FEATURES

The Effect of Distance to Cell Phone Towers on House Prices in Florida

ABSTRACT

This article outlines the results of a study carried out in Florida in 2004 regarding the effect that cell phone tower proximity has on residential property prices. The study involved an analysis of residential property sales transaction data. Both GIS and multiple regression analysis in a hedonic framework were used to determine the effect of linear distance of homes to towers on residential property prices. The results of the research show that prices of properties decreased by just over 2%, on average, after a tower was built. This effect generally diminished with distance from the tower and was almost negligible after about 656 feet.

by Sandy Bond, PhD

The siting of cellular phone transmitting antennas, their base stations, and the towers that support them (towers) is a public concern due to fears of potential health hazards from the electromagnetic fields that these devices emit. Negative media attention to the potential health hazards has only fueled the perception of uncertainty over the health effects. Other regularly voiced concerns about the siting of these towers are the unsightliness of the structures and fear of lowered property values. However, the extent to which such attitudes are reflected in lower property values affected by tower proximity is controversial.

This article outlines the results of a cell phone tower study carried out in Florida in 2004 to show the effect that distance to a tower has on residential property prices. It follows on from several New Zealand (NZ) studies conducted in 2003.[1] The first of the NZ studies examined residents' perceptions toward living near towers, while the most recent NZ study adopted GIS to measure the impact that distance to a tower has on residential property prices using multiple regression analysis in a hedonic pricing framework. The study presented in this article was conducted to determine if homeowners in the United States make price adjustments that are similar to those of NZ homeowners when buying properties near towers, and hence, whether the results can be generally applied.

The article commences with a brief literature review of the previous NZ studies for the readers' convenience. The next section describes the research data and methodology used. The results are then discussed. The final section provides a summary and conclusion.

1. Sandy Bond and Ko-Kang Wang, "The Impact of Cell Phone Towers on House Prices in Residential Neighborhoods," *The Appraisal Journal* (Summer 2005): 256–277; S. G. Bond, and K. Beamish, "Cellular Phone Towers: Perceived Impact on Residents and Property Values," *Pacific Rim Property Research Journal* 11, no. 2 (2005): 158–177; and S. G. Bond, and J. Xue, "Cell Phone Tower Proximity Impacts on House Prices: A New Zealand Case Study" (European Real Estate Society and International Real Estate Society Conference, Dublin, Ireland, June 15–18, 2005).

Literature Review

Property Value Effects

First, an opinion survey by Bond and Beamish[2] was used to investigate the current perceptions of residents towards living near towers in the case study city of Christchurch, New Zealand, and how this proximity might affect property values. Second, a study by Bond and Wang[3] that analyzed property sales transactions using multiple regression analysis was conducted to test the results of the initial opinion survey. It did this by measuring the impact of proximity to towers on residential property prices in four case study areas. The Bond and Xue[4] study refined the previous transaction-based study by including a more accurate variable to account for distance to a tower.

The city of Christchurch was selected as the case study area for all the NZ studies due to the large amount of media attention this area had received in recent years relating to the siting of towers. Two prominent court cases over the siting of towers were the main cause for this attention.[5] Dr. Neil Cherry, a prominent and vocal local professor, brought negative attention to towers by regularly publishing the possible health hazards relating to these structures.[6] This media attention had an impact on the results of the studies outlined next.

The Opinion Survey

The Bond and Beamish opinion survey study included residents in ten suburbs: five case study areas (within 100 feet of a cell phone tower) and five control areas (over 0.6 of a mile from a cell phone tower). Eighty questionnaires[7] were distributed in each of the ten suburbs in Christchurch (i.e., 800 surveys were delivered in total). An overall response rate of 46% was achieved.

The survey study results were mixed, with responses from residents ranging from having no concerns to being very concerned about proximity to a tower. In both the case study and control areas, the impact of proximity to towers on future property values is the issue of greatest concern for respondents. If purchasing or renting a property near a tower, over one-third (38%) of the control group respondents would reduce the price of their property by more than 20%. The perceptions of the case study respondents were less negative, with one-third of them saying they would reduce price by only 1%–9%, and 24% would reduce price by between 10% and 19%.

Transaction-Based Market Study

The Bond and Wang market transaction-based regression study included 4283 property sales, in four suburbs, that occurred between 1986 and 2002 (approximately 1000 sales per suburb). The sales data from before a tower was built was compared to sales data after a tower had been built to determine any variance in price, after accounting for all the relevant independent variables.

