

Wai-Ora

A study of the sustainable construction of Wai-Ora.

By Lucy, Amelia, and Ashleigh



About Wai-Ora



The name Wai-Ora, meaning *The Living Waters* was gifted to us from Taumutu, who have also gifted us the names Te Waimarama and Te wai mātau for our buildings. This building (Wai-Ora) was built in 2016 and was built due to roll growth at Lincoln. The government gave the school the money they needed for the building, but the school board put in some of their own money to upgrade some systems.

Wai-Ora cost around \$1.7 million, and most teachers and students enjoy learning and teaching in this space. Wai-Ora is a good learning opportunity for students at this school as it has many background stories behind the choices of features and designs, through the connection we have with our Iwi.

We found the building provides a healthy, comfortable environment for learning, which is superior to most other classrooms in Lincoln High School.

A limiting factor of our research is the 3 years that have passed since Wai Ora was built and us starting our project, as Architects and Engineers have moved on.



We investigated six sustainable materials used in the construction of Wai-Ora:

Solar shading

LED lighting

Acoustic performance

Thermomass cladding

Roof insulation

Heating and ventilation

Solar shading

The solar shading on the outside of the building has a story that connects the school to the Māori iwi in the area. They gifted us the name Wai-Ora, and the solar shading on the building is supposed to depict an eel net, much like the nets they use to catch the eels in Lake Ellesmere.

Solar shading is a form of shading from the sun's rays, it controls and optimises the amount of light and the amount of warmth that is admitted into the room/building.

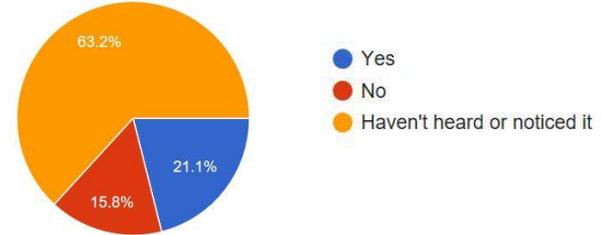
Solar Shading costs around \$50-70,000

This design feature is a new technology so there is not a lot of information on it out there yet, but it is basically black metal that attracts the sun and somehow regulates the temperature.

Lincoln high used solar shading because it greatly increases solar gain in winter which means improved thermal comfort, solar shading has a good environmental story and learning opportunities surrounding it.

Solar shading continued..

We surveyed teachers at Lincoln high and asked how effective they found solar shading and these are the results.



I guess so the temperature is fairly even but it could be the heating/cooling

I have no idea what this is sorry.

I guess in part but a lot of light spills onto the whiteboards making them often unusable.

Sun comes in the huge windows

I was still blinded by sunshine in F2 i think it was for a 3.30pm meeting

As you may see 63.2% haven't heard or noticed it, so we think that solar shading may not be as effective as it seems. But maybe if we informed more people they can realise and notice the effects.

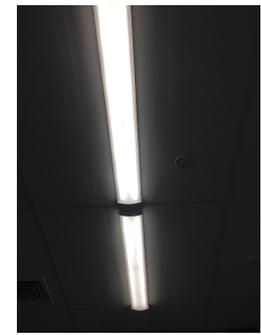


LED Lighting

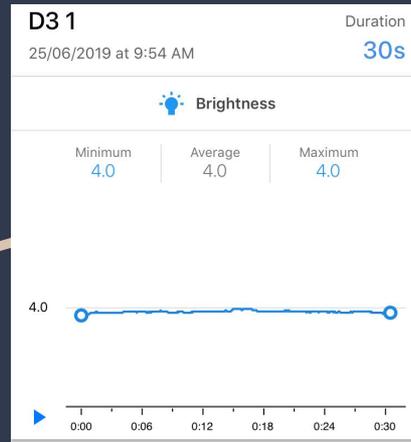
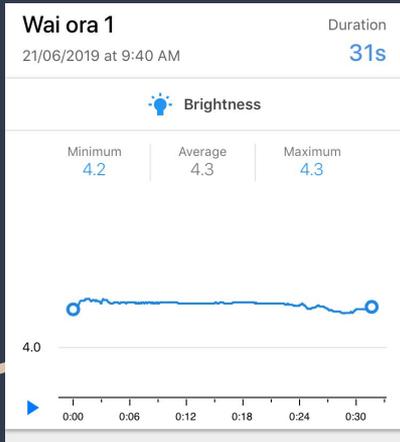
Room with
LED lighting
(wai-ora)

Room without
LED lighting
(D3)

Wai-ora is .3 brighter than D3



LED lighting is a more efficient type of lighting. LED lights are more efficient at turning energy into light, this means that less energy is released as heat, making it a better alternative to incandescent and CFL bulbs. LED lighting costs around \$10,000, and LEDs are made of compound semiconductor materials, which are made up of materials like gallium arsenide (GaAs) and gallium phosphide (GaP).

