

# Medium density housing – how to design well, and build better

# BOINZ

Building Officials Institute of New Zealand

GUY MARRIAGE – FNZIA

ARCHITECT – FIRST LIGHT STUDIO

ACADEMIC – VICTORIA UNIVERSITY OF WELLINGTON

AUTHOR – TALL, MEDIUM, M.A.D.





11 years working in London (5 years at Fosters)  
22 years working in New Zealand (7 years at Studio Pacific)  
20 years lecturing in Architecture and Construction  
75 articles and papers published  
3 books published  
1 Solar Decathlon (right) USA + back  
Relevant Experience in Apartment buildings:  
Willis St, Wellington  
Wakefield St, Wellington  
Frederick St, Wellington  
Oriental Parade, Wellington  
Halsey St, Viaduct Harbour, Auckland  
Townhouses in Ngarara, Waikanae  
Kainga Ora + KiwiBuild housing in Auckland  
Lives in an apartment building I designed  
Built own apartment + Built own bach (Grand Designs NZ)




TALL & M.A.D. available @ Unity Books & Vic Books  
Medium is via EBOSS only



# medium is the message

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- 
- As New Zealand finally embraces medium density housing (MDH), the increase in this type of development has exploded.
  - The year ending 2022 saw **26,823** multi-unit homes consented, accounting for nearly half of all residential consents.
  - The pace of change has been dramatic, and BCOs are struggling to keep ahead of the game.
  - BOINZ are not alone in this - nearly everyone working in this area in New Zealand needs to rapidly upskill in the subject.
  - But first – we must answer one very important question:

Subject area: MDH

**WHAT IS**

Medium Density  
Housing?

?

## The Missing Middle – between single houses and tall apartment blocks



This is the concept of "The Missing Middle" developed by Daniel Parolek and the AIA (USA), ie some housing types possible between Single detached houses, and Tall apartment towers.

**Illustration** courtesy of Palmerston North City Council, who say:

“ currently missing from our property market. Any developments higher than 3 storeys are not considered medium density and therefore not covered in the ”

# BRANZ Definition of Medium Density ([www.mdh.org.nz](http://www.mdh.org.nz))

BRANZ definition of MDH: “**multi-unit housing up to six storeys high.**”

BRANZ divides this into three key categories:

## Category One:

1-2 storey attached houses, such as duplexes or semi-attached townhouses

## Category Two:

2-4 storey attached houses, such as terraced housing

## Category Three:

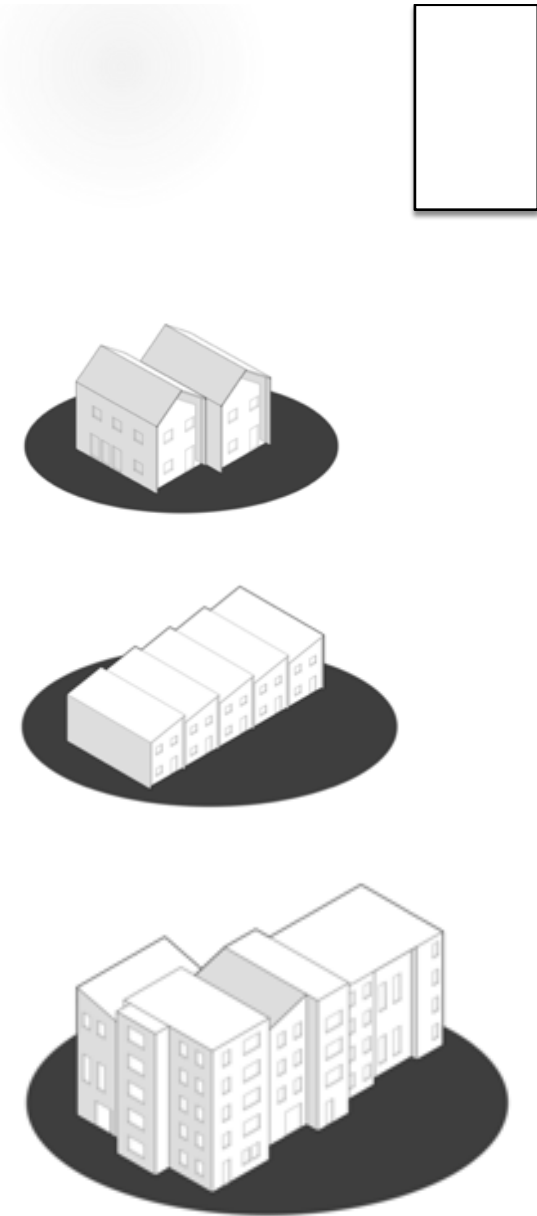
3-6 storey apartments.

Bryson, K & Allen, N. (2017). *Defining medium-density housing*. BRANZ Study Report SR376.



MEDIUM-DENSITY  
HOUSING

Note: definition adopted by **MBIE**





# Types of **Low-Medium** Density Housing



Duplex / triplex



Two-storey  
Adjoined  
townhouses



Terraced housing

## **Category One:**

1-2 storey attached houses,  
such as duplexes or semi-  
attached townhouses

## **Category Two:**

2-4 storey terraced houses,  
such as attached terrace  
housing

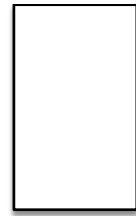
# Types of **Medium** Density Housing



3 storey walk-ups



Courtyard housing –  
no back yards, no  
side yards



Perimeter block housing

**Category Three:**  
3-6 storey apartments.



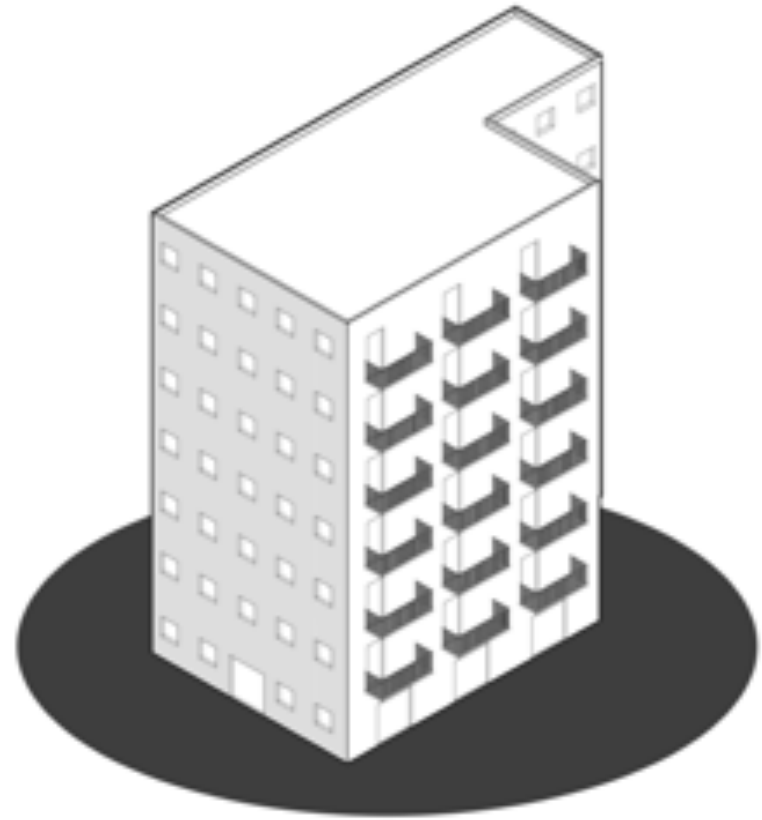
3-4 storey terraced housing

# Types of **High** Density Housing

Therefore, **High density** = apartment buildings 6 storeys and above



Perimeter block housing 6 or more storeys high



Apartment buildings 6 or more storeys high



- Best practice for the design and construction of this type of development

- How we can successfully move away from our suburban past and move towards a more compact and densely populated future.

- How designers and BCOs can work together to achieve faster, smoother consenting processes

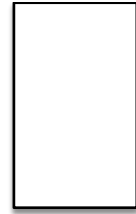
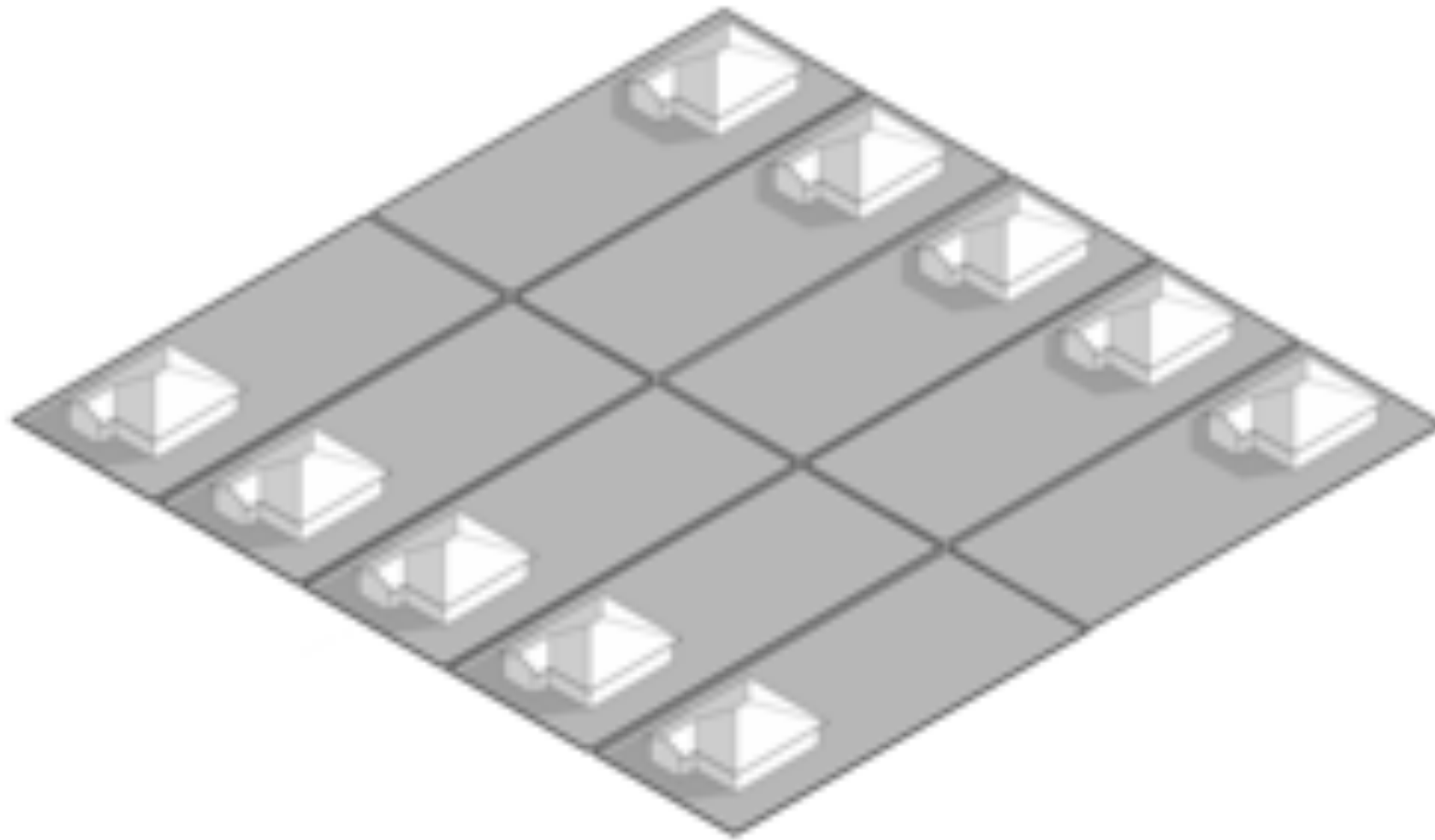
- How designers and BCOs can resolve key issues, design well, and build better.