Interestingly, the effect of a tower on price (a decrease of between 20.7% and 21%) was very similar in the two suburbs where the towers were built in 2000, after the negative media publicity given to towers following the two legal cases outlined above. In the other two suburbs, the results indicated a tower was either insignificant or increased prices by around 12%, where the towers had been built in 1994, prior to the media publicity.

The main limitation affecting this study was that there was no accurate proximity measure included in the model. A subsequent study was performed using GIS analysis to determine the impact that distance to a tower has on residential property prices. The results from that study are outlined next.

Proximity Impact Study

The Bond and Xue study conducted in 2004 involved analysis of the residential transaction data using the same hedonic framework as the previous Bond and Wang study. It also included the same data as the previous study, but added six suburbs to give a total of ten suburbs: five suburbs with towers located in them and five control suburbs without towers. In addition, the geographical (x, y) coordinates that relate

2. Bond and Beamish, "Cellular Phone Towers: Perceived Impact on Residents and Property Values."
3. Bond and Wang, "The Impact of Cell Phone Towers on House Prices in Residential Neighborhoods."
4. Bond and Xue, "Cell Phone Tower Proximity Impacts on House Prices: A New Zealand Case Study."
5. *McIntyre v. Christchurch City Council,* NZRMA 289 (1996), and *Shirley Primary School v. Telecom Mobile Communications Ltd.*, NZRMA 66 (1999).
6. For example see Neil Cherry, *Health Effects Associated with Mobil Base Stations in Communities: The Need for Health Studies*, Environmental Management and Design Division, Lincoln University (June 8, 2000); available at http://pages.britishlibrary.net/orange/cherryonbasestations.htm.
7. Approved by the University of Auckland Human Subjects Ethics Committee (reference 2002/185).

to each property's absolute location were included. A total of 9,514 geocoded property sales were used (approximately 1000 sales per suburb).

In terms of the effect that proximity to a tower has on price the overall results indicate that this is statistically significant and negative. Generally, the closer a property is to the tower, the greater the decrease in price. The effect of proximity to a tower reduces price by 15% on average. This effect is reduced with distance from the tower and is negligible after 1000 feet.

The study reported here, outlined next, adds to the growing body of evidence and knowledge from around the world on property value effects from cell phone towers.

Florida Market Study

The Data

Part of the selection process was to find case study areas where a tower had been built that had a sufficient number of property sales to provide statistically reliable and valid results. Sales were required both before and after the tower was built to study the effect of the existence the tower had on the surrounding property's sale prices.

Case study areas were selected using both GIS maps that showed the location of cellular phone towers, and sale price and descriptive data about each property located in Orange County. The maps and sales data were obtained from the Florida Geographic Data Library (FGDL).[8]

Approximately 60% of the towers located in Orange County were constructed between the years 1990 and 2000. Additionally, frequency distributions of properties sold during that period indicate that twenty of the towers have the greatest potential for impact on the price of residential properties, based on the greatest number of residential properties close to each tower. These twenty towers were selected to construct a data set for the study.

Parcel data recorded in the FGDL was collected from the Office of the Property Appraiser for Orange County, Florida.[9] Residential properties that sold between 1990 and 2000 (the years the towers were constructed) and that are closest to the twenty towers were selected. Areas close to Interstate 4 and limited access roads were avoided to ensure sale prices (i.e., home buyers' choices) were not affected by highway access or traffic noise variables. Similarly, properties south of Colonial Drive were avoided due to the lower socioeconomic nature of that location. The final areas were selected after site visits had been made to verify that each mapped tower existed, to confirm the location of the homes to the tower, and to ensure nonselected towers were not located near the homes that might impact on the study results. Overall, 5783 single-family, residential properties were selected from northeast Orange County (see the Location Map in the Appendix).

Variables

The study investigates the potential impact of proximity to a tower on the price of residential property, as indicated by the dependant variable *SALE_PRICE*.[10] The study controls for site and structural characteristics by assessing the impact of various independent variables. The independent data set was limited to those available in the data set and known to be related to property price, based on other well-tested models reported in the literature and from valuation theory. The independent variables selected include lot size in square feet (*LOT*), floor area of the dwelling in square feet (*SQFT*), age of the dwelling in years (*AGE*), the time of construction (*AFTER_TWR*), the closest distance of each home to the associated tower (*DISTANCE*), and the dwelling's absolute location is indicated by the Cartesian coordinates (*XCOORD*) and (*YCOORD*).[11]

