Density comparisons in New Zealand and European housing

Guy Marriage and Eliot Blenkarne
Victoria University of Wellington, Wellington, New Zealand

guy.marriage@vuw.ac.nz, eliot.blenkarne@hotmail.com

Abstract: This project combines existing statistical information on housing projects in Europe with a new comparison on a variety of apartment buildings in New Zealand. A housing review was first undertaken via a series of case studies on projects by Housing New Zealand, various councils and private developers. These case studies examined dwelling statistics such as FAR (floor area ratio), site coverage, dwelling units/hectare, and people/hectare. The research will provide important background data for the continued development of medium density housing projects in New Zealand, as a comparison with some traditional and more recent European medium density housing schemes.

Keywords: Density; housing; New Zealand.

1. Introduction

This research was undertaken to bring some clarity to data on New Zealand (NZ) medium-density housing. The research in this project was undertaken as part of a summer scholarship program being run at Victoria University, Wellington (VUW). The research aim was to analyse recent NZ attempts at medium-density housing and to directly compare them with more well-known medium-density housing schemes in Europe, as a means of better understanding and ultimately improving apartment design. A number of standard housing metrics were gathered for comparison, all relating to issues of density, so that the housing concerned could be examined across international borders on a ‘level playing field.’

2. NZ apartment housing

New Zealand’s history of housing is primarily in the semi-rural/suburban field, almost exclusively comprised of small, detached, suburban housing subdivisions with ensuing environmental damage from extensive suburban sprawl. Much has been written about the quality and style of the individual NZ home, ranging from Skinner’s The whare in the bush (2008) to Walsh and Reynold’s Big House Small House (2013). Little has been written about mass medium-density housing schemes in the mainstream press in NZ, but there is considerable current interest in the subject within academia and within the architectural profession. Gatley examines the history of NZ apartment housing in both Long live the modern (2008) and Vertical Living (2013), while Petrovic, in Your new house: Or would a flat suit you...
better? (2003), argues that time has come for NZ to stop focusing inwards on small houses, and to look more seriously at the issues of apartment living. Over the past two decades, a push towards medium-density housing schemes has resulted in a variety of apartment types, some more successful than others. Recent work from the School of Architecture Masters program, has focused on innovative methods of medium-density housing, including Batchelor (2014), Shepherd (2014), and Robinson (2014). This paper gathers further information helping inform the debate over apartment living.

There have been a number of well-designed NZ medium-density housing schemes throughout the 20th century, starting predominantly in the inter-war and post WWII periods, achieving significant prominence not just because of their scarcity, but also because of their quality. These include, in Auckland: the Mayfair apartments, Courteville, and the Grey St and Symonds St flats, but these are in the minority. In Wellington, as a comparison, more efforts were put into large scale housing, with the Dixon St flats and the Douglas Maclean flats both notable examples, along with a considerable number of housing projects by the Wellington City Council, including the Central flats, the Berkeley Dallard flats, the Ara Hou medium-density housing scheme, Marshall St apartments, and more. Christchurch had significantly fewer apartment buildings, with many of the multi-story residential buildings being demolished post-quake in the Canterbury swathe of seismic-related destruction. The number of other medium-density housing schemes throughout the rest of NZ has traditionally been very small indeed, although in retirement markets such as Tauranga, recent growth in medium-density multi-unit apartment buildings is strong.

Petrovic (2003) notes that flats and apartments were still viewed by many mid-century émigrés as a symbol of the over-crowded and war-torn country they were trying to leave behind, although the better schemes were designed by émigré architects such as Ernst Plischke. Mitchell notes the desire for suburbia in the NZ psyche in The Half-Gallon Quarter-acre Pavlova Paradise (1972), the reality of which has long since passed on for most New Zealanders and especially for those living in NZ’s biggest city, Auckland. With the adoption of the Auckland Council’s new Unitary Plan, there is a gradual, albeit reluctant, acceptance by many that Auckland must concentrate itself more in the centre, and less expansion out on the edges. Housing quality of new apartment buildings and new medium-density housing schemes are mixed, with both some excellent housing schemes produced, along with some that have been widely derided for their lack of amenity.