How to: **MDH**

**Part One**

# PLAN

PLAN looks at Background behind the book



1 house per  
quarter acre

Suitable for 1940  
perhaps, but not  
now

1-2 cars (min) per  
household

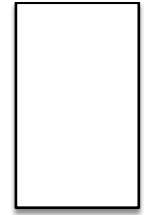
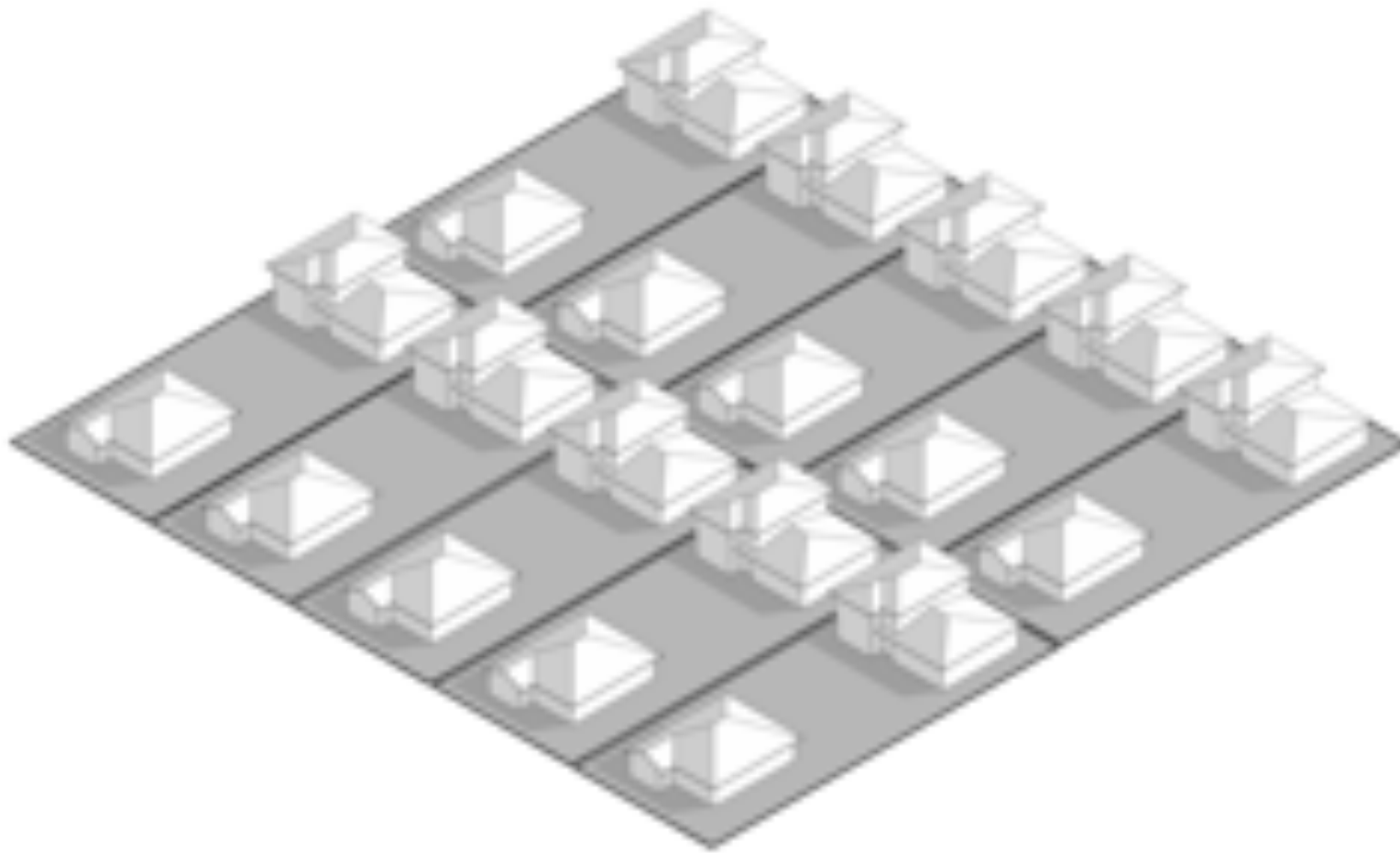
Requires driving  
everywhere

10 dwellings per hectare = outdated



Upper Hutt





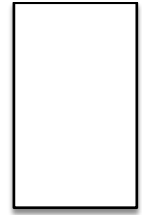
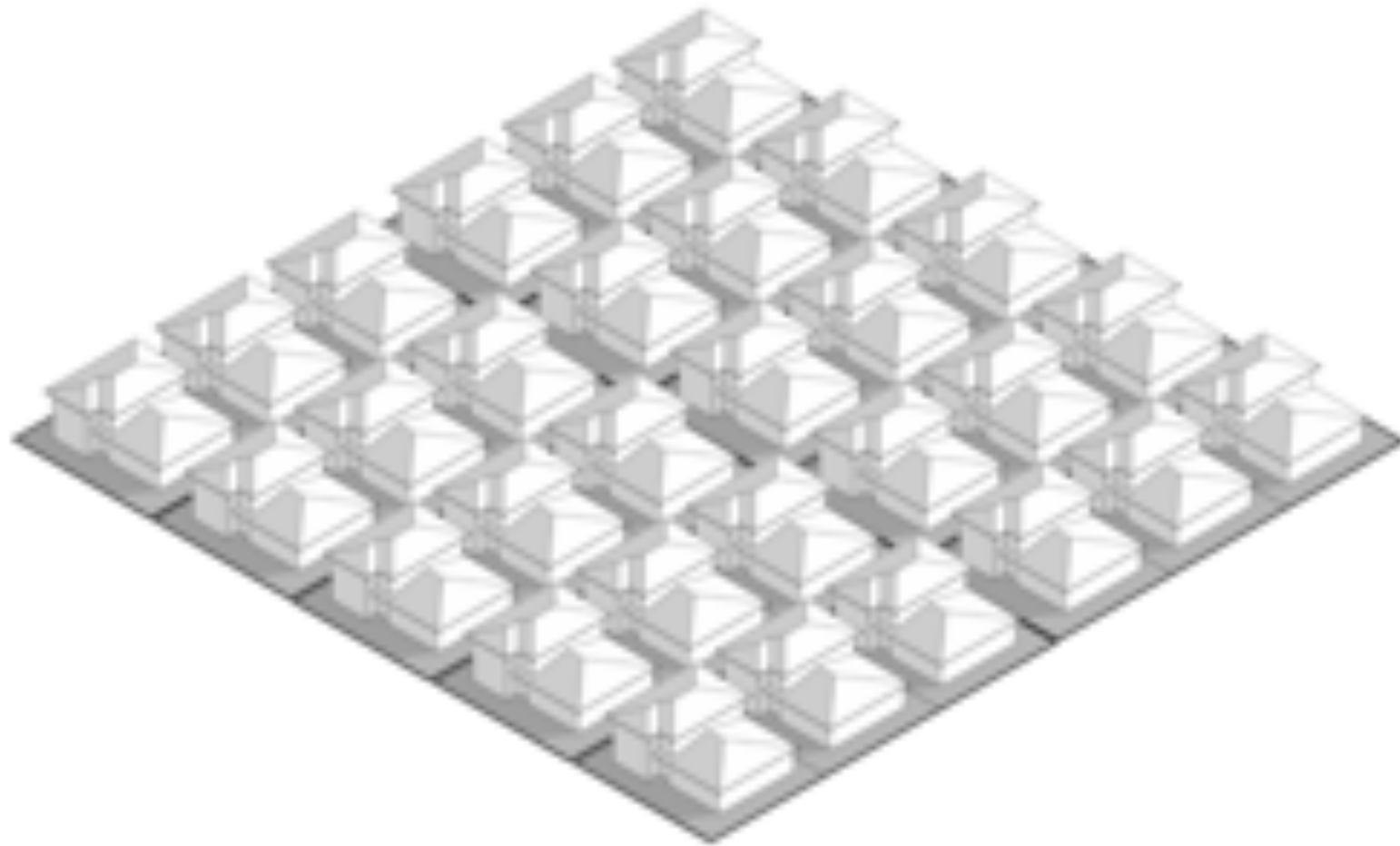
1 house per eighth  
acre

Infill housing  
doubles the  
density, but it is still  
far from “medium”  
density