The effect of construction of a tower on price is taken into account by the inclusion of the dummy, independent variable *AFTER_TWR*. By including *AFTER_TWR*, property prices prior to tower construction can be compared with prices after tower construction.[12] Frequency distributions indicate that

8. The FGDL is an assemblage of virtually every geographic data set for Florida that the GeoPlan Center of the University of Florida was able to obtain, this mostly from government sources, including the Federal Communications Commission.
9. As reported to the Florida Department of Revenue.
10. Model 1 and Model 2 estimate the log of the *SALE_PRICE*.
11. For further discussion of the significance of the absolute location in the form of {*x*, *y*} coordinates see Timothy J. Fik, David C. Ling, and Gordon F. Mulligan, "Modeling Spatial Variation in Housing Prices: A Variable Interaction Approach," *Real Estate Economics* 31 (Winter 2003): 647–670.
12. Dummy variables for each year of residential sales were also incorporated into both model specifications to control for the potential effects of time on the price of residential property.

among the residential properties sold between 1990 and 2000, approximately 80% of the residential properties were sold after tower construction.

Based on the parcel and tower data for Orange County, the mean sale price of single-family, residential property that sold between 1990 and 2000 is \$113,830. The mean square footage is 1535 square feet, the mean lot size is 8525 square feet, and the mean age is 14 years. The mean distance from a residential property to a tower is 1813 feet.[13] Descriptive statistics for select variables are presented in Table 1.

Research Objectives and Methodology

The study hypothesis is that in areas where a tower is constructed, it will be possible to observe discounts made to the selling prices of homes located near these structures. Such a discount will be observed where buyers of homes close to the towers perceive them in negative terms due to, for example, the risk of adverse health, or aesthetic and property value effects.

The literature dealing specifically with the measurement of the impact of environmental hazards on residential sale prices (including proximity to transmission lines, landfill sites, and groundwater contamination) indicates the popularity of hedonic pricing models, as introduced by Court[14] and later Griliches[15] and further developed by Freeman[16] and Rosen.[17] The standard hedonic methodology was used to quantify the effect of cellular phone towers on sale prices of homes located near these. GIS was also adopted to aid the analysis of distance to the towers.

Model Specification

In hedonic housing models the linear and log-linear models are most popular. The linear model implies constant partial effects between house prices and housing characteristics, while the log-linear model allows for nonlinear price effects and is shown in the following equation:

$$\ln P_i = b_0 + b_1 X_{1,i} + b_2 X_{2i} + b_3 X_{3i} \ldots + b_n X_{n+1} + a_o D_o + \ldots + a_m D_m + e_{0\ldots}$$

where:

$\ln P_i$ = the natural logarithm of sale price

b_0 = the intercept

$b_1 \ldots b_n$; $a_o \ldots a_m$ = the model parameter to be estimated, i.e., the implicit unit prices for increments in the property characteristics

$X_1 \ldots X_n$ = the continuous characteristics, such as land area

$D_o \ldots D_m$ = the categorical (dummy) variables, such as whether the sale occurred before (0) or after (1) the tower was built

Sometimes the natural logarithm of land area and floor area is also used. The parameters are estimated by regressing property sales on the property characteristics and are interpreted as the households' implicit valuations of different property

Table 1 Descriptive Statistics for Selected Variables, Orange County, Florida

Variable	Mean	Std. Dev.	Min.	Max.
SALE_PRICE	113830.6	58816.68	45000	961500
SQFT	1535.367	503.8962	672	5428
LOT	8525.193	4363.28	1638	107732
AGE	13.92755	10.03648	0	35
XCOORD	664108.9	6130.238	640460	671089
YCOORD	511489.4	2422.946	506361	531096
DISTANCE	1813.077	725.5693	133	6620

Notes: n = 5783. Polynomial expansions of the independent variables, identified by the $VARIABLE^2$ were included in the interactions in the two model specifications discussed in the methodology.

13. Initially, *HEIGHT* was also included among the explanatory variables. However, the *HEIGHT* variable provided no significant explanatory power.
14. A. T. Court, "Hedonic Price Indexes with Automotive Examples," in *The Dynamics of Automobile Demand* (New York: General Motors, 1939).
15. Zvi Griliches, ed., *Price Indexes and Quality Change* (Cambridge, Mass.: Harvard University Press, 1971).
16. A. Myrick Freeman, III, *The Benefits of Environmental Improvement: Theory and Practice* (Baltimore: Johns Hopkins University Press, 1979).
17. Sherwin Rosen, "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition," *Journal of Political Economy* 82, no. 1 (Jan/Feb 1974): 34–55.

attributes. The null hypothesis states that the effect of being located near a tower does not explain any variation in property sale price.

