High-Voltage Transmission Lines: Proximity, Visibility, and Encumbrance Effects

by James A. Chalmers, PhD, and Frank A. Voorvaart, PhD

ABSTRACT

In this study, over 1,200 home sales in 1998–2007 are aggregated into four study areas with a 345-kV transmission line. Field data are collected on the sale properties relative to proximity to and visibility of transmission line towers, and the extent of encumbrance by a transmission line easement. A multiple regression model is used to test whether the sale prices are affected by line proximity, tower visibility, or property encumbrance. In both continuous distance and distance zone models, the proximity and visibility variables typically fail to be statistically significant. The only variable that appears to have any systematic effect is the encumbrance variable; however, its magnitude is generally small.

There will be a significant expansion of the 345-kV transmission grid in New England over the next decade; this has raised issues on the potential effects of transmission lines on the value of nearby properties.[1] As will be reviewed briefly, the professional literature on the impact of high-voltage transmission lines (HVTLs) on residential real estate values is extensive. While the literature creates a relevant foundation for addressing the potential effects of new 345-kV transmission lines on property values, the current research is designed to investigate three outstanding issues.

First, most of the literature is somewhat dated. Of the most important studies (those that examined large numbers of sales using statistical procedures), only one study analyzes data from a period subsequent to 2000.[2] Since attitudes, behaviors, and their reflection in the market can change over time, it is important to have contemporary evidence on the question of possible property value effects.

Second, the construction that motivates this study is specific to 345-kV lines (which are mostly on 130-foot steel poles), while the historical research has no such focus and only occasionally has dealt with this corridor configuration.

Third, a careful analysis has to look at the interaction of three interrelated variables–proximity, visibility, and the extent to which an adjoining property is actually encumbered by the transmission line right-of-way easement. Since proximity and encumbrance are highly correlated, the effects of one could be

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1. This research was carried out under contract to Northeast Utilities over the period April 2008–October 2008 High-voltage transmission lines carry currents of 138 kilovolts (kV) up to 765 kV; see Energy Information Administration, "The U.S. Electric Power Industry Infrastructure: Functions and Components," in *The Changing Structure of the Electric Power Industry 2000: An Update* (Washington, DC: U.S. Department of Energy, 2000), available at http://www.eia.doe.gov/cneaf/electricity/chg_stru_update/chapter3.html.
2. These studies will be referenced and summarized in the next section.

attributed to the other if both are not adequately accounted for. Similarly, the effects of visibility and proximity must be considered in tandem if the effect of each is to be properly measured.

In the course of this research, three additional questions were investigated: (1) are higher-valued properties more vulnerable to HVTL effects than lower-valued properties? (2) are properties in general more vulnerable to HVTL effects in a down housing market? and (3) since much of the proposed expansion of the grid will take place in existing utility corridors, how can the incremental effect of these expansions be measured?

Summary of the Literature

Methodology

Reliable evidence of the effect of HVTLs on the value of adjacent or nearby residential property must rely on actual, arm's-length sales of property that lie in close proximity to an existing line. These sales are then compared to other selected transactions involving properties located outside of the potential area of influence.[3] The three most common approaches for performing this comparison are paired data analysis, retrospective appraisal, and multiple regression analysis.

Paired Data Analysis. The paired data approach attempts to match the characteristics of a subject property sold within a claimed area of impact (the subject area) with individual sales of similar properties sold outside the claimed area of impact (the control area). The issues here center on the availability of sales and the ability to identify sales that can be considered a match to the subject property.[4]

Retrospective Appraisal Based on Control Properties. The retrospective appraisal approach recognizes that a perfect match is unlikely and relies on standard residential appraisal sales comparison methodology. A subject property is selected that has been sold, and it is then appraised retrospectively, i.e., at the date of its historical sale. The appraised value based on control area comparables can then be compared to the actual sale price to see if the HVTL had any effect on the sale price of the subject property. This is obviously an improvement over the paired data analysis, but still suffers from the fact that, as discussed later, the effects under investigation are likely to be small, and may well be within the error range of standard appraisal methodology.

