TIMBER OUTDOOR CLASSROOMS PROGRAM

GENERAL INFORMATION

Project
Timber Outdoor Classrooms Program

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Applicant
Andrew Barrie Lab

Schools
Onehunga Primary School, Auckland, New Zealand
Henderson High School, Auckland, New Zealand
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PLANT IN EARLY
SPRING TO HAVE
STRAWBERRIES
FOR XMAS !
BASIL

NARRATIVE

This project consists of an ongoing series of timber structures—eleven so far—that form outdoor learning spaces dotted around two school campuses (Onehunga Primary School and Henderson High School) in relatively deprived neighborhoods of Auckland, New Zealand.

We worked with the leadership and teachers at each school to identify practical needs for each space—at Onehunga the need was for a defined entranceway and for seating areas where children and parents could meet for after-school pick ups, and at Henderson the need was for sheltered rest areas for use during lunch and break times. The Schools also identified learning subject areas that each shelter would communicate and provide for. These have included environmental quality, waste disposal and recycling, food cultivation and preparation, timber construction, and so on.

However, the schools had few resources to provide such spaces for themselves. Much of a designer's skill is about finding freedoms; finding a way to do something useful or to make something valuable within the given constraints. The project seeks to do a lot with a little by aligning the needs of the client schools with the resources and capabilities of staff and students at the school of architecture at a nearby university. By rearranging the teaching program at the architecture school, the structures were each produced *pro-bono* under the supervision of an academic who worked with a senior architecture students to design and construct each learning area as a year-long 'thesis' project. The construction of each structure was assisted by groups of 20 junior architecture students as part of a timber technology course, and made use of the university's workshops and advanced fabrication tools – modeling software, milling machines, and so on.

This vertical teaching structure (that is, involving students from multiple year levels) provides freedom to experiment that would be difficult to achieve in other environments. Further, the structures have all been designed to exploit a loophole in the New Zealand Building Code that exempts buildings under 10m2 in area from the need for building consent, allowing more design freedom and avoiding a number of complexities and costs. The projects have also been supported by industry, with many partners donating or providing discounts on materials and services, and by the client school community of students, teachers and parents.

The push to involve and energise students from primary to post-graduate university level, and to involving members of the wider community, is one of the most distinctive aspects of this project.

CONCEPT

What need inspired your innovation and how does it help students and the community?

This project sought innovative ways to address two needs:

Firstly, it provides innovative, flexible spaces for teaching and learning at Henderson High and Onehunga Primary. At their most basic level the structures provide covered rest areas for use by students during lunchtime, breaks, and after school. Each structure has also been designed for both active teaching and incidental learning. The seating of each structure is arranged to allow teachers to effectively work with small groups, moving around the space to demonstrate the teaching material on offer, as well as to have the students engage directly with the material.

Secondly, the structures provide powerful learning experiences for their student creators, as demonstrated by the quality of the design results. However, the structures benefit multiple communities of learners. The production and use of the structures combines University-level teaching with the efforts of staff, students, and parents at the client schools. Learning flows in multiple directions. The projects model a way of improving learning facilities at schools that would otherwise struggle to provide such resources.

To achieve this, the project aligned the needs of the client schools with the resources and capabilities of staff and students at the school of architecture at a nearby university. This vertical teaching structure (that is, involving students from multiple year levels, as well as the client school community of students, teachers and parents) provides freedom to experiment that would otherwise be difficult to achieve. Further, the structures have all been designed to exploit a loophole in the New Zealand Building Code that exempts buildings under $10m^2$ in area from the need for building consent, allowing more design freedom and avoiding a number of complexities and costs.

VALUE

What educational environment planning opportunities does your innovation address? What are the cost impacts of implementing the innovation? How can costs be mitigated for underserved communities?

The project is intended to be transformative at several levels.

1. .The structures benefit multiple communities of learners. The production and use of the structures combines vertical teaching at the University – senior students leading design, junior students providing labor for construction – with the efforts of staff, students, and parents at the client schools. Learning is able flow in multiple directions. The creators of the educational space are, literally, students. The project models a way of improving learning facilities at schools that would otherwise struggle to provide such resources.

2. The structures are technologically innovative. While the structures vary significantly in their appearance, their designs employ innovative timber structural systems resulting from close collaboration with structural engineers, and their production employs the use of advanced computer-controlled milling equipment. This has been recognized with multiple awards for their engineering and timber design.