To address the many difficulties in estimating the composite effects of externalities on property price an interactive approach is adopted.[18] To allow the composite effect of site, structure, and location attributes on the value of residential property to vary spatially, they are interacted with the Cartesian coordinates that are included in the model.[19]

Unless the hedonic pricing equation provides for interaction between aspatial and spatial characteristics, the effects of the explanatory variables on the dependant variable will likely be underestimated, misspecified, undervalued, or worse, overvalued. Including the Cartesian coordinates in the model is intended to increase the explanatory power of the estimated model and reduce the likelihood of model misspecification by allowing the explanatory variables to vary spatially and by removing the spatial dependence observed in the error terms of aspatial, noninteractive models.

Empirical Results

The model of choice is one that best represents the relationships between the variables, and has a small variance and unbiased parameters. Adhering to the methodology proposed by Fik, Ling, and Mulligan,[20] various empirical models were selected and progressively tested. The models were based on other well-tested hedonic housing price equations reported in the literature to derive a best-fit model.

To test the belief that the relationship between *SALE_PRICE* and other specific independent variables such as *SQFT*, *AGE*, and *DISTANCE* is not a linear function of *SALE_PRICE*, the variables were transformed to reflect the correct relationship. It was found that the best result was obtained from using the log of *SALE_PRICE* and the square of *SQFT, AGE*, and *DISTANCE*.

The methodology progresses from an interactive model specification, which controls for site and structural attributes of residential property as well as the effects of absolute location, to a model that incorporates the impact of explicit location to measure the effects of the proximity to towers (as indicated by *DISTANCE*) on the sale prices of residential property.

Preliminary tests of each model, proceeding from interactive aspatial and spatial estimates, were executed to identify an appropriate polynomial order, or a model that provided the greatest number of statistically significant coefficients and the highest adjusted R-squared value.[21] Like the study by Fik, Ling, and Mulligan, sensitivity analyses suggested the use of a fourth-order model, at most. Similarly, the following model specifications are estimated with a stepwise regression procedure to minimize the potential for model misspecification due to multicollinearity and to ensure that only the independent variables offering the greatest explanatory power are included in the second model. The study used Levene's test for equality of variances. The assumption of homoskedasticity, like the assumption of normality, has been satisfied.

Model 1 was utilized as a benchmark for the second model. The sale price (*SALE_PRICE*) is estimated using the following independent variables: lot size (*LOT*); square footage of the dwelling (*SQFT*); age of the dwelling in years (*AGE*); and the dwelling's absolute location (*XCOORD*) and (*YCOORD*). To investigate the effect of tower construction on the price of homes, the dummy variable (*AFTER_TWR*) was also included. Residential sale prices prior to tower construction ($AFTER\_TWR = 0$) were compared to sale prices after tower construction ($AFTER\_TWR = 1$). With the addition of the absolute location, Model 1 was used to provide a sound model specification, to maximize the explanatory value of the study and minimize the potential for misspecification in the estimated second model.

Model 2 includes distance-based measures indicating the property's explicit location, with respect to the closest tower. Both explicit distance and the distance squared were included. Model 2 integrated the base model (Model 1) with the distance from the tower to the property. The independent variable *DISTANCE* is introduced in the model and interacted

18. Externalities include influences external to the property such as school zoning, proximity to both amenities and disamenities, and the socioeconomic make-up of the resident population.
19. Model misspecifications could include inaccurate estimates of the regression coefficients, inflated standard errors of the regression coefficients, deflated partial *t*-tests for the regression coefficients, false nonsignificant *p*-values, and degradation of the model predictability.
20. Fik, Ling, and Mulligan.
21. Ibid., 633.

with the variables from Model 1. This model is used to assess the variation in sale price due to proximity to a tower.

Table 2 shows the development of a spatial and fully interactive model specification to estimate the effects of the proximity to towers on the price of residential property, according to Model 1, the base model.

In the semilogarithmic equation the interpretation of the dummy variable coefficients involves the use of the formula $100(e^{b_n}-1)$, where b_n is the dummy variable coefficient.[22] This formula derives the percentage effect on price of the presence of the factor represented by the dummy variable.