Multiple Regression Analysis of Large Numbers of Subject and Control Area Sales. The third approach, multiple regression analysis, uses statistical tools to try to isolate the effects of the HVTL from all of the other determinants of value. This is only possible with a relatively large number of subject area and control area sales. If the sales, property, and neighborhood data exist to carry out this approach, it is ideally suited to identifying the independent effect of the transmission line, holding the other value-determining factors constant.[5] In addition, it is the least subjective of the three potential approaches and is the only approach to give explicit measures of reliability, which helps the user determine what weight to give the results.

Conclusions from the Literature

While the literature on the effect of HVTLs on property values is extensive, it is of uneven quality, ranging from anecdotal reports to large, rigorously conducted statistical studies. Several hundred articles were reviewed as part of the current study, and thirty-eight had direct relevance to either the methodological or empirical questions at issue here. These are referenced in footnotes or in the Additional Reading section at the end of this article.

Over the past twenty-five years, the literature has increasingly recognized multiple regression analysis as the most reliable technique to investigate whether HVTLs impact property values and, if so, to quantify the effect. As mentioned, multiple regression has the significant advantage of not relying on the subjective judgment of the appraiser. Rather, it represents an objective reflection of the data together with measures of reliability that attach to the results. A large number of studies have been undertaken since the 1980s using large databases and statistical

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[3] Analysis of trends, days on market, or turnover rates can be suggestive of the existence of effects, but are not useful in quantifying the magnitude of the effect. Surveys of market participants can also be instructive as to how these effects are perceived, but are no substitute for analysis of how these effects actually manifest themselves in the market.

[4] The problem with this approach is evident by a review of residential appraisals; despite best efforts to find comparables, it is very rare to see a comparison sale to which no adjustments are made.

[5] For a general discussion of the methodological issues associated with multiple regression, see Thomas O. Jackson, "Evaluating Environmental Stigma with Multiple Regression Analysis," *The Appraisal Journal* (Fall 2005): 363–369.

tools to investigate the effect of transmission lines on property values. Sixteen of these studies form the core of the professional literature and are widely quoted and cross-referenced one to the other.[6] The results of these studies can be generally summarized as follows:

- Over time, there is a consistent pattern with about half of the studies finding negative property value effects and half finding none.
- When effects have been found, they tend to be small; almost always less than 10% and usually in the range of 3%–6%.
- Where effects are found, they decay rapidly as distance to the lines increases and usually disappear at about 200 feet to 300 feet (61 meters to 91 meters).
- Two studies investigating the behavior of the effect over time find that, where there are effects, they tended to dissipate over time.
- There does not appear to have been any change in the reaction of markets to high-voltage transmission line proximity after the results of two widely publicized Swedish health-effects studies were preliminarily released in 1992.[7]

These general conclusions have characterized the appraisal and economic literature throughout the last twenty-five years, and there do not appear to be any new or different trends in the research. It is during this period that most of the medical studies on electromagnetic field (EMF) exposure were published, including the oft-referenced Swedish studies. One of the questions, therefore, is the apparent inconsistency between these statistical results and the intensity of opposition that new transmission line corridors generate. How can it be that if people are so intensely adverse to HVTLs, we do not see more of a market effect? This inconsistency is seen clearly when residents along existing HVTLs are interviewed.

The basic thrust of survey questioning is whether home purchasers were aware of the transmission lines prior to their purchases and, if so, whether their purchase decisions or the prices they paid were affected by the lines.[8] Like the statistical analyses of sales, the results of these survey studies are quite consistent with one another. Their findings can be summarized as follows:

- A high proportion of the residents were aware of the lines at the time of purchase.

