

LIVING BUILDING CHALLENGE 3.1

A LEARNING BUILDING
FOR UNIVERSITY HIGH SCHOOL & THE
BROADER COMMUNITY

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Studio Fire 2017

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This booklet is a record of my attempt at the Living Building Challenge 3.1, undertaken during Studio Fire at the University of Melbourne in 2017. It represents my research into what the challenge is, and how it can be achieved. It should be read in conjunction with the posters & slides from the final presentation package.

A description of the twenty imperatives is given and followed with a brief outline of how it might be achieved in my project.

Due to the nature of the challenge, of course it cannot literally be achieved in the studio, however it has been an opportunity to learn about pushing the boundaries of sustainability, and using these ideas to inform design decisions.

INTRODUCTION

WHY THE CHALLENGE?

1. Studio Fire is an opportunity for me to explore the kind of architect I want to be. I'd like to pursue a career within architecture (or the broader industry) with a focus on improving the world, not destroying it. This is first time I've had relatively complete freedom to create work for my portfolio which showcases my personal values.

2. It's my belief that in the context of global climate change, all newly built buildings should be 'sustainable'. Use of the word sustainability has become tenuous at best due to two causes. Firstly there is the idea that all good design should be sustainable, this is true, and indeed there wouldn't be a project in studio that hasn't addressed sustainability in some way. On the other hand the term can be used as a catchphrase for advertising value.

The L.B.C. offers a definition of sustainability that aims to be regenerative rather than just 'better than bad'. The standard pushes the limits of what is possible and sets the leading example of what sustainability can be.

3. As an extension of point 2, education buildings should lead the way in sustainable building. I believe educating the next generation will play a big role in combating climate change. Therefore it's the schools responsibility to both instill in youths both a want to make change, and a means of how to do it.

Furthermore my design concept envisages educational institutes as extroverted community facilities, giving equal access to educational opportunities for all people, e.g. after-hours night school use, or gardening classes.

THE CLIENT, SITE & BRIEF

University High School chool originated in 1910 and has since developed a reputation for academic excellence. Within the context of the current student boom, the school needs to adapt to an increased catchment zone, and subsequent rise in student numbers. Currently funding is being sought for new facilities chiefly including a sports stadium, renaissance centre, and general learning areas.

Interestingly the brief has only called for six new learning studios, but given the context of the student boom I have opted to provide seven, and ample informal study spaces. Additionally as it is my intention for the new facility to be used by the broader community, this opens up opportunities for University High School students to make use of others institutions facilities, i.e. attending classes across the road at the University of Melbourne. I'm not saying this would practically work in the real world, it is merely a reality envisaged in studio.

The site is located on the corner of Story Street and Royal Parade, fronting onto residences to the north, the University of Melbourne to the east, and the Royal Melbourne Hospital to the south. Within the site boundary a row of pine trees follow the pedestrian footpath which the schools desires to be removed, outside the site boundary there is a parallel row of protected trees.

01. LIMITS TO GROWTH

IMPERATIVE REQUIREMENT:

- Projects must be built only on previously developed sites that are not on or adjacent to sensitive ecological habitats.
- No petrochemical fertilizers or pesticides used on site landscape.
- On-site landscape should emulate the project's reference habitat.
- On-site landscape should also provide habitat appropriate to the project's transect.

DESIGN SOLUTION:

- The site is previously developed, specifically it is a turf area with a two level carpark below.
- The site is not adjacent to any sensitive ecological habitats
- According to the WWF Wildfinder tool the project's reference habitat (biome) is Southeast Australian Temperate broadleaf and mixed forests (scientific code AA04.09). [Link](#)
- The temperate broadleaf biome features Eucalyptus woodland and grasslands, and therefore landscaping for the project will utilise these species. I made sure to use Australian species in my visualisations to represent this.



