by-Making model developed by the author provides the students with equal design time to develop their respective solutions. Students are paired and spend a set period designing their project according to the project brief. This programming must be strictly adhered to ensuring adequate time is provided for construction. At a nominated stage in the program, the suite of designs produced by the students are presented to a panel of assessors, comprising the unit coordinator, a representative of the client and the consulting engineer.

The panel should consider how the brief has been addressed, form and function of the design and its buildability within the constraints of the budget and available workshop facilities. Depending on the project's intended location, adopting a prefabricated approach ensures that students undertake the majority of the construction in a controlled environment. Prototyping can also benefit if multiple construction processes are available. Undertaking a mock assembly in the confines of the workshop will also assist final assembly on site.

2 CASE STUDIES

2.1 SWEDEN

The author's initial attempt at facilitating a Learn-by-Making exercise was undertaken at the School of Architecture and the Built Environment at the Swedish Kunliga Tekniska Högskolan (Kings Technical University) in Stockholm in conjunction with Dr. Andreas Falk in 2010. This project was undertaken within the confines of an Architectural Technology unit entitled *Translated Structures and Material Combinations*. In addition to lectures, materials research and assignments, the students were provided with plans and materials for a simple box beam grillage structure. The task was to construct and test the structure and reflect on the process of translating the design into its built form.

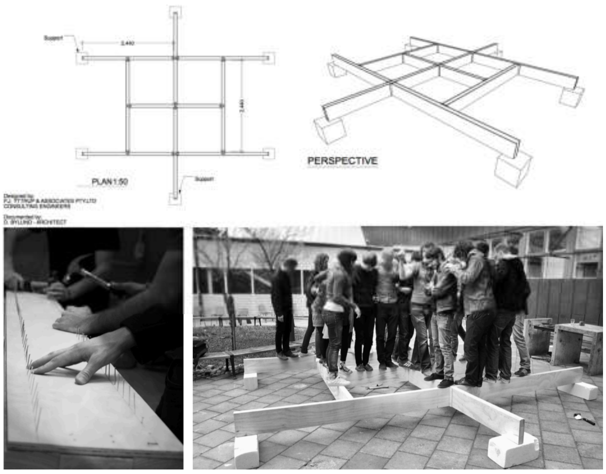

Figure 3: *Swedish architecture students build and test timber box beam grillage structure in 2010. Design Credit: P.J Yttrup & Associates in conjunction with the Centre for Sustainable Architecture with Wood.*

2.2 CAREY BAPTIST COLLEGE PERMACULTURE GARDEN SHADE PAVILION

This was the first LbM project attempted by the author as a stand-alone, full semester elective unit for 4th and 5th year Masters of Architecture students at University of Western Australia's (UWA) Faculty of Architecture, Landscape and Visual Arts (ALVA).

The project brief called for a shade structure to be located in a primary school permaculture garden. It was required to provide shade during school hours, act as a focal point for the garden and provide teachers a place to hold small classes in a sheltered outdoor environment within the confines of the garden. Parallel to designing solutions for the project brief, the students undertook a series of small timber related technical research assignments to complement and expand their general timber design knowledge which they presented to the class progressively over the semester. This project won an *Australian Timber Design Award* for *Recognising Excellence in the Use of Timber Products* in the Treated Pine category in 2013.

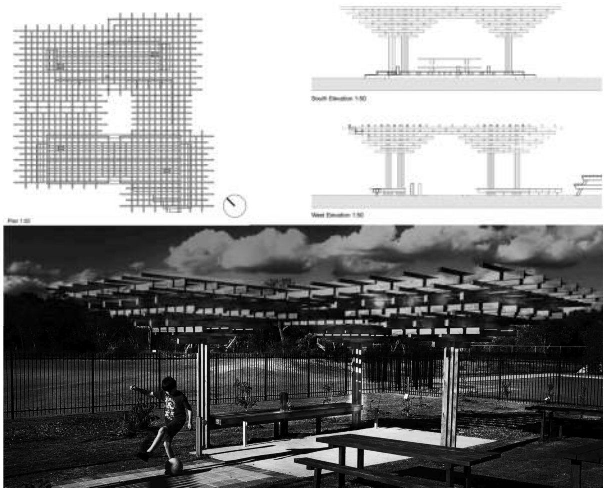

Figure 4. *Carey Baptist College permaculture garden shade pavilion. Plans: Dustin Diep & Sing Liang Chai.*

