

CELLULAR PHONE TOWERS: PERCEIVED IMPACT ON RESIDENTS AND PROPERTY VALUES

SANDY BOND
University of Auckland

and

KAREN BEAMISH
Jones Lang LaSalle

ABSTRACT

This paper outlines the results of a case study to determine residents' perceptions towards living near cellular phone base stations (CPBSs) in Christchurch, New Zealand and how they evaluate the impact of these structures. The results provide initial evidence that if used together with the results from econometric analysis of transaction data can help resolve valuation and compensation issues in a quantitative way. Further, they provide a potential source of information for related government agencies in assessing the necessity for increasing health and other information pertaining to CPBSs to help allay public concerns.

Keywords: Electromagnetic fields, radio frequency & microwave radiation, cellular phone base stations, property values, stigma.

INTRODUCTION

Cellular phone base stations (CPBSs) are increasingly in demand as the two major cellular phone companies in New Zealand (NZ), Telecom and Vodafone, seek to upgrade and extend their network coverage. This demand could provide the owner of a well-located property a yearly income for the siting of a CPBS¹. However, as CPBSs and associated equipment increase the exposure of the population to electromagnetic fields (EMFs) the new technology represents potential hazards to human health and safety. This may cause property values to diminish due to the existence of "widespread public fear" and "widespread public perceptions of hazards". The increased media attention to the potential health hazards of CPBSs has caused a spread of such fear with a resulting increase in

¹ Williams, R. "Phone zone – renting roof space to Ma Bell," *The Property Business* (12, April 2001): 6-7.

resistance to CPBSs due to the perceived negative effects on health, aesthetics and property values in close proximity to these structures. However, the extent to which such attitudes are reflected in lower property values affected by CPBSs is not widely known in NZ.

Understanding the effects of CPBSs on property values is important to telecommunications companies in helping plan the siting of these and for determining likely opposition from property owners. Similarly, property valuers need to understand the valuation implications of CPBSs when valuing CPBSs-affected property. The owners of affected property also want to understand the magnitude of effects, particularly if compensation claims or an award for damages are to be made against such property.

Two studies have been conducted (commissioned by Telecom in Auckland (1998/99) and Christchurch (2001)) to ascertain the adverse health and visual effects of CPBSs on property values, but these have not been made publicly known. Although the results reported by Dunbar and Albrecht (2002)² showed that property prices are not statistically significantly affected by the presence of CPBSs, the research in both cases involved only limited sales data analysis. Further, no surveys of residents' perceptions were undertaken, nor of the media attention to the sites and the effect this may have on saleability of properties in close proximity to CPBSs. Finally, as the sponsoring party to the research was a telecommunication company, it is questionable whether the results are completely free from bias. Hence, this initial study aims to help fill the research void on this contentious topic in an objective way. The research develops a case study approach to determine residents' perceptions towards living near CPBSs in several suburbs in Christchurch and to quantify these effects in monetary terms according to an increasing or decreasing percentage of property value.

The paper provides a brief review of the use of cellular phone technology in NZ and relevant literature. The following section describes the research procedure used, including a description of both case study and control areas. The results are then discussed. The final section provides a summary and conclusion.

LITERATURE REVIEW

Background: cellular phone technology in NZ

The cellular telephone service first became available in New Zealand in 1987. This figure has continued to balloon in recent years. It is estimated that 80 percent of people will be mobile within five years (Telecom, 2002)³. The location of cell sites and cell site capacity

² In personal correspondence with Bond.

³ At the end of March 2002, Telecom had more than 1.3 million mobile phone customers and more than 750 mobile phone sites throughout New Zealand (a 54% share of the mobile market) Vodafone had over 1.1 million mobile phone customers throughout New Zealand (a 46% share of the mobile market), (Vodafone, 2002).

is a major issue that the telecommunication companies are faced with at present. Despite the high level of demand from customers for better cell phone coverage in areas where they live and work, the majority of them do not want a site in their neighbourhood. Concerns expressed usually relate to health, property values and visual impact (Szmigielski and Sobiczewska, 2000; Barnes, 1999).

For service providers, the preferred location for cell sites is in commercial or industrial areas due to the previous difficulty in obtaining resource consent for towers located in residential areas under the Resource Management Act⁴. Under the Resource Management Act 1991 (RMA), resource consent may be required in prescribed circumstances from the local council to establish a cell site in the area. This may be either notified or non-notified. If the council decides it is to be notified, this allows anyone in the community to have their say about it. One of the positive outcomes of the RMA resource consent procedure is the resulting unobtrusive nature of most cell sites. Some sites have even been incorporated into clock towers, building's chimneys and building signage.