20 dwellings per hectare

Hutt –  
ripe for  
redevelop-  
ment





Medium Density =  
housing 3-6 storeys  
high

= density above 30  
du/ha

= density below  
about 150du/ha in  
NZ terms

= townhouses,  
duplexes, triplexes,  
apartments, etc

30 dwellings per hectare = low-to-medium



6 sites per quarter  
acre site

1 68m<sup>2</sup> per site

4 apartments per site

Each apartment =  
84m<sup>2</sup>

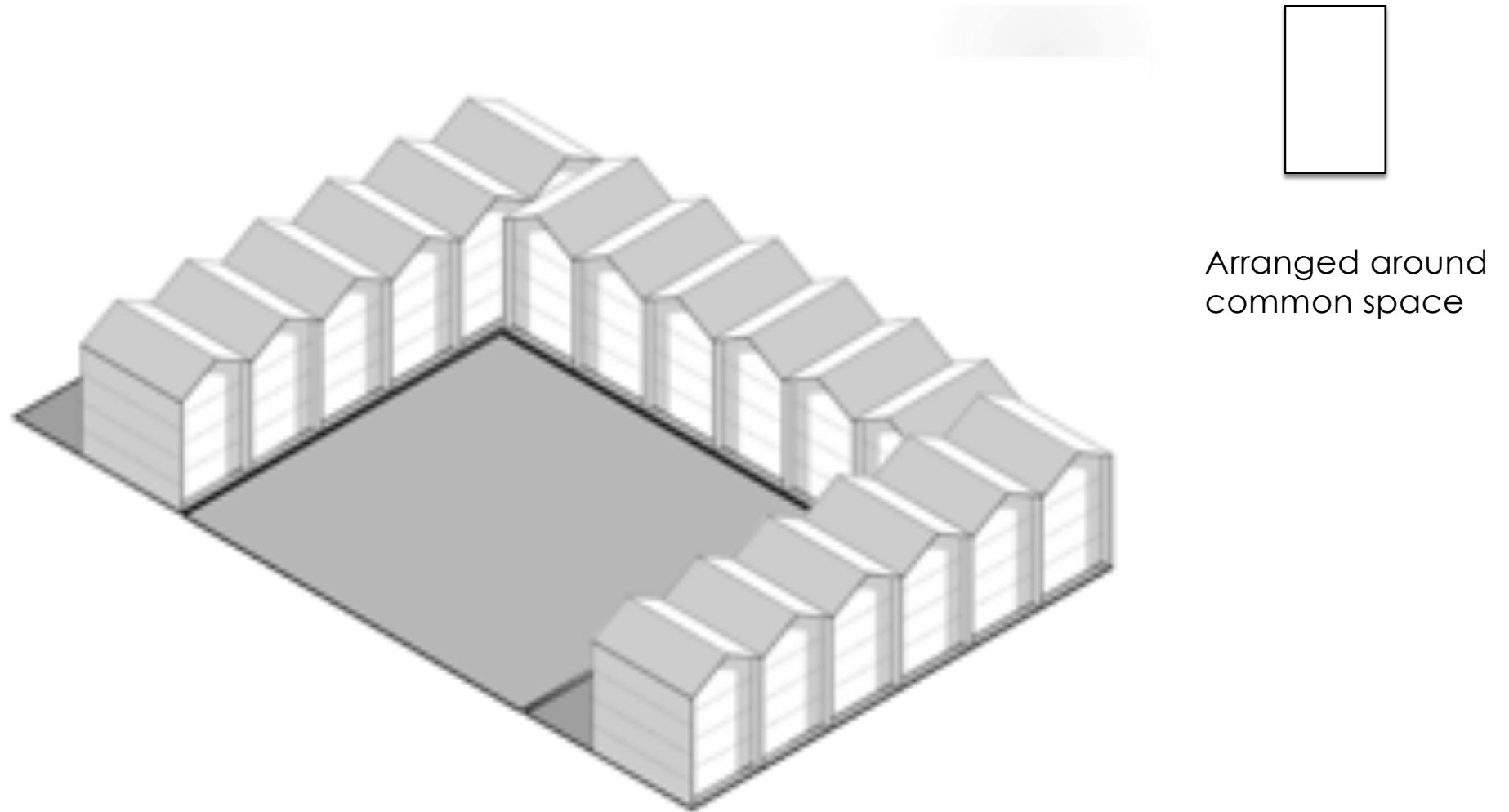
Good two-bed size –  
still only 50% site  
coverage

250 dwellings per hectare = medium → high

Part Two

# DESIGN

Design advice



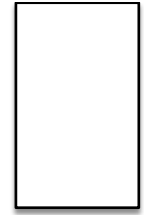
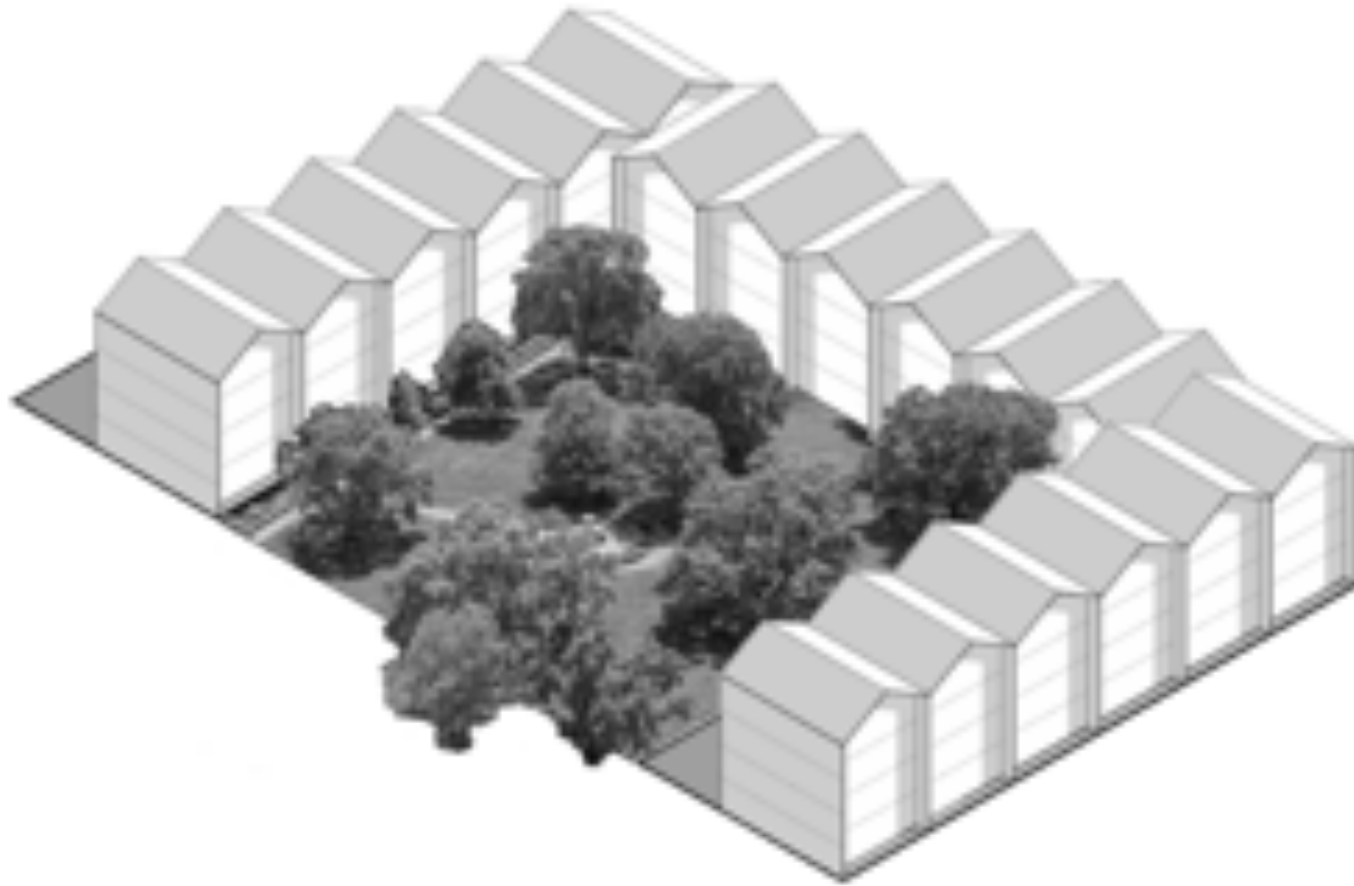
180 du/ha in Apartments = medium

- It is inevitable that MDH will play a bigger part in our future – in major cities and minor towns.

- MDH, when done well, provides a number of benefits for urban planning and quality of life of the occupants, and when well sited, needs less / no cars.

- The key to successful MDH lies in careful design and good construction, **centred around quality common outdoor space.**

Growth area: **MDH**



Arranged around  
well-planted,  
sunny, common  
space

Chapter 4  
**COMMUNITY**  
By  
Hannah Hopewell

Working with Ngati  
Toa Rangatira and  
other iwi – creating  
homes and places,  
for people to live in  
excellent  
community  
facilities

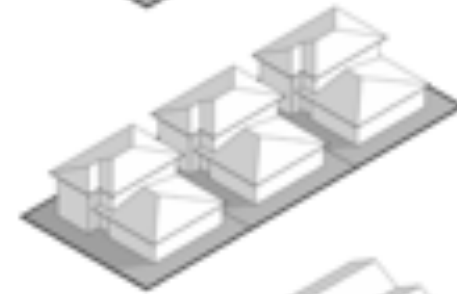
180 dwellings + Gardens = Homes



**No** more this →



**Not** the answer →



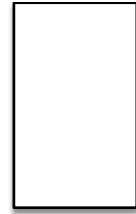
**Maybe** tall townhouses →



**Definitely** apartments →



- Individual stand-alone houses (up to 10m tall) require LBP Design Class 2 or 3, or a Registered Architect.



- Residential buildings under 10m – fall under “Restricted Building Work” (RBW) and require LBP to both design and to build – but the details of the Building Act says over 10m high = not RBW



- Obviously, all MDH developments SHOULD require **ONLY** experienced **Registered Architect** or **LBP DC3**, and all **MDH** construction work should be classified as **RBW** – BOINZ should be insisting on this.



## Who is permitted to Design / Build MDH ?



Only one design in Canterbury?



- Are endless two-storey townhouses the answer? With courtyards full of cars?

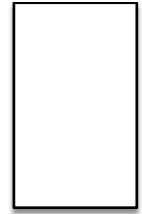


Better Outcomes ?