2.3 NEDLANDS BUS SHELTER

In 2014, the ALVA students were commissioned by the City of Nedlands in Perth, Western Australia, to design, construct and install a bus shelter on a busy highway as part of a city-wide bus shelter upgrade program. The bus shelter brief required the students to apply the public transport authority's design guidelines to ensure compliance with the appropriate standards. The project was constructed in components in the faculty workshops, assembled off-site and transported to the site. Construction took six weeks and installation took one day. As with the permaculture garden project, the architecture students were required to research technical timber related topics, present them to the class and apply the principles to their designs. This project won the *Australian Timber Design Awards* for *Recognising Excellence in Timber Design* in the Treated Pine category in 2014.

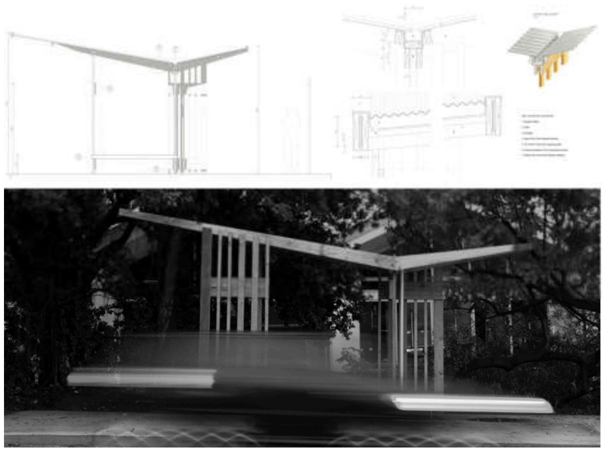

Figure 5. *The Bus Shelter on Stirling Highway in the City of Nedlands. Plans: Clare Holmes & Lan Nguyen*

2.4 THE ARRAY AND THE WOOD WAVE

The project brief for semester one of 2015 was to provide a formal seating area in the pick-up and drop-off zone for students at a local primary school near the university. Unlike the previous semester's project, some more conservative proposals emerged from the design process, allowing two projects to be constructed. One project was to be located at the primary school as intended, and the other would be located at the entrance to the School of Architecture, Landscape and Visual Arts. As public seating structures, the brief allowed for treated pine to be used structurally, but native Australian hardwoods were specified for all surfaces that would come in direct contact with users. In a break from previous projects, the proposal for ALVA included strong organic forms reminiscent of a stylized wave or dynamic ribbon and combining three different types of timber products, Radiata pine for its structural frame, Marine Grade Plywood for cladding and prefinished Jarrah decking for the seating surfaces.

The primary school project, *The Array*, is very popular amongst the students and has demonstrated that even simple repetitive rectilinear forms can be appealing. The ALVA project, *The Wood Wave*, was also entered into the 2015 *Australian Timber Design Awards*, being in direct competition with *The Rose* from semester two in 2014. It was awarded runner up, being one of two finalists in the Treated Pine category.

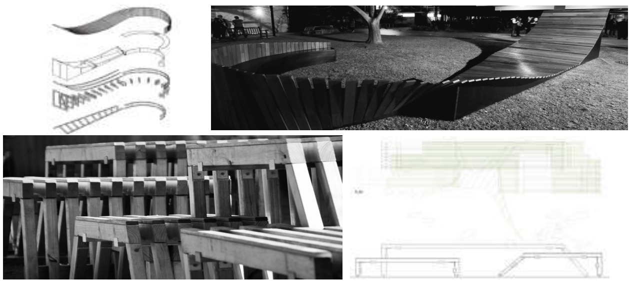

Figure 6. *Top - The Wood Wave by Anna Mustard and Kristen DiGregorio. Bottom – The Array by Tamara Glick and Aine Dowling.*

3 THE ROSE

3.1 THE BRIEF

In semester two of 2014, the City of Nedlands once again engaged ALVA, this time to design and construct a shade structure for one of the city's war memorial parks. The brief called for a proposal that would provide some shade and a reflective place to sit for visitors to the memorial. Given the success of the previous two semesters' work, this new suite of students embraced the challenge wholeheartedly.