Assessment of environmental effects

Adverse health effects

The analog phone system (using 800-900 Megahertz band) and digital phone system (using 1850-1990 Megahertz band) expose humans to EMF emissions: radio frequency radiation (RF) and microwave radiation (MW) respectively. These two radiations are emitted from both the cellular phones and CPBSs (Barnes, 1999; Szmigielski and Sobiczewska, 2000).

For years, the cell phone companies have assured the public that cell phones are perfectly safe. They state that the particular set of radiation parameters associated with cell phones are the same as any other radio signal. However, reported scientific evidence challenges this view and shows that cell phone radiation causes various biological effects, including: cancer, specifically brain tumours and leukaemia; altered brain activity; disturbed sleep; significant changes in local temperature, and in physiologic parameters of the cardiovascular system; memory loss, fatigue, and headaches, raised blood pressure, etc⁵.

The main health concerns relating to EMF emissions from CPBSs are caused by the fact that RF fields penetrate exposed tissues. RF energy is absorbed in the body and produces heat. All established health effects of RF exposure are clearly related to heating. Public concern regarding both cell phones and CPBSs in many countries has led to a number of independent expert groups being requested by governments and cellular service providers to carry out detailed reviews of the research literature. The reviews conclude that there are

⁴ This has now been amended and replaced with a much simpler consent process.

⁵ Mann & Roschke (1996), Krause et al. (2000), Borbely et al. (1999), Kellenyi et al. (1999), Khdnisskil, Moshkarev & Fomenko (1999), Hocking (1998), Burch et al. (1998) and others as reported in Cherry, N. (2000).

no clearly established health effects under low levels of exposure. Such exposures typically occur in publicly accessible areas around RF transmitters⁶.

While, at present, medical and epidemiological studies reveal weak association between bio-effects and low-level exposures of RF/MW fields, controversy remains between scientists, producers and the general public.

Radio frequency exposure standards

Despite ongoing controversy, the reviews of research on the health effects of exposure to RF helped establish the basis for exposure standards that limit exposures to a level for safe and healthy living and working conditions. The NZ Standard for RF exposures, NZS 2772.1:1999 Radiofrequency Fields Part I: Maximum Exposure Levels – 3kHz to 300GHz was based largely on the widely accepted and respected 1998 International Commission on Non-Ionising Radiation Protection (ICNIRP) guidelines.

Currently, the NZ standard sets out a limit of continuous exposure to the public for RF levels from mobile phone sites of 450 microwatts per square centimetre. This standard is the same as used in most European countries, and is more stringent than that used in the United States, Canada and Japan. This exposure level has been lowered even further in some cases. For example, the Christchurch City Council has made their allowable standard 200 microwatts per square centimetre (less than 50% of the NZ Standard). In reality however, mobile phone sites only operate at a fraction of the level set by the standard. The National Radiation Laboratory has measured exposures around many operating cell sites. Maximum exposures in publicly accessible areas around the great majority of sites are less than 1% of the public exposure limit in the standard. Exposures are rarely more than a few percent of the limit, and none have been above 10%.

NZ legal cases on property values effects from CPBSs

Very few cell site cases have actually proceeded to Environment Court hearings in NZ. The two main court cases were McIntyre and others vs. Christchurch City Council [1996] NZRMA 289 and Shirley Primary School vs. Telecom Mobile Communications Ltd [1999] NZRMA 66. Based on these cases, there are two main alleged adverse effects of CPBSs on property values: the risk of adverse health effects from RF radiation emitted from CPBSs and the adverse visual effects.

In McIntyre and others vs. Christchurch City Council, Bell South applied for resource consent to erect a cell phone base station in the suburb of Fendalton in Christchurch. Residents' objected to the application based on the harmful health effects from RF

⁶ See for example, The New Zealand Radiation Laboratory (2001), the World Health Organization (1993), International Commission on Non-Ionizing Radiation Protection (ICNIRP) (1997, 1998), the Royal Society of Canada (1999) and the UK Independent Expert Group on Mobile Phones (2000).

radiation. The Planning Tribunal considered residents' objections and heard experts' opinions as to the potential health effects, and granted the consent, subject to conditions. It was found that there would be no adverse health effects from low levels of radiation from the proposed transmitter, not even effects of low probability but high potential impact.