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[6] The sixteen referenced articles are the following: Judith Callanan and R.V. Hargreaves, “The Effect of Transmission Lines on Property Values: A Statistical Analysis,” *New Zealand Valuers Journal* (June 1995): 35–38; Peter F. Colwell, “Power Lines and Land Values,” *Journal of Real Estate Research* 5, no. 1 (Spring 1990): 117–127; Peter F. Colwell and Kenneth W. Foley, “Electric Transmission Lines and the Selling Price of Residential Property,” *The Appraisal Journal* (October 1979): 490–499; J. R. Cowger, Steven C. Bottemiller, and James M. Cahill, “Transmission Line Impact on Residential Property Values: A Study of Three Pacific Northwest Metropolitan Areas,” *Right of Way* (September/October 1996): 13–17; François Des Rosiers, “Power Lines, Visual Encumbrance and House Values: A Microspatial Approach to Impact Measurement,” *Journal of Real Estate Research* 23, no. 3 (2002): 275–301; Murtaza Haider, “Influence of Power Lines on Freehold Property Values in the Greater Toronto Area” (Series in Spatial Econometrics, University of Toronto, January 2000); S. W. Hamilton and Cameron Carruthers, “The Effects of Transmission Lines on Property Values in Residential Areas” (University of British Columbia, Vancouver, April 1993); Stanley W. Hamilton and Gregory M. Schwann, “Do High Voltage Electric Transmission Lines Affect Property Value?” *Land Economics* 71, no. 4 (November 1995): 436–444; Patrice C. Ignelzi and Thomas Priestley, *A Statistical Analysis of Transmission Line Impacts on Residential Property Values in Six Neighborhoods* (Southern California Edison Environmental Affairs Division, 1991); William N. Kinnard, Jr., Mary Beth Geckler, and Jake W. DeLottie, *Post-1992 Evidence of EMF Impacts on Nearby Residential Property Values (Nevada)* (Storrs, CT: Real Estate Counseling Group of Connecticut, Inc., April 1997); William N. Kinnard, Jr., Mary Beth Geckler, and Jake W. DeLottie, *Post-1992 Evidence of EMF Impacts on Nearby Residential Property Values (Missouri)* (Storrs, CT: Real Estate Counseling Group of Connecticut, Inc., April 1997); William N. Kinnard, Jr., Phillip S. Mitchell, and James R. Webb, “The Impact of High-Voltage Overhead Transmission Lines on the Value of Real Property” (paper presented at Fifth Annual American Real Estate Society Conference, Arlington, VA, April 1989); William N. Kinnard, Jr., Mary Beth Geckler, and Phillip S. Mitchell, *Effects of Proximity to High-Voltage Electric Transmission Lines on Sales Prices and Market Values of Vacant Land and Single-Family Residential Property: January 1978–June 1988* (Storrs, CT: Real Estate Counseling Group of Connecticut, Inc., 1988); William N. Kinnard, Jr., Mary Beth Geckler, and Phillip S. Mitchell, *An Analysis of the Impact of High Voltage Electric Transmission Lines on Residential Property Values in Orange County, New York* (Storrs, CT: Real Estate Counseling Group of Connecticut, Inc., 1984); Phillip S. Mitchell and William N. Kinnard, Jr., “Statistical Analysis of High-Voltage Overhead Transmission Line Construction on the Value of Vacant Land,” *Valuation* (June 1996): 23–29; and Marvin L. Wolverton and Steven C. Bottemiller, “Further Analysis of Transmission Line Impact on Residential Property Values,” *The Appraisal Journal* (July 2003): 244–252.

[7] The two studies are Maria Feychting and Anders Ahlbom, “Magnetic Fields and Cancer in Children Residing Near Swedish High-Voltage Power Lines,” *American Journal of Epidemiology* 138, no. 9 (1993): 467–481; and Birgitta Floderus et al., “Occupational Exposure to Electromagnetic Fields in Relation to Leukemia and Brain Tumors: A Case-Control Study in Sweden,” *Cancer Causes Control* 4 (1993): 465–476. The results of these two studies were released preliminarily in 1992 by Susan Kolare, “Power Lines Increase Cancer Risk for Children,” *Forskning & Praktik* (Solna, Sweden: National Institute of Occupational Health) (July 1992): 387–388; and Lars Gronkvist, “Cancers Related to Strong Electromagnetic Fields,” *Forskning & Praktik* (Solna, Sweden: National Institute of Occupational Health) (July 1992): 383–385.