3. These structures provide both space *and* content for small group teaching and learning. Each structure has been designed to promote learning around a particular theme. For example, the 'Timber Cloud' was designed to funnel rainwater into a collection zone, and includes a small lab where samples collected can be viewed under a microscope and compared with other water samples. The 'Atmosphere of Joinery' provides hands-on information on the qualities and appearance of ten different species of commonly used timber. The 'Onehunga Gateway' includes sample plants, information, seeds and recipes on how to grow and prepare organic food. In the Botanic Kiosk, instructions on raising plants are engraved on inlaid panels, with specific species being cultivated by students in planters of various sizes.

To reinforce their respective pedagogical objectives, each structure was intended to be distinctive (rather than a variation on a theme) and each employs technical innovations of various kinds—the creation of variety with repetitive timber elements or joints, the development of innovative timber structural systems, and the use of digital milling to create new timber jointing techniques. The structures produced most recently have been particularly adventurous in their use of solid timber—structures fabricated from relatively slender structural elements machined with relatively complex joints. However, this is always in service of educational goals. The Timber Cloud borrowed the interlocking form of a Japanese puzzle to create a timber lattice—think wooden Meccano in which the pieces aren't bolted together but pass through each other in three dimensions— with the resultant 'cloud' reinforcing the educational focus on rain water and water purity.

These are not areas for play, but which facilitate teaching, discussion, and hands-on learning. The structures at Henderson High, in particular, take into account the more adult sensibilities of the students. They are open and inviting—the need for a level of transparency was taken into account—but also provide a dynamic, exciting space intended to appeal to the Instagram generation.

The costs of the project are discussed in the next section.

DELIVERY

How have you shared and/or communicated your innovation and made it available to those who need it?
How have you balanced personal and professional goals with implementation of the innovation?

This project seeks to overcome a fundamental characteristic of educational facilities—creating them is expensive and time consuming. A new building typically requires millions of dollars and years of planning, approvals, and construction. This project developed a way to procure new facilities despite extremely limited means by linking the otherwise disconnected needs and resources:

- Address otherwise unmet needs of primary and secondary school student users
- Exploit a Building Code loophole that allows construction of buildings under 10m^2 without a building consent, allowing more design freedom and removing potential delays and costs associated with consent processes
- Make use of the design time and skills of post-graduate students developing ‘thesis’ projects
- Make use of the labour of undergraduate university students who need to learn hands-on construction skills
- Employ university workshops and sophisticated machinery for fabrication

The projects have been supported by industry, with many partners (paint manufactuer Resene, screw maker Spax, timber company Abodo, building supplies chain Placemakers, engineering firm Ruamoko Solutions, the WIDE Trust, and others) donating or providing discounts on materials and services. However, the structures have been produced for extremely low budgets. By making use of the voluntary labour of students and helpers, donated materials, and community support, the structures have been produced for an average of around US$4,000 each. This is about one tenth of the budget required were they produced on a commercial basis.

IMPACT

Who benefits from your innovation and how do you define and measure that impact?
What success has your innovation achieved?
What is the realistic potential for expanding its impact?

The project has so far produced eleven structures over a number of years (2012-2019).