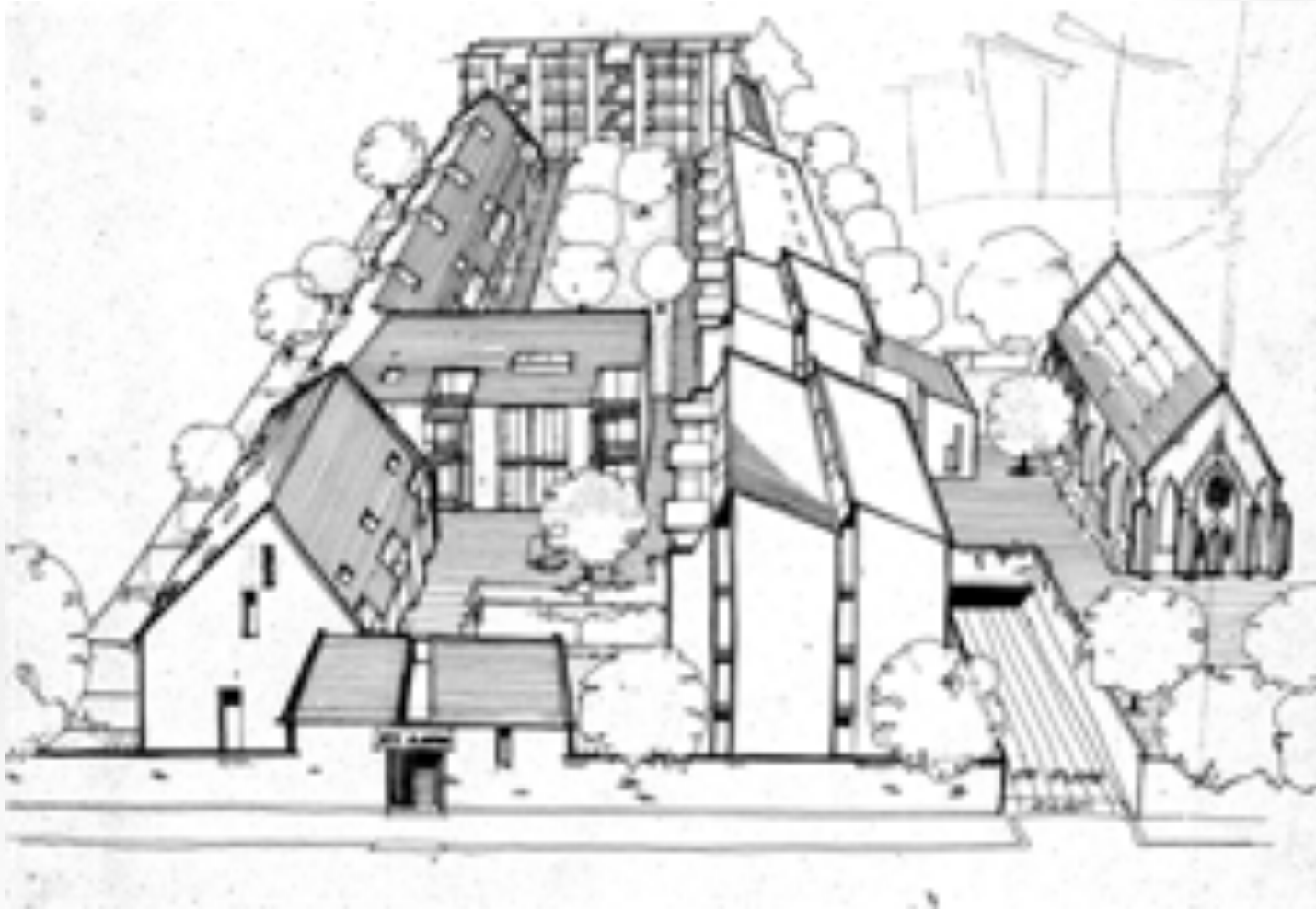
- Or is it better to concentrate new housing in well-designed environments, such as master-planned apartment buildings ?

Better  
Outcomes!





St Marys Apartments – Arch: Peter Beaven



St Mary's –

“Really good quality  
medium density town  
house and apartment  
construction, centred  
around 2 internal  
courtyards”

St Marys Apartments – Arch: Peter Beaven



St Marys Apartments – Arch: Peter Beaven



## Design Factors to Consider

Table 3.2

# Design factors

Density level	Storeys	Approx. height	Lifts	FIRI without sprinklers	FIRI with sprinklers	Fire Engineer	Wind Report	Urban Design Report
high	11+		required	80	30	required	required	recommended
high	10	30m	required	80	30	required	required	recommended
high	9	27m	required	80	30	required	required	recommended
high	8	24m	required	80	30	required	required	recommended
medium-high	7	21m	required	80	30	required	required	recommended
medium	6	18m	required	80	30	required	required	recommended
medium	5	15m	required	80	30	required	required	recommended
medium	4	12m	required	80	30	required	required	recommended
low-medium	3	9m	voluntary	n/a	voluntary	n/a	n/a	n/a
low	2	6m	voluntary	n/a	voluntary	n/a	n/a	n/a
low	1	3m	n/a	n/a	voluntary	n/a	n/a	n/a

## Material Factors to Consider

Table 3.3

# Material factors

Density level	Storeys	Approx. height	Light timber frame	Concrete block masonry	Insitu and precast concrete	Structural steel frame	CLT	Plywood panels	SFS
high	11+				recommended	recommended	possible		
high	10	30m			recommended	recommended	possible		
high	9	27m			recommended	recommended	possible		
high	8	24m			recommended	recommended	possible		
medium-high	7	21m		allowed	allowed	allowed	recommended		
medium	6	18m		allowed	allowed	allowed	recommended		
medium	5	15m		allowed	allowed	allowed	recommended		
medium	4	12m	SFD	allowed	allowed	possible	recommended	allowed	allowed
low-medium	3	9m	allowed	allowed	allowed	partial	possible	allowed	allowed
low	2	6m	allowed	allowed	possible	partial	possible	allowed	allowed
low	1	3m	allowed	allowed	possible	n/a	n/a	allowed	allowed

## Walk Score®

- 90-100 Walker's Paradise**  
Daily errands do not require a car
- 70-89 Very Walkable**  
Most errands can be accomplished on foot
- 50-69 Somewhat Walkable**  
Some errands can be accomplished on foot
- 25-49 Car Dependent**  
Most errands require a car
- 0-24 Car Dependent**  
Almost all errands require a car

SOURCE: [www.walkscore.com](http://www.walkscore.com)

Walkscore.com



## 75 Ferry Road

A location in Christchurch

Ferry Road, Chch

Favorite Map Nearby Apartments

Walk Score **73** Very Walkable  
Most errands can be accomplished on foot.

About your score

Add scores to your site



75 Ferry Road, Christchurch

## 16 Riccarton Avenue

A location in Christchurch

Riccarton

Favorite Map Nearby Apartments

Walk Score **61** Somewhat Walkable  
Some errands can be accomplished on foot.

About your score

Add scores to your site



## Walk Score®

- 90-100 Walker's Paradise  
Daily errands do not require a car
- 70-89 Very Walkable  
Most errands can be accomplished on foot
- 50-69 Somewhat Walkable  
Some errands can be accomplished on foot
- 25-49 Car Dependent  
Most errands require a car
- 0-24 Car Dependent  
Almost all errands require a car

SOURCE: [www.walkscore.com](http://www.walkscore.com)

## Car-Dependent

Add scores to your site

Favorite Map Nearby Apartments

More about it

Walk Score **0** Car-Dependent  
Almost all errands require a car.

About your score



Outskirts of  
Rolleston

## Frederick Street

A location in Wellington

Te Aro, Wellington

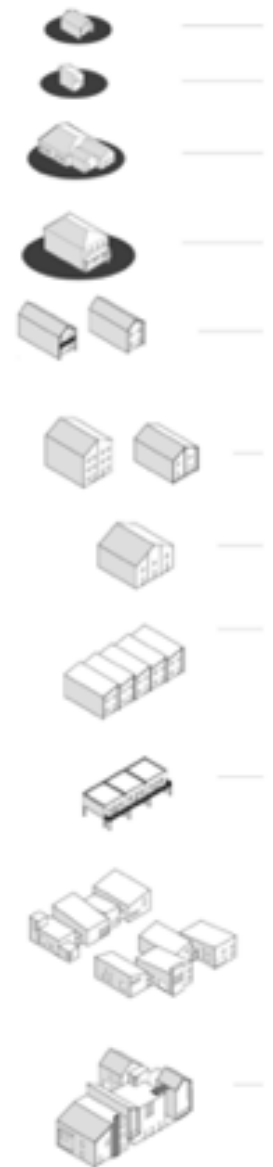
Favorite Map Nearby Apartments

Walk Score **99** Walker's Paradise  
Daily errands do not require a car.