3.2 SITE

The project was located in a suburban war memorial, making the design brief for this project significantly more challenging than any of the prior projects undertaken by prior classes and as such, a greater degree of contextual, emotional and social sensitivity was required. The brief required the design and construction of a predominately timber based shade structure that incorporated a casual seating element to be located in line with the parks central axis.

Its intent was to provide a focal point within the park context and connect to the contemplative rose garden theme embodied by the heritage listed war memorial and associated gardens.

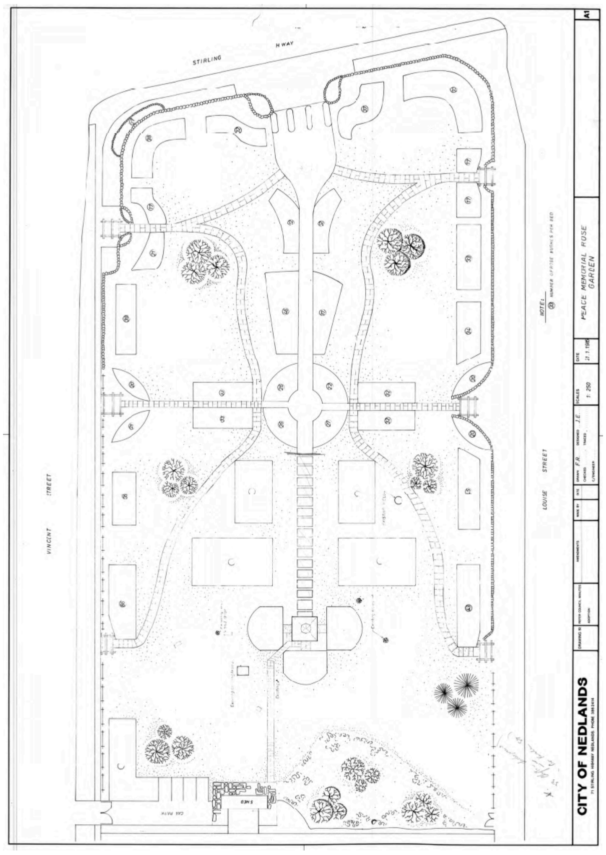

Figure 7: *Nedland's Rose Memorial Garden Site Plan*

Figure 8: *Top - Existing heritage listed structures at the entry to Nedland's Rose Memorial Garden.*

3.3 CLASS SOLUTIONS

The class comprised 16 architecture students and, as with units of a similar nature held in previous years, they were paired to develop and present their proposals within a very short time to allow for construction, testing and installation. A broad range of solutions were developed, ranging from cuboidal three dimensional grillage structures to elegantly screened lineal pavilions. Figures 9, 10 and 11 provide some examples of the student's work.

***Figure 9:** Proposal by Rebecca Hawker & Erin Fowler.*

***Figure 10:** Proposal by Andrew Nguyen and Danny Nguyen.*

***Figure 11:** Proposal by Jaime Mayger and Daniel Martin*

3.4 THE ROSE

Of the eight designs proposed, the Timber Rose proposal by Soudabeh Alavi and Hamidreza Mahboudi Soufiani was a standout. It featured innovative and imaginative technical detailing with an eye catching dynamic profile.

The student's solution adapted the Golden Ratio evident in a rose's petal structure and skillfully reinterpreted it into an interlocking, four mega-petal, planar arrangement as can be seen in the development sketches in Figures 12.

The design is deceptively simple, ultimately appearing as two, side-by-side squares, each with a cruciform central column with radiating 1/4 'mega-petals' and angled seating benches. Refer to Figure 15.

The twin structures straddle a central walkway, ensuring visitors engage with the structure. Refer to Figure 14. The confluence of members that occur at the intersection of each quarter's 'petal', reach to the sky suggesting a much more complex structure.

