NEIGHBOURHOODS AND INTENSIFICATION: MEASURING SUSTAINABILITY IMPACTS OF HIGHER DENSITY AND MIXED USE

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ABSTRACT

In New Zealand, while territorial authorities throughout the country attempt to optimise the social and economic as well as environmental performance of New Zealand's cities and towns, they are confronting contradictory views around the merits or otherwise of the intensification of urban settlements and the trend to mixed use neighbourhoods. Beacon Pathway's vision is that New Zealanders will all live in "homes and neighbourhoods that work well into the future and don't cost the earth." In developing a Neighbourhood Sustainability Framework and associated neighbourhood assessment tools, Beacon has undertaken a survey of 1,613 people around their behaviours, perceptions and experiences in relation to their neighbourhoods. That survey provides, for the first time, direct evidence as to the impact of built environment densities and use profiles on aspects of neighbourhood sustainability. This paper sets out key findings generated from that survey. The data provides an insight into: (a) the impacts of neighbourhood density on neighbourhood experiences; (b) the impacts of mixed use neighbourhoods relative to unmixed neighbourhoods on neighbourhood experiences; and (c) the relative importance of density and mixed use on neighbourhood sustainability.

KEYWORDS:

Neighbourhoods; built environment; sustainability; density.

INTRODUCTION

The Beacon Neighbourhood Sustainability Framework (NSF) and its associated tools has been extensively reported[1] and reflects Beacon's vision that New Zealanders should be able to live in "homes and neighbourhoods that work well into the future and don't cost the earth". In developing the tools for the NSF, Beacon has undertaken a national survey of householders around their perceptions of their neighbourhoods, their neighbourhood experiences, and their patterns of consumption and behaviour. Those household patterns can be related directly to two key aspects of neighbourhood built environments – neighbourhood densities and the range of uses allowed in a neighbourhood.

The sample frame for the survey was designed in such a way as to allow assessments to be made of the sustainability of "virtual neighbourhoods"[2] with different density and use characteristics. This paper presents a preliminary analysis of that data and comments on its implications for the development of mixed use and intensified settlements as a pathway to neighbourhood sustainability.

[1] Bijoux, Lietz, Saville-Smith (2007); Bijoux, Saville-Smith, Lietz (2008); Bijoux, Saville-Smith, Lietz (2007); Lietz et.al. (2006); Lietz, Saville-Smith, Bijoux (2007); Lietz, Saville-Smith, Bijoux (2008); Saville-Smith (2008); Saville-Smith et.al (2005).

[2] "Virtual neighbourhoods" are modelled assuming 500 dwellings per neighbourhood and with specified density and use characteristics. These are not real neighbourhoods, but are analytic construct based on the behaviours, perspectives and appearances of households surveyed as part of the 2008 Beacon National Neighbourhood Survey.

THE NEIGHBOURHOOD SURVEY & NEIGHBOURHOOD TYPES IN NZ

The 2008 National Neighbourhood Survey involved 1,613 householders drawn from a stratified random sample of householders living in different types of urban neighbourhoods. The six neighbourhood types are respectively characterised by:

- high density and mixed used
- medium density and mixed use
- low density and mixed use
- high density with non-mixed use
- medium density with non-mixed use, and
- low density with non-mixed use.

Table 1 sets out the definitions of density and use that specified each of those six neighbourhood types. Each of New Zealand's major urban centres was then characterised into those six categories of neighbourhoods using 2006 census meshblock data and property valuation data.[3]

Mix Category	Mix Measure	Density Category	Density Measure
Non-mixed	<36% residential or >78% residential	Low residential density	0-14 units of use per hectare
Mixed	36%-77.9% residential	Medium residential density	15-30 units of use per hectare
		High residential density	31 units of use or more per hectare

Table 1 The Measurement of Built Environment Mix and Density Characteristics

Table 2 sets out the proportions of dwellings by neighbourhood types in each of New Zealand's major cities. It can be seen that there are no neighbourhoods within New Zealand's main urban areas that can be described as being simultaneously high density and non-mixed use. It is also clear than New Zealand cities are dominated by low density neighbourhoods that are almost entirely residential. The stratified sample of 1,600 dwellings was drawn with dwellings 'equal split' between each category in the neighbourhood taxonomy. Table 3 sets out the numbers of dwellings and the margin of error.