[8] Five studies are prominent in the literature: William N. Kinnard, Jr., “Tower Lines and Residential Property Values,” *The Appraisal Journal* (April 1967): 269–284; Thomas Priestley and Gary Evans, *Perceptions of a Transmission Line in a Residential Neighborhood: Results of a Case Study in Vallejo, California,* Southern California Edison Environmental Affairs Division, December 1990; Hsiang-te Kung and Charles F. Seagle, “Impact of Power Transmission Lines on Property Values: A Case Study,” *The Appraisal Journal* (July 1992): 413–418; Sandy G. Bond, “The Impact of Transmission Lines on Property Values” (paper presented at Twelfth Annual American Real Estate Society Conference, South Lake Tahoe, CA, March 1996); and Cheryl Mitteness and Steve Mooney, “Power Line Perceptions: Their Impact on Value and Market Time” (College of Business, St. Cloud State University, 1998).

- Between one-half and three-fourths of the respondents have negative feelings about the lines.
- The negative feelings center on fear of health effects, aesthetics, and property-value effects.
- Of those who have negative feelings about the lines, the vast majority (67%–80%) report that the purchase decision and the price they offered to pay were not affected by the lines.

In summary, the relatively small effects on property value attributed to HVTL proximity in the literature does not mean that the direction of the effect of transmission lines on property values is not negative. The general interpretation is that, even though transmission line issues have been a prominent concern in most of the communities studied, and even though the direction of effect on real estate value is generally negative, the presence of transmission lines is apparently not given sufficient weight by buyers and sellers of real estate to have had any consistent, material effect on property values.

Connecticut and Massachusetts 2008 Case Study

Study Area Selection

Given the anticipated expansion of the 345-kV transmission grid in New England over the next decade, this study focused on Connecticut and Massachusetts. The objective was to find both rural residential and suburban residential developments along existing 345-kV corridors where the effects of the lines could be studied. The study called for at least 10 years of sales data (1998–2007). The criteria for study area selection were (1) the existing transmission corridor had to contain a 345-kV line, preferably on 130-foot steel poles; (2) the line had to have been built by 1997; and (3) the development patterns along the corridor had to produce a sufficient number of sales to make statistical analysis feasible.

Based upon a combination of field inspection, review of aerial photography, and review of maps of the existing electric transmission grid, nine areas were selected for the study.[9] Table 1 describes the location, configuration of transmission lines, and number of records for each area for the 10-year period analyzed in this study; maps of the specific locations are shown in the Appendix 1.

Database Development

Once the study areas had been selected, local appraisers were retained to assist in the data collection process.[10] A download from the Warren Group identified all sales within a set of street addresses that had been developed to describe an area that approximated 2,000 feet on either side of the transmission line corridor. Using this information, appraisers collected the assessors' record and the multiple listing service (MLS) "sold record" for each of the transactions in the data set. A sales database containing the information shown in Table 2 was then populated for each sale transaction.

Next, the sales database record for each property was returned to the appraisers together with a hard copy of the assessors' record and the MLS sheet. The appraisers were then asked to visit each property and record its location coordinates with a GPS device at the street curb opposite the front door. When obtaining the location information, they were also asked to verify the data entry to the sales database and to opine as to whether, in their judgment, the sale appeared to be an arm's-length transaction.

Next, the appraisers recorded the extent to which the transmission line structures were visible from the property.[11] For each property, the appraisers were given an aerial photograph that showed and labeled all structures in the vicinity of the property. Since the field observations were taken in July and August, it was important for the appraisers to know where structures might potentially be seen. Standing at the street curb, they made three observations and took photos of each; one from the right edge of the property, one from the left edge of the property, and one from the point on the street curb opposite the front door. These views were then coded for up to three of the most visible structures (or structure combinations) from each of the three locations.[12] Visibility was rated as follows:

- Highly Visible–At least one arm holding a conductor is fully visible and not obscured by trees or foliage.

