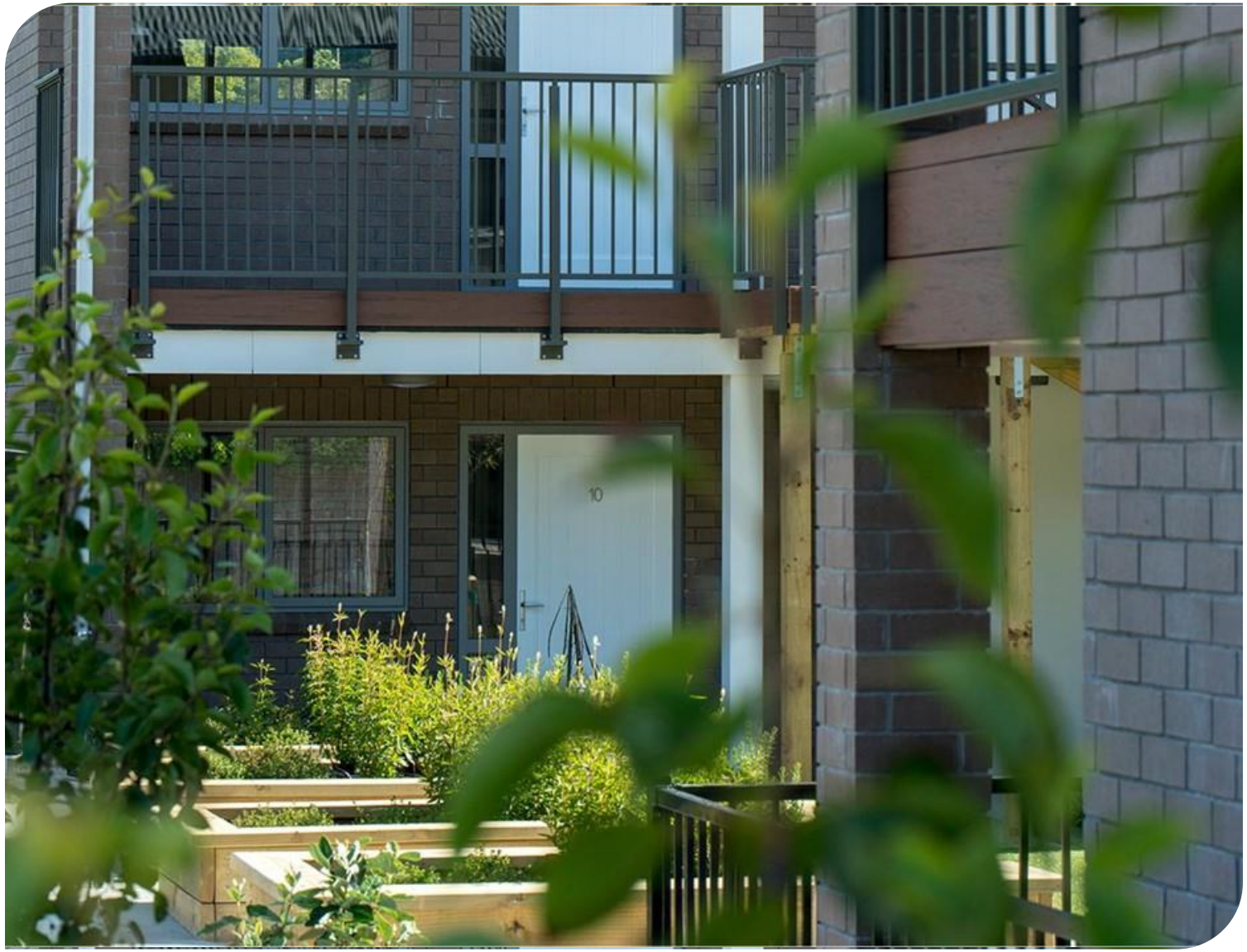
Minimizing the cost increase for transitioning to Homestar V5 through optimized design