About your score

Add scores to your site

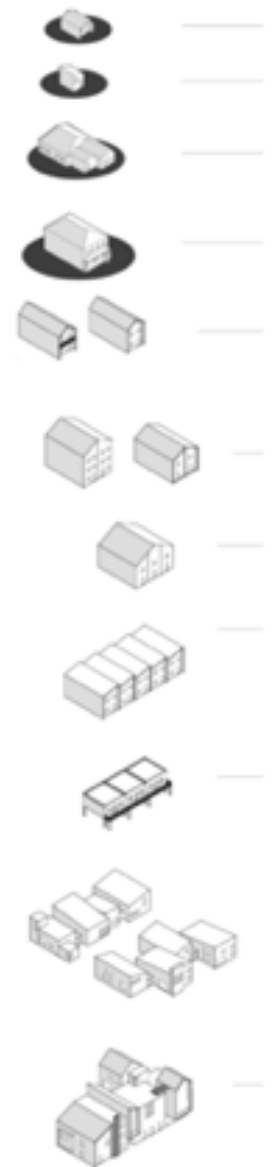




# Transport Oriented Development

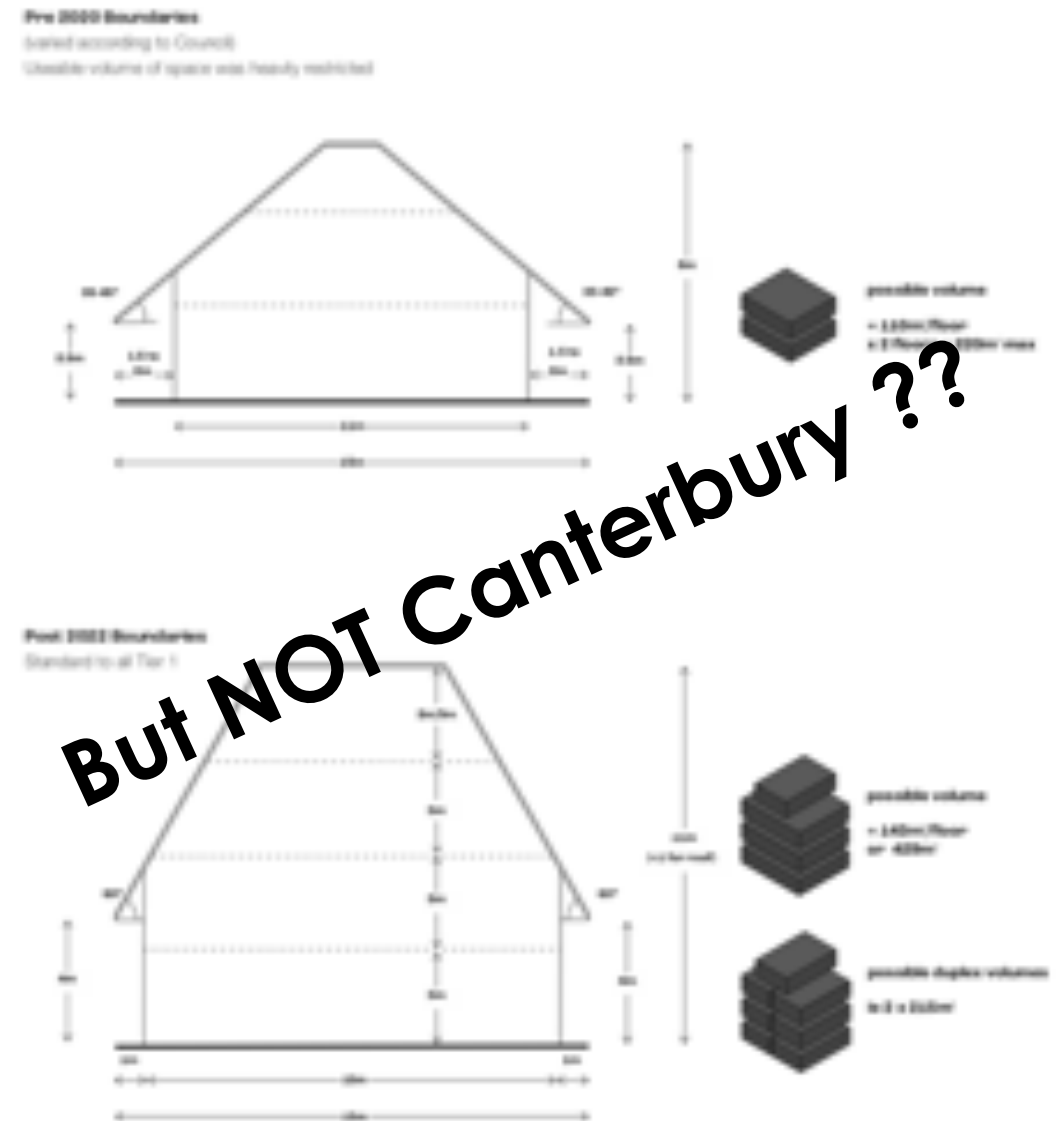


# Transport Oriented Development



- **Existing rules → Proposed change**
- 1 house only → **3 houses**
- Max height 8-10m → max height **11-12m**
- 2.5m height at boundary → 4m + 60°
- Front yard 3m → Front yard 2.5m or 0m?
- Side yard 0m → side yard 1m or 0m?
- Site coverage max 50% → no change Well
- (Porirua & Hutt will change from 35→50% )
- Impervious coverage → to be 60%
- Outdoor Living Space Ground floor 20m<sup>2</sup>
- Outlook Space → 4m x 4m space living
- Outlook Space → 1m x 1m bedroom

**MDRS** Medium Density Residential Standards  
But Zero standards for Quality



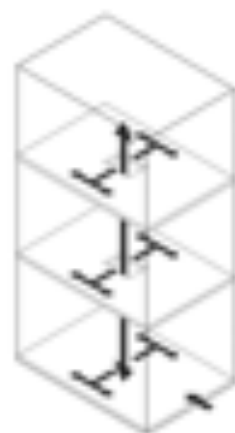
## Access Routes Figure 5.3



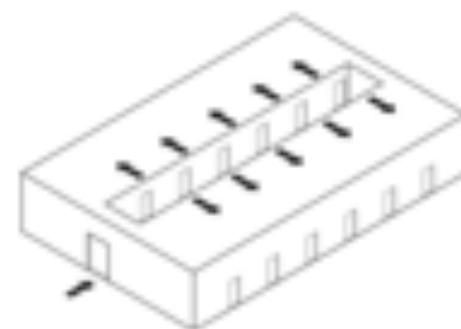
**Horizontally adjoining**  
Vertical internal circulation routes



**Vertically adjoining horizontal gallery access**  
- Single-sided  
- Privacy concerns



**Apartment buildings**  
Central access core with combination of both vertical and horizontally adjoining properties



**Double-Loaded internal corridor**  
Hotels/Apartments

## Stair Orientation Figure 5.4

1 Stair by plan height



2 Stair with stair flight



3 Straight side flight



4 Stair with window



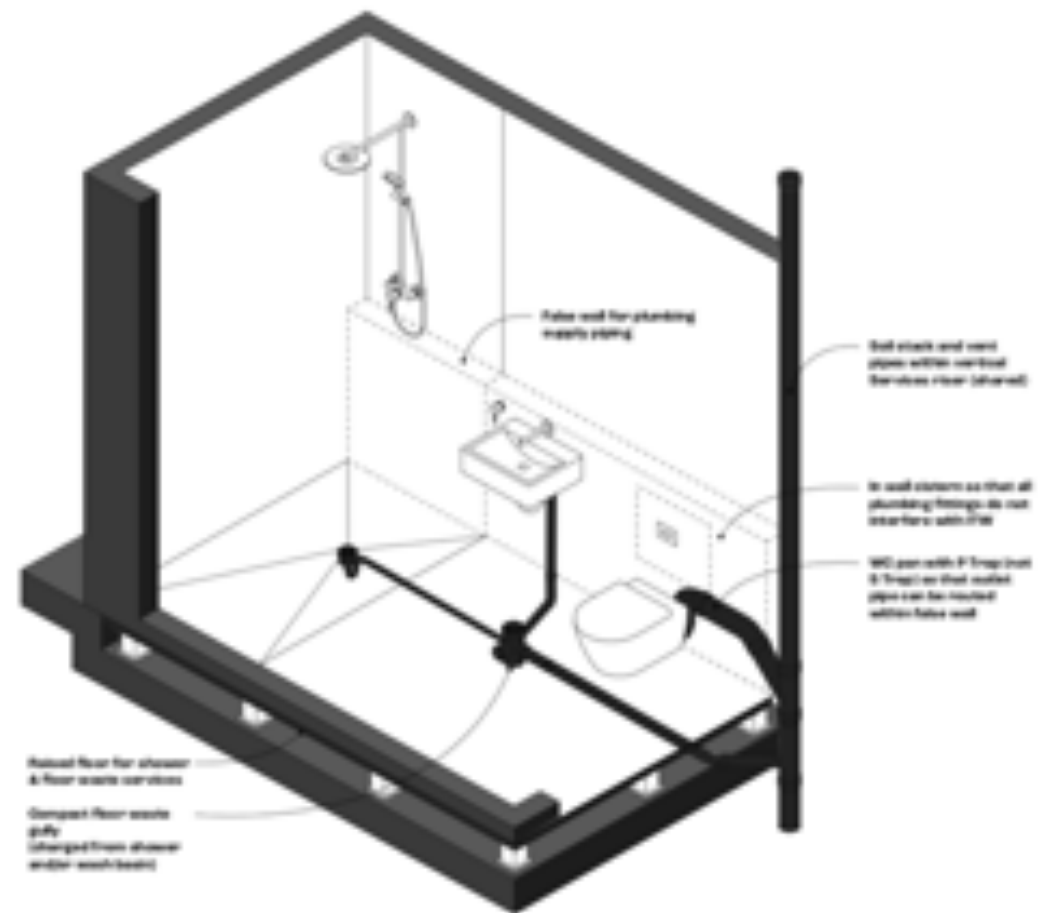
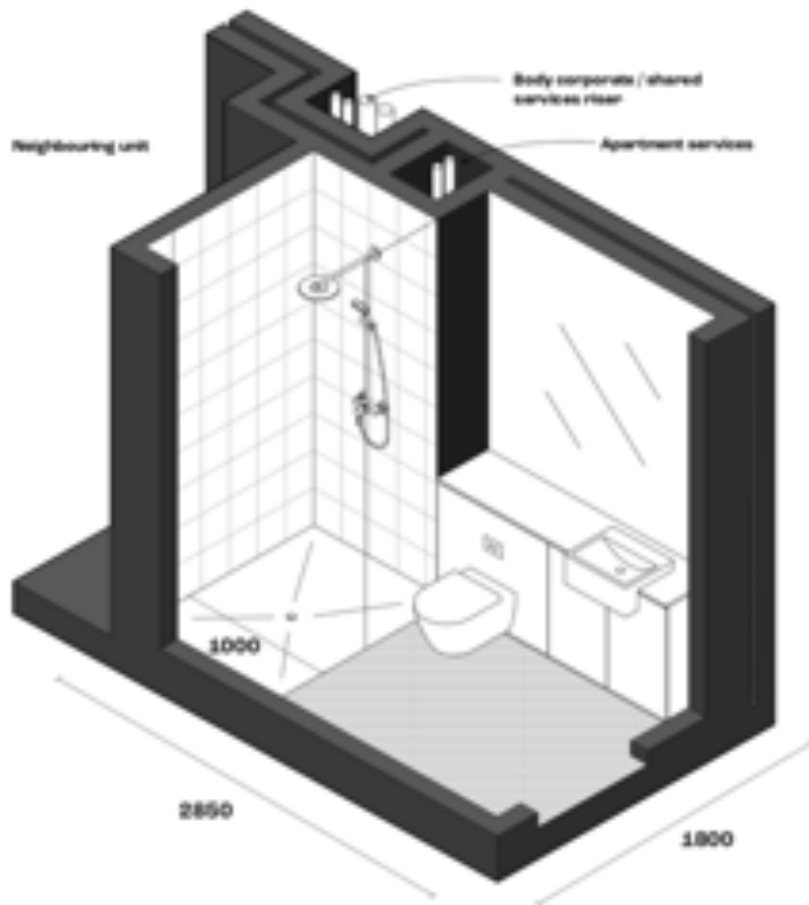
5 Landing half flight