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[9] When this research began, the number of sales that occurred in each area over the 10-year period was unknown. It was anticipated that some of the areas could be aggregated in the final analysis.

[10] Race Appraisal Services, LLC, was retained for the four Massachusetts study areas, Oles & Jerram, Inc., for the three western Connecticut areas, and Archambault & Murray Appraisal Group for the two north-central Connecticut areas.

[11] Structures would include steel poles, steel lattice towers, and wood H-frame towers.

[12] In instances where a 345-kV structure was collocated with a 115-kV line or another 345-kV line, visibility ratings to both structures were recorded.

Table 1 Study Area Locations and Transmission Line Configurations

Area	Location	Transmission Line Configuration	Total Records Considered
Study Area 1			
Subarea 1.1 (South-Central MA)	Located in Ludlow, Hampton County, MA, approx. 5 miles east of I-291 and bordered by I-90 to the north.	345-kV line supported by steel poles and 115-kV line supported by H-frame structures.	71
Subarea 1.2 (South-Central MA)	Located on the CT and MA border in East Longmeadow, Hampton County, MA, approx. 7 miles east of I-91.	345-kV line supported by steel poles and 115-kV line supported by H-frame structures.	35
Subarea 1.3 (North-Central CT)	Located in Bloomfield, Hartford County, CT, approx. 3.5 miles west of I-95 and east of CT 189.	345-kV line supported by steel poles and 115-kV line supported by H-frame structures.	80
Subarea 1.4 (North-Central CT)	Located in Windsor and Bloomfield, Hartford County, CT, immediately west of I-91 and north of CT 218.	345-kV line supported by steel poles and 115-kV line supported by H-frame structures.	445
Study Area 2			
Subarea 2.1 (West CT)	Located in New Milford, Litchfield County, CT, approx. 13 miles north of I-84 along Route 202.	345-kV line supported by H-frame structures and 115-kV line supported by H-frame structures.	77
Subarea 2.2 (West CT)	Located in New Milford, Litchfield County, CT, approx. 10 miles north of I-84 along Route 202.	345-kV line supported by steel poles.	85
Subarea 2.3 (West CT)	Located in Brookfield, Litchfield County, MA, approx. 5 miles north of I-84 along Route 202.	345-kV line supported by steel poles.	237
Study Area 3 (East MA)	Located in Stoughton, Norfolk County approx. 4 miles south of I-93 and east of State Hwy 138.	Two 345-kV lines supported by steel lattice towers.	206
Study Area 4 (East MA)	Located in Randolph, Norfolk County approx. 4 miles south of I-93 and east of State Hwy 24.	Two 345-kV lines supported by steel lattice towers.	418
All Areas			**1,654**

- Somewhat Visible–Some portion of the structure is visible independent of trees or foliage, but not a full arm holding a conductor.
- Barely Visible–The entire structure is mostly obscured by trees or foliage, but can be recognized, especially in winter.

Given that the appraisers knew where to look, the ratings reflect the distinction between Barely Visible and not visible as they would be recorded in the winter. That is not an issue with the first two categories as the structure elements are visible independent of trees or foliage. A larger issue is that visibility is being measured as of the summer of 2008 and not as of the date of the sale transaction. Thus, visibility of the structures is being underestimated, especially for sales early in the study period.[13] Another issue is the visibility of the conductors them-

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[13] Perhaps a forestry PhD candidate could develop a height and density foliage model that could be used to make visibility adjustments over time.