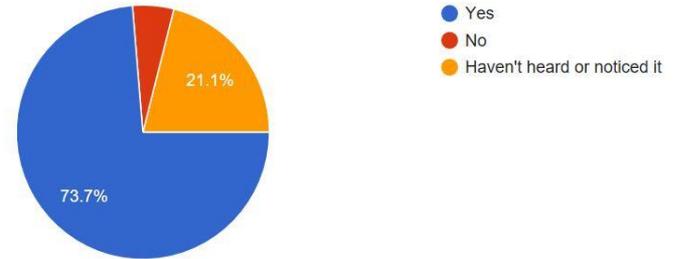


LED lighting continued..

Lincoln high used LED lighting because it is more effective compared to other lighting and has a much longer lifespan, and they don't flicker like other light bulbs. LED lighting is the more cost effective solution out of all other light bulbs



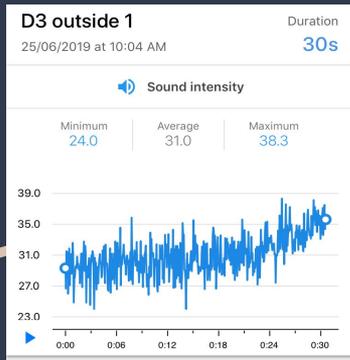
We surveyed teachers and asked if they find LED lighting effective. These are the results.



After surveying teachers at Lincoln High 73.7% said that they found the LED lighting effective, which shows that LED lighting would be a good feature for future buildings.

Due to energy bills covering the whole site it was difficult for us to see if there are any energy savings.

Acoustic Performance



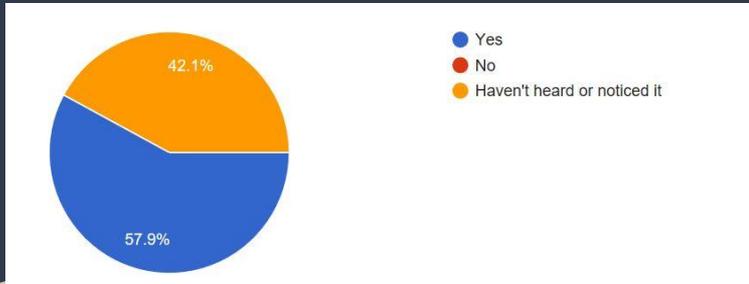
Acoustic performance is a building feature that reduces noise from external sources and provide sound separation between adjoining rooms. Acoustic performance costs around \$8,000/\$10,000/\$3,000 respectively and the acoustic insulation is made from 100% polyester so it's safe and non toxic.

Lincoln high used acoustic performance in Wai-Ora to reduce sounds coming from other classrooms, so it's easier for students and teachers to focus on their own work. The architects pushed for a fully open/modern learning style building, but the board and Mrs Paterson pushed back to have some closed in classrooms. We think this was beneficial because it means you can have 4 completely separate classrooms but if you wanted to you could have all classrooms open and in use together.

We tested the sound intensity in both Wai-Ora and D3, which is our normal science classroom and found that the sound in Wai-Ora both inside and outside sounded similar to D3, but was louder inside D3.

Acoustic performance continued...

Majority of the teachers we surveyed (57.9%) said that they found the acoustic performance effective, i believe if we informed more teachers and students about these features it would increase the amount of votes because they would realise and notice the effects of using them.



Here are some of the comments we received about acoustic performance.

When the doors are closed, it's amazing how much noise is blocked out from other classes, especially when they're watching video clips.

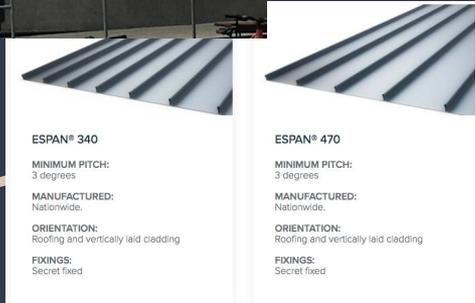
Sound is good and can be isolated in the big space.

cannot hear other classes, no echoes

can hear speakers (meetings)

This shows that acoustic performance would be a good feature to use in future buildings because teachers have found that it is effective.

Thermomass cladding



ESPAN® 340

MINIMUM PITCH:
3 degrees

MANUFACTURED:
Nationwide.

ORIENTATION:
Roofing and vertically laid cladding

FIXINGS:
Secret fixed

ESPAN® 470

MINIMUM PITCH:
3 degrees

MANUFACTURED:
Nationwide.

ORIENTATION:
Roofing and vertically laid cladding

FIXINGS:
Secret fixed

Thermomass cladding is roofing and vertical wall cladding used on the outside of buildings.