Homestar team

Presentation by: Dr Iman Khajehzadeh

Date: 22/05/2024

Kāinga Ora
Homes and Communities

1.0 Definitions and assumptions

Kāinga Ora
Homes and Communities

1.1 Definitions and assumptions

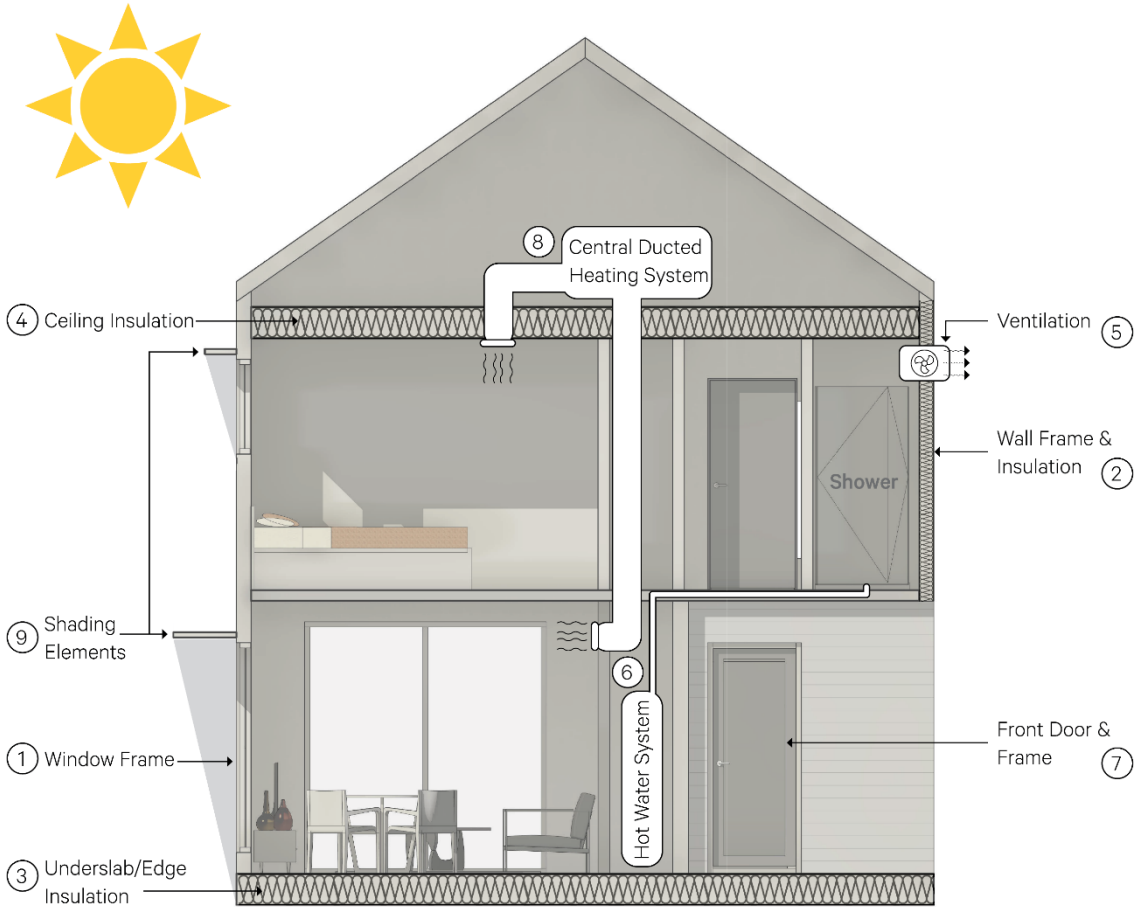
- The **cost** of designing/building to **Homestar version 5**
- Uplift cost: **6 Homestar v5** certified vs **Building Code** compliant

Kāinga Ora
Homes and Communities

1.2 How to Achieve 6HSV5 Requirements by Upgrading / Adding 9 Building Elements

There are four thresholds/requirements that we need to meet in Homestar v5 energy modelling:

- Maximum annual delivered electricity
- Maximum space heating demand
- Overheating threshold
- Indoor temperature is in the range of 20-25°C all the year



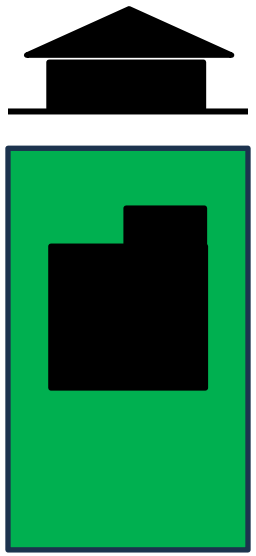
Kāinga Ora
Homes and Communities

2.0 Case studies

Kāinga Ora
Homes and Communities

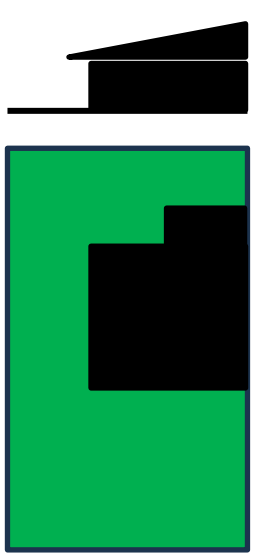
2.1 Five Typologies were redesigned, modelled, and costed

1



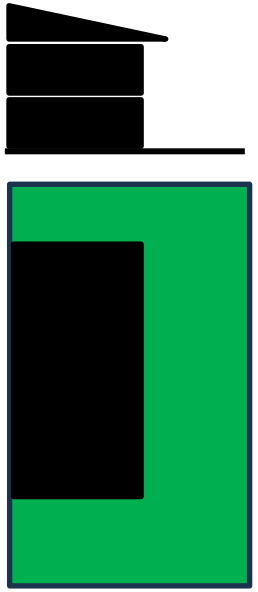
- 1 Bedroom
- Stand-alone
- Single storey
- GFA: 53 m2