In *Shirley Primary School vs. Telecom Mobil Communication Limited*, Telecom applied to the Christchurch City Council for resource consent to establish, operate and maintain a CPBS on land at Shirley Road, Christchurch, adjacent to the Shirley Primary School. Again, the Council granted the consent subject to conditions. However, the school appealed the decision, alleging four main adverse effects, as follows:

- The risk of adverse health effects from the radio frequency radiation emitted from the cell site
- The school's perception of the risks and related psychological adverse effects on pupils and teachers
- Adverse visual effects
- Reduced financial viability of the school if pupils were withdrawn because of the perceived adverse health effects.

The Court concluded that the risk of the school children or teachers at the school incurring leukaemia or other cancer from RF radiation emitted by the cell site is extremely low, and the risk to the pupils of exposure to RF radiation causing sleep disorders or learning disabilities is higher but still very small. Accordingly, the Telecom proposal was allowed to proceed.

In summary, the Environmental Court has ruled that there is no established adverse health effects arising from the emission of radio waves from CPBSs as there is no epidemiological evidence to show this. The court was persuaded by the 1998 ICNIRP guidelines that risk of health effects from low-level exposure is very low and that the cell phone frequency imposed by the NZ standard is safe, being almost two and a half times lower than that of the ICNIRP.

However, in the court's decisions, they did concede that while there is no proven health effects that there is evidence of property values being affected by both of the above allegations. Yet they suggest that such a reduction in property values should not be counted as a separate adverse effect from, for example, adverse visual or amenities effects. That is, a reduction in property values is not an environmental effect in itself; it is merely evidence, in monetary terms, of the other adverse effects noted.

In *Chen vs. Christchurch City Council*, the court stated that valuation is simply another expert opinion of the adverse effect (loss). Further, in this case the court established a precedent relating to the effects on property values. In *Goldfinch vs. Auckland City Council (NZRMA 97)*, the Planning Tribunal considered evidence on potential losses in value of the properties of objectors to a proposal for the siting of a CPBS. The Court concluded that the valuer's monetary assessments support and reflect that the adverse

effects of the CPBS. Further, it concluded that the effects are more than just minor as the CPBS stood upon the immediately neighbouring property.

Research on property value effects

Few studies have been conducted to ascertain the adverse health and visual effects of CPBSs on property values. Further, as there has been very few cell site cases proceeding to the Environment Court, little evidence of property value effects has been provided by the courts. Thus, the extent to which opposition from property owners affected by the siting of CPBSs are reflected in lower property values is not well known in New Zealand.

The two studies by Dunbar and Albrecht, mentioned earlier, whilst showing that property prices are not statistically significantly affected by the presence of CPBSs involved only limited sales data analysis with potentially biased results due to the financial interest Telecom had in the research.

CPBSs are very similar structures to high voltage overhead transmission lines (HVOTLs), therefore despite the limited research relating to value effects from CPBSs, it is worthwhile reviewing the body of literature on the property values effects from HVOTLs. The only recently published study in NZ on HVOTLs effects is Bond and Hopkins (2000). Their research consisted of both a regression analysis of residential property transaction data in a case study area to determine the effect of HVOTLs on residential property values and an opinion survey to determine the attitudes and reactions of property owners in the case study area toward living close to HVOTLs and pylons.

The results of the sales analysis indicate the effect of having a 'pylon' close to a particular property is statistically significant and has a negative effect of 20% at 10-15 metres from the pylon, decreasing to 5% at 50 metres. This effect diminishes to a negligible amount after 100 metres. However, the presence of a 'transmission line' in the case study area has a minimal effect and is not a statistically significant factor in the sales price.

The attitudinal study results indicate that nearly two thirds of the respondents have negative feelings about the HVOTLs. Proximity to HVOTLs determines the degree of negativity: respondents living closer to the HVOTLs expressed more negative feelings towards them than those living further away. It appears, however, from a comparison of the results, that the negative feelings expressed are often not reflected in the price paid for such property.