[3] Those density and mix measures reflect the measurement of use and density used in Beacon's Built Environment Observational Tool. See www.BeaconPathway.co.nz

City	High Density Mixed	Medium Density Mixed	Medium Density Non-mixed	Low Density Mixed	Low Density Non-mixed
Auckland City	14.67%	13.24%	31.29%	0.00%	40.80%
Manukau	0.00%	15.56%	15.23%	4.34%	64.88%
Waitakere	0.00%	0.00%	10.89%	19.20%	69.91%
Hamilton	2.03%	15.62%	13.24%	10.19%	58.93%
Hutt City	0.00%	2.71%	14.04%	12.32%	70.93%
Wellington	11.42%	17.61%	17.65%	10.05%	43.28%
Christchurch	1.50%	14.80%	21.90%	10.39%	51.41%
Dunedin	0.00%	5.12%	18.80%	17.48%	58.60%
Total	*5.53%*	*12.27%*	*20.58%*	*8.25%*	*53.36%*

Table 2 Proportions of Dwellings in Selected Cities by Built Environment Category

Built Environment Category	Dwellings	Percent	Equal Split	
			Sample Size	Margin of Error
High - Mixed	33302	5.5%	320	0.056
Medium-Mixed	73854	12.3%	320	0.056
Medium-Non-mixed	123832	20.6%	320	0.056
Low-mixed	49645	8.3%	320	0.056
Low-Non-mixed	321092	53.4%	320	0.056
Overall	*601725*	*100.0%*	*1600*	*0.033*

Table 3 Proportions of Dwellings in Selected Cities by Built Environment Category

A company specialising in telephone survey was commissioned to undertake telephone surveying using the NSF Resident Assessment Self-report questionnaire with some minor household data additions. The data was subject to both univariate analysis of frequencies and cross-tabulations.

PROFILE OF SURVEY PARTICIPANTS

Over a quarter (27.2 percent) of the survey participants reported incomes of $20,000 or less. Most households, however, had access to income beyond the personal incomes of the participants in the survey. Only 9 percent of households were reported as having incomes of $20,000 or less. Participants living in areas of high density and mixed use have the highest household income profiles. Over half the participants in those areas have household incomes in excess of $70,000. Low density mixed use areas have the lowest household income profile with 31.3 percent of households having incomes of $40,000 or less.

The participants in the national neighbourhood survey are overwhelmingly owner occupiers. This is consistent with national tenure patterns. Only 29.9 percent are in rental accommodation. The tenure status of households is strongly related to neighbourhood type. Higher density areas have high proportions of rental housing. Mixed areas, irrespective of density, also tend to have higher proportions of rental housing. This reflects the strong historical association between suburbanisation and the desire for home ownership.[4]

About a fifth of participants live in one-person households with around a third living in couple-only households. The occupancy rate is 2.78 persons per dwelling. High density areas are least likely to have larger households. Households with members in the dependent ages are most likely to be found in low density areas.

KEY FINDINGS

Some key findings are:

- Most (63.6 percent) householders have no intention to move in the next few years.
- Intention to move because of home or dwelling problems are most evident in high and medium density mixed use neighbourhoods and low density non-mixed use neighbourhoods.
- Intention to move because of neighbourhood dissatisfaction is small (2.9 percent overall) but most pronounced in medium density mixed-use neighbourhoods.
- Density and mix both impact on travel mode and the average kilometres travelled by private car in a four week period.