Table 2 Sale and Property Characteristic Data

Variable	Description
Sale Price	Transaction sale price
Liveable Area	Liveable area in square feet
Lot Size	Lot size in acres
A/C	Value of 1 if property has central A/C; zero otherwise
Age (at the time of sale)	Age of property at time of transaction (sale year minus year built)
Total Bathrooms	Sum of full, half, and three-fourths baths (full = 1; half = 0.5; three-fourths = 0.75)
Basement Area	Basement area in square feet
Deck-Small	Value of 1 if the property's deck size is less than or equal to the median deck size of the area; zero otherwise
Deck-Large	Value of 1 if the property's deck size is greater than the median deck size of the area; zero otherwise
Garage-Small	Value of 1 if the property's garage size is less than or equal to the median garage size of the area; zero otherwise
Garage-Large	Value of 1 if the property's garage size is greater than the median garage size of the area; zero otherwise
Patio-Small	Value of 1 if the property's patio size is less than or equal to the median patio size of the area; zero otherwise
Patio-Large	Value of 1 if the property's patio size is greater than the median patio size of the area; zero otherwise
Porch-Small	Value of 1 if the property's porch size is less than or equal to the median porch size of the area; zero otherwise
Porch-Large	Value of 1 if the property's porch size is greater than the median porch size of the area; zero otherwise
Sale Year 1999	Value of 1 if transaction occurred in 1999; zero otherwise
Sale Year 2000	Value of 1 if transaction occurred in 2000; zero otherwise
Sale Year 2001	Value of 1 if transaction occurred in 2001; zero otherwise
Sale Year 2002	Value of 1 if transaction occurred in 2002; zero otherwise
Sale Year 2003	Value of 1 if transaction occurred in 2003; zero otherwise
Sale Year 2004	Value of 1 if transaction occurred in 2004; zero otherwise
Sale Year 2005	Value of 1 if transaction occurred in 2005; zero otherwise
Sale Year 2006	Value of 1 if transaction occurred in 2006; zero otherwise
Sale Year 2007	Value of 1 if transaction occurred in 2007; zero otherwise
Subarea 1.1	Value of 1 if property is located in Subarea 1.1; zero otherwise
Subarea 1.2	Value of 1 if property is located in Subarea 1.2; zero otherwise
Subarea 1.3	Value of 1 if property is located in Subarea 1.3; zero otherwise
Subarea 2.1	Value of 1 if property is located in Subarea 2.1; zero otherwise
Subarea 2.2	Value of 1 if property is located in Subarea 2.2; zero otherwise

selves. It was observed that conductors were seldom noticeable without a structure or structures being visible and that structure visibility was the defining characteristic of the visibility of the conductor/structure combination.

The final field task carried out by the appraisers was to review assessor maps for all properties adjacent to the transmission line corridor to determine if each property was encumbered with an easement associated with the HVTL. If so, the size of the encumbrance was estimated from assessor maps.

Once the field data had been collected, the final step was to construct the proximity and visibility variables to be used in the analysis. Since the location coordinates of all the structures were known, the distance could be calculated from the street curb opposite the front door of each property to any structure coded as visible by the appraisers. The perpendicular distance was also calculated, from the street curb opposite the front door to the centerline of the transmission line corridor. Using all the collected information, six variables were constructed designed to test for proximity, visibility, and encumbrance effects: Continuous Distance; Zone 0–75 Meters; Zone 75^+–150 Meters; Number of Structures Visible; Weighted Number of Structures Visible; and Encumbrance. Table 3 describes these six variables.

Aggregation of the Data

Based on the data on geographic proximity, sale prices, and sale prices per square foot, the nine initial areas were aggregated to four large study areas. Study Area 1 (A1) is an aggregated area consisting of the two South-Central Massachusetts areas (Subareas 1.1 and 1.2) and the two North-Central Connecticut areas (Subareas 1.3 and 1.4). Study Area 2 (A2) is an aggregated area consisting of the three West Connecticut areas (Subareas 2.1, 2.2, and 2.3). The two East Massachusetts areas continue to be treated independently as Study Area 3 (A3) and Study Area 4 (A4), respectively, due to the significant difference in their sale price per square foot and the practical consideration that both have large enough numbers of sales to support independent analysis.