2



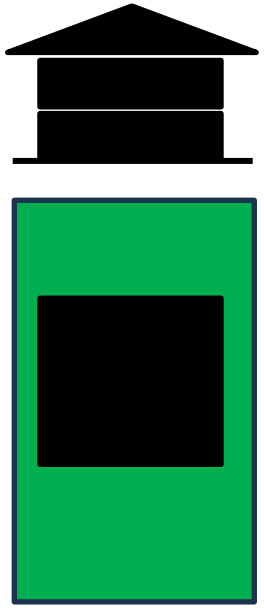
- 1 Bedroom
- Duplexed
- Single storey
- GFA: 53 m2

3



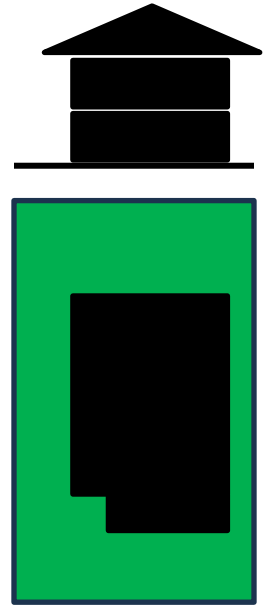
- 2 Bedroom
- Duplexed
- Two storey
- GFA: 82 m2

4



- 3 Bedroom
- Stand-alone
- Two storey
- GFA: 119 m2

5



- 4 Bedroom
- Stand-alone
- Two storey
- GFA: 135 m2

3.0 Design updates

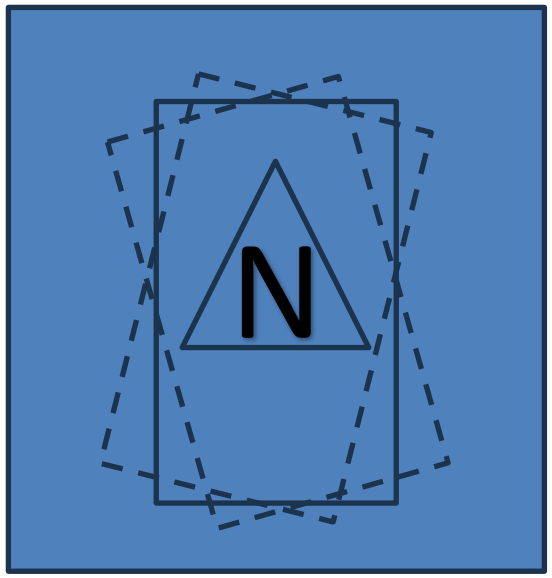
Kāinga Ora
Homes and Communities

3.1 Design updates

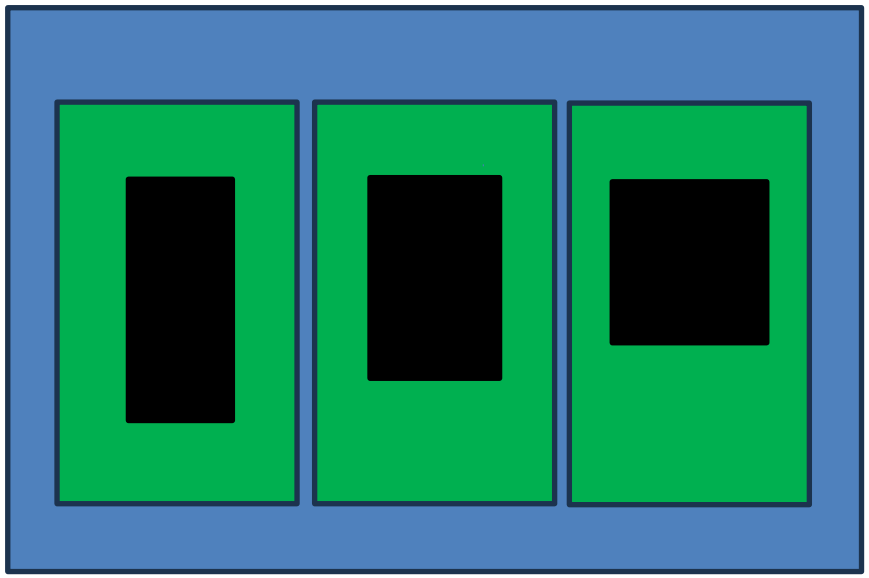
We considered the following design updates on all typologies and measured the impact of each design intervention:

- **Add / Remove / Relocate / Modify windows**
- **Add Shading to some Windows (where required)**
- **Finding the most energy efficient orientation for each typology**
- **Specifying energy efficient heating systems in some climate zones (e.g. central ducted heat pump)**
- **Finding the most cost-effective combination of the nine building elements (i.e. specifying the most economic combination)**
- **Avoiding expensive upgrades (e.g. window frames) where possible**