6 Continuous side flights

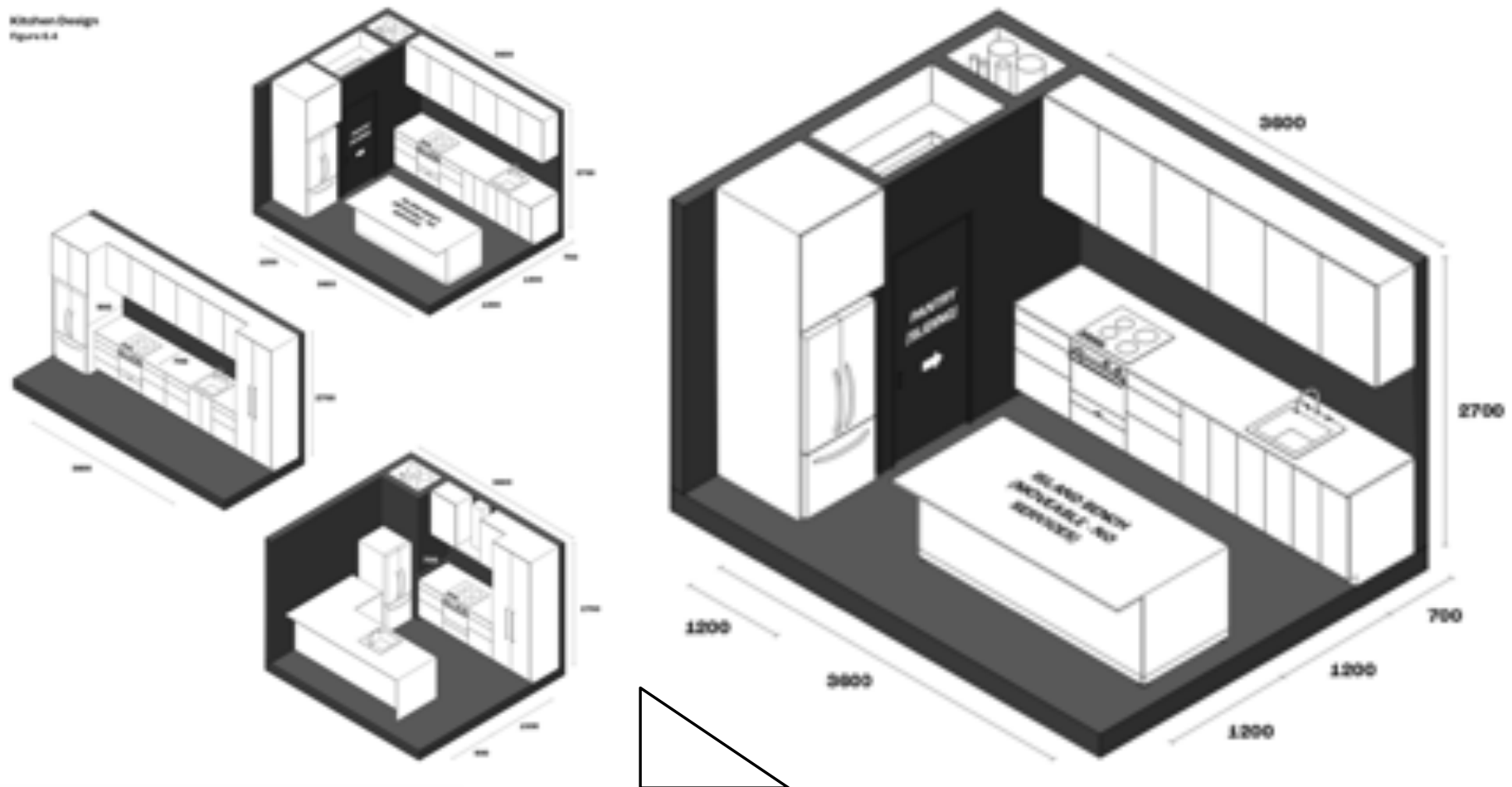




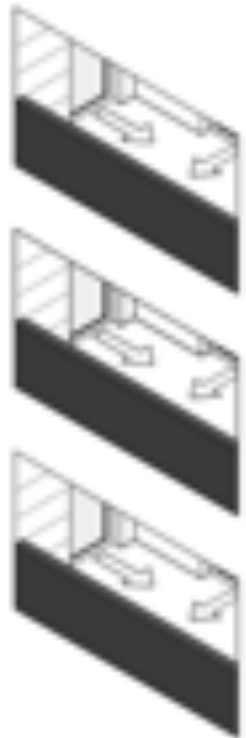


# Bathroom design

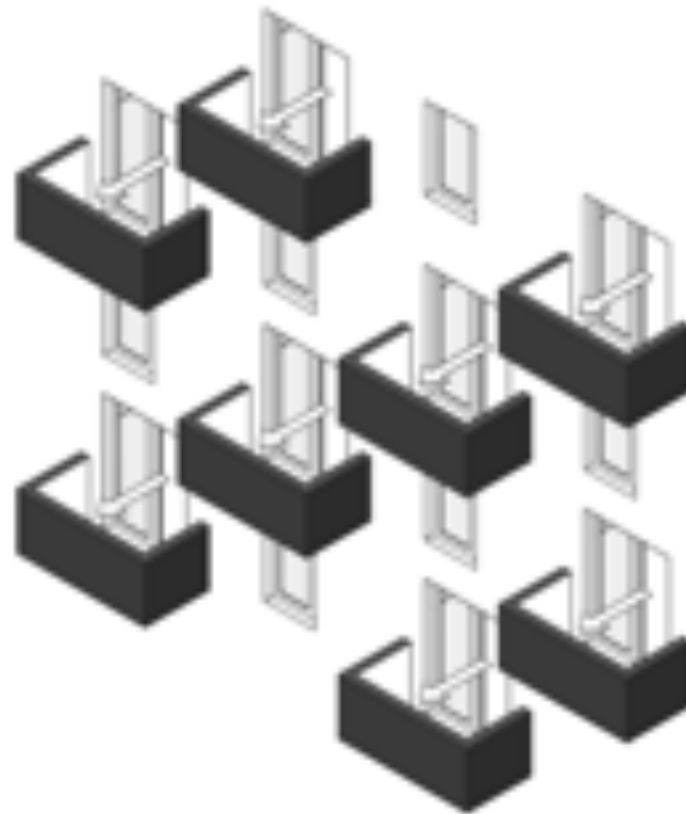
Kitchen Design  
Figure 1.4



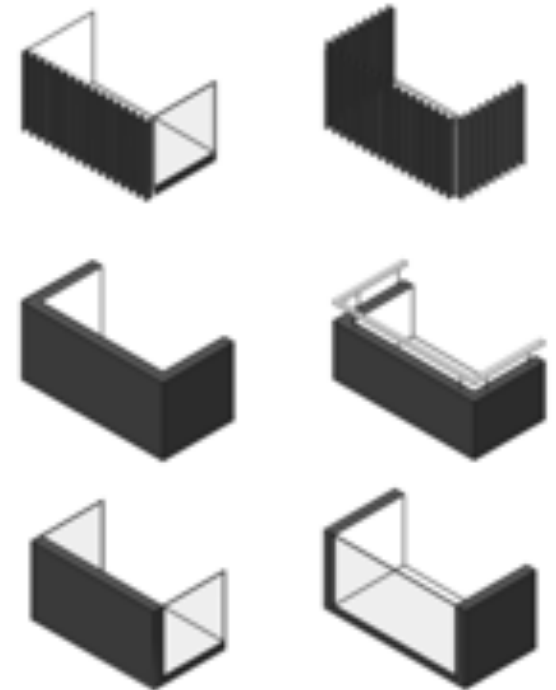
Kitchen planning



Fully recessed



Fully projecting and alternating



Balustrade variations

# Balcony variations

**Part Three**

# BUILD

Details and materials and systems

468 *Reviews*

The system is a lightweight timber construction for and around site-boring (auger) foundations. The floor system uses two layers (Glaser<sup>TM</sup>) floor joist battens for timber or steel floor joists and the second layer battens into wooden battens over a timber deck creating a floating floor (Glaser & Glaser<sup>TM</sup>). The system also offers solutions for timber joist, D/T and concrete slabs on or over a pile and existing walls. The system is ideal for site-boring, foundations, apartments, multi-unit residential, hotels, hospitals, retail, mixed use and office complexes.

Standard™ is a 100% free stand with stands of wood joined together under heat and pressure. It can also be treated to kill it. Stands can be specified as open-edge or can include a polyurethane vapor barrier to prevent moisture loss. (This may add to the price.) Call 800-445-4455.

### Applications

With the growth of medium to high density residential housing, there was a need for an alternative wood based solution that could address the issue of neither allowing noise in multi-story tenancy buildings.

- Accurate performance of GTC 40-60 kg meeting from its two-tones in adding new tones. The accuracy performance values are listed in a table that the four coverings. Improved accuracy performance is achieved with installation of four coverings, able to GTC-New Control Method. (GTCN file)
- The performance of GTC 40-60 kg tested by GTCN2 (Appendix 206)
- GTCN2/40-60 kg provides a set of values
- Comparison of GTCN and values distributed test of 40 kg effect and test results on values 40-60 kg (100) providing concentrated or even weight distribution
- GTCN2 is lighter than comparable solutions
- GTCN2 is GTCN2/40-60 kg argument used parallel do not require special lifting equipment
- Multiple steel size available - 300 x 100 mm and 300 x 100 mm
- Batters can be up to 100 mm in size for sections in Batten & Gable/40-60 kg - a solution for GTC construction

There is currently no further information available.

## Discussion

- 4. The system is lighter than comparable systems, and so concrete & steel construction is less cement solution
- 5. Needs no lighters and easier to handle
- 6. Easy to install, less complicated than other types of systems in the market
- 7. Does not require special cutting equipment, can cut on site with standard concrete tools, no structural management in site required if compared with flow cement solution
- 8. Lightweight modular frame construction has advantages over beam systems in certain ground conditions
- 9. To have good installability during renovation work, assembly performance can be achieved with no reliance on support or vertically unloading, especially if mechanical fixtures in site are used