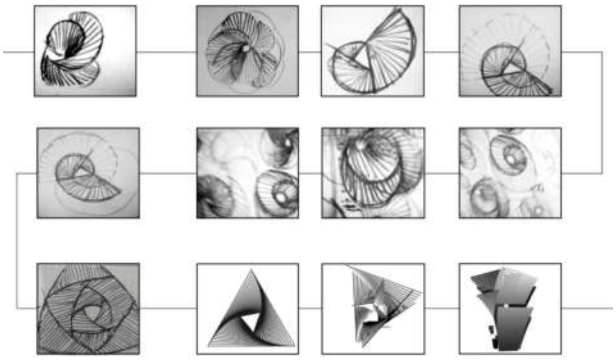

***Figure 12:** Developmental concept sketches exploring the Golden Mean ratio evident in the petals of a rose and its transition from organic to rectilinear by winning students, Soudabeh Alavi and Hamidreza Mahboudi Soufiani*

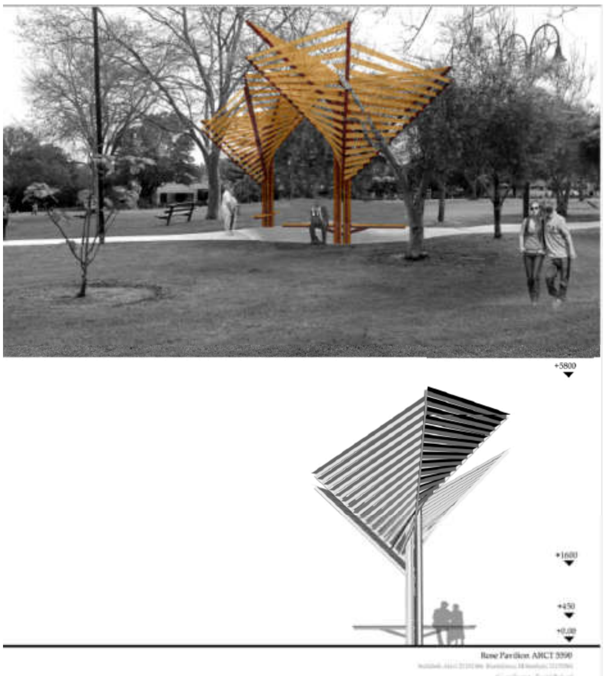

***Figure 13:** Perspective and elevations of the winning proposal*

An inventive and well thought out process explored the student's journey from organic forms through to their rectilinear outcomes. This process tested a range of methods to express a curvilinear object along a series of overlapping vectors.

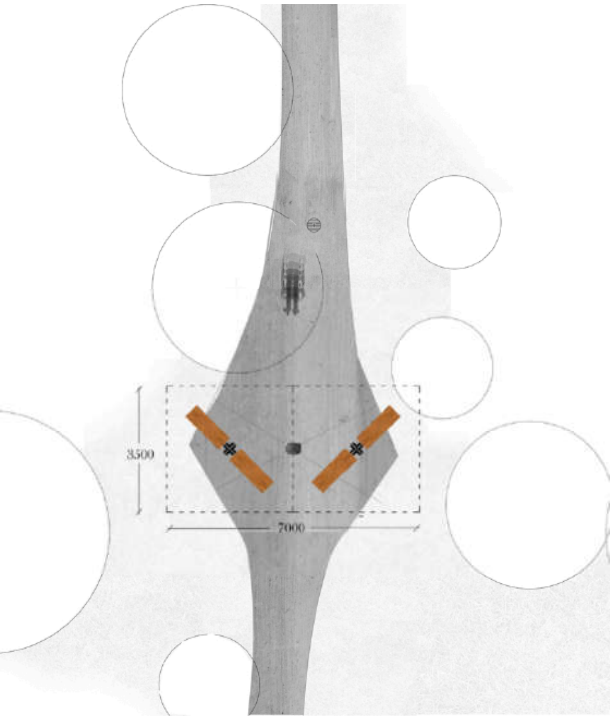

Figure 14: *Site Plan of the winning proposal showing the two central columns and the extent of each of the four sided 'petal' arrangements*

3.5 CONSTRUCTION CHALLENGES

Despite the student's exhibiting a high degree of enthusiasm for this project and the broad range of project's successfully completed by previous years, building this project was a challenge because of its design complexity, scale and unique structural challanges.

As with previous projects, the proposal was required to incorporate Designed for Manufacture and Assembly (DfM) principals to allow project to constructed in a workshop in components and transported to site where it would be reassembled. Despite its complex nature, each rose has only two axis allowing for each of the two the main cruciform elements to be assembled horizontally and lifted into place. Refer to Figure 17.