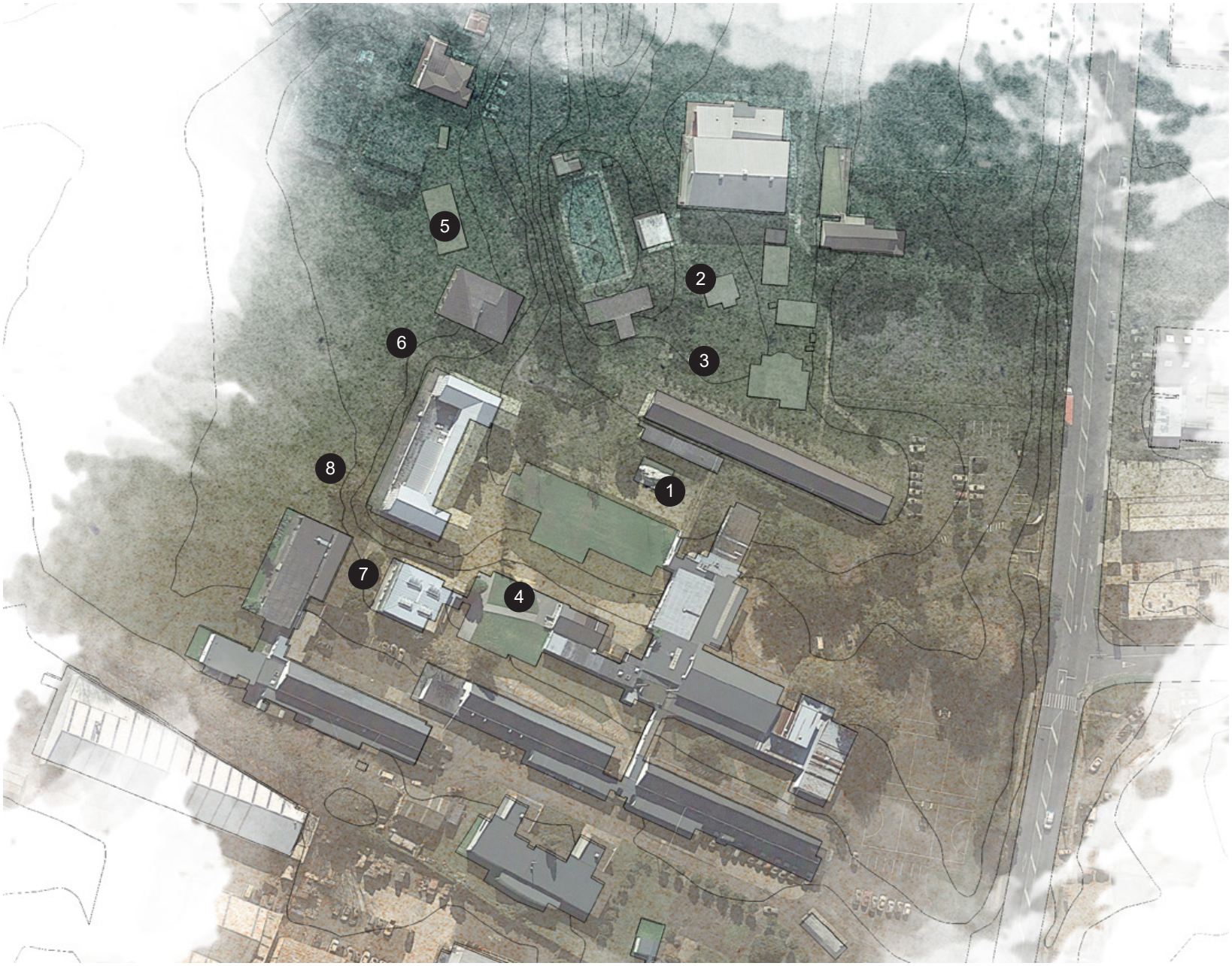
In completing the projects, the architecture students develop skills in consultation, learn to innovate within limited budgets, understand construction, and to communicate and collaborate with their peers. The new approach provides a number of benefits: it exposed high school students to university-level thinking; it creates a new model for the construction of university student projects which are of long-term benefit to the community; it creates connections between year levels which aid the sharing and accumulation of knowledge of construction, with ideas and experience being developed and passed down through the student cohort; and, it provides first-hand experience of full-scale project management. Perhaps most importantly, it pushes the level of educational design and technological development to a higher level.

Every structure has been presented in either professional or peer-reviewed academic publications, and most have won significant national and international awards for design or structural innovation. The most recent structures in the series have each attracted US$6,000 grants from an educational funder to support the purchase of more robust materials and more sophisticated fabrication support. The program is also attracting attention from others schools seeking structures—we are now embarked on a full-scale classroom and other facilities for a new forest school—and is being seen as a model for how the university can provide tangible benefit to the community.