The travel mode and extent of private vehicle use in relation to neighbourhood type is particularly pronounced. As Table 4 show, the proportion of householders in low density non-mixed use neighbourhoods who drove to work or study in a private car was 58.3 percent compared to a little more than a third of householders living in high density mixed use neighbourhoods. The impacts are clear. Households in non-mixed use neighbourhoods use private vehicles for more kilometres than households in mixed use neighbourhoods. Households in low density neighbourhoods drive more kilometres than households in high density neighbourhoods.

Travel Mode	High Density Mixed Use	Medium Density Mixed Use	Medium Density Non-mixed Use	Low Density Mixed Use	Low Density Non-mixed Use
Public transport	12.8	9.3	12.1	9.5	8.1
Private car	35.0	48.4	53.7	51.0	58.3
Foot or bicycle	37.2	22.8	11.8	15.3	11.8
Other	1.6	2.8	1.6	1.8	1.6
Not applicable	13.4	16.7	20.8	22.4	20.2
Average kms	***766.12***	***586.83***	***1060.6***	***928.32***	***943.17***

Table 4 Transport Use for Study or Work Travel (n=1613) and Average Kms Travelled by Private Car in Previous Four Weeks

[4] Kilmartin and Thorns, 1978; Wilkes and Shirley, 1984.

Some other key findings are that:

- Householders living in high density mixed use are most likely to have positive feelings about safety.
- High density mixed use and medium density mixed use householders were more likely to see noise as a serious problem.
- Irrespective of density or use characteristics, 79 percent of householders know some people in their neighbourhood. Only 3.9 percent reported knowing no one. There is little different in relation to propensity to greet and chat with neighbours.
- High density mixed use and medium density mixed use households are least likely to find neighbourhoods friendly and they are less likely to have a sense of attachment to the neighbourhood.
- There is broadly an inverse relationship between density and level of gardening and wildlife involvement. High density dwellers are more likely to use public spaces.
- Membership in neighbourhood groups is more likely in lower densities but there is less differentiation between neighbourhoods of different density in relation to participation in local groups at least once a month.
- People living in low density non-mixed neighbourhoods are least likely to shop locally for food.

SUSTAINABILITY OF DIFFERENT NEIGHBOURHOOD TYPES

The National Neighbourhood Survey was based on the instrument used in the NSF for the Resident Assessment Self-Report Tool. That tool collects data that relate directly to the six domains around which the NSF makes an assessment of a neighbourhood's sustainability (see Figure 1).

The NSF identifies achievement in those performance domains as the pathway to sustainable neighbourhoods. Those are neighbourhoods in which the built environment is designed, built and managed to generate adaptive and resilient places providing satisfying lives within the limitations of the natural environment. Table 5 sets out the measures related to those domains.