3. European apartment housing

In the European architectural press there is not so much focus on the individual house as there is in NZ. Instead, the focus is on creating and highlighting good quality medium-density housing, suitable for the masses. While there may have been a stigma attached to apartment housing in NZ, as Petrovic notes, apartment housing is readily acceptable in Europe. Both between and after the two major World Wars, Europe was rebuilt with considerable effort towards a more egalitarian society, utilising architecture for the masses to smooth the way. Projects like Corbusier’s Unite d’Habitation (Marseilles, 1952), and Goldfinger’s Trellick Tower (London, 1972), are examples of mass housing schemes that have gone from popular, to deeply unpopular, and returned back to popularity again, but in countries like the densely populated Netherlands and the more sparsely populated Spain, medium-density housing continues to be a well-accepted way of living. Increasing world population and rising political unrest in Europe and the Middle East will put further pressure on Europe to house the masses, but there appears to be little appetite in Europe for more Asian-style high-density apartment projects.
Recent interest in density has been promoted heavily by A+T Publishing, with a series of publications all focusing around density. This includes Why Density: Debunking the myth of the cubic watermelon; Density is Home; D-Book: Density, Data, Diagrams, Dwellings, and a series of magazines and newsletters about Density. Elsewhere in Europe, Schneider has published several editions of their book on Floor plan Housing Manual, while in the USA, publications have also recently been focusing on issues of medium-density housing. A key aim of this research was to examine NZ housing on the same basis that the European and American examples were examined. Information on European examples of high-density and medium-density housing was drawn down directly from these European publications, while information on NZ housing was researched and data gathered from NZ raw data sources (LINZ, Koordinates) in the same format in order for direct comparisons to be made.

4. Data mining

4.1. Data sets

Units of measurement were not the same between different publications. While both NZ and Europe are metricated, the USA is still using imperial measurements (miles, acres and square feet), while the UK sits somewhere in-between, with most buildings being planned in metric units, but still largely reported by estate agents in square feet. Wikipedia publishes data for many USA and European cities in people(pp)/mile$^2$, as well as pp/km$^2$, but not in pp/ha. Data was given by different publications as dwellings per acre, per square kilometer, per square mile, or dwellings per hectare; it was unclear if these figures are inclusive or exclusive of public spaces such as roads, footpaths, and common garden areas. Other data was stored in the format of habitable rooms per kilometre, people per acre, or people per m$^2$. The overall results are unclear unless measurement systems are standardised and relatable. All of these data sets can be inter-related with some degree of intuition or accuracy, but a system of reporting with commonly used units of measurement was needed for any of the work to be comparable. Table 1 clarifies how standard area measurements relate to each other.

<table>
<thead>
<tr>
<th>hectare</th>
<th>acre</th>
<th>square mile</th>
<th>km$^2$</th>
<th>m$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.471</td>
<td>0.003861</td>
<td>0.01</td>
<td>10,000</td>
</tr>
<tr>
<td>40</td>
<td>98.84</td>
<td>0.15444</td>
<td>0.4</td>
<td>400,000</td>
</tr>
<tr>
<td>100</td>
<td>247.1</td>
<td>0.3861</td>
<td>1</td>
<td>1,000,000</td>
</tr>
<tr>
<td>259</td>
<td>640</td>
<td>1</td>
<td>2.59</td>
<td>2,590,000</td>
</tr>
</tbody>
</table>

It was resolved that for consistency, only the metric system would be used, and figures involving acres, square feet and square miles would be converted into hectares. Rather than looking at large neighbourhoods, which by necessity include a lot of open common areas such as roads (ie gross area), our research concentrated on actual built envelopes of projects where available (ie net area). There is a relationship between dwellings per area, habitable rooms per area, and people per area, but while some publications used one data type, another publication used a different type. While the amount of people/area can be presumed from the number of bedrooms, this figure is obviously the least reliable and least definite, while the amount of habitable rooms/area is widely used, but required a lot of access to internal apartment plans. As a result, this research publishes results in dwelling units per hectare, as the most reliable and commonly interchangeable unit of density. Table 2 shows the inter-relationship...
between all these units. Our final calculations of density include Site coverage, Floor to Area Ratios (FAR), etc. These are shown on the individual data sets produced (Figures 1-5 and table 3).