International Awards
Scott Lofgren Structural Design Award, 2013 Bentley Systems Awards for *Food for Thought*
Scott Lofgren Structural Design Award, 2014 Bentley Systems Awards for *Furniture to Architecture & Reinterpreting Transit*

National Awards
Gold Pin, 2013 Best Awards for *Food for Thought*
Gold Pin, 2014 Best Awards for *Furniture to Architecture & Reinterpreting Transit*
Highly Commended (Outdoor Infrastructure category), 2014 NZ Timber Design Awards for *Food for Thought*
Finalist (Exterior Innovation category), 2015 NZ Timber Design Awards for *Furniture to Architecture & Reinterpreting Transit*
Finalist (Exterior Innovation category), 2015 NZ Timber Design Awards for *Learning Kiosk*
Finalist, 2016 Best Awards for *Multifunction Pavilion*
Winner (Student Category), 2017 NZ Timber Design Awards for *Multifunction Pavilion*
Finalist (Exterior Innovation category), 2018 NZ Timber Design Awards for *Atmosphere of Joinery*
Finalist (NZ Specialty Timber category), 2018 NZ Timber Design Awards for *Atmosphere of Joinery*
Highly Commended (Exterior Innovation category), 2018 NZ Timber Design Awards for *Timber Cloud*
Highly Commended (Exterior Structure Design category), 2020 NZ Timber Design Awards for *Supernormal Play Structure*
Bronze Pin, 2020 Best Awards for *Supernormal Play Structure*
Winner (Innovative Educational Initiative category), 2020 Learning Environments New Zealand Awards for *Timber Outdoor Classrooms Program*

SUPPLEMENTARY INFORMATION



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LEGEND

1 BOTANICAL KIOSK
2 DIVERTING WASTE
3 CITIZEN SERVICE LAB
4 MULTIFUNCTION PAVILION
5 ATMOSPHERE OF JOINERY
6 TIMBER CLOUD
7 CULINARY KIOSK
8 INTROSPECTIVE PAVILION

SITE PLAN: HENDERSON HIGH SCHOOL

The shelter itself was designed in collaboration with the Science Department at HHS to be an outdoor learning kiosk. Instructions on raising plants and background information was engraved on colored panels inlaid into the structure of the shelter. Specific plants were studied by classes and cultivated by students in planters of various sizes around the structure, promoting hands on learning and the sharing of knowledge. It can also be used as a seating area by students during break times.

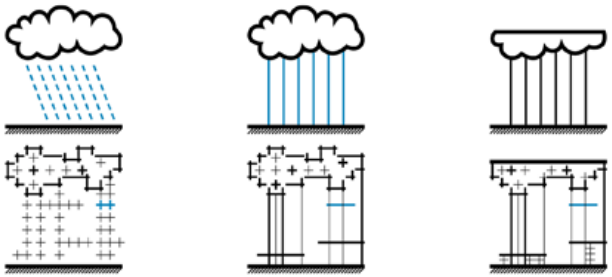
Technically, the shelter was designed to be constructed from flat pack elements like IKEA furniture. Each structural component was fabricated with a CNC milling machine from a full sheet of plywood. It allows the user to assemble the structure with minimal time, skill, and tools.