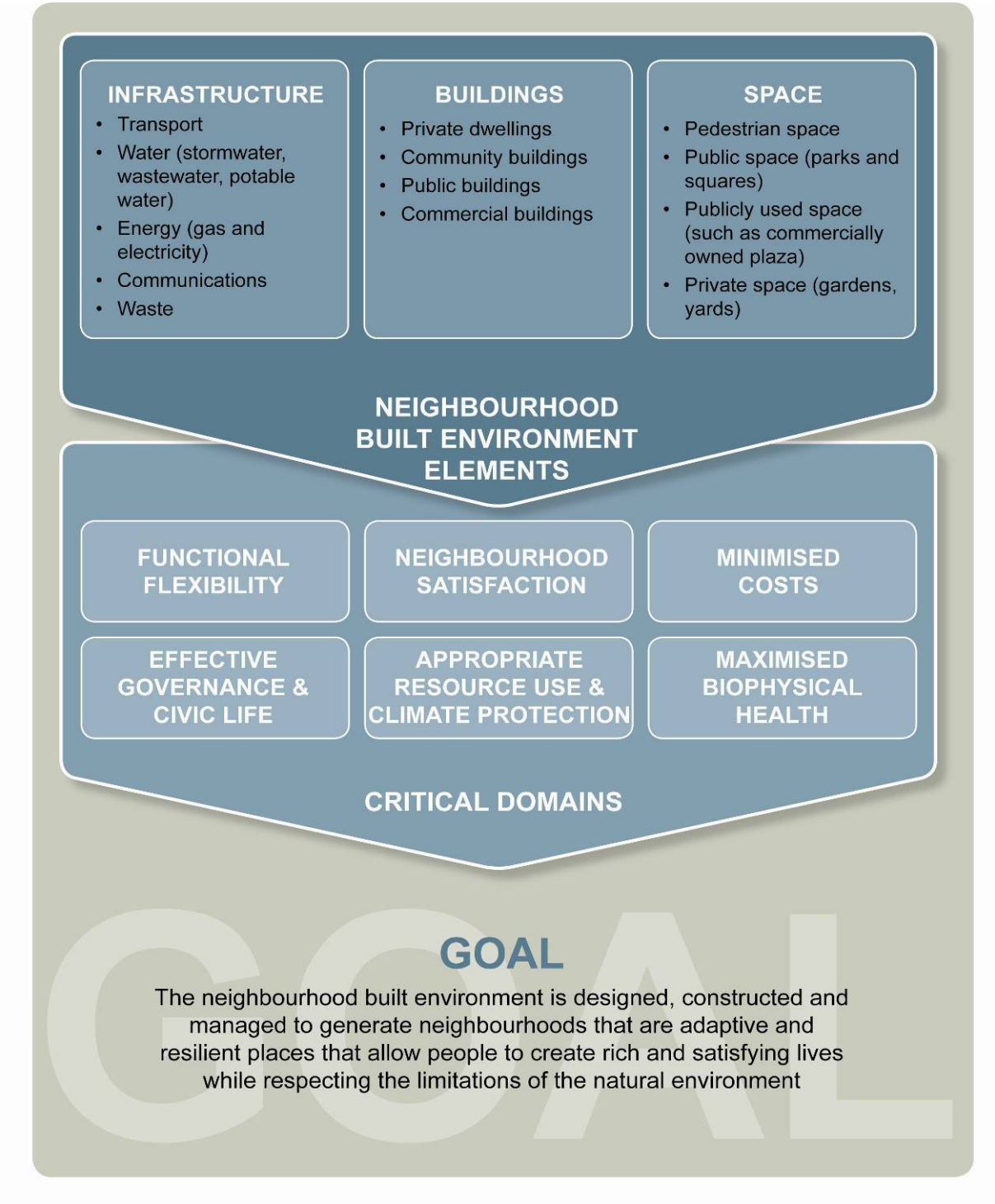


Figure 1 Goals, critical domains and elements for sustainable neighbourhoods[5]

[5] Saville-Smith, K., et.al. (2005).

Domain	*Measure*
Functional Flexibility	- % intention to move because of housing
	+ % foot/bicycle/public transport for work/ study
Neighbourhood Satisfaction	- % intention to move because of neighbourhood
	+ % describing house/garden condition as 'very good'
	+ % describing walking in street at night as 'very safe'
	- % describing walking in street at night as 'very unsafe'/ 'do not go out at night'
	+ % noise disturbance described as 'not a problem'
	-% noise disturbance described as a 'serious problem'
	- % no chat or greeting of neighbours
	- % no neighbours known by name
	+ % knowing many in the neighbourhood
	+ % strongly agree that the neighbourhood is friendly
	+ % strongly agree that neighbourhood reflects own identity
	+ strongly agree that has a sense of belonging
Maximised Bio-physical Health	- exceeding average aggregate kms last 4 weeks car use
	+ % use bicycle/walk for work/study
	+ % undertakes composting
	+ % leaves undisturbed area for wildlife
	+ % maintains shrubs and garden
	+ % provides pond
	+ % provides food and water for wildlife
	+ % undertakes organic gardening
Effective Governance and Civic Life	+ % membership and participation in local or neighbourhood groups
	+ % participation in local or neighbourhood group at least once a month
	+ % use of local public spaces at least once a month
Resource Use & Climate Protection	- exceeding average aggregate kms last 4 weeks car use
Minimised Cost	+ % who expend more than half of their food expenditure in the neighbourhood