The total number of sale transactions considered for each of the four areas is shown in Table 4. Of the initial 1,654 records, 308 records were discarded because they did not meet the arm's-length criterion in the opinion of the appraisers (or the sale transactions could not be confirmed). The two most common reasons given were (1) an institution was identified as one of the parties to the sale, or (2) only a single party was indentified in the transaction. There were also sales in which the buying and selling parties had the same last names or cases where the reported consideration was zero. For 38 transactions, the appraisers were not able to complete all required data fields for the analysis, the transaction appeared to be a duplicate transaction, or the transaction was otherwise sufficiently unrepresentative of the general study area as to be discarded.[14]

Finally, a relatively small number (22) of additional sales were eliminated to improve the fit of the regression model. A base model was estimated for each area and observations with residuals of more than ± 2.5 standard deviations were excluded from subsequent regression runs. Overall, this filter improved the fit of the regression models by several percentage points, but only eliminated 1.7% of the usable transactions. The residual filter did not impact the sign of the estimated coefficients, but generally improved the significance of the studied variables, i.e., if an estimated coefficient was negative and borderline significant before applying the residual filter, it

Table 3 HVTL Variables

Variable	Description
Continuous Distance	Shortest distance from the street curb opposite the front door of the property to the centerline of the transmission line
Zone 0–75 Meters	Value of 1 if the property is less than or equal to 75 meters away from the centerline of the transmission line; zero otherwise
Zone 75⁺–150 Meters	Value of 1 if the property is greater than 75 or less than or equal to 150 meters away from the centerline of the transmission line; zero otherwise
Number of Structures Visible	Number of unique structures visible from the property
Weighted Number of Structures Visible	Sum of the numeric value of the rating assigned to each tower visible from the property; Highly Visible = 4, Somewhat Visible = 2, Barely Visible = 1
Encumbrance	Square feet encumbered by the easement

Table 4 Number of Records Considered

	Study Area				
	A1	**A2**	**A3**	**A4**	**Total**
Total Records Considered	631	399	206	418	1,654
Less Non-Arm's-Length Transactions	142	37	48	81	308
Less Incomplete, Duplicate, or Otherwise Not Usable Transactions	8	12	1	17	38
Less Outliers Filtered by Residual Filter	6	6	4	6	22
Transactions Used in Regression Models	**475**	**344**	**153**	**314**	**1,286**

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[14] Nine transactions were excluded that were not representative of the general study areas. For example, we excluded a transaction with a sale price of $800,000 in a neighborhood with average home values of $192,611, a property (which sold twice during our study time period) that contained a 130 acre lake, and a property that appeared to be a lot sale only.

stayed negative, but typically became more significant after applying the residual filter. Appendix 2 contains descriptive statistics of the four Study Areas.

The Base Model

Before working with the transmission line–related variables, a base model was estimated for each of the four study areas; the results are shown in Table 5. Various functional formats were explored during the model specification stage. Based upon guidance provided in the published literature and an evaluation of alternative specifications, the natural log of the sale price was used as the dependent variable. Three of the independent variables (*Liveable Area*, *Lot Size*, and *Basement Area*) were also entered as natural logs to allow for a nonlinear response of the sale price to increases in size.

Data for the total number of bedrooms was available, but it was not included in the model because it did not add statistical explanatory power after liveable area and number of bathrooms were accounted for. Data on square feet of finished basement was available for most sales, but it also did not add any explanatory power once total basement size was in the model, so it was dropped as well.[15] For deck, garage, and porch square footage, the dummy variables of small and large were used, depending on whether the feature was above or below the median size.[16] A regional home price deflator was not used to adjust sale prices, since there were plenty of observations and the annual dummy variable for year of sale (1998 is the excluded year) seemed more reliable. Finally, dummy variables were included for the subareas that were aggregated to form Study Area 1 (A1) and Study Area 2 (A2).[17]

Overall, the base models have very good explanatory power; the independent variables are generally statistically significant with the anticipated sign and are of reasonable magnitudes.[18] Table 6 provides a sample interpretation of the regression coefficients for A2.[19]

Testing for the Effects of Proximity, Visibility, and Encumbrance

Table 7 shows the frequency distribution and the summary statistics of the key transmission line–related variables in the sales database. As expected, encumbered properties are slightly larger than the unencumbered properties.