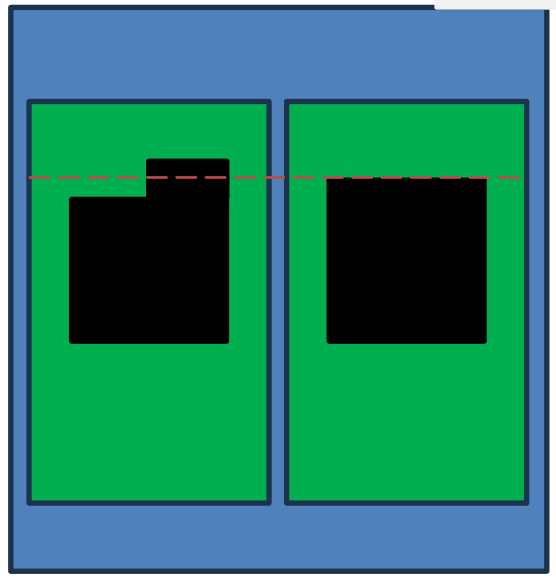
3.2 Design updates on the building shape and orientation



Finding the best orientation



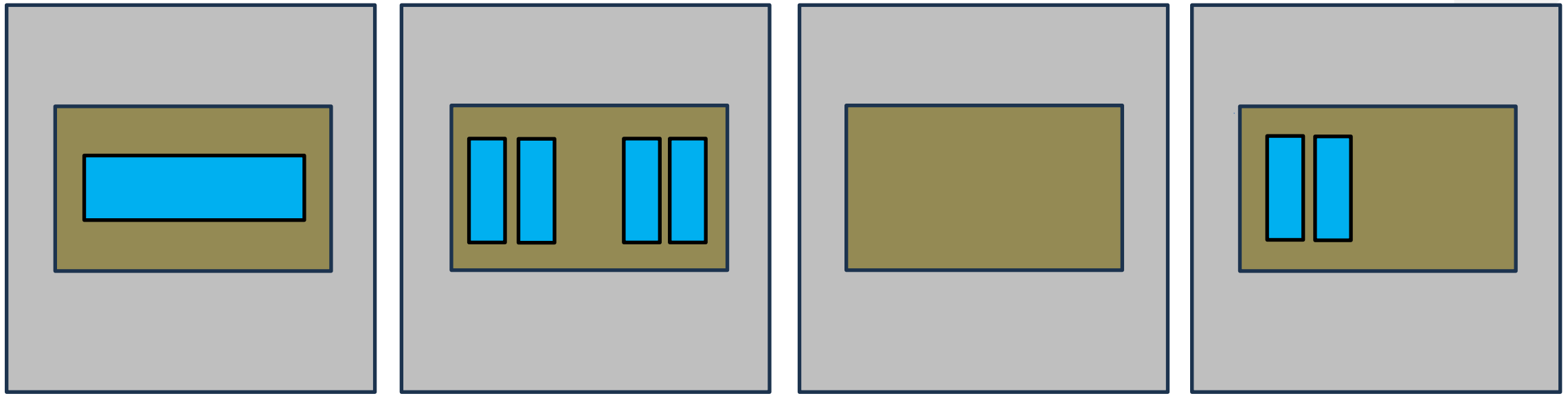
What is the best length to width ratio?



Creating a full shape (same GFA)

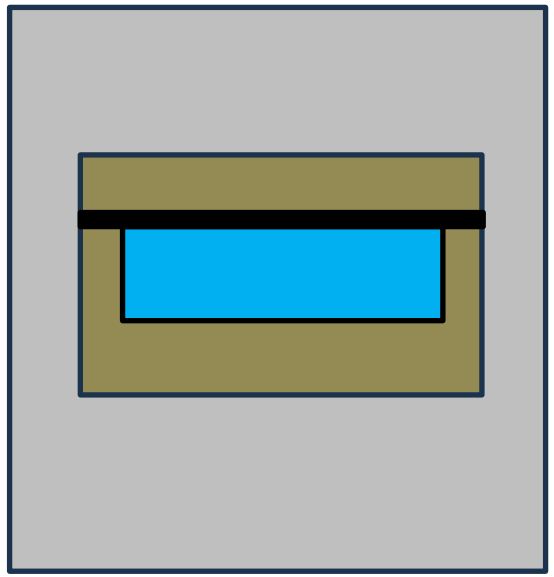
3.3 Design updates on building elevations

The shape and location of windows were adjusted in all elevations, with strategies varying by climate zone.



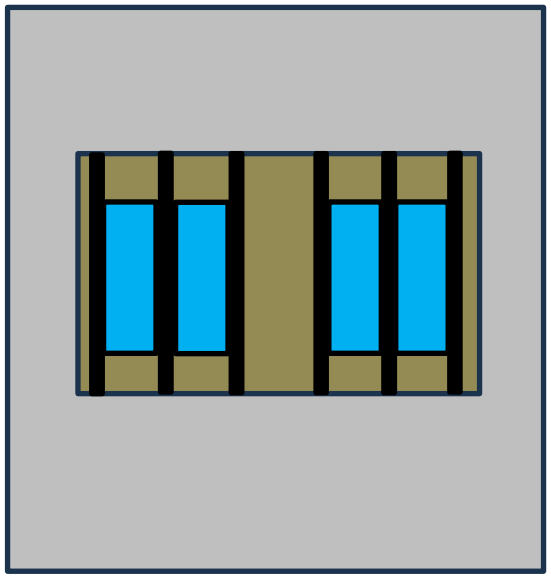
North Elevation	East Elevation	West elevation	South Elevation
Maximise the window area	**Minimise the window area**	**Remove windows when possible (Climate sensitive)**	**Minimise the window area**
Short and wide windows	**Tall and narrow windows**		**Tall and narrow windows**