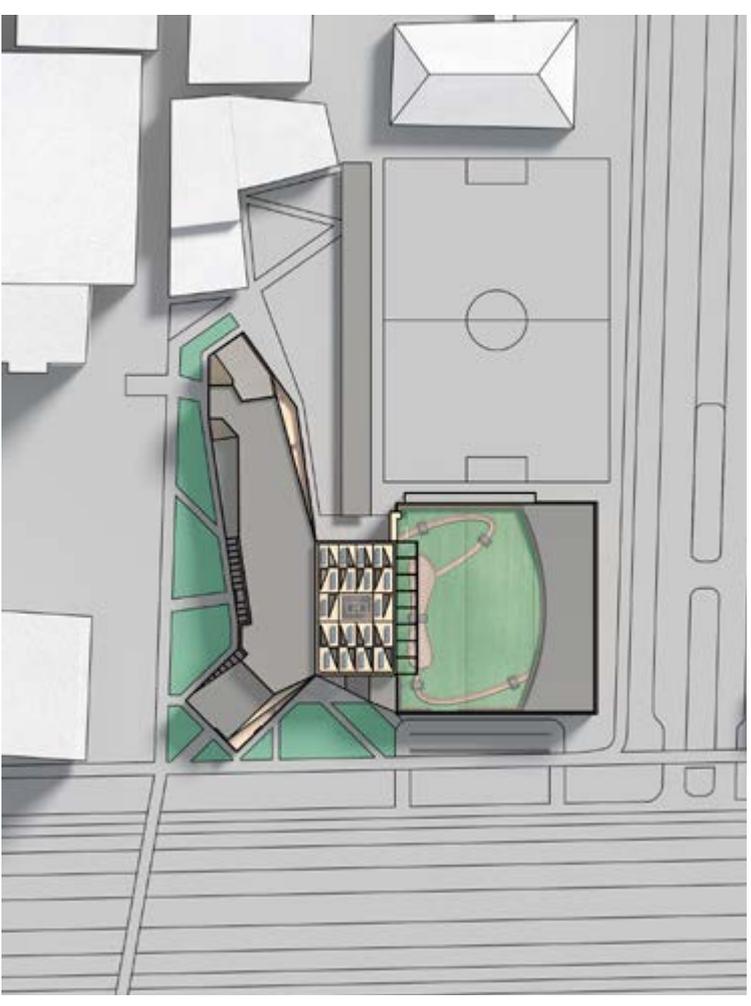
02. URBAN AGRICULTURE

IMPERATIVE REQUIREMENT:

- Project must provide opportunities for agriculture based upon Floor Area Ratio (FAR).
- Floor Area Ratio = Gross Building Area / Total Project Area.

DESIGN SOLUTION:

- As best as I can figure out, Parkville is classified as transect L4 urban-center zone, with medium-to-high density mixed-use development (FAR of 1.5-2.99).
- Depending on the exact FAR of the project, area provided for urban agriculture should be in the region of 2% - 5%.
- The project has three major areas suitable for urban agriculture, the gardens fronting onto Royal Parade, the green strip along the southern laneway, and the rooftop garden on level 2.



NOT TO SCALE



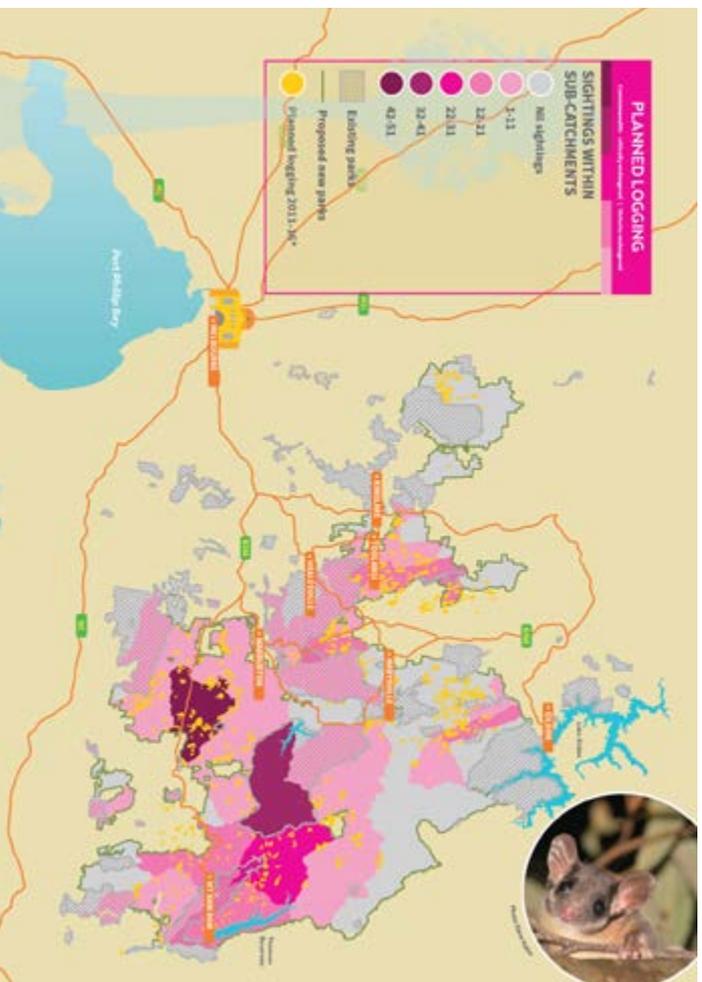
03. HABITAT EXCHANGE

IMPERATIVE REQUIREMENT:

- Set aside an amount of land away from the project as permanent habitat. Area of land should equal the area of the projects development and have a minimum offset of 0.4 hectares (4,000 square metres).