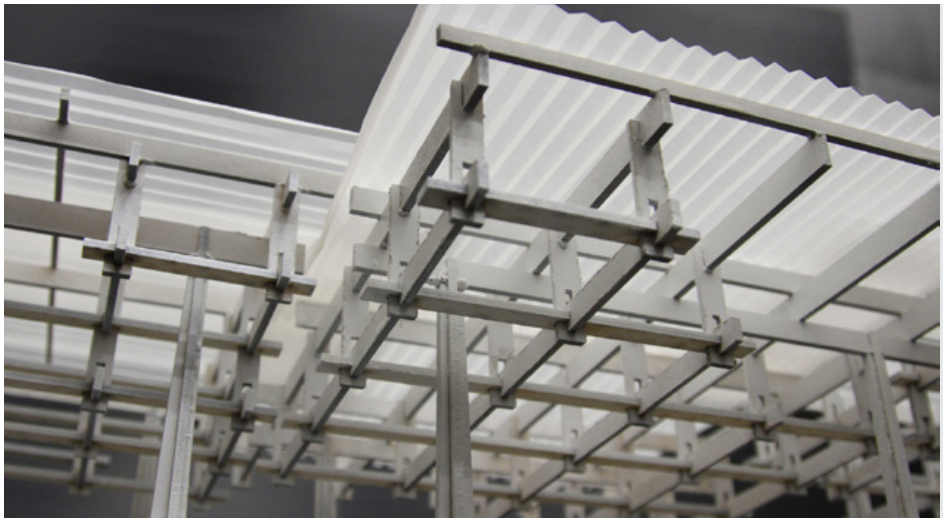

Bon

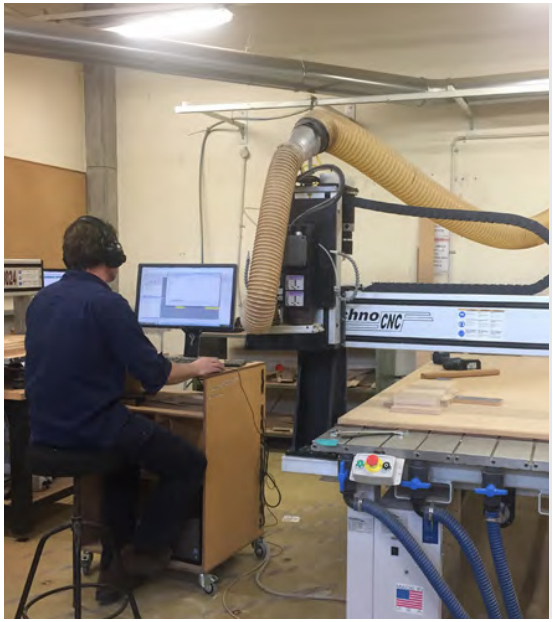
This structure is located adjacent to the School's tuck shop, and serves as both covered seating and as a teaching space with a special emphasis on water quality. A simple roof of polycarbonate – installed on site – provides shelter from the rain, and directs all rainwater down onto a stone water collector, where it can be captured for analysis. Students use