Lambert<sup>2</sup>, Hengstfuss<sup>2</sup>, Hengstfuss<sup>2</sup>

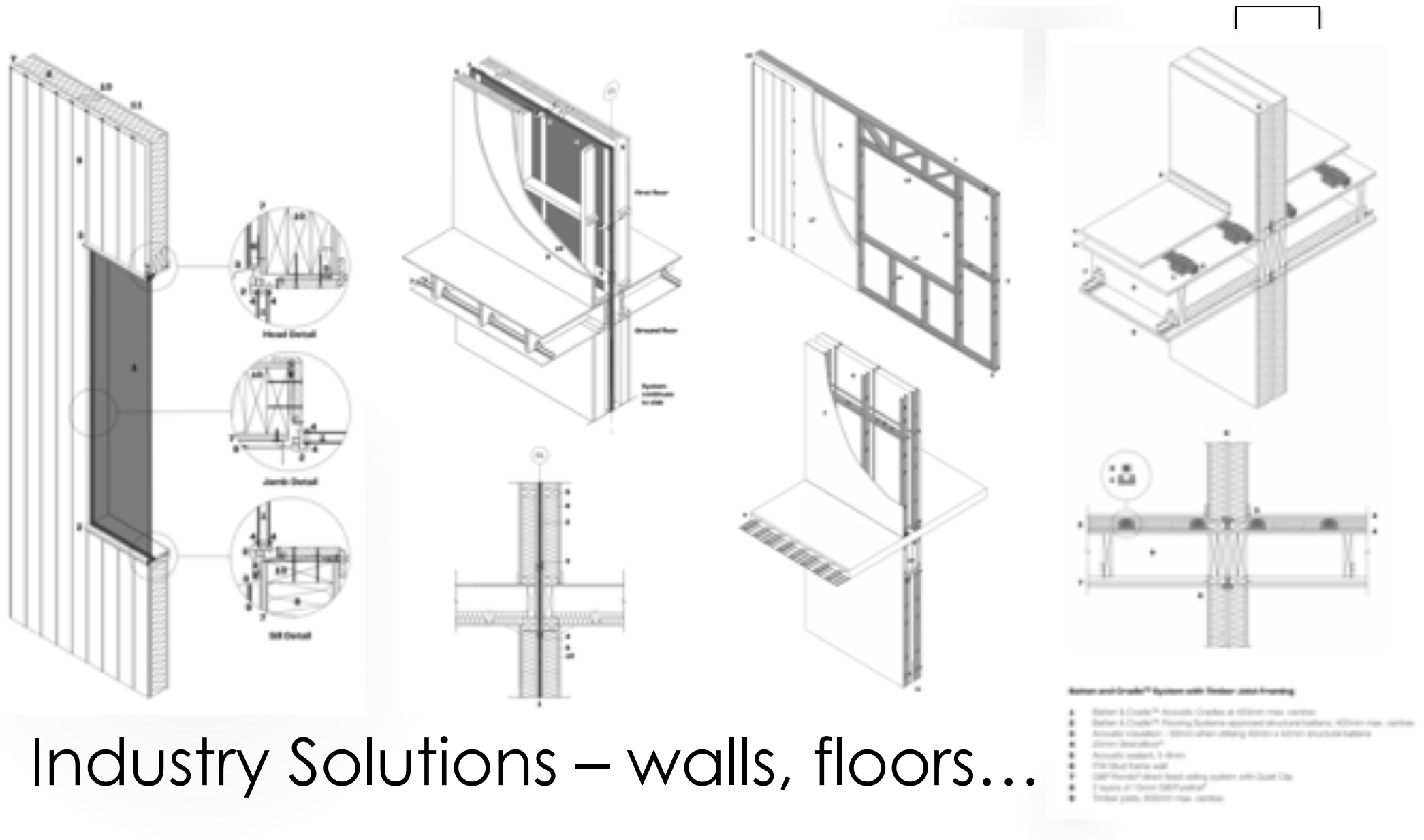
- ```

10 10mm-SteelRebar® being cast into 100mm-200mm along structural floor system
11 10mm-SteelRebar® being cast into 100mm-200mm along ceiling joist
12 Reinforced concrete slab floor system
13 4-100mm2 square rebar, 100mm-40
14 100mm-100mm 10mm
15 10mm-100mm 10mm
16 10mm-100mm 10mm
17 10mm-100mm 10mm
18 10mm-100mm 10mm
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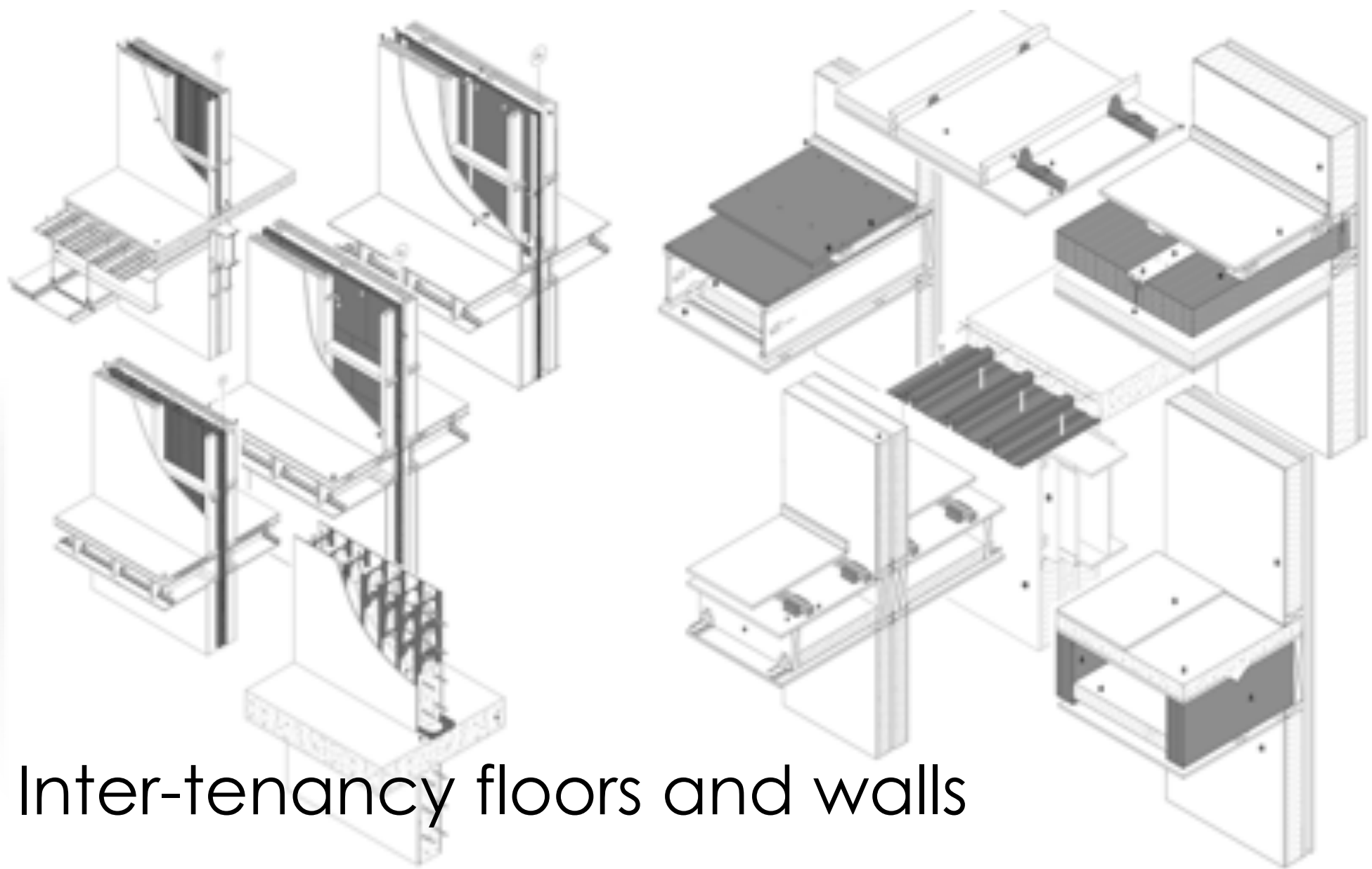
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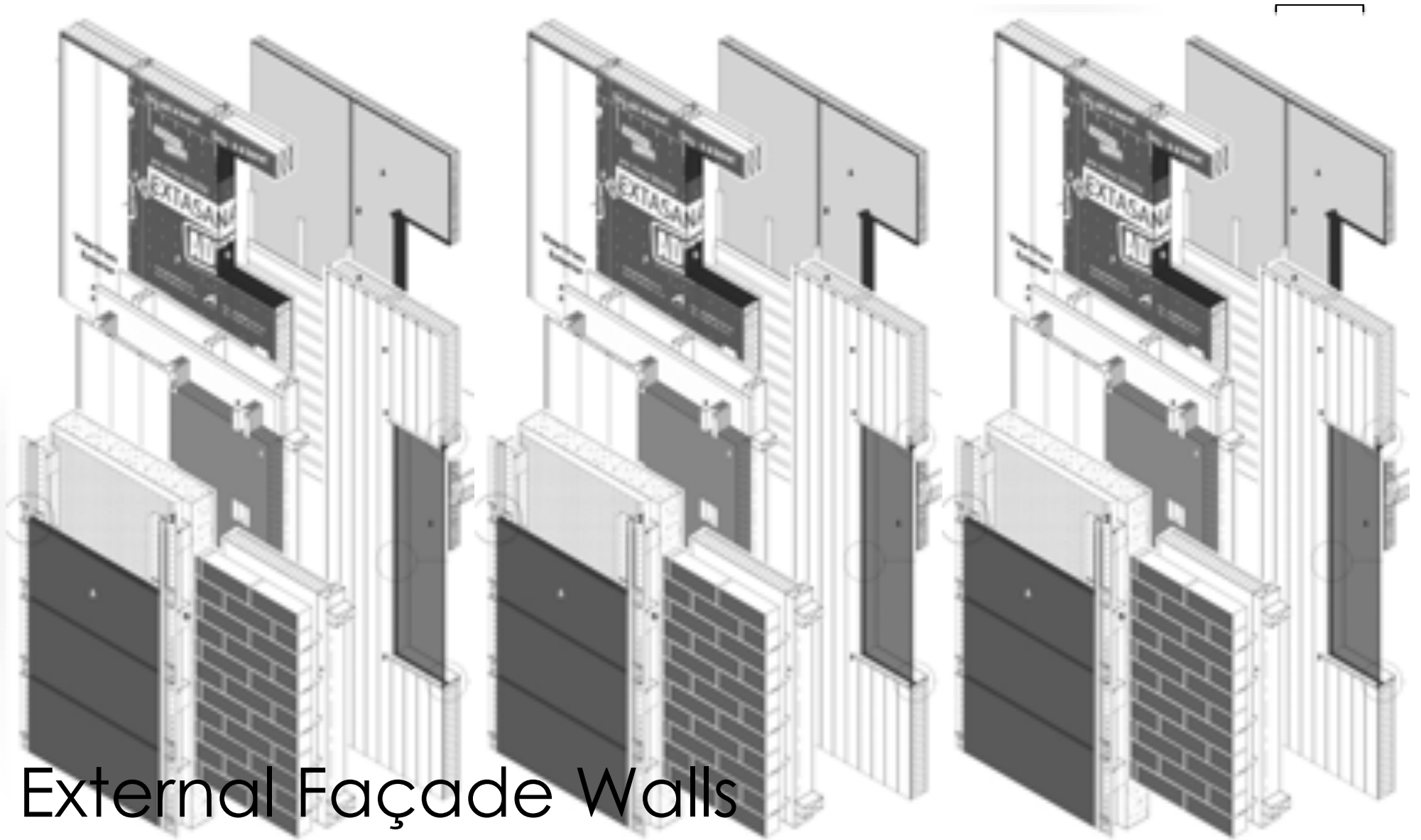
Laminex 150



Industry Solutions – walls, floors...



Inter-tenancy floors and walls



External Façade Walls



### Ventiler MEV Mechanical Extract Ventilation

§

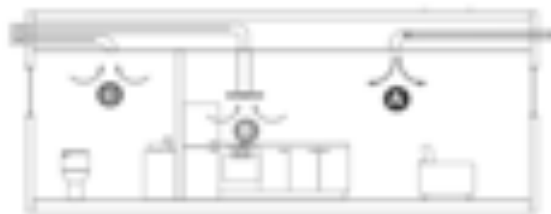
- ① Outdoor air supplied via opening windows
- ② Kitchen area extracted via rangehood
- ③ Bathroom zone extracted via bathroom fan



### Ventiler BPV Balanced Pressure Ventilation

§§

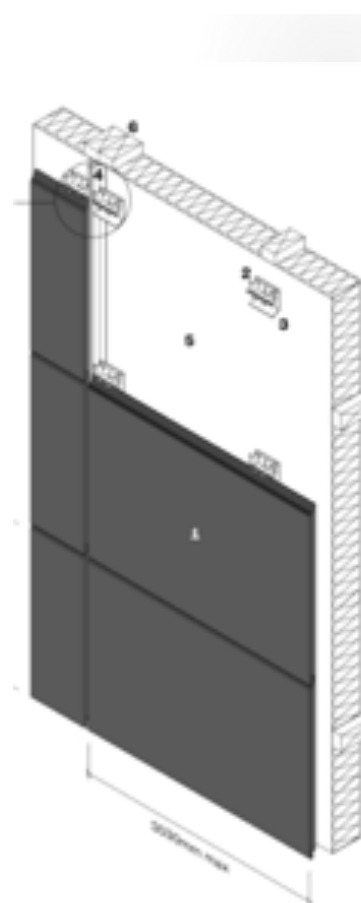
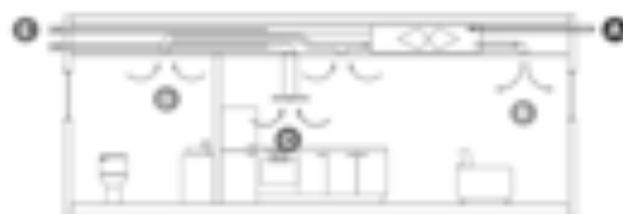
- ① Outdoor air introduced via supply air fan
- ② Kitchen area extracted via rangehood
- ③ Stale air drawn out via extract fan at the same rate as outdoor air is being supplied



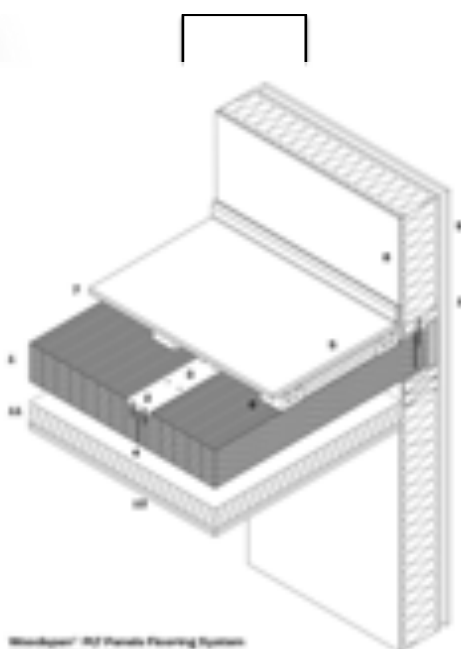
### Ventiler MVR Mechanical Ventilation with Heat Recovery

§§§

- ① Outdoor air drawn into heat exchanger and passed over outgoing air stream
- ② Pre-heated fresh air introduced to indoor space
- ③ Kitchen fumes extracted via rangehood and dedicated duct
- ④ Outgoing warm, moist air is extracted from bathrooms and other zones and passed through heat exchanger
- ⑤ Outgoing air stream exhausted to exterior of building

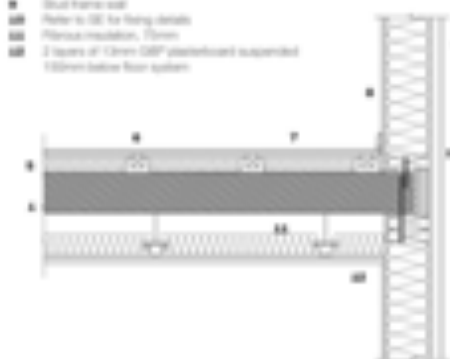


term



### Woodpecker® R2 Parallel Floor Heating System R200-80/100/120 R200-120/150 R200-150/180

- 1 R200 - 140 Woodpecker R2
- 2 Range (30mm from edge at 100mm centres)
- 3 Pipework, 10mm
- 4 Insulation, 50mm
- 5 Slab-on-Grade™ Floor System
- 6 Parquetboard, 20mm
- 7 Continuous vapour barrier (only if required)
- 8 Stud frame wall
- 9 Refer to G2 for fixing details
- 10 Floor insulation, 75mm
- 11 2 layers of 12mm GYP plasterboard suspended 150mm below floor system



# 30+ Industry Solutions

**Part Four**

**BUILT**

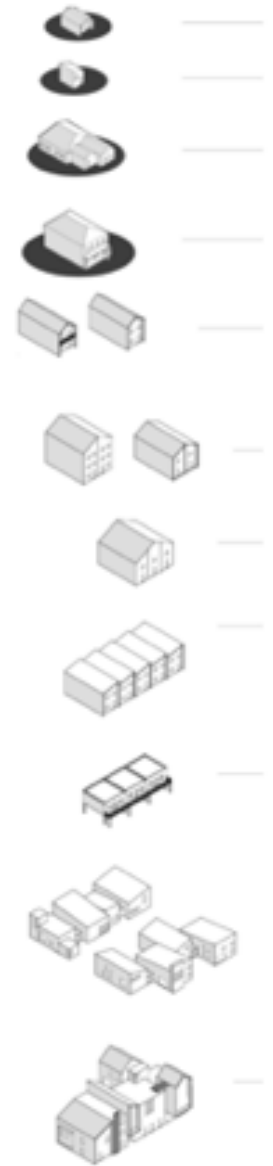
Case Studies – Auckland, Wellington, Chch



Case Studies – Bernoulli Gardens (Auck),  
340 Onehunga (Auck), Altair (Wellington),  
Latimer Terraces (Christchurch).

- ▶ Parolek, Daniel (2020). *Missing Middle Housing*. Washington: Island Press.
- ▶ Turner, David (2010). *Planning for Higher Density – Concepts of privacy in Auckland’s culture of housing*. Auckland: PhD thesis.
- ▶ Syme, McGregor and Mead (2005). *Social implications of housing intensification in Auckland region*. Auckland Regional Council.
- ▶ Sills van Bohemon (2005). *Good Apartment Guide*. North Shore Council.
- ▶ *Auckland Design Manual* (2022).
- ▶ + another 80 other references

## Sources



Illustrators:

Maddie Zwart

Leyland Rodrigo

Lauren Hayes

Brittany Irvine

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Thanks:

# Better MDH by:

- Ensure quality developments based around denser housing, with more public / **common spaces** - for people not cars.
- Ensure **wide range of units sizes** and bedroom numbers, so you do not get a monoculture. 1-bed, 2-bed, 3-bed, 4-bed all needed in same development – NOT all 2-bed, 2-storey townhouses – insist on a variety of solutions