Table 5 Measurement of NSF critical domains through self-report data

Using the 2008 National Neighbourhood Survey data and the Resident Assessment Self-Report Tool calculator, a sustainability assessment has been made for each neighbourhood type. That assessment is illustrated in Figure 2 and shows a significant difference between the assessments of these different neighbourhood types than might have been expected from some of the current expectations around pathways to sustainability. In particular, New Zealand medium density mixed use neighbourhoods get low scores while those with low density and non-mixed use score higher.

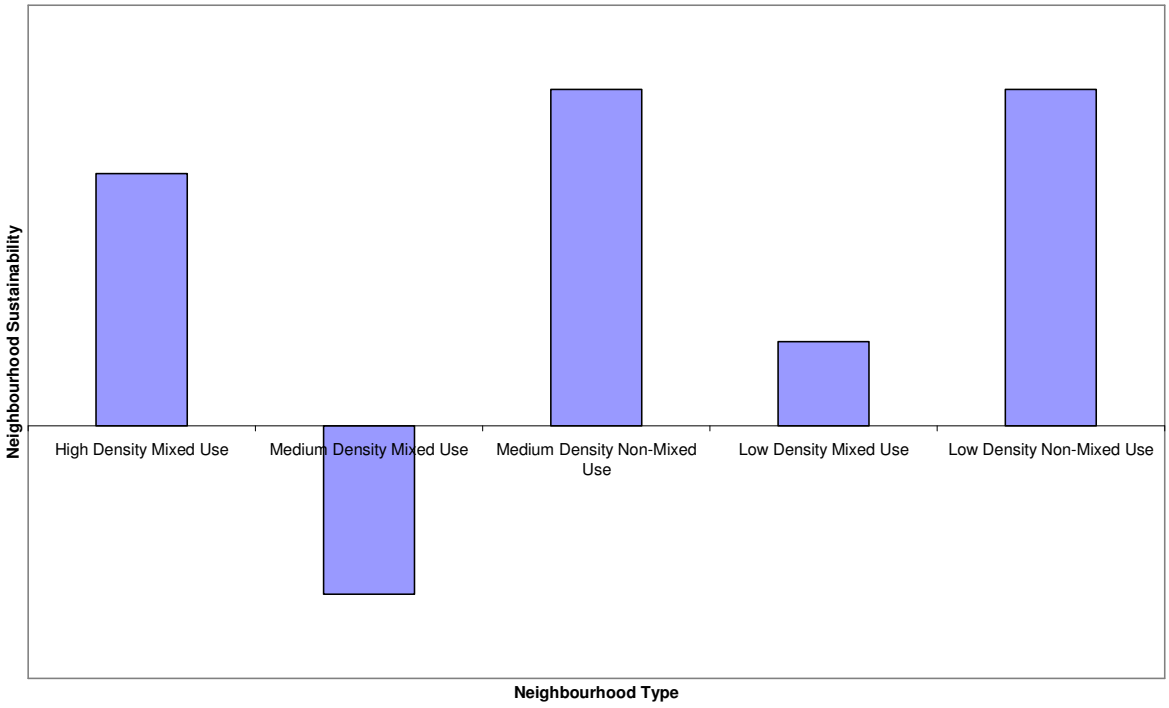


Figure 2 NSF Sustainability of NZ's Current Neighbourhood Types Using Resident Self-Report Data