3.4 Shading strategies



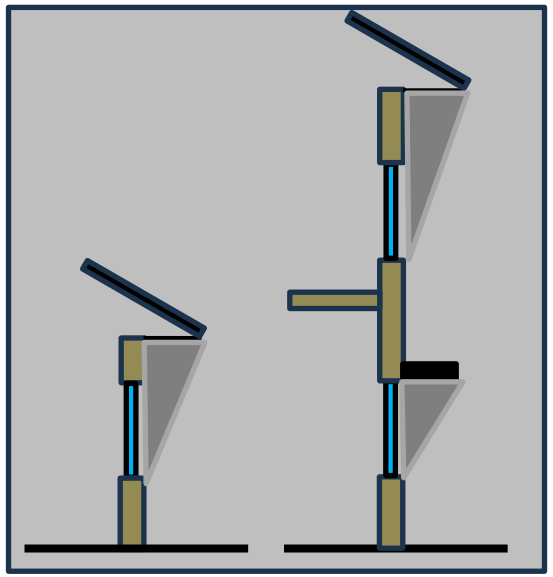
North Elevation

Horizontal shading



East and North Elevations

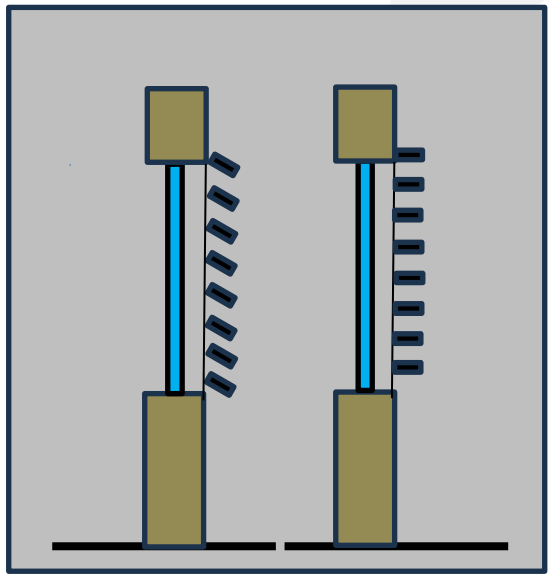
Vertical shading



Horizontal shading

Eaves (at no cost)

Specific shading element (has cost)

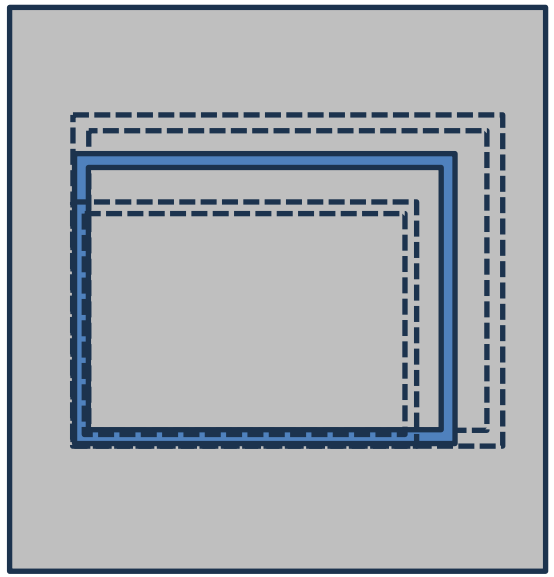


Adjustable shading tools

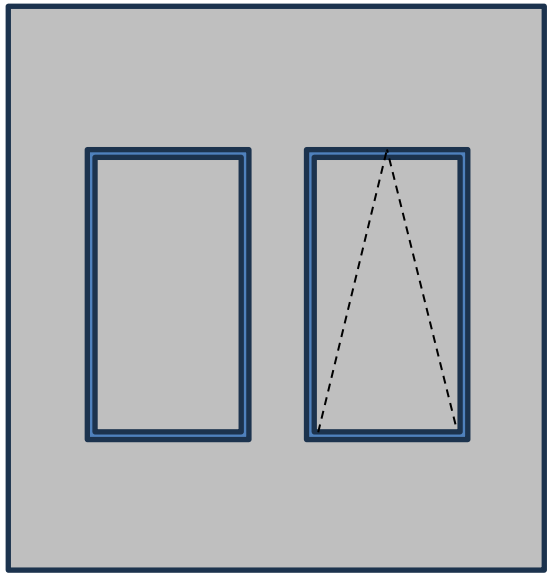
(Only if we have to have West facing windows)

3.5 Design updates on windows

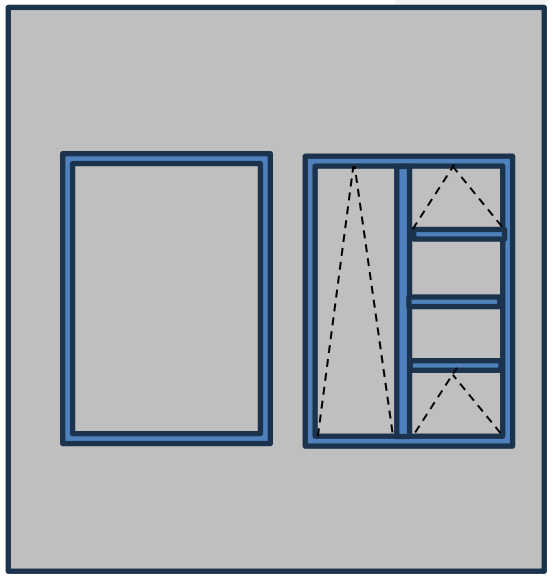
Window were modified where required.