<table>
<thead>
<tr>
<th>pp/ha</th>
<th>pp/acre</th>
<th>pp/square mile</th>
<th>pp/km²</th>
<th>pp/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.404694</td>
<td>259</td>
<td>100</td>
<td>0.0001</td>
</tr>
<tr>
<td>40</td>
<td>16.18778</td>
<td>10,360</td>
<td>4,000</td>
<td>0.004</td>
</tr>
<tr>
<td>100</td>
<td>40.46945</td>
<td>25,900</td>
<td>10,000</td>
<td>0.01</td>
</tr>
</tbody>
</table>

4.2. Density data examination methods

Geographic information system (GIS) data was obtained through the Koordinates website (which includes data from various city councils and NZ government agencies) and City Council GIS mapping websites. This data related to legal boundaries for properties, building footprints and land contours, and was used in instances where case studies were not provided, or were not sufficiently detailed. This data extraction was also paired with the CAD programs Archicad and Sketchup to develop basic block models of the developments being researched, as a visual aid for further research. Issues relating to maximum and minimums of housing / apartment sizing have been examined previously, with the observation being made that while most developed countries have a minimum housing size standard, neither the UK nor NZ have such a standard, instead leaving this up to the market to self-regulate (Marriage, 2010). Whether or not the self-regulation is working is debatable. In the UK most developers work to the recommended minimum sizes from the 1961 ‘Parker-Morris’ report, while in NZ the more laissez-faire, hands-off style of regulation and government leads to some exceptionally small apartments being produced. This is unusual, given that in NZ there is not a shortage of readily-developable land.

Dependant on how many inhabitants per dwelling, how many habitable rooms per dwelling, and socio-economic factors, the amount of people per dwelling unit also can vary significantly from scheme to scheme. An indicative scale of effects is that a Studio or One-bedroom apartment contains, on average, 1.25 people; a Two-bedroom apartment contains 2.5 people; a Three-bedroom apartment contains 3.75 people; while Four (or more) bedroom apartments contain on average 5 people. In developing countries and in slum conditions, these occupation figures will all be much higher.

5. Case studies

The following set of case studies comprises data gathered on four prominent medium-density housing projects in NZ, the first known time that this data has been gathered in this format, in a comparison with the more well-known Unité d’Habitation in Marseilles. Further studies were made of several other housing schemes, but space permits only a small portion to be examined here in detail. The information gathered aligns with data collected by European agencies, allowing direct comparison to be made between NZ and European housing examples. The data is set out here individually, and then combined in a comparison (Tables 3 and 4) for further analysis.

5.1. Case study 1 – Dixon Street apartments - Wellington

NZ’s “first high-density [social] housing scheme”, the Dixon Street apartments were constructed by the Labour government towards the end of World War II (Gatley, 2014). The scheme was an attempt to alleviate the issues around returning servicemen post World War II, but also proved beneficial in the following baby-boom years. It proved to be a flexible and popular addition to social housing stock,
although is currently awaiting seismic strengthening (or demolition). The east-west single-loaded corridor arrangement means the living and bedroom spaces both have access to the private balcony, and thus an exterior wall, while the service areas on the western face border the various “ocean liner-like galleries providing access” (Gatley, 2008). The lack of green space is mitigated by proximity to the central city.

- **Date of Construction:** 1941-1944
- **Architects:** Ministry of Works (Gordon Wilson / Ernst Plishcke)
- **Number of units:** 115
- **Site Coverage:** 21%
- **Floor to Area ratio:** 2.09
- **People per hectare:** 332
- **Dwelling units per hectare:** 266
- **Floor area per person:** 63 m²

### 5.2. Case study 2 – Freeman’s Bay Star housing (Phillips Street Block) — Auckland

The Phillip Street Block plan was the by-product of a housing shortage in New Zealand following World War II, the government’s “desire to limit suburban sprawl result[ing] in the introduction of various types of medium-density housing in the mid-1950s” (Gatley, 2008) and the desire of the Auckland City Council to rid the city of the slum housing existing on the site. The now iconic Star Blocks were named for their floor plan configuration. Four two-bedroom apartments are arranged around a central circulation core, this plan being repeated over three or four storeys. As a result, some apartments receive better sunlight ingress than others depending on their site orientation, however all liveable spaces are on exterior walls. There are no private open spaces, with a focus instead on shared green areas surrounding the blocks. Adding to this relaxed feel are the “meandering” roads running through the block, connecting the various peripheral streets and offering access to the open car parking. The various other buildings on site vary between single and four storeys, with differing levels of access and privacy, with the net result being a desirable and popular development close to the central city.