There have been a number of HVOTLs studies carried out in the United States and Canada. A major review and analysis of the literature by Kroll and Priestley (1992) indicated that in about half the studies carried out, HVOTLs had not affected property values and in the rest of the studies, there was a loss in property value between 2-10%. Kroll and Priestley found that the Colwell (1990) study was one of the more careful and systematic analysis of residential impacts. This study was carried out in Illinois and found that the strongest effect of the HVOTLs was within the first 15m but with this dissipating

quickly further away, disappearing beyond 60m.

A Canadian study (Des Rosiers, 2002) based on a sample of 507 single-family house sales showed that although severe visual encumbrance due to a direct view of either a pylon or lines exerts a significantly negative impact on property values, a house located adjacent to a transmission corridor may increase in value. This was particularly evident where the transmission corridor was on a well wooded 90m right of way. The proximity advantages include enlarged visual field and increased privacy. The decrease in value from the visual impact of the HVOTLs and pylons (between, on average, 5-10% of mean house value) tends to be cancelled out by the increase in value from proximity to the easement.

A study by Wolverton and Bottemiller (2003) utilized a paired-sale methodology of home sales occurring in 1989-1992 to ascertain any difference in sale price between properties abutting rights-of-way of transmission lines (subjects) in Portland, Oregon; Vancouver, Washington; and Seattle, Washington and those located in the same cities but not abutting transmission line rights-of-way (comparisons). Subjects sold during the study period were selected first. Then a matching comparison was selected from the subject neighbourhood that was as similar to the subject as possible. Their results did not support a finding of a price effect from abutting an HVTL right-of-way. In their conclusion, they warn that the results cannot and should not be generalized outside of the data. They explain that “limits on generalizations are a universal problem for real property sale data because analysis is constrained to properties that sell and sold properties are never a randomly drawn representative sample. Hence, generalizations must rely on the weight of evidence from numerous studies, samples, and locations”.

Thus, despite the varying results reported in the literature on property value effects from HVOTLs, each study adds to the growing body of evidence and knowledge on this (and similar) valuation issue(s). The study reported here is one such study.

DATA COLLECTION AND ANALYSIS

Research objectives and methodology

An opinion survey was conducted to investigate the current perceptions of residents towards living near CPBSs and how this proximity might affect property values. Case study areas in the city of Christchurch, NZ were selected for this study. The study included residents in ten suburbs: five case study areas (within 300 metres of a cell phone tower) and five control areas (over 1km from the cell phone tower). The five case study suburbs were matched with five control suburbs that had similar living environments (in socio-economic terms) except that the former were areas where a CPBS is located, while the latter were without a CPBS.

The number of respondents to be surveyed (800) and the nature of the data to be gathered (perceptions/personal feelings towards CPBSs) governed the choice of a self-administered

questionnaire as the most appropriate collection technique. Questionnaires were mailed to residents living in the case study and control areas.

A self-administered survey helps to avoid interviewer bias and to increase the chances of an honest reply where the respondent is not influenced by the presence of an interviewer. Also, mail surveys provide the time for respondents to reflect on the questions and answer these at their leisure, without feeling pressured by the time constraints of an interview. In this way, there is a better chance of a thoughtful and accurate reply.

The greatest limitation of mail surveys is that a low response rate is typical. Various techniques were utilised to help overcome this, including careful questionnaire design; inclusion of a free-post return envelope, an accompanying letter ensuring anonymity, and reminder letters. An overall response rate of 46% was achieved for this study.

The questionnaire contained 43 individual response items. The first question acted as an identifier to determine whether the respondent was the homeowner or tenant. While responses from both groups were of interest, the former was of greater importance, as they are the group of purchasers/vendors that primarily influence the value of property. However, it was considered relevant to survey both groups as both are affected by proximity to a CPBS to much the same extent from an occupiers' perspective, i.e. they both have to live with the knowledge, and perceived risks associated with a CPBS. It was hypothesised, however, that tenants, being of a less permanent nature, would perceive the effects in a similar way, but to a much lesser degree.

Other questions relate to overall neighbourhood environmental desirability, the timing of the CPBS's construction and the proximity of it in relation to the respondent's home, the importance they place on the CPBS as a factor in relocation decisions and on the price/rent they were prepared to pay for their house, how a CPBS might affect the price they would be willing to pay for their property; the degree of concern of the effects of CPBSs on health, stigma, aesthetics, property values, etc.