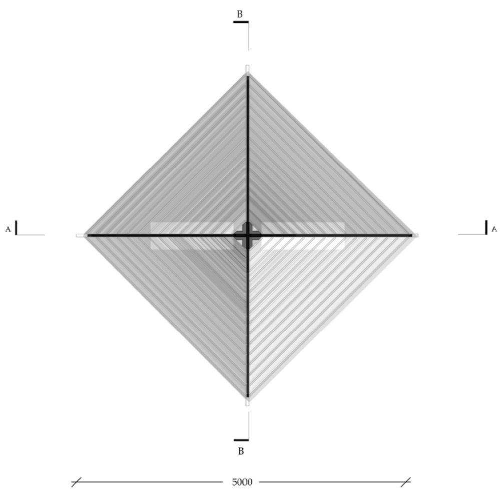

Figure 15: *Plan view of one rose showing the four 'mega-petals'*

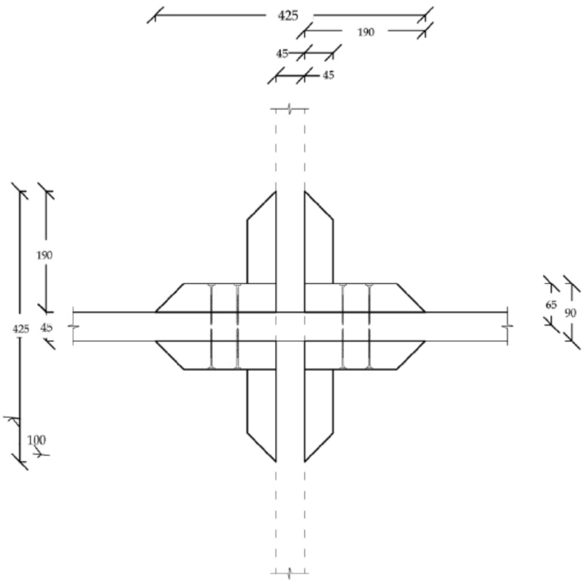

Figure 16: *Plan view of one rose*

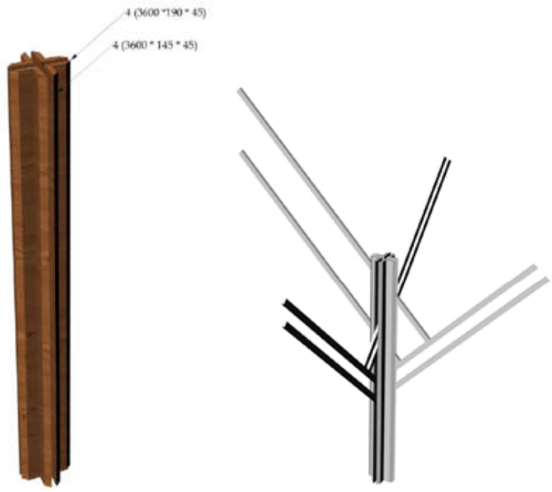

Figure 17: *Perspective views of the central column and column with primary outrigger arms*

The elements were broken down into their individual components according to the schedule of parts optimized through extensive three dimensional computer modelling and a scale physical model. This minimized the amount of calculations and shop drawings required by the students throughout the construction process. As two rose structures were required, lessons learnt from building the first structure allowed for a degree of streamlining for the second rose.

Being a free standing top heavy structures, the interconnected issues of height, wind load, weight and balance were overcome through an exhaustive process of consultation with the structural engineer. The result was a successful collaboration between the architectural and structural design disciplines, serving as a valuable learning exercise for the students and a rewarding endeavour for the engineer. The solution involved the incorporation of the surrounding monolithic concrete path and footing acting as a counterbalance to the overhead, cantilevered rose structure.

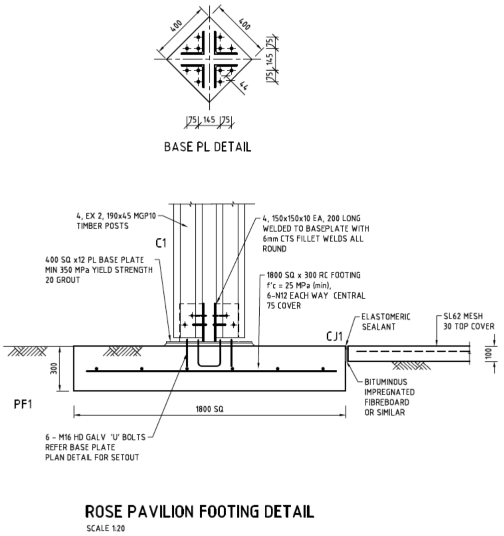

Figure 18: *Engineer's detail of the column footing detail and steel base plate. Image Credit: Scott Smalley Partnership*

3.6 CONSTRUCTION PROCESS

Each rose was fully constructed in the university workshops, disassembled and then reassembled on site. Being the largest structures undertaken to date by the course, considerable thought was given to the the most efficient method of construction whilst ensuring student safety at all times.