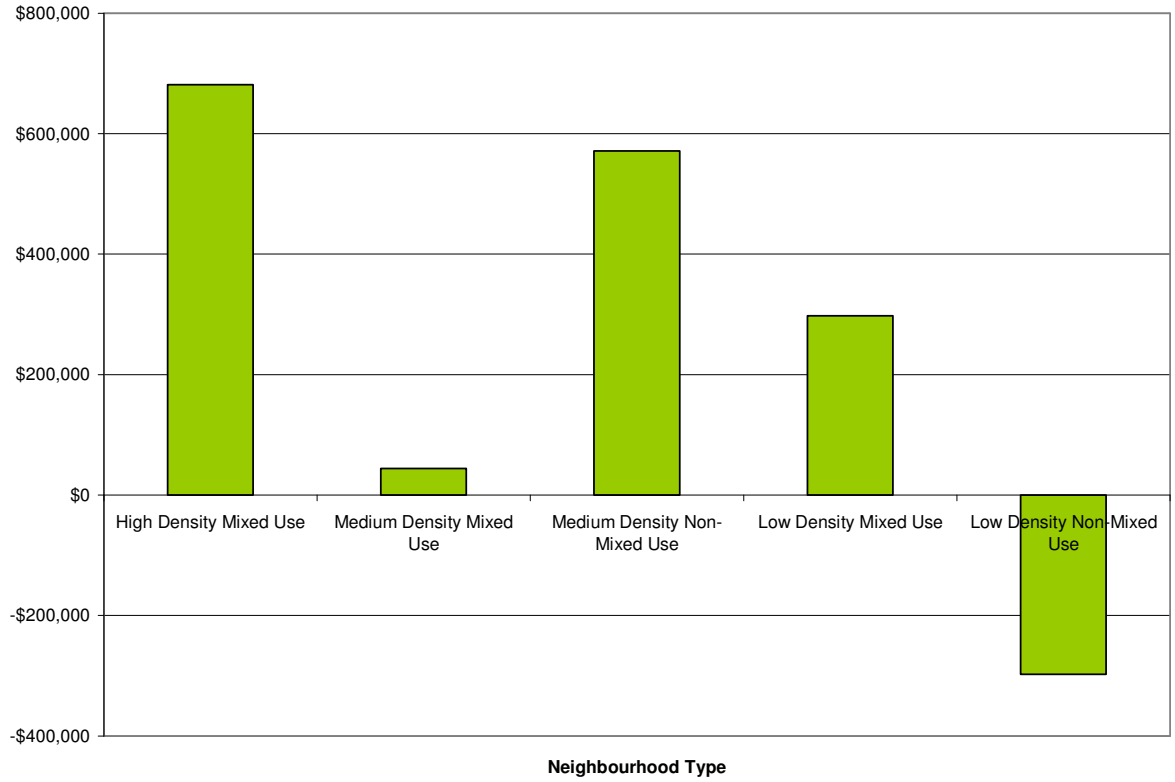
This raises the issue of whether the tool is incorrect, or whether our current expectations around built environments and sustainability are incorrect?

Actually neither are incorrect. In the New Zealand context, the 2008 Neighbourhood Survey shows that levels of attachment, identification, and participation tend to increase with age. Older age cohorts tend to be found in low density, non-mixed use neighbourhoods and medium density, non-mixed use neighbourhoods. Consequently, the Resident Self-Report Calculator currently generates higher scores in these neighbourhoods. However, these scores are much lower for lower density and non-mixed neighbourhoods when values are monetised

Through another exercise a monetised value was placed on each sustainability measure in the Resident Self-Report calculator.[6] The monetisation of the parameters in the Resident Self-Report Assessment tool is based on a range of existing monetised costs and benefits found in a range of research, commentary and administrative data.[7] In monetising the parameters in the tool, no attempt was made to distribute those costs and benefits. Although it has recognised that those are distributed across different scales the data were too fragmentary and uneven to make such a step possible at this stage.

This found that the pattern of monetised value for different neighbourhood types did not follow exactly the assessed sustainability pattern using non-monetised measures. Rather, the monetised value of sustainability associated with the various neighbourhood types fits much more closely with expectations around the sustainability of different neighbourhood types. That is, both higher density and mixed use neighbourhoods show greater sustainability than those with lower density and/or non-mixed use.