The surveys were coded to identify the property address of each. This enabled each respondent's property to be located on a map and to show this in relation to the cell site. Eighty questionnaires were distributed to each of the ten suburbs (five case study and five control areas) in Christchurch (i.e. 800 surveys were delivered in total). Homes were selected in the case study area based on being within 300 metres of the CPBS. Control group homes within each selected suburb were selected at random. Respondents were instructed to complete the survey and return it in the free-post, self-addressed envelope provided. The initial response rate was 31%. A month later, a further 575 questionnaires with reminder letters were sent out to residents who had not yet responded. A total response rate of 46% was achieved. Response rates from each suburb ranged from 33% (Linwood) to 61% (Bishopdale).

The questionnaire responses were coded and entered into a computerised database.⁷ The analysis of responses included the calculation of means and percentage of responses to each question to allow for an overview of the response patterns in each area.

Case study and control areas

The suburbs of Beckenham, Papanui, Upper Riccarton, Bishopdale and St Albans were selected as there is at least one CPBS erected within them. The control suburbs selected include Spreydon, Linwood, Bromley, Avonhead and Ilam. These were located further away (over 1 kilometre) from the CPBS within the case study area they were matched with. Each suburb was selected and matched to a comparable case study area based on it having a similar living environment, housing stock and socio-economic characteristics, but without a CPBS nearby.

Demographic statistics from the 2001 Census used to select and match the control areas to the case study areas included ethnic breakdown, household and family incomes, education and occupational type of residents in each suburb. Papanui and Spreydon have the highest proportion of Europeans (around 90%), Bromley has the highest proportion of both Maoris and Pacific Island people (13.9% and 8.5% respectively), while Ilam, Avonhead and Upper Riccarton have the highest proportion of Asians (16.1 to 18.5%)⁸.

The 2001 Census data on median household and family incomes (MHI and MFI) in each suburb show that these are highest in Ilam and Avonhead (MHI: \$34,751NZ to \$53,405NZ and MFI: \$51,530NZ to \$65,804NZ, respectively) and lowest in Linwood and Beckenham (MHI: \$22,275NZ, \$26,398NZ and MFI: \$29,673NZ, \$33,847NZ respectively).⁹ Residents of St Albans West have the highest levels of education (21.7 to 26.2% have a degree or higher degree) followed by Upper Riccarton (18.7%), Ilam (16.7%) and Avonhead (16.2%). These same suburbs have the highest proportion of professionals by occupational class (20.3 to 27.3%). Residents of Bromley have the lowest education (40% have no qualification) and the lowest proportion of professionals (5.5%).¹⁰

⁷ The computer programme SPSS was selected as the appropriate analytical tool for processing the data.

⁸ Christchurch City Area Unit Profile statistics from <<http://www.ccc.govt.nz/census/Income.asp#AreaUnit>>.

⁹ \$1NZ = \$0.65US, thus, \$34,751NZ = \$22,588US.

¹⁰ The median house price for Christchurch city in August 2003 was \$185,000NZ/\$120,000US (New Zealand national median house price at this time was \$215,000NZ/\$140,000US), (<http://www.reinz.co.nz/files/HousingFacts-Sample-Pg1-5.pdf>, accessed on 17 March 2004). Median house prices in each individual suburb could not be obtained as the median sales data from the Real Estate Institute of NZ (REINZ) contains more than one suburb in each location grouping.

The matching process ensured that the case study and control areas had an even distribution of suburbs from both the higher and lower socioeconomic spectrums. The suburbs are listed in decreasing socioeconomic order as follows: Ilam, Avonhead, Upper Riccarton, St Albans West, Papanui, Spreydon, Bishopdale, Bromley, Beckenham and Linwood.

RESEARCH RESULTS

Survey 1: Cell Phone Tower Case Study Areas

Of the 400 questionnaires mailed to homeowners and tenants in the case study areas, 50% were completed and returned. Over three-quarters (78.5%, n=186) of the respondents were homeowners.

Desirability of the suburb as a place to live

More than half (58.3%, n=187) of respondents have lived in their suburb for more than five years and a quarter (25%) have lived in their suburb between 1- 4 years. Nearly two-thirds (65%, n=179) rated their neighbourhood as either above average or superior as a place to live when compared with other similar named suburbs. The reasons given for this are due to the close proximity to amenities including shops, medical facilities, public transport, recreational facilities and good schools. Reasons given for the neighbourhood been rated as inferior to other similar neighbourhoods was due to lower house prices, older homes, more student housing and lower income residents.