Increase / Decrease the window size



Convert fixed windows to openable windows



Increase the number of panes on the same window

4.0 Cost reductions after design modifications

Kāinga Ora
Homes and Communities

4.1 Changes to uplift costs after redesign for 5 typologies

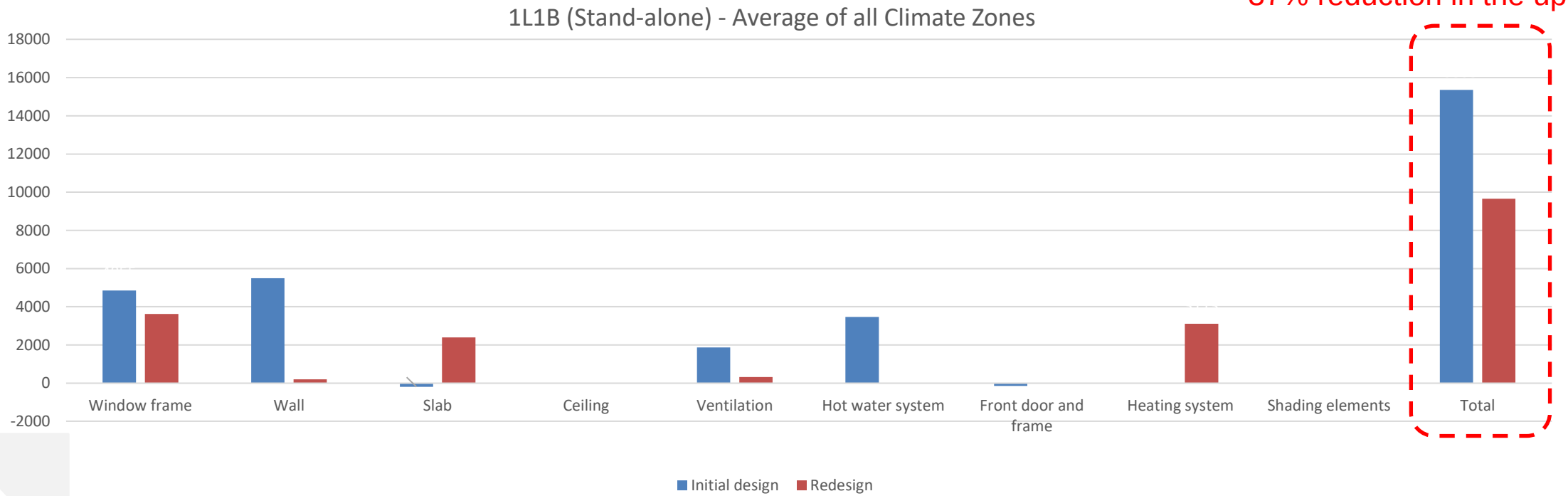
37-87% reduction in the uplift cost

Typology	Changes to the uplift cost after redesign						
	Climate zone 1 Auckland	Climate Zone 2 Hamilton	Climate Zone 3 Wellington	Climate Zone 4 Rotorua	Climate Zone 5 Christchurch	Climate Zone 6 Invercargill	Average of all Climate Zones
2L2B (Duplexed)	+301%	-247%	-37%	-62%	-112%	-93%	**-87%**
1L1B (Stand-alone)	-52%	-18%	-25%	-50%	-27%	-47%	**-37%**
1L1B (Duplexed)	-63%	-78%	-78%	-74%	-76%	-91%	**-84%**
2L3B (Stand-alone)	-95%	-36%	-36%	-96%	-40%	-23%	**-43%**
2L4B (Stand-alone)	-94%	-86%	-72%	-50%	-84%	-57%	**-72%**

4.2 How does the smart selection of specifications impact the uplift cost?

Case study: 1L1B Stand-alone typology (Average of all Climate Zones)