- **Date of Construction:** 1960-1967
- **Architects:** Ministry of Works (Neville Burren)
- **Number of units:** 200 (approx)
- **Site Coverage:** 21.7%
- **Floor to Area ratio:** 0.60
- **People per hectare:** 143
- **Dwelling units per hectare:** 57
- **Floor area per person:** 42 m²

### 5.3. Case study 3 – Chester Court - Christchurch

The Chester Court development comprises 15x 2-3 bedroom units in two main terrace blocks, with garage and service buildings between them. These buildings form a perimeter to a central hard surfaced courtyard space to allow for vehicle maneuvering, with the primary access to the development through an archway. The blocks are oriented so that each unit faces north-south, meaning both living and bedroom spaces are on exterior walls. This allows for sunlight and daylight penetration to these spaces. The building itself attempts to reference various historically significant buildings from the area. The
central city is located close-by, offering a high level of amenity for potential occupiers. Chester Court is close to high-density, according to the Housing New Zealand requirements, whilst retaining character and a high level of quality.

- **Date of Construction:** 1995
- **Architects:** Phillip Kennedy Associates
- **Number of units:** 15
- **Site Coverage:** 21%
- **Floor to Area ratio:** 0.89
- **People per hectare:** 162
- **Dwelling units per hectare:** 65
- **Floor area per person:** 55 m²

### 5.4. Case study 4 – Courtyard townhouses, Seatoun - Wellington

The site for this development was surplus Defense Force land, known as Fort Dorset. The use of a varying scale of house has allowed privacy to be retained to courtyard spaces, with excellent sunlight and daylight ingress to the homes, whilst also offering a visual interest to the streetscape through the alternating forms. The single storey homes have two bedrooms and a single garage, with the two storey home allowing for an extra bedroom, as well as larger living and garaging spaces. This development has eschewed the typical suburban requirement for side yards, in favour of an intelligent design response that retains quality of life (Marriage, 2014).

- **Date of Construction:** 2005
- **Architects:** Studio Pacific Architecture (Nick Barratt-Boytes/Peter Mitchell)
- **Number of units:** 13
- **Site Coverage:** 49%
- **Floor to Area ratio:** 0.53
- **People per hectare:** 109
- **Dwelling units per hectare:** 34
- **Floor area per person:** 49 m²

### 5.5. Case study 5 – Unite d’Habitation – Marseilles, France

The model of a modernist housing block, this particular example proved inspirational to Le Corbusier’s contemporaries, with innumerable examples of the typology drawing on the “Radiant City” in the following decades, though not always as successfully. This example of housing retains its relevance through a variety of design decisions made that ensure a high quality of living. These include double height duplexes as the typical residence, ensuring natural light ingress from the balconies. The use of double-height units also allowed for the inclusion of the ‘streets’ that allow access to the residences. These streets occur every three floors, with pairs of homes interlocking around the central street corridor. Alongside the residential use, was that of levels dedicated to businesses and recreation. The seventh and eighth floors housed (and still do) a variety of professional services, with the roof space dedicated to pools, a running circuit and a nursery, though this has since shifted to an art space. The sculptural qualities of both the exposed concrete and *piloti* helps the building avoid the starkness of the later models of housing, and quite literally elevates it above them as one of Le Corbusier’s most well-respected works.
Density comparisons in New Zealand and European housing

- **Date of Construction:** 1952
- **Architects:** Le Corbusier
- **Number of units:** 337
- **Site Coverage:** 8%
- **Floor to Area ratio:** 1.44
- **People per hectare:** 320
- **Dwelling units per hectare:** 69
- **Floor area per person:** 45 m²

### 6. Conclusion

The results of the research work are summarized in Table 3 below. Analysis follows on the following page. Statistical information was derived from GIS and historical sources for NZ data, while published data exists for the European samples (Fernandez et al, 2011).