Thermomass cladding costs around \$95,000 (+ \$20-30,000 for architectural finish)

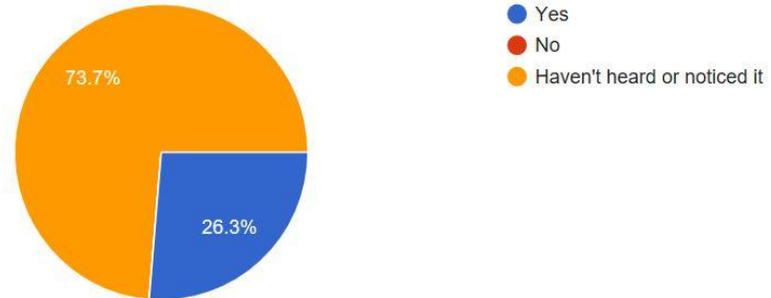
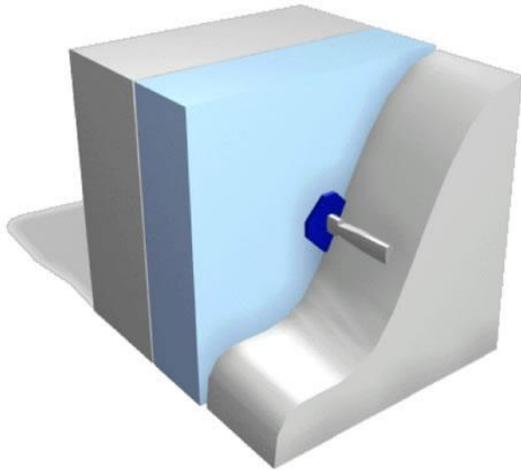
Thermomass connectors are designed for the support of structurally composite, load-bearing and cladding concrete sandwich wall panels. The connectors include a structural portion composed of E-CR glass fiber and cured vinyl ester resin.

These were used in the building



Thermomass cladding continued...

After surveying teachers, we think that the thermomass cladding isn't as effective because 73.7% of them haven't heard or noticed it. So this shows that we need to inform more people about this so they know what thermomass cladding is, and can notice its effects. We believe that heating and ventilation may be enough.



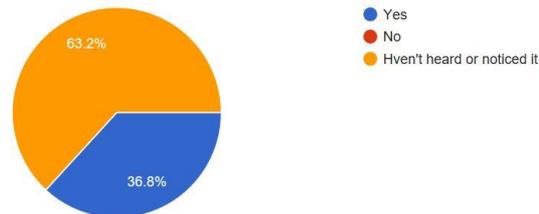
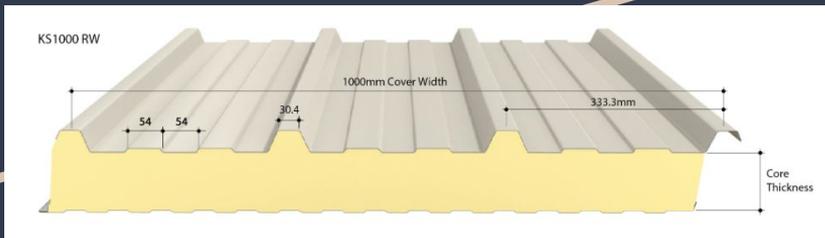
Roof insulation



Roof insulation is an insulation installed in your roof which can help lower heating bills and help with thermal comfort in buildings.

Roof insulation costs around \$12,000

Made of 100mm kingspan rather than the 60mm kingspan the school has used in other buildings.



After surveying teachers we found that only 36.8% of teachers who participated in the survey found the roof insulation effective, but no one said that it wasn't effective so we think this is a good feature.

Heating and Ventilation



Heating and Ventilation is a technology of indoor and vehicular environmental comfort. Its goal is to help provide thermal comfort, for rooms/ buildings.

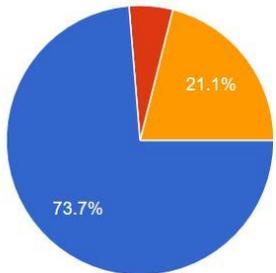
Heating and ventilation costs around \$50-70,000.

This is an advanced heating and ventilation system that circulates through the whole building, heating it in winter, and cooling it in summer.

We also have several heat pumps throughout the buildings that help to heat and cool certain spaces. (The staff teaching in these rooms feel like they wouldn't want to be without them)

Heating and ventilation continued...

Always a good temp
Can be as warm or cool as we need to be.
I guess so the temperature is fairly even
The heat pumps are great!
Works well.
pleasant temperature usually
Rooms heat up quickly.
Too excessive in some areas. Confusing to control.
as before
Easy to keep rooms at a comfortable temperature
Nice and warm/cool according to the heatpump controls
very warm in winter and cool in summer - quick to heat or cool



● Yes
● No
● Haven't heard or noticed it

Majority of the teachers that participated in the survey (73.7%) said that they found the heating and ventilation effective. This shows that this feature would be a good feature for future buildings as it has been one of the most effective features in Wai-Ora.