the microscope and water samples at the heart of the structure to compare the rainwater to a set of reference samples to study the purity of rainwater run-off from the site.

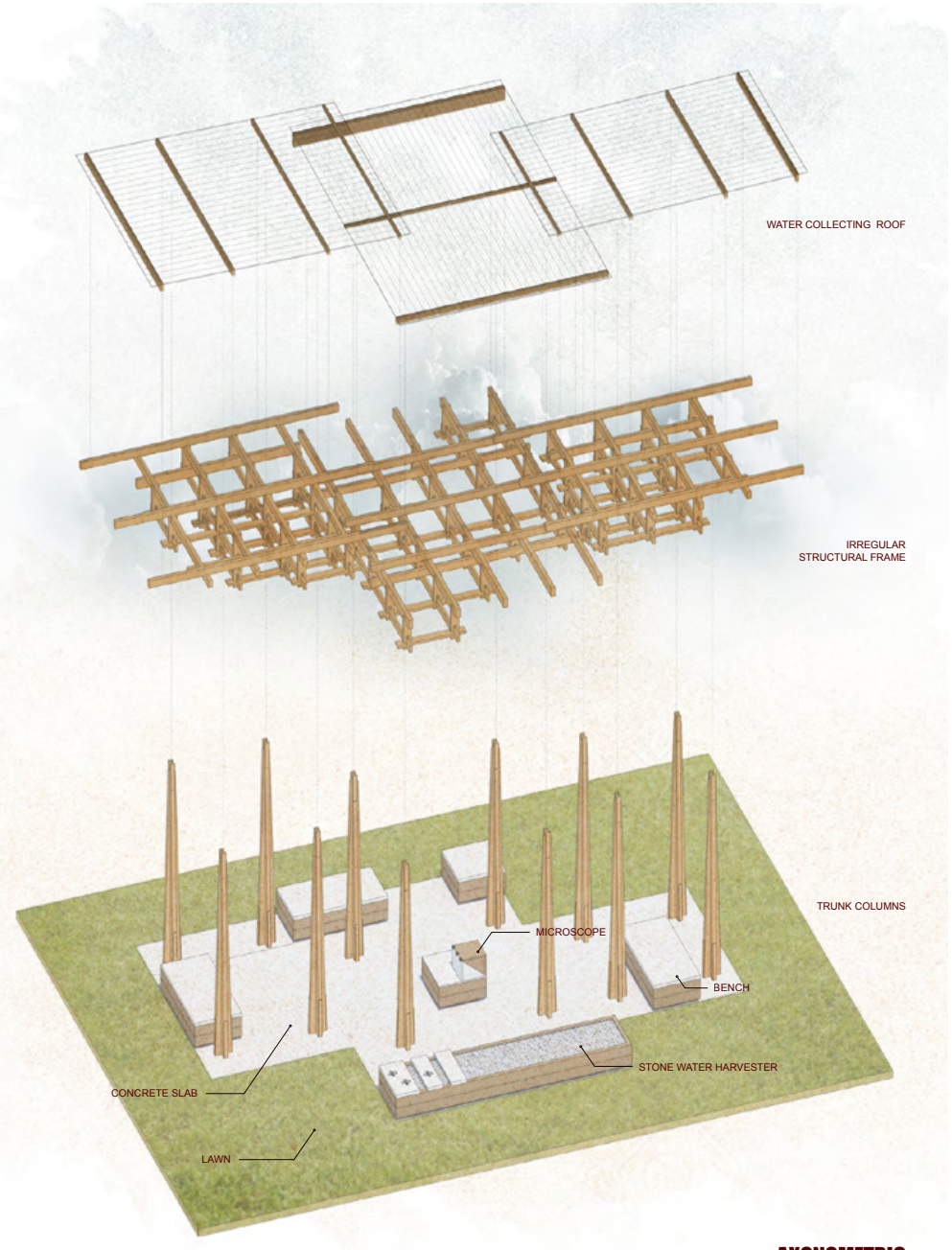
In addition to its function, the physical construction of the shelter reflects a fascination with the natural world. An system of small, simple, interlocking timber elements simulates an unstable form within nature – the rain cloud.