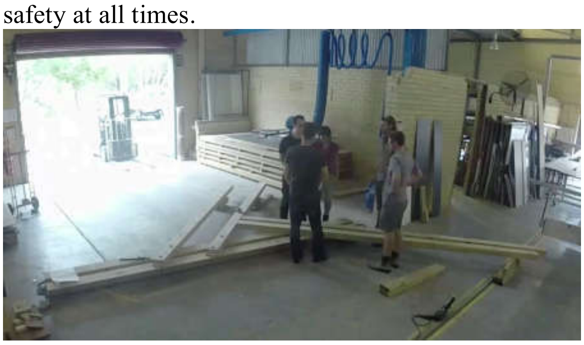

Figure 19: *Half of the central column and outriggers being assembled on the workshop floor.*

Figure 20: *Central column and outriggers temporally propped in place. Note the use of scaffold and caged safety platform.*

Figure 21: *Both roses in place at the workshops. The structure on the right is having the petals fitted.*

3.7 COMPLETED PROJECT

As with the Carey Baptist College Shade Pavilion in 2013 and the City of Nedlands Bus Shelter in 2014, this design won its category for *Recognising Excellence in Timber Design* in the Treated Pine category at the 2015 *Australian Timber Design Awards*. Figures 22, 23 and 24 show the completed structures.

Figure 22: *Completed project in its parkland context.*

Figure 23: *View looking up at the two roses side by side.*

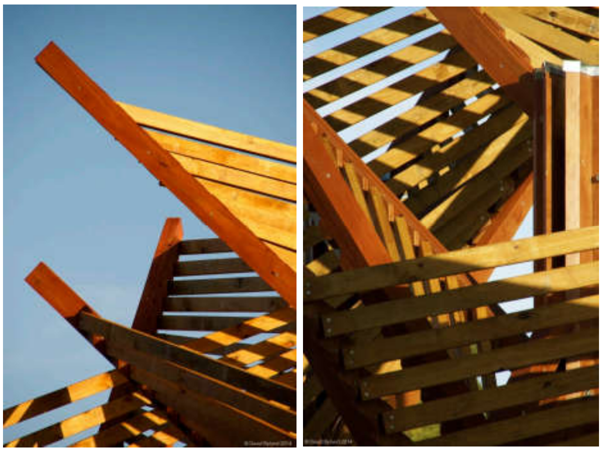

Figure 24: *Detail of the apparent overlapping petals and outriggers and the complexity expressed by the interwoven planes*

4 CONCLUSION

Learn-by-Making can be a valuable tool for students of architecture, allowing them the opportunity to experience the realization of their designs and the satisfaction of seeing a project from start to finish.

LbM can demonstrate the role that well resolved documentation plays in issues such as buildability and the planning of the construction process followed by its implementation.

Valuable lessons can be learnt in the art of translating student designs into the built form and in exploring concepts such as digital prefabrication and DfMA.

LbM projects require extensive organisation with material suppliers, local authorities and consultants and the case studies presented in this paper have demonstrated that LbM can benefit both the students involved in their design and construction and the community at large. As stated by William J. Carpenter in his book, *Learning by Building*:

> 'The architect should not stay distant from the act of building. This is not to say that the architect must build everything, but the architect must not simply *observe*; the architect should be immersed in the potential of construction and its conception' (Carpenter, 1997).

Design and build projects such as The Rose demand 100% commitment by the students, the client and the teaching and support staff.

They require a measured degree of risk taking that is befitting of the desired learning outcomes. Success is measures by both the tangible, in the form of a successfully completed structure, and the intangible, such as the experience of transforming an idea into reality.

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Unless otherwise stated, all photographs by the Author.

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