Our principal Mrs Paterson also said that she hadn't had any complaints from teachers about the temperature of these classrooms, as she has with other, older, classrooms with a less advanced climate control.

Future ideas for building

We did of survey to teachers at lincoln high and found some ideas...

Green plant walls- some benefits of using green plant walls is they act as an extra insulation, they also reduce noise levels by reflecting and refracting as well as absorbing acoustic energy.

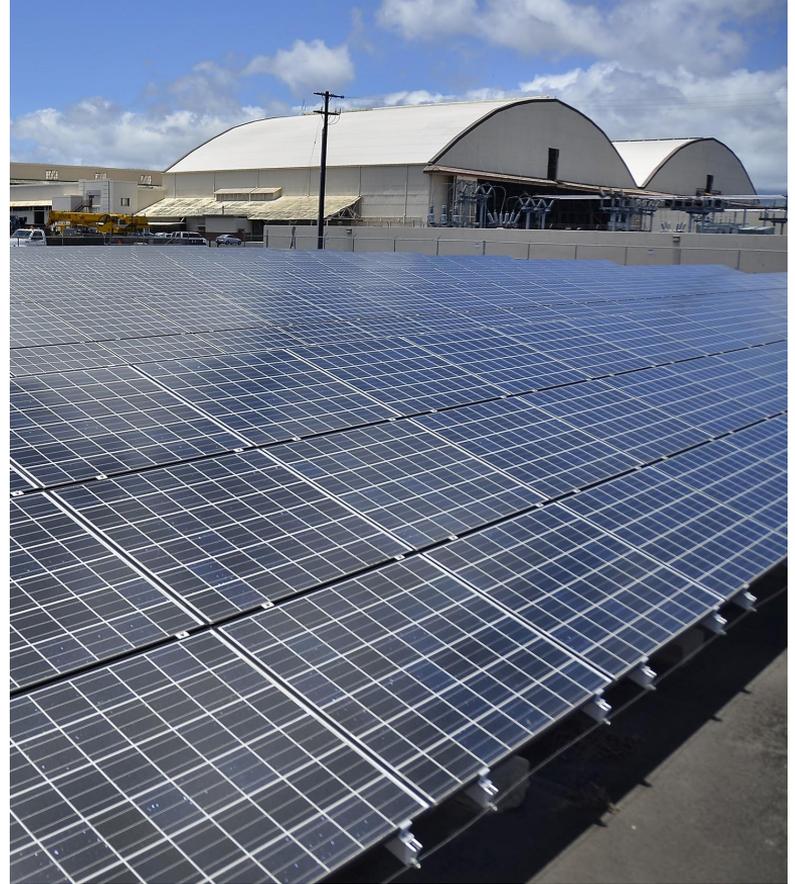
Grey water systems- Reducing the need for freshwater. Saving on freshwater use can significantly reduce water bills, but also has a broader community benefit in reducing demands on public supply. Reducing the amount of wastewater entering sewers or on-site treatment systems

Heavy insulated buildings to minimise heating costs

Solar panels

We believe that solar panels would have been a good investment for this building when it was built because then it would produce its own energy needed, so it would cut down the schools power bill a little. We also think it would have been a good learning opportunity for students that have classes in the building.

Solar Panels could be an option for future buildings or installation on existing buildings (Gym 3, Wai-Ora) to make our school more sustainable for the future.



Ideas for displaying



We think we could inform and show teachers, students and caregivers about some of the main design features in Wai-Ora and the environmental story behind Wai-Ora. We could show this by creating an information board that could be placed on a main wall in Wai-Ora that visitors can read as they enter. Another way we believe we could show this is possibly investing in a tv that would hang on the wall in Wai-Ora and could play a powerpoint or slideshow explaining the features and photographs of the building. We think that maybe a tv would be a good investment because it catches your eye and it makes the space more interesting.

Reflection

A lot of the information that we discovered, we found to be new and interesting and we were surprised at how many features there were, as well as how much thought had gone into the building.

It was quite challenging to get motivated at the start of the project, because we didn't quite understand what we were trying to figure out and we found it difficult to gather the information.

It was really cool at the end to see all the hard work we had put in be acknowledged, it is exciting that it is a project that continues on and we can leave our mark at school, by allowing our research to inform teachers and students of the decisions the board made, including the connections to our Iwi for this building. Also what will work well for future buildings at Lincoln High School.

It is likely that some of our information from teacher surveys is misleading as knowledge of how the aspects work together is missing.

Bibliography

[Metal Craft](#)

[Autex](#)

Mrs Paterson

Southbase

**We had difficulty gathering information from architects due to the time lapse between building and our project.