DESIGN SOLUTION:

- Set aside forest somewhere to the east of Melbourne where there is habitat for the endangered Leadbeater's Possum.



04. HUMAN POWERED LIVING

IMPERATIVE REQUIREMENT:

- Encourage use of stairs over elevators.

DESIGN SOLUTION:

- Attempted to make the stairways visually engaging and playful, whilst also making the stairs more immediately accessible.
- Lightweight stairway wraps around glass lift core.



05. NET POSITIVE WATER

IMPERATIVE REQUIREMENT:

- All stormwater, grey and black water must be captured and treated on site, and reused or managed via infiltration.
- One hundred percent of water use must come via captured precipitation, or a similar closed-loop water system.
- Chemicals cannot be used to purify water.

DESIGN SOLUTION:

- Basement plant to include:
 - Greywater treatment system, water reused from sinks for toilet flushing.
 - Blackwater treatment system, water from toilets treated and reused for external gardens.
 - High capacity rainwater tank, water feeds taps, and hydronic heating/cooling system.
- Large areas of roof left aside for rainwater catchment.

06. NET POSITIVE ENERGY

IMPERATIVE REQUIREMENT:

- One hundred and five percent of the projects annual energy usage must be produced on-site (without on-site combustion).
- Provide on-site energy storage.

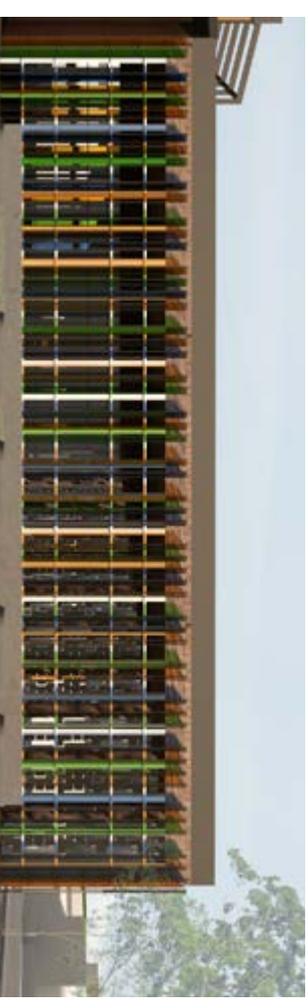
DESIGN SOLUTION:

- Utilise passive cooling/heating via:
 - Vertical/horizontal shading and mechanical louvers .
 - Thermal chimney/stack ventilation, with geothermal exchange .
 - High proportion of north facing glazing for heat gain, and minimal south facing glazing to avoid heat loss.
- Integrate PV into vertical shading (solar window system).
- PV bank on roof.
- Tesla PowerPack (or similar) to store energy in basement plant room.

SOLAR PANELS



SOLAR WINDOW



07. CIVILIZED ENVIRONMENT

IMPERATIVE REQUIREMENT:

- Every regularly occupied space must have access to operable windows that provide fresh air and daylight.

DESIGN SOLUTION:

- Make all windows operable with the following exceptions.
 - Basement lecture theatre need not have windows.
 - Basement stadium, gym, and staff areas naturally lit with clerestory windows.
- Smaller windows, for example in classrooms will be operable by hand, whereas larger windows such as the atrium curtain wall will have mechanically operated openings for ventilation.