The interlocking elements of the cloud were designed as a standardized set of lengths with holes at standard intervals – similar to a Meccano set. These lengths were milled en masse to high tolerances using a CNC router, and then rapidly slotted together to build up the three parts of the cloud.









AXONOMETRIC

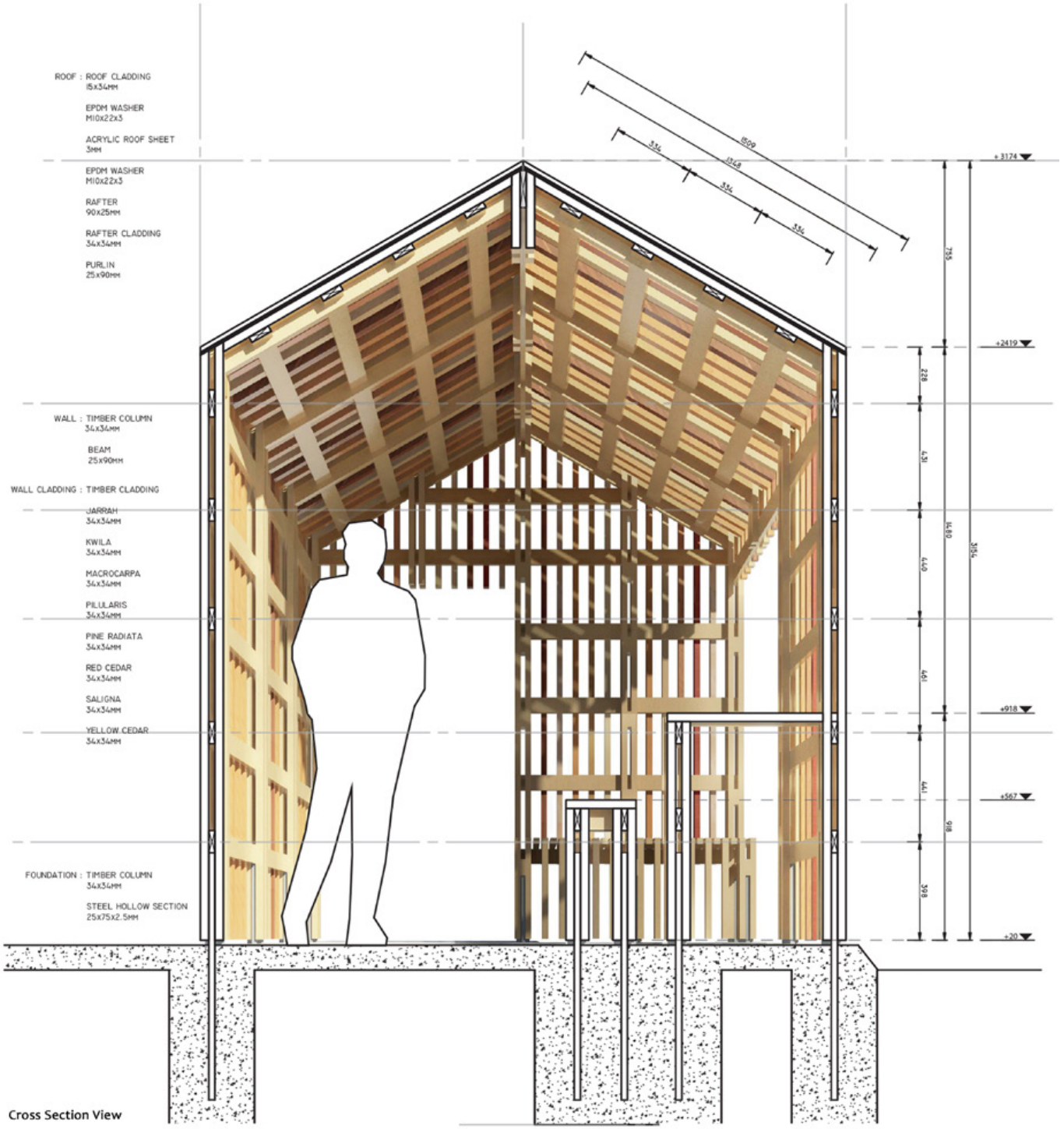
As well as serving as a seating shelter, this structure is intended for education on timber technology and construction - it includes seating, a desk, and built-in information panels describing the sourcing and qualities of the various kinds of timber used in the structure.