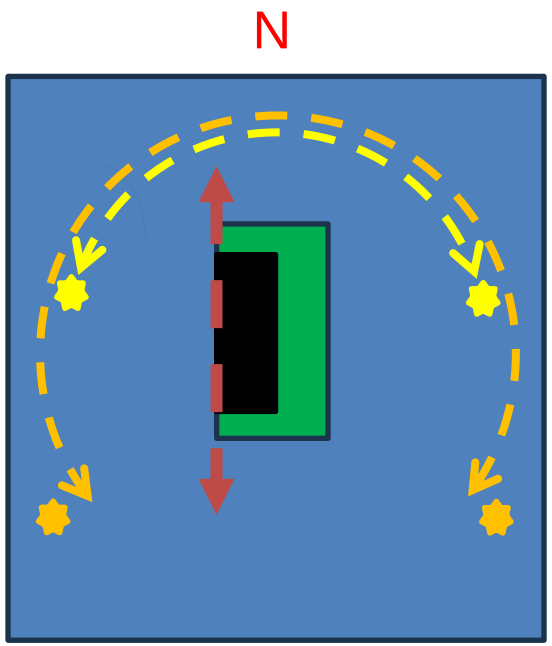
37% reduction in the uplift cost



5.0 The impact of building orientation on the uplift cost

Kāinga Ora
Homes and Communities

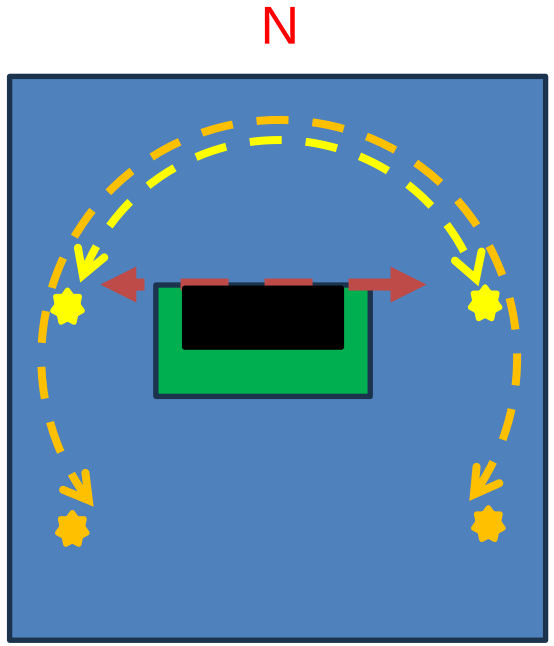
5.1 The impact of building orientation on the uplift cost (2L2B typology)