<table>
<thead>
<tr>
<th>Housing Name</th>
<th>Land (ha)</th>
<th>F.A.R.</th>
<th>Dwelling Units(DU)</th>
<th>People (pp/ha)</th>
<th>Area/person (m²)</th>
<th>Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>NZ-Dixon St flats</td>
<td>0.43</td>
<td>2.09</td>
<td>115</td>
<td>332</td>
<td>63</td>
<td>LINZ / KOORD</td>
</tr>
<tr>
<td>NZ-Freeman</td>
<td>3.50</td>
<td>0.60</td>
<td>200</td>
<td>143</td>
<td>42</td>
<td>LINZ / KOORD</td>
</tr>
<tr>
<td>NZ-Chest Court</td>
<td>0.23</td>
<td>0.89</td>
<td>108</td>
<td>162</td>
<td>55</td>
<td>LINZ / KOORD</td>
</tr>
<tr>
<td>NZ-Scene One</td>
<td>0.37</td>
<td>9.93</td>
<td>120</td>
<td>728</td>
<td>63</td>
<td>LINZ / KOORD</td>
</tr>
<tr>
<td>NZ-Seatoun</td>
<td>0.38</td>
<td>0.53</td>
<td>13</td>
<td>109</td>
<td>49</td>
<td>LINZ / KOORD</td>
</tr>
<tr>
<td>NZ-Peak 1 (high-density)</td>
<td>0.04</td>
<td>9.56</td>
<td>108</td>
<td>3506</td>
<td>24.5</td>
<td>LINZ / KOORD</td>
</tr>
<tr>
<td>NZ-Elevat (high-density)</td>
<td>0.07</td>
<td>14.71</td>
<td>82</td>
<td>2985</td>
<td>49.3</td>
<td>LINZ / KOORD</td>
</tr>
<tr>
<td>FRANCE-Unite d’H</td>
<td>4.84</td>
<td>1.44</td>
<td>337</td>
<td>320</td>
<td>48.6</td>
<td>DEZEEEN</td>
</tr>
<tr>
<td>FRANCE-Druon</td>
<td>0.35</td>
<td>4.52</td>
<td>104</td>
<td>813</td>
<td>57.5</td>
<td>Fernandez p198</td>
</tr>
<tr>
<td>FRANCE-XTU</td>
<td>0.18</td>
<td>3.46</td>
<td>63</td>
<td>903</td>
<td>53</td>
<td>Fernandez p256</td>
</tr>
<tr>
<td>DEN-BIG 8</td>
<td>2.05</td>
<td>2.98</td>
<td>476</td>
<td>937</td>
<td>25.7</td>
<td>Fernandez p118</td>
</tr>
<tr>
<td>UK – S333 Block 3</td>
<td>0.18</td>
<td>2.55</td>
<td>32</td>
<td>606</td>
<td>40.9</td>
<td>Fernandez p160</td>
</tr>
<tr>
<td>UK – S333 Arch St</td>
<td>0.20</td>
<td>2.74</td>
<td>52</td>
<td>618</td>
<td>41.2</td>
<td>Fernandez p152</td>
</tr>
<tr>
<td>NED-Kempe T</td>
<td>0.25</td>
<td>2.28</td>
<td>64</td>
<td>550</td>
<td>46.5</td>
<td>Fernandez p166</td>
</tr>
</tbody>
</table>
Table 3 shows that while the European housing schemes are typically slightly more dense than typical medium-density NZ housing schemes, two extremely dense NZ outliers (the Peak and Elevate) affect the results to the extent that the NZ housing statistics tell a very different story. These figures are then further analysed in Table 4, where it can be seen that the two high-density NZ examples significantly skew the statistics. The results are therefore broken down into a comparison with just NZ medium-density housing; just NZ high-density housing; and an overall NZ to Europe comparison.