Figure 3 shows that low density, non-mixed use neighbourhoods have a lower monetised value of sustainability than others. This is because in, for instance, medium density mixed use neighbourhoods, the indicators on which 'scored' poorly in the Resident Assessment Self-Report Tool had relatively low monetary values. Consequently, the impact of poor performance on those areas did not offset the monetary value of better performance in other indicators. By way of contrast, in the low density neighbourhoods poor performance around transport use, bio-physical health and so forth have relatively high negative monetary value. In low density neighbourhoods, those are only somewhat off-set by the value associated with community participation, residential stability and so forth.



[6] See: Saville-Smith et al., 2009.
[7] These range from analysis calculating the net value of walking to hedonic pricing data related to the impact of trees on house prices to the costs of neighbourhood policing.

Figure 3 $ Value of Sustainability for Each Virtual Neighbourhood and Type

CONCLUSIONS AND IMPLICATIONS

There is considerable debate in New Zealand and overseas about the relative sustainability of city and settlement built environments. Two major, albeit contested, strategies have emerged out of those debates. First, there is a strong thrust away from strongly separating different uses within the city and generating neighbourhood precincts that are mixed use. Second, environmental concerns have also promoted intensification of existing residential areas as well as new subdivisions.

The merits of intensification have generated much debate. Many developers are resistant to intensification because building on an existing site creates a number of complexities around redevelopment and construction. In addition, land prices tend to be higher for existing and developed sites than perimeter, greenfield sites. Consequently, a number of commentators argue that intensification will increase the costs of new housing relative to the city perimeter, greenfields developments. Increasing residential density, particularly by way of local authority planning, has also been resisted, despite a strong market tendency towards intensified land use, on the grounds that intensification reduces quality of life and neighbourhood liveability.

In the context of that debate, the NSF tools have given more credit to intensified settlement forms than low density forms. It promotes mixed use relative to single use neighbourhood built environments. There are good reasons for that approach. Those are set out in the various reports describing the rationale, development and operationalisation of the NSF and its associated tools.[8]

Moreover, the 2008 National Neighbourhood Survey further confirmed that householders living in dwellings located in high density and mixed use environments have activity patterns that are more environmentally sustainable. Householders in higher density locations are, for instance, much more likely to walk or cycle and/or use public transport. The average kilometres driven by members of households in higher density neighbourhoods are considerable lower than among households in low density suburbs.

At the same time, however, the 2008 National Neighbourhood Survey found that on some of the neighbourhood satisfaction, civic participation and governance indicators, there was a tendency for households living in high density neighbourhoods to be somewhat less engaged or attached to the neighbourhood. Similarly, while those households used public open spaces more they gardened less and were less likely to provide environments that promoted biodiversity within their private space.

New Zealand medium density built environments appear not to be adapted to mixed use. Further research into this is required, but the data suggest that the problems residents find with medium density environments with mixed use may reside in the failure of dwellings and street design to mitigate the impacts of mixed use. That is, it may be that low density, single use designs are simply being compacted in medium density mixed use environments.

[8] Saville-Smith, K. et.al., 2005.

There is a broad alignment between values and prevailing planning views around sustainable urban form. However, there is considerable complexity. In particular, the evidence suggests that the location of dwellings, the management of noise, and the management of traffic all contribute to lower sustainability experience in mixed use neighbourhoods. These problems appear to be most pronounced in medium density neighbourhoods. This suggests poor adaptation of dwelling and lot design as New Zealand has moved from low density towards medium density.

Both market trends and sustainability imperatives are pushing settlements towards intensification and mixed use. Given that, there must be a concerted effort to establish appropriate design for both neighbourhoods and residential buildings in medium density, mixed use settings, given the poor performance of medium density, mixed use neighbourhoods on high dollar value indicators.

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