Feelings towards the CPBS as an element of the neighbourhood

The CPBS was already constructed when only 39% (n=168) of the respondents bought their house or began renting in the neighbourhood. Some responded that were not notified that the CPBS was to be built, so they had no opportunity to object to it. They felt that they should have been consulted about this. For the respondents' that said the proximity of the tower was of concern to them, the most common reasons given were the effects of the CPBS on health, aesthetics and property values. Nearly three-quarters (74%, n=157) of the respondents said they would have gone ahead with the purchase or rental of their property anyway if they had known that the CPBS was to be constructed.

Effect on decision to purchase or rent

The tower was visible from the house of 46% (n=184) of the respondents, yet two-thirds (66%) of these said it was barely noticeable, and a quarter said it mildly obstructed their view. When asked in what way the CPBS impacts on the enjoyment of living in their home, over a third (37%, n=136) responded that it impacted on their health concerns, 21% on neighbourhood aesthetics, 20% on the property value and 12% on the views from their property. When asked about the effect that the CPBS had on the price/rent they were prepared to pay for their property, nearly a half (48.5%, n=195) said that the tower was not constructed at the time and 47% of the respondents said the proximity to the CPBS did

not affect the price they were prepared to pay for the property. Nearly 3% said they were prepared to pay a little less, 2% said they were prepared to pay a little more.

Ten percent (n=21) of the respondents gave an indication of the effect that the CPBS had on the price/rent they were prepared to pay for their property. A third of these felt it would decrease price/rent by between 1 to 9%. The responses are outlined in Table 1.

Table 1: Effect of the CPBS on Purchase/Rental Price Decision	
Price/Rent Effect (%)	% of Respondents
20% more	5%
10-19% more	10%
1-9% more	14%
1-9% less	33%
10-19% less	24%
20% or greater reduction in price/rent	14%

Concerns about the proximity to the CPBS

Over half of the respondents were not worried about the effects that proximity to a CPBS has on health (50%, n=179), stigma (55%, n=174), future property value (61%, n=173) or aesthetics (63%, n=177). Around one quarter to a third of the respondents were somewhat worried about the affects that proximity to a CPBS has on health (38%), stigma (34%), and future property value (25%) or aesthetics (25%). From the list of issues, respondents were most worried about future property value, but only 13.5% of the respondents responded this way. The responses are outlined in Table 2.

Table 2: Worries about Living Near a CPBS

Extent to which respondents worry about these possibilities (Percentage of respondents by category of concern)			
Concern	Does not worry me	Worries me somewhat	Worries me a lot
Possibility of harmful health effects	50	38	12
Stigma effect	55	34	11
Affect on future property values	61.5	25	13.5
Aesthetics	63.5	25	11.5

Reasons for the lack of concern may be due to the CPBS being either not visible or only barely visible from the homes of respondents or was far enough away from their property (as was indicated by many respondents, particularly in St Albans West, Upper Riccarton, and Bishopdale) and consequently it did not affect them much. The CPBSs were either far enough away or hidden by trees to not affect these respondents directly. The results may have been quite different had the CPBS being more visually prominent.

Survey 2: Control Groups

Of the 400 questionnaires mailed to homeowners and tenants in the control areas, 41% were completed and returned. The majority (94%, n=156) of the respondents were homeowners.

Desirability of the suburb as a place to live

Nearly two-thirds (65%, n=155) of respondents have lived in their suburb for more than five years and over a quarter (28%) have lived in their suburb between 1- 4 years. Over two-thirds (68%, n=152) rated their neighbourhood as either above average or superior as a place to live when compared with other similar suburbs. The reasons given for this are due to the close proximity to amenities including shops, library, medical facilities, public transport, and educational facilities; less traffic/quieter; more owner-occupiers; and better schools. Reasons given for the neighbourhood been rated as inferior to other similar neighbourhoods was due to it being further from the CBD (Avonhead); smell from the sewerage oxidation ponds and composting ponds (Bromley); lower socio-economic area and noise from the airport (Linwood).

Feelings towards a CPBS as an element of the neighbourhood

Nearly three-quarters (72%, n=154) of the respondents would be opposed to the construction of a CPBS nearby. The location of a CPBS would be taken into account by 83% (n=151) of respondents if they were to consider moving. As with the results from the case study survey, those control group respondents' that said the proximity of the tower was of concern to them, the most common reasons given for this were the effects of the CPBS on health, aesthetics and property values.