- Inter-tenancy walls (ITW) and inter-tenancy floors (ITF) need to be aimed well above NZBC – use methods shown in *Medium* to **create better fire/acoustic barriers**
- Encourage 3-storey townhouses with integrated inter-generational living e.g. granny flats – ie simple second dwelling on-site, no strings attached.

# MDH into the future:

- Consider setting up a list/directory of accepted common details such as the UK's *Robust Details* service – or perhaps MBIE or BRANZ or EBOSS will ?



## Introduction

Table 3b – Combinations of Robust Details separating walls and floors for flat/apartments in timber frame constructions

| Separating walls | Separating floors |       |
|------------------|-------------------|-------|
|                  | 0-F10             | 0-F10 |
| 0-W1             | ✓                 | ✓     |
| 0-W2             | ✓                 | ✓     |
| 0-W3             | ✓                 | ✓     |
| 0-W4             | ✓                 | ✓     |

Table 3c – Combinations of Robust Details separating walls and floors for flat/apartments in reinforced concrete and steel frame constructions

| Separating walls | Separating floors |        |        |        |        |        |
|------------------|-------------------|--------|--------|--------|--------|--------|
|                  | 0-F0-1            | 0-F0-2 | 0-F0-3 | 0-F0-4 | 0-F0-5 | 0-F0-6 |
| 0-W1             | ✓                 | ✓      | ✓      | ✓      | ✓      | ✓      |
| 0-W2             | ✓                 | ✓      | ✓      | ✓      | ✓      | ✓      |
| 0-W3             | ✓                 | ✓      | ✓      | ✓      | ✓      | ✓      |
| 0-W4             | ✓                 | ✓      | ✓      | ✓      | ✓      | ✓      |

### Key to Table 3b and Table 3c

1. Only the separating floor requires pre-completion sound testing.
2. Only the separating wall requires pre-completion sound testing.
3. Lightweight steel joist/beam floor construction. The lightweight steel joist/beam floor may be replaced by a reinforced concrete floor.
4. See view of other requirements of the Robust Details, including building regulations.
5. The construction of the separating wall and floor must have a minimum U-value of 0.18 W/m²K and a minimum sound reduction index of 50 dB.
6. In framing systems must be installed up to the separating wall as shown in the separating floor detail.

See also notes relating to Combining soundproofing measures and lightweight framed separating walls included under Table 3a.

Edition 4

March 2020 update

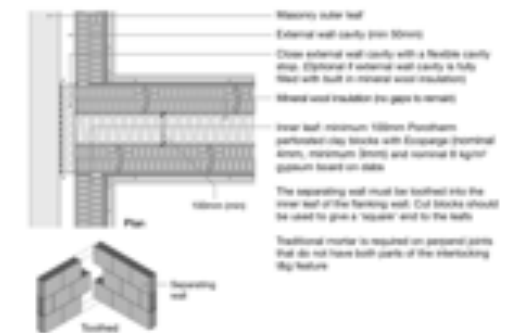
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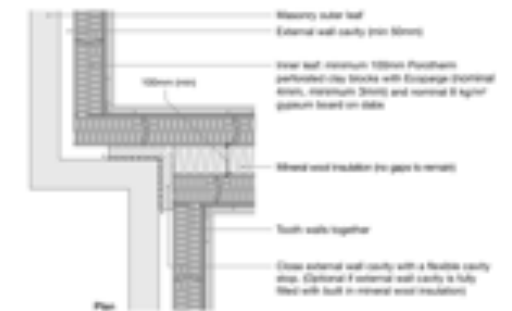
## Separating Wall – Cavity Masonry

E-WM-25

### 1. External (barb) wall junction



### 2. Staggered external (barb) wall junction



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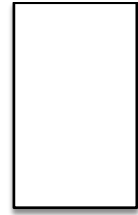
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Edition 4

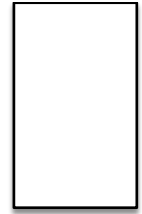
October 2020

# Better MDH Consenting by:



- Insist on quality, **experienced architects**, and then TRUST them, don't penalize them
- Reject plans by designers at only LBP DC 1 or DC2
- Set up means of quickly **approving Alternative Solutions** – as most Acceptable Solutions may simply not apply. Make the process for **Alternative Solutions simple and transparent.**
- Be careful with R.F.I. - don't sit on it for ages and then issue multiple RFIs at last moment. Not appreciated by those who wait.
- Don't issue RFI just because you have to reach a target number of queries. Just genuine problem areas only.





Thank you. Any questions?