Results from Model 1 suggest that the price of residential properties sold after the construction of a tower increases by 1.47% (i.e., *AFTER_TWR* = 1.46E-02). Interactions with *AFTER_TWR* and other variables also suggest an increase in the price for single-family residential properties sold after tower construction. Among the control variables, *SQFT* increases price by 0.039% with each additional square foot of space (i.e., *SQFT* = 3.88E). *AGE* reduces price by 0.25% for each additional year of age. The *t*-statistics for the explanatory variables *SQFT, AGE, XCOORD,* and *YCOORD* suggest significant explanatory power within the specification (i.e., *SQFT* = 47, AGE^2 = 7, XCOORD = -7.105 and *YCOORD* = 6.799). Model 1 accounts for 82% of the variation in the *SALE_PRICE* (i.e., Adj. *R*-Squared = 0.8219987).

Model 2 introduces the independent variable *DISTANCE* to assess the variation in sale price due to the external effect of a tower. The Model 2 results are presented in Table 3; Table 4 provides a summary of the distance results.

The results clearly show that the price of residential property increases with the distance from a tower. The independent variable, *DISTANCE*, estimates a coefficient with a positive sign, which increases with increasing distance from the tower (i.e., *DISTANCE* = 5.69E-05). As distance from the tower increases by 10 feet, price of a residential property increases by 0.57%. Moreover, the *t*-statistic associated with the estimated coefficient indicates the significance of the explanatory power of this variable (i.e., *t*-statistic = 10.751).

DISTANCE presents significant interactions with the other independent variables. The *t*-statistics associated with these interactions provide strong evidence that the price of residential property, while highly associated with site and structural characteristics, may be significantly impacted by proximity to towers (i.e., *AFTER_TWR*DISTANCE* = 3.519; $DISTANCE^2$ = -12.258; *DISTANCE*AGE* = 4.829).

Further, although the estimated effect of the explanatory variable *AFTER_TWR* continues to suggest that the value of residential property increases with the distance from towers, the interactive nature of *AFTER_TWR* with $DISTANCE^2$ suggests that the effect of *AFTER_TWR* may vary due to varying distances from the tower. Indeed, the estimated coefficient for *AFTER_TWR* from Model 1 is diminished in Model 2 when the explicit, distance-based locational attribute is included in the model specification (i.e., Model 1, *AFTER_TWR* = 1.46E-02 (1.47%); Model 2, *AFTER_TWR* = 0.012722 (1.28%)).

Table 2 Model 1 Results

Variables	Est. Coefficient	Std. Error	Std. Coefficient	*t*-Stat	Significance
Constant	3.689244	0.257416		14.332	0.0000
AFTER_TWR	1.46E-02	5.08E-03	0.0353	2.867	0.0042
*AFTER_TWR*AGE*	5.99E-04	2.62E-04	0.0395	2.290	0.0221
*AFTER_TWR*LOT*	8.79E-07	2.91E-07	0.0272	3.018	0.0026
SQFT	3.88E-04	8.20E-06	1.2072	47.368	0.0000
$SQFT^2$	-3.02E-08	1.90E-09	-0.3779	-15.912	0.0000
*SQFT*AGE*	3.52E-07	1.78E-07	0.0429	1.982	0.0475
AGE	-2.81E-03	5.17E-04	-0.1739	-5.429	0.0000
AGE^2	7.12E-05	9.94E-06	0.1527	7.165	0.0000
XCOORD	-1.14E-06	1.61E-07	-0.0432	-7.105	0.0000
YCOORD	3.05E-06	4.48E-07	0.0456	6.799	0.0000

Notes: n = 5783. Adjusted R^2 = 0.8219987.

22. Robert Halvorsen and Raymond Palmquist, "The Interpretation of Dummy Variables in Semilogarithmic Equations," *American Economic Review* 70, no. 3 (June 1980): 474–475.

Table 3 Model 2 Results

Variable	Est. Coefficient	Std. Error	Std. Coefficient	*t*-Stat	Significance
Constant	3.097387	0.268028		11.556	0.0000
AFTER_TWR	0.012722	4.42E-03	0.0309	2.877	0.0040
*AFTER_TWR*AGE*					
*AFTER_TWR*LOT*	1.26E-06	2.86E-07	0.0389	4.400	0.0000
*AFTER_TWR*DISTANCE*^{2}	2.72E-09	7.73E-10	0.0550	3.519	0.0004
SQFT	4.01E-04	8.45E-06	1.2464	47.460	0.0000
SQFT^2	-3.04E-08	1.93E-09	-0.3797	-15.726	0.0000
*SQFT*AGE*					
AGE	-2.80E-03	3.95E-04	-0.1731	-7.077	0.0000
AGE^2	6.72E-05	9.70E-06	0.1442	6.931	0.0000
XCOORD	-1.61E-06	1.63E-07	-0.0610	-9.911	0.0000
YCOORD	4.70E-06	4.80E-07	0.0702	9.798	0.0000
DISTANCE	5.69E-05	5.29E-06	0.2548	10.751	0.0000
DISTANCE^2	-1.49E-08	1.22E-09	-0.2927	-12.258	0.0000
*DISTANCE*AGE*	6.20E-07	1.28E-07	0.0909	4.829	0.0000
*DISTANCE*SQFT*	-5.43E-09	2.71E-09	-0.0568	-2.002	0.0453