Affect on decision to purchase or rent

If a CPBS was located nearby, 45% (n=141) of the respondents would be prepared to pay substantially less for their property, over one-third (38%) would be prepared to pay just a little less for their property and 17% responded that it would not influence the price they would be prepared to pay. When asked what percentage affect that the CPBS had on the price/rent they were prepared to pay for their property, over a third (38%, n=125) felt it would decrease price/rent by more than 20% and a similar number (36%) said they would be prepared to pay between 10 to 19% less for their property. The responses are outlined in Table 3.

Table 3: Affect of the CPBS on Purchase/Rental Price Decision	
Price/Rent Effect (%)	% of Respondents
20% more	3%
10-19% more	2%
1-9% more	2%
1-9% less	19%
10-19% less	36%
20% or greater reduction in price/rent	38%

This was an interesting result when compared to the case study areas. It seems that those living further away from the CPBSs are far more concerned about proximity to CPBSs than those that live near to them. The possible explanations for this are outlined below.

Concerns about the proximity to a CPBS

Of the concerns about CPBSs that respondents were asked to comment on, the negative effects on future property values and aesthetics were what respondents were most worried about. Nearly a half (47%, n=156 and 45%, n=154 respectively) of the respondents were worried a lot about these issues. Similar responses were recorded for the possibility of

harmful health effects in the future from CPBSs (42%, n= 151 were worried a lot about this) and “stigma” associated with houses near CPBSs (43%, n=149 were worried a lot). The responses are outlined in Table 4.

Table 4: Worries about Living Near a CPBS			
Extent to which respondents worry about these possibilities (Percentage of respondents by category of concern)			
Concern	Does not worry me	Worries me somewhat	Worries me a lot
Possibility of harmful health effects	20	38	42
Stigma effect	21	45	34
Affect on future property values	15	37	47
Aesthetics	18	37	45

In both the case study and control areas, the impact of proximity to CPBSs on future property values is the issue of greatest concern for respondents.

Other comments provided by respondents at the end of the survey were most informative. In summary, the main issues relating to CPBSs were that the potential health affects are not well known or understood enough; there are possible socioeconomic implications on both the siting of CPBSs and how they affect property values; some people do not mind, and accept the need for CPBSs, but do not want them built in their back yard, or they would prefer them to be disguised so they blend better with their environment. More importantly, there are concerns that the city council is not notifying the public about the possible construction of a CPBS.

Those comments relating specifically to property value affects and NIMBY syndrome are shown below:

Property Value Affects:

- We lived under high power transmission lines for 14 years and had a hard time selling the house: never again!
- I do not believe CPBSs have any affect on health: it is a perceived problem only but it does have an affect on property values.

- Initially the CPBS concerned me when first built because I felt it was an intrusion to the neighbourhood. This has diminished with time.
- In higher priced residential areas, prospective purchasers are more discerning than those buying in poorer quality residential areas and consequently the percentage diminution in value caused by closeness to a CPBS would be greater in Ilam than in a poorer quality residential area.

NIMBY syndrome:

- I am not opposed to CPBSs but would not want one in my back yard.
- People want new technology as long as it is not in their back yard.
- Having being involved with selling real estate in close proximity to cell phone towers, most folk do not want them next door to their property, nor across the road from them, but the Upper Riccarton tower seems to be well hidden by trees and consequently is not noticed. It seems that it is a case of “out of sight, out of mind”.

Discussion of the results

The results indicate that people who live near CPBSs are far less concerned about the possible effects from living near CPBSs than those people who live further away from them. This was a surprising result. One explanation is that generally the residents cannot see, or barely notice, the CPBS from their homes and as such, they may be less concerned about it than if the CPBS were more noticeable. They may also consider it to be far enough away from their property to be of no influence, as the results from this study showed.

Alternatively, case study residents’ apparent lower sensitivity to the CPBS than the control groups’ residents may be due to the possible affect of cognitive dissonance reduction. In this case, they may be unwilling to admit, due to the large investment made in their home, that they have made a poor purchasing decision buying a property located close to a CPBS. Similarly, if the CPBS was built after they purchased their home they may be unwilling to admit that they have worries about the proximity of the CPBS as they may be concerned that admitting this will have a negative impact on their property’s value. This is not the result that they would want if they were contemplating selling and moving due to the CPBS, or for any other reason.