The thread of inquiry for the design of this structure was simple: to investigate the possibility of using a repetitive timber joint as a vehicle for creating architectural atmosphere. In essence, the project was envisaged as a system based on a single detail; this detail was designed to satisfy all the conditions within the structure, and then be ‘infinitely’ replicated. Even barely perceptible manipulations of the joint – subtle changes to element sizes or spacings or fixings or materials – would multiply out across the structure, altering the atmosphere of the space. The joint is the generator.

Workbench Upon Completion

Wall to Roof Joint

Timber and Stain Sample



Cross Section View


Structure Refining


Facade Cladding


Timber Clear Coating


Foundation Joint Welding

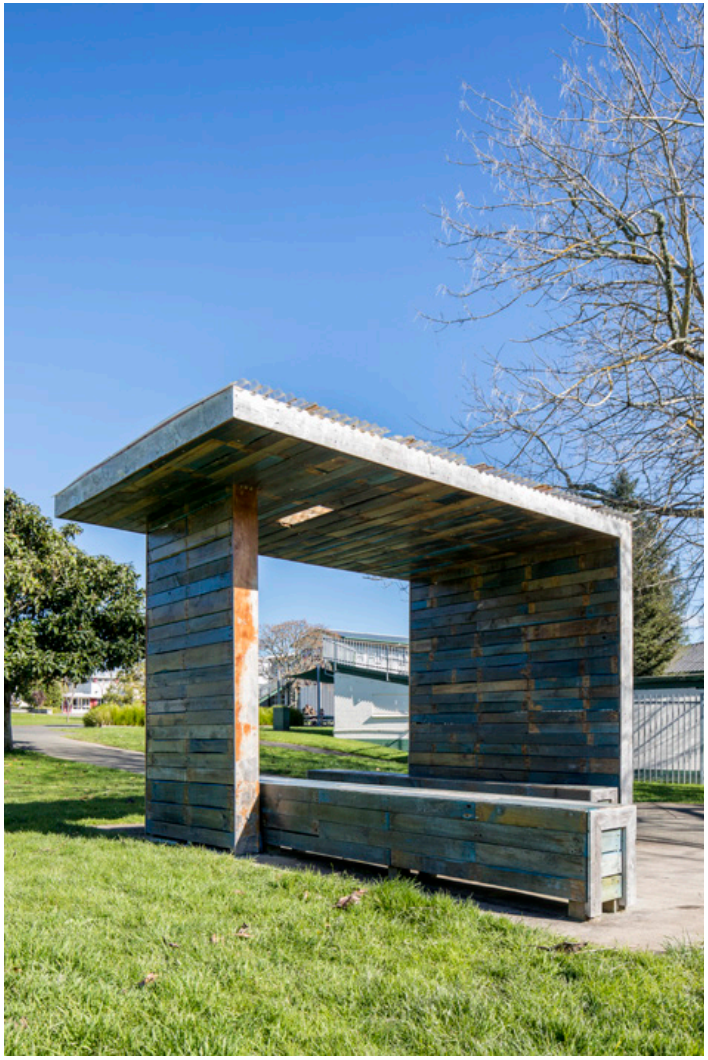

Installing Workbench

FURNITURE TO ARCHITECTURE & REINTERPRETING CITY TRANSPORT, OPS

INTROSPECTIVE PAVILION, HHS

MULTIFUNCTION PAVILION, HHS

CITIZEN SCIENCE LAB, HHS



DIVERTING WASTE, HHS

The Onehunga Primary School Entranceway was designed to support and communicate the School's environmental values. The structure incorporates edible plants and information displays so that children, waiting parents and even passers-by can learn how to grow and harvest food. Its positioning was intended to give the School a stronger street presence, and to ensure the safety of the students by more clearly defining the School's pedestrian entrance.

The structure had to be constructed from donated materials – sheets of 17mm exterior grade structural plywood. A prefabricated modular structural system was designed, consisting of 50 laminated ply members that were cut by a CNC machine to aid ease of production. A diagonal grid geometry was used to provide the basic structure of frames and bracing, as well as to create a dynamic aesthetic and street presence. The density of the diagonal grid increases at the corners where more structure is needed, and over the footpath to create more shelter for pedestrians walking underneath. Built-in furniture such as benches and shelves were also CNC-cut and slotted into the structure.

ONEHUNGA ENTRANCEWAY, OPS
TIMBER OUTDOOR CLASSROOMS


EXIT


DULUX TRADE

ONEHUNGA ENTRANCEWAY, OPS
TIMBER OUTDOOR CLASSROOMS

ENDORSEMENT

UOA School of Architecture & Planning

Purcell, Mike <MPurcell@hhs.school.nz>

Mon 2/24/2020 3:46 PM

To: Andrew Barrie <a.barrie@auckland.ac.nz>;

To whom it may concern

I have been Principal at Henderson High School (HHS) since 2010. We have been working with Andrew's lab at the University of Auckland School of Architecture & Planning on these structures since 2014, and over the intervening years have had eight structures either installed on site or in the pipeline.

HHS students and staff are proud of 'our place' in the heart of Henderson, a suburb on the western fringes of Auckland's metropolitan area. Intended as part of a larger campus renewal, these series of structures are part of our long-term landscaping plan, and are intended as the physical manifestations of both the place of technology, innovation and design within the School, and of our relationship with Auckland University. We believe that learning engagement, personal pride, and community awareness are significantly enhanced through the quality of our campus facilities.

Each year the designers from Andrew's lab the University of Auckland (UoA) meet with key staff to consult on the placement and the specific features required for each structure. Later in the year, the construction team of students and staff from the UoA meet with HHS students and staff to introduce themselves and present the project. The construction team also carries out cleaning and maintenance on the existing structures, which has the benefit of making them familiar with the designs, their construction detailing, and provide an understanding of the way the structures are standing up to weather and wear-and-tear.

The structures are intended to be adaptable to a variety of uses. As well as their intended functions as shelters for our students and as venues for small group learning, the structures are also used as subject matter by our art and design students – for example, capturing the striking geometry and light-and-shadow as the subject for photography and design assignments.

I understand these projects have budgetary constraints. The restrictions that this might ordinarily impose are overcome using the time provided pro-bono by students as part of their courses and using the technical resources of the University – both the design and construction work are carried out by Andrew's team at no cost. The budget has been further extended through the design team's success in gathering in-kind sponsorship for materials, fixings, and engineering advice.

This project attempts to make the most of the resources available – donated materials, loaned technology, free labour, advanced software, and design know-how. The design and construction of the structures is intended to benefit two communities – to support and inspire the students and parents of HHS, and to develop the design and construction skills of Andrew's group of architecture students.

Many of the projects in the series have received international and national awards—projects have twice received the international Bentley Systems' Scott Lofgren award for engineering innovation, and a number

of projects have received Gold Pins at the Designers Institute of New Zealand Best Awards and nods at the New Zealand Timber Design Awards.

Ngā mihi

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Our vision is to foster a progressive learning environment that helps all our students graduate as mature, confident young people, who have the know-how and drive to achieve success in their chosen fields.