While NZ’s medium-density housing schemes compare well with the European examples, achieving broadly similar levels of density, NZ’s more high-density examples have proved to be significantly higher on statistical allocation of people housed: 537% more people housed on average than these typical European housing schemes, on sites that are only 6% of the land area used in Europe. Corbusier’s notion of apartment buildings sitting in an open green field is clearly long-gone at this level of intensification. This research shows that despite NZ being still one of the most sparsely populated countries on Earth, some of our recent housing schemes are very much high-density. Further investigation in this field will look at Asian housing standards as a further level of comparison. Whether this level of intensification is truly necessary in the NZ situation has not yet been validated, and although Auckland’s well-publicised property inflation issues are ongoing, these two particular examples are from Wellington, which is not suffering house price increases to the same extent. It would appear therefore that it is not just migration concerns or the price of land that is the pressure point for high-density housing.

### Table 4: Comparison analysis of European housing vs NZ housing.

<table>
<thead>
<tr>
<th>Country</th>
<th>Land (avg.)</th>
<th>F.A.R. (avg.)</th>
<th>D.U. (avg.)</th>
<th>pp/ha (avg.)</th>
<th>Area/person</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Europe</td>
<td>0.98 ha</td>
<td>2.63</td>
<td>152</td>
<td>605</td>
<td>51.2 m² each</td>
</tr>
<tr>
<td>NZ medium</td>
<td>0.98 ha</td>
<td>2.81</td>
<td>111</td>
<td>295</td>
<td>54.4 m² each</td>
</tr>
<tr>
<td>NZ high</td>
<td>0.06 ha</td>
<td>12.14</td>
<td>95</td>
<td>3245</td>
<td>36.9 m² each</td>
</tr>
<tr>
<td>All NZ examples</td>
<td>0.72 ha</td>
<td>5.47</td>
<td>107</td>
<td>1138</td>
<td>49.4 m² each</td>
</tr>
<tr>
<td>NZ med-dens to</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td>NZ = 100% of site size</td>
<td>NZ = 107% larger F.A.R.</td>
<td>NZ = 73% of D.U. density</td>
<td>NZ = 49% size alloc.</td>
<td>NZ = 106% size alloc.</td>
</tr>
<tr>
<td>NZ high-dens to</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td>NZ = 6% of site size</td>
<td>NZ = 461% larger F.A.R.</td>
<td>NZ = 62% of D.U. density</td>
<td>NZ = 537% size allocation</td>
<td>NZ = 72% size allocation</td>
</tr>
<tr>
<td>Difference: all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NZ to all Euro</td>
<td>NZ = 73% of site size</td>
<td>NZ = 208% larger F.A.R.</td>
<td>NZ = 70% of D.U. density</td>
<td>NZ = 188% size allocation</td>
<td>NZ = 97% size allocation</td>
</tr>
</tbody>
</table>

Although this small survey is not statistically reliable (the sample size is too small), the analysis indicates the direction being taken by certain recent housing projects. Apart from the two outlying
examples, on the whole NZ’s examples compare well with European housing, being broadly similar on many of the statistical fronts. Physical area occupied per person is broadly similar (54.4 m² vs 51.2 m²), but traditional methods of density measurement still show NZ schemes as half the density of the Europeans (295 pp/ha vs 605 pp/ha). France’s much-lauded Unite has generated decades of interest as an architectural game-changer, as has NZ’s Dixon Street flats, but both of these schemes are significantly different from the housing schemes being promulgated in both countries today.

Over-population continues to be a serious concern throughout the world, far more serious an issue than was imagined at the time the Unite or the Dixon St buildings were being designed, and yet many recent medium density housing schemes appear to show no awareness of the pressures of housing requirements for the future. Housing schemes such as Elevate and the Peak in NZ, although designed for far greater density levels than NZ is used to, and far more dense than housing schemes in Europe indicate from the studied schemes, may yet become a regular part of the apartment housing scenario in NZ.

Acknowledgements

Grateful acknowledgements are given to Victoria University and First Light Studio for their sponsorship of the summer research scholarship.

References


Fernandez Per, A. Mozas, J. and Arpa, J. (2011) Density is home: housing by a+t research group, a+t architecture publishers, Spain.