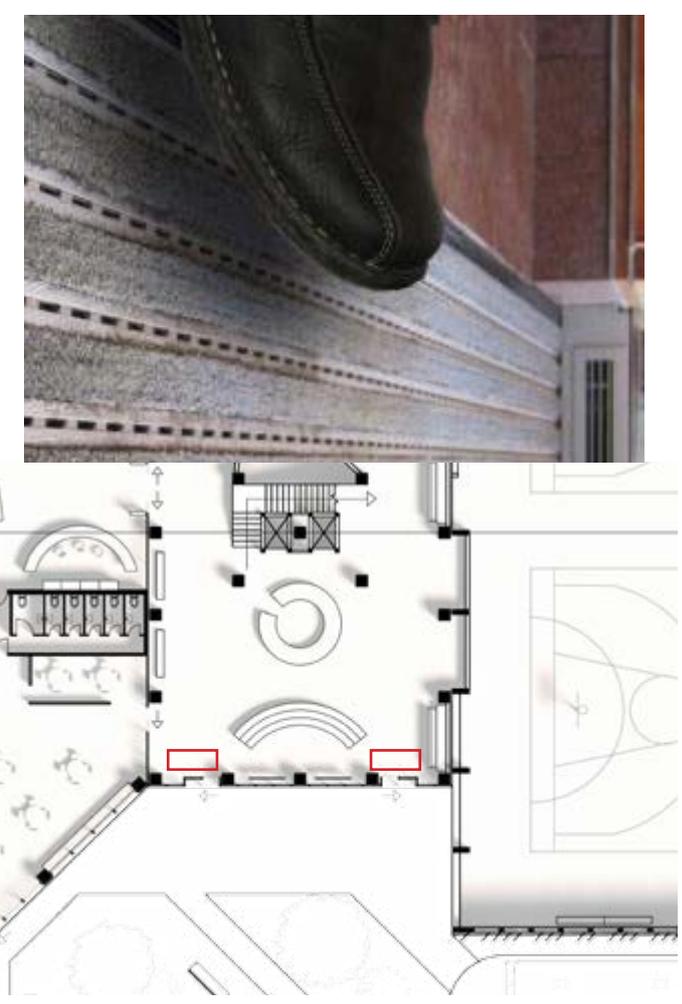
08. HEALTHY INTERIOR ENVIRONMENT

IMPERATIVE REQUIREMENT:

- Compliance with ASHRAE 62 (or equivalent), e.g. Green Star: quality if indoor air.
- Smoking prohibited within the project boundary.
- Dedicated exhaust systems for kitchens, bathrooms, and cleaners areas.
- An entry that reduces particulates brought in by shoes.
- Outline for a cleaning protocol with products what comply with EPA Design for the Environmental label (or equivalent).

DESIGN SOLUTION:

- Ground treatment around entries to be detailed with appropriate entryway systems



09. BIOPHILIC ENVIRONMENT

IMPERATIVE REQUIREMENT:

- Project must be 'transformed' by incorporating nature via environmental features, light and space, and natural shapes and forms.
- Incorporate nature's patterns and processes.
- Project is uniquely connected to the place, climate, and culture through place-based relationships.
- Provision of frequent human-nature interactions for interior and exterior of project.

DESIGN SOLUTION:

- The rooftop garden over the stadium is designed to reflect the natural slope of a mound or hill, this form is accommodated with the curved glulam beams.
- A gutter system on the roof garden channels water through the space to reflect the idea of a stream. Gives the users access to water, and it can be used in the gardens.
- Hanging vines in the atrium, the internal courtyard garden, and dedicated classroom balcony gardens mean the students will be in constant contact with nature.

10. RED LIST

IMPERATIVE REQUIREMENT:

- Cannot use any of the following materials/chemicals:
 - Alkylphenols, Asbestos, Bisphenol A (BPA), Cadmium, Chlorinated and Chlorosulfonated Polyethylene, Chlorobenzenes, Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs), Chloroprene (Neoprene), Chromium VI, Chlorinated Polyvinyl Chloride (CPVC), Formaldehyde (added), Halogenated Flame Retardants (HFRs), Lead (added), Mercury, Polychlorinated Biphenyls (PCBs), Perfluorinated Compounds (PFCS), Phthalates, Polyvinyl Chloride (PVC), Polyvinylidene Chloride (PVDC), Short Chain Chlorinated Paraffins, Wood treatments containing Creosote, Arsenic, or Pentachlorophenol, Volatile Organic Compounds (VOCs) in wet-applied products.

DESIGN SOLUTION:

- Not to use any of these materials/chemicals, and where possible use only natural products such as timber.

11. EMBODIED CARBON FOOTPRINT

IMPERATIVE REQUIREMENT:

-Account for embodied carbon (including construction) with a one-time carbon offset from an approved provider.

DESIGN SOLUTION:

- Minimise embodied carbon via:
 - Use of timber over metal for structure and claddings where possible.
 - Geopolymer concrete (Earth Friendly Concrete by Wagner) structure in the basement.
 - Source all materials as close to site as possible.

12. RESPONSIBLE INDUSTRY

IMPERATIVE REQUIREMENT:

- Use at least one "Declare product for every 500 square meters of gross building area.
- "Declare" products are is a platform for transparency around materials characteristics. A Declare product makes plain: where it comes from? What it's made from? And where it goes at the end of its life?
- Timber must be one hundred percent Forest Stewardship Council (FSC) certified.

DESIGN SOLUTION:

- The glulam used for the stadium portal frame could be sourced from Timber Lab Solutions (in New Zealand so not ideal).
- Australia has only 5 Declare products listed on the Living Future institute search tool.
- The Weatherex timber panels used for interior/exterior cladding are a Declare product.
- The Porcelanosa Floor/Walls tiles used in wet areas are a Declare product, distributed through Earp Bros (Australian company).