Option 1:
Small elevation facing North

Duplexed from the West side

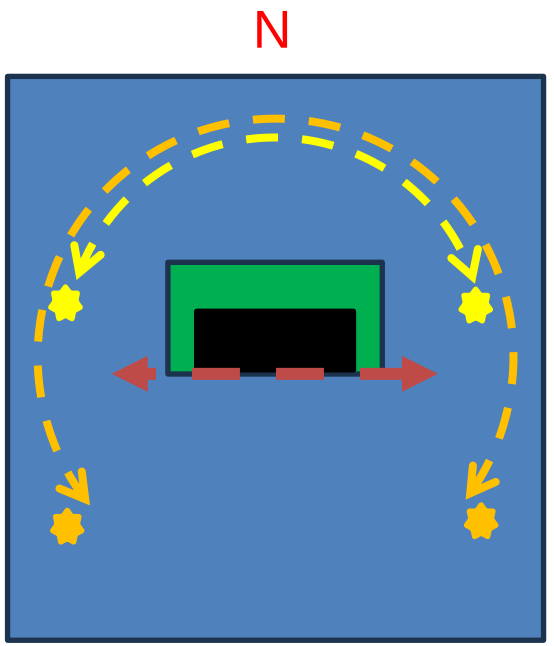
+85% compared to Option 3



Option 2:
Large elevation facing South

Duplexed from the North side

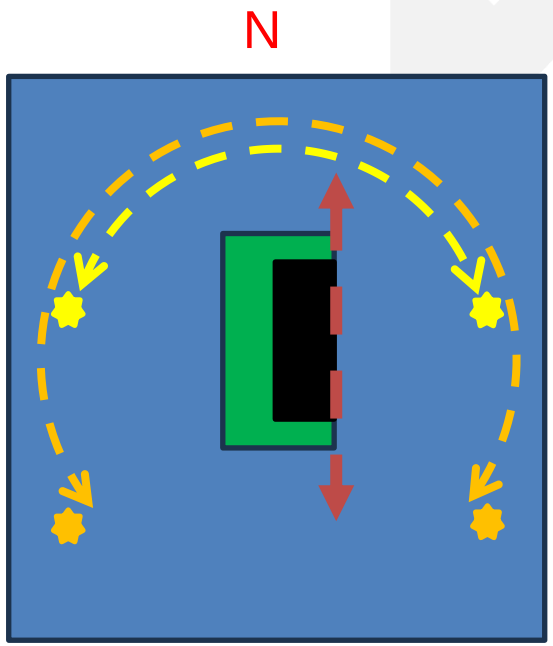
+420% compared to Option 3



Option 3:
Large elevation facing North

Duplexed from the South side

LOWEST UPLIFT COST

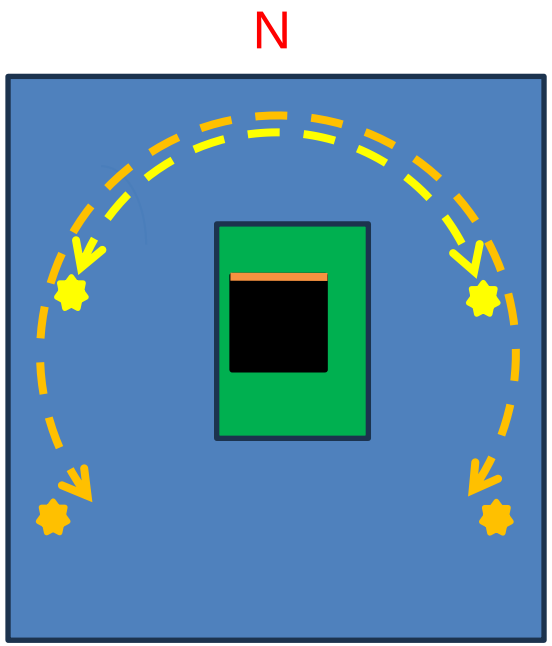


Option 4:
Small elevation facing North

Duplexed from the East side

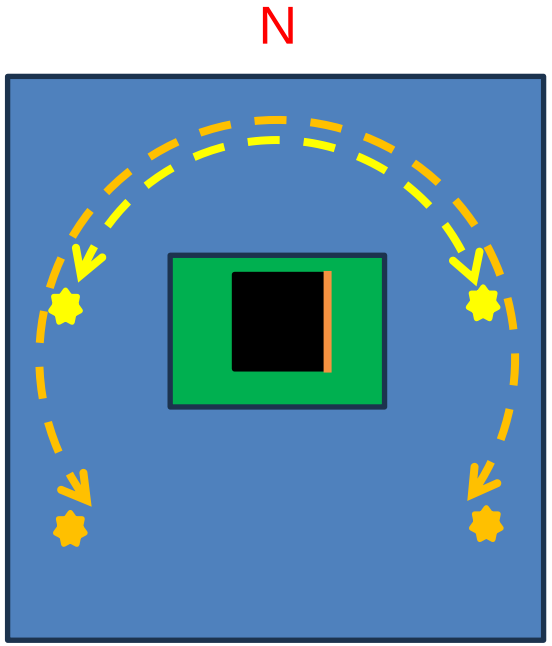
+170% compared to Option 3

5.2 The impact of building orientation on the uplift cost (2L3B typology)



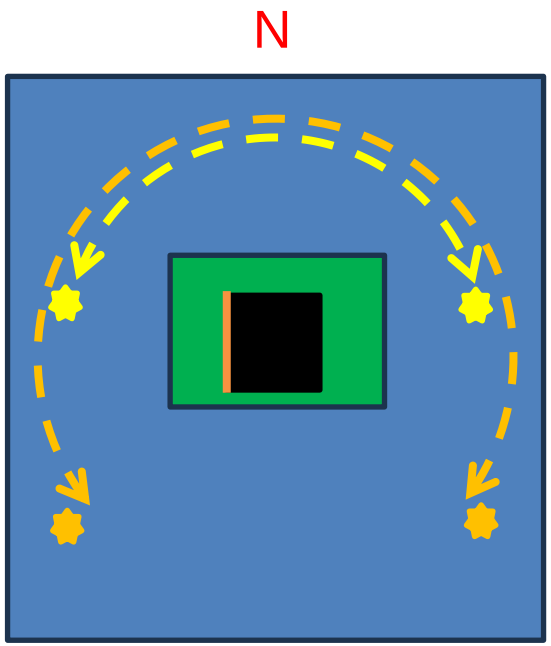
Option 1:
Main elevation facing North

LOWEST UPLIFT COST



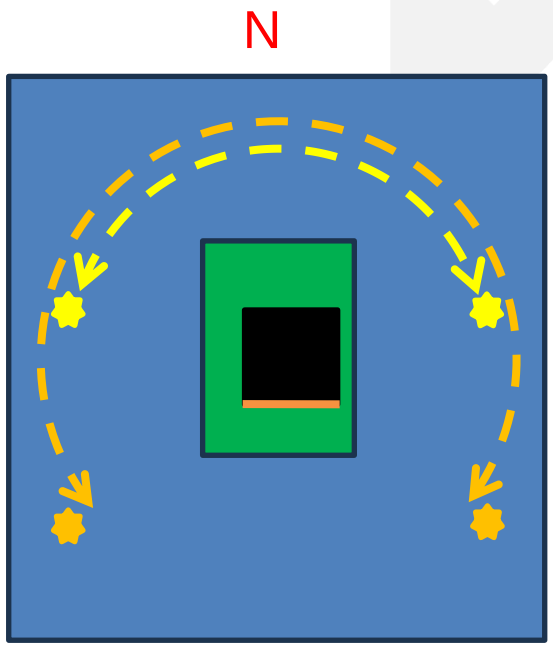
Option 2:
Main elevation facing East

+8% compared to Option 1



Option 3:
Main elevation facing West

+0.3% compared to Option 1



Option 4:
Main elevation facing South

+2% compared to Option 1

Thank you very much for your attention

Kāinga Ora
Homes and Communities