Notes: n = 5783. Adjusted R^2 = 0.8282641

Table 4 Summary of Model 2 Location Results

Variable	Estimated Coefficient (% Impact on Price)
DISTANCE	5.69E-05 (5.69-03%)
DISTANCE^2	-1.49E-08

Note: ADJ. R^2 = 0.8282641

Limitations

This study analyzed residential property sales from different but neighboring suburbs as an entire data set, i.e., the suburbs were grouped together and analyzed as a whole. The absolute location was included in the model to take into account composite externalities as well as to allow these and other independent variables in the model to vary spatially, and therefore preclude the need to analyse neighborhoods separately. However, it is possible that not all neighborhood differences were accounted for.

For example, when comparing these results to those from the NZ study by Bond and Xue, it appears the results from both studies based on an analysis of the whole data set were similar. Towers have a statistically significant, but minimal, effect on the prices of proximate properties. However, what the NZ study showed by analyzing the suburbs separately was that substantive differences exist in the effect that towers have on property prices between suburbs, since the distribution of the property sale prices is quite different in each. It is possible that if the current study had analyzed suburbs separately that similar differences would have been found.

Summary and Conclusions

This article presents the results of a study carried out in Florida in 2004. The study involved the analysis of market transaction data of single-family homes that sold in Orange County between 1990 and 2000 to investigate the effect on prices of property in close proximity to a tower. The results showed that while a tower has a statistically significant effect on prices of property located near a tower, this effect is minimal.

Each geographical location is unique. Residents' perceptions and assessments of risk vary according to a wide range of processes including psychological, social, institutional, and cultural. The results of this study may vary with the NZ results not only due to the differences in study design (for example, this study excluded an analysis at a neighborhood level), but also due to differences in the landscape. In New Zealand, there are fewer structures such as high voltage overhead transmission lines, cell phone towers, and billboards than there are in the United States. As a result, it is possible that U.S. residents simply have become accustomed to these features and so notice them less.

The value effects from towers may vary over time as market participants' perceptions change due to increased public awareness regarding the potential (or lack of) adverse health and other effects of living near a towers. Further research into factors that impact on the degree of negative reaction from residents living near these structures could provide useful insights that help explain the effects on property price. Such factors might include, for example, the kinds of health and other risks residents associate with towers; the height, style, and appearance of the towers; how visible the towers are to residents and how they perceive such views; and the distance from the towers residents feel they have to be to be free of concerns.

As the results reported here are from a case study conducted in 2004 in a specific geographic area (Orange County, Florida) the results should not be generally applied. As Wolverton and Bottemiller explain,

> The 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.[23]

Thus, many similar studies in different geographic locations would need to be conducted to determine if the results are consistent across time and space. Such studies would need to be of similar design, however, to allow valid comparison between them. As suggested by Bond and Wang, the sharing of results from similar studies would aid in the development of a global database to assist appraisers in determining the perceived level of risk associated with towers and other similar structures from geographically and socioeconomically diverse areas.

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Bond is currently a senior lecturer at Curtin University of Technology. Her doctoral research was on the assessment of stigma relating to remediated contaminated property. Her current areas of research interest include the valuation of contaminated land, the impact of cell phone towers and high voltage transmission lines on residential property values, and public sector asset valuation. She has published numerous articles in journals in New Zealand, Australia, Malaysia, the United Kingdom, and the United States, and was responsible for drafting the NZPI Practice Standard on the Valuation of Contaminated Sites. **Contact: dr_sandybond@yahoo.com**

Additional Reading

Christchurch City Council Web site at http://www.ccc.govt.nz/index.asp

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23. Marvin L. Wolverton and Steven C. Bottemiller, "Further Analysis of Transmission Line Impact on Residential Property Values," *The Appraisal Journal* (July 2003): 252.

Appendix

Location Map, Orange County, Florida