13. LIVING ECONOMY SOURCING

IMPERATIVE REQUIREMENT:

- Minimum 20% of the materials construction budget must come from within 500 kilometres of construction site.
- 30% of the materials construction budget must come from within 1000 kilometres of the construction site.
- 25% of the materials construction budget must come from within 5000 kilometres of the construction site.
- 25% of materials can come from any location.
- Consultants can come from within 2500 kilometres of the project location.
- Note that materials construction budget refers to material costs only, excluding the cost of labour and land. "Declare" and salvaged material may be counted at twice their value.

DESIGN SOLUTION:

- For this imperative there is not much to say, other than the building has been designed with local plants, materials, and consultants in mind. In this sense it is vernacular.

14. NET POSITIVE WASTE

IMPERATIVE REQUIREMENT:

- Reduce or eliminate waste through design, construction, operation, and end of life stages.
- Waste may be reintegrated through either natural or industrial loops (reusing and recycling).
- Must feature one salvaged material per 500 square meters of gross building area.
- Project must have dedicated infrastructure for the collection of recyclables and compostable food scraps.

DESIGN SOLUTION:

- Use recycled timber/brick for planters in community garden.
- Composting facility in community garden, combined with a collection system through out the building. This way waste from the cafe, and students lunch boxes can be reused.
- Encouraging building occupants to compost and recycle through interactive displays and disposal units.
- Reuse all excavated soil for gardens.

15. HUMAN SCALE + HUMANE PLACES

IMPERATIVE REQUIREMENT:

- Project should be designed human-scaled and not automobile-scaled places that foster culture and interaction.
- 15% of project area allowed for parking.
- Advertising billboards are prohibited, only one 4-6m2 project sign allowed.
- 30m maximum distance between facade openings.
- 1000m2 maximum for building footprint before human scale articulation is required.
- Provision of places for people to gather and connect, one every 1000m2.
- Along project edge provide space that supports the human scale of the wider neighborhood, e.g. seat walls, art, displays, pocket parks.

DESIGN SOLUTION:

- Project adds no new parking space, and removes existing parking space.
- Entrances distributed all the way around the building to make it permeable (although it would have been best to include another entrance on the north side).
- Landscaping includes provision for benches, seat walls, community art display wall, and many intersitial green spaces.

16. ACCESS TO NATURE + PLACE

IMPERATIVE REQUIREMENT:

- The public realm must be provided for with features such as street furniture, public art, gardens, and benches.
- Project must be designed to provide equal access for those with physical disabilities.
- Transportation, roads and non-building infrastructure that are externally focused must be equally accessible to the public, regardless of background.

DESIGN SOLUTION:

- Exterior designed as a public open space with trees, gardens, benches, market stalls, bike storage, benches, art display walls.



17. EQUITABLE INVESTMENT

IMPERATIVE REQUIREMENT:

-For every dollar of the total project cost, a minimum of half a cent must be set aside and donated to either a charity of choice, or the International Living Future Institute's Living Equity Exchange program (funds renewable infrastructure for charitable enterprises).

DESIGN SOLUTION:

-N/A.

18. JUST ORGANIZATIONS

IMPERATIVE REQUIREMENT:

-Create a more just or equitable society through transparent disclosure of business practices.
-At least one of the project consultants/team members must have a Just label.
-A Just label is a transparency platform for organisations to disclose information, attempting to make a more just society.

DESIGN SOLUTION:

-There is not much I can implement into my project for this imperative. Other than to say that if I really was an architect designing a building for University High School, I would seek Just certification for my practice.



19. BEAUTY + SPIRIT

IMPERATIVE REQUIREMENT:

- The project must meaningfully integrate public art.
- The project must have design features intended solely for human delight that celebrate culture, spirit, and place whilst being appropriate to the project's function.

DESIGN SOLUTION:

- As a means of supporting the overall design concept, an artwork could be commissioned for each of the main four community groups; high school, university, hospital, and residential. Either a series of four individual works, or a single collaborative work.

20. INSPIRATION + EDUCATION

IMPERATIVE REQUIREMENT:

- All projects must provide:
 - A Living Building Challenge Case Study.
 - An annual open day for the public.
 - A copy of the Operations and Maintenance Manual.
 - A brochure describing the design and environmental features of the project.
 - Interpretive signage that teaches visitors and occupants about the project.
 - An educational website.

DESIGN SOLUTION:

- For a case study I researched the University of Queensland's Global Change Institute (refer to design journal).