Regardless of the reasons for the difference in responses from the case study and control groups, the overall results show that residents perceive CPBSs negatively. In both the case study and control areas, the impact of proximity to CPBSs on future property values was the issue of greatest concern for respondents. Overall, respondents felt that proximity to a CPBS would reduce value by between 10% to over 20%. The second part of the study that is the focus of a later article, involving an econometric analysis of Christchurch property sales transaction data, helps to confirm these results.

The comments added at the end of the survey indicate the ongoing concerns that residents have about CPBSs and issues that city councils need to address. In particular, the city council could help address concerns that residents have by providing more information about the potential health (and other) effects of CPBSs and notifying the public about any possible construction of a CPBS. Through public consultation, the council would likely gain greater acceptance of their siting decisions for the CPBSs. Additionally, the consultation process could lead to innovative approaches to the siting of CPBSs and the blending of these with their environment.

LIMITATIONS OF THE RESEARCH

The main limitation affecting this survey was in the selection of the case study areas. Specifically, the areas selected had CPBSs located in them that were not highly visible to residents. Had more visible CPBSs been selected, the results may have been quite different. Thus, caution must be used in making generalisations from the study or applying the results directly to other similar studies or valuation assignments. Factors that could affect results are the distance that homes are from the CPBS, the style and appearance of the CPBS, how visible it is to residents, and the socio-economic make-up of the resident population.

Further, it must be kept in mind that these results are the product of only one case study carried out in a specific area (Christchurch) at a specific time (2003). The value-effects from CPBSs may vary over time, as market participant's perceptions change due to increased public awareness regarding the potential adverse health and other affects of living near a CPBS. Perceptions toward CPBSs can change either positively or negatively over time. For example, as more information is discovered that refutes any adverse health effects from CPBSs and as this, together with information about the NZ Standards for high safety margins regarding the emission of RF and MW radiation, are made more publicly available, the perceptions of risk may gradually decrease. To confirm this, many similar studies need to be conducted over time and the results made public.

AREAS FOR FURTHER STUDY

This research has focused on residents' perceptions of living near CPBSs. Further research is needed to determine if the residents' reported willingness to pay for affected property, as indicated in this survey, are reflected in the price they actually pay for such property. To this end, a study that involves an econometric analysis of the sales transaction data has been completed and is the focus of a later article.

Given the public concerns about the potential risks arising from living near these structures, it is important for future studies to focus more attention on this issue. More information is needed on the kinds of health and other risks the public associates with CPBSs, and the level of risk perceived. How far away from the CPBS do people feel they

have to be to be safe? What CPBS design, size, and the kind of surrounding landscape would help CPBSs to be more publicly acceptable? What are the social, economic, educational and other demographic variables that influence how people perceive the risks from CPBSs? Are these perceived risks reflected in property values and to what extent? Do these perceived risks vary over time and to what degree?

Answers to these questions, if shared amongst researchers and made public, could lead to the development of a global database. Such a database could assist valuers in determining the perceived level of risk associated with CPBSs and other similar structures¹¹ from geographically and socio-economically diverse areas to aid in the valuation of property affected by these, anywhere in the world. Similarly, knowledge of the extent these risks are incorporated into property prices and how they vary over time will lead to more accurate value assessments of properties in close proximity to a CPBS and other similar structures.

SUMMARY AND CONCLUSIONS

This article presents the results of an opinion survey undertaken in 2003 of residents' perceptions towards living near CPBSs and how this impacts on property values. From the results, it appears that people who live close to a CPBS perceive the sites less negatively than those who live further away. However, the issue of greatest concern for respondents in both the case study and control areas was the impact of proximity to CPBSs on future property values. Overall, respondents would pay from 10-19% less to over 20% less for a property if it were in close proximity to a CPBS.

As research to date (ICNIRP) reports that there are no clearly established health effects from RF emissions of CPBSs operated at, or below, the current safety standards the only reason a rational investor might continue to avoid property near a cell site would be because it was intrusive on the views received from the property or because of the adverse aesthetic effects of the CPBS on the property. Yet, recent media reports (for example, Fox) indicate that people still perceive that CPBSs have harmful health effects.

Thus, whether or not CPBSs are ever proven conclusively to be free from health risks is only relevant to the extent that buyers of property near a CPBS perceive this to be true. Consequently, values of residential property located in close proximity to CPBSs may be adversely affected by the negative perceptions of buyers, regardless of research evidence to the contrary.

¹¹ For example, high-power overhead transmission lines

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