Out of the 1,286 sales, over 100 properties are within 75 meters of an existing 345-kV transmission line, 78 properties are encumbered with an easement associated with the transmission line, and 527 are of properties from which one or more transmission line structures can be seen.

Tables 8 and 9 summarize the results when the transmission line variables are added to the base model for each of the four study areas. There are two basic approaches to testing for proximity effects: (1) distance as a categorical variable representing distance zones, and (2) distance measured as a continuous variable. Both approaches are investigated, with distance zones shown in Table 8 and continuous distance shown in Table 9. The tables are structured so that distance is examined first by itself (Model 1), the encumbrance variable is then added (Model 2), and then two visibility variables are considered–the number of structures visible (Model 3) and the number of structures visible weighted by the degree of visibility (Model 4).[20]

Proximity. Tables 8 and 9 are striking in that there is no systematic effect of proximity to the transmission

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[15] Care must be exercised here not to misinterpret the effect of the variables in the base model. Because many of the variables are highly correlated (e.g., liveable area, number of bathrooms, number of bedrooms), the regression may not be able to sort out the independent effect of each. The coefficients on the included variables must, therefore, be interpreted as the joint effect of the included variables and any excluded, highly correlated variable(s).

[16] Since for a significant number of transactions, the properties did not have a garage, deck, and/or porch, these variables exhibit a skewed distribution with most of the transactions centered around the ‘0’ value (i.e., these variables do not follow a normal distribution). Therefore, to address the non-normal distribution of the variables these variables were entered as categorical variables (dummy variables). For a categorical variable, one category must be left out of the regression, and the coefficients on the included categories measure the effect on sale price relative to the excluded category. For the garage, deck, and porch dummy variables, the excluded groups are properties that do not have a garage, deck, and/or porch.

[17] The excluded subarea for Study Area 1 was Subarea 1.4; for Study Area 2, it was Subarea 2.3.

[18] Given that the dependent variable is in natural logs, the interpretation of the coefficients on the independent variables is as follows: (1) the coefficient of an untransformed continuous variable (e.g., number of bathrooms) approximates the percentage change in sale price due to a one-unit change in the underlying variable; (2) the coefficient of a dummy variable approximates the percentage change in the sale price if the value of the dummy variable is 1; and (3) the coefficient of a log transformed continuous variable approximates the percentage change in sale price given a 1% change in the log transformed variable.

[19] Property characteristics were assumed that approximate the median values for Study Area 2.

[20] Without additional research, the weights attached to the three categories of visibility are necessarily subjective. The results shown in the tables are based on a 4:2:1 scheme, i.e., highly visible carries twice the weight of somewhat visible, which has twice the weight of barely visible. Other schemes were tried, but the results were largely unaffected.

Table 5 **Base Model Estimation Results**

	Study Area			
Variable	**A1**	**A2**	**A3**	**A4**
Constant	9.3295**	9.0552**	9.7858**	9.5877**
	(51.3163)	(41.2176)	(33.2529)	(53.7392)
ln*Liveable Area* (in sq. ft.)	0.3018**	0.3700**	0.3149**	0.3032**
	(11.9133)	(11.9432)	(7.6257)	(11.8995)
ln*Lot Size* (in acres)	0.0569**	0.0174	0.0523**	0.0389**
	(4.1087)	(0.9404)	(2.2025)	(2.0536)
A/C (yes/no)	–0.0012	0.0505**	0.0433*	0.0211
	(–0.0773)	(2.7320)	(1.7767)	(1.6144)
Age	–0.0039**	–0.0009**	–0.0049**	–0.0017**
	(–9.2045)	(–3.0085)	(–5.1140)	(–6.0633)
Total Bathrooms	0.0681**	0.0397**	0.0180	0.0762**
	(5.9799)	(2.5000)	(0.9160)	(6.5439)
ln*Basement Area* (in sq. ft.)	0.0139**	0.0313**	0.0126**	0.0159**
	(5.2651)	(4.8848)	(4.0452)	(5.1089)
Deck-Small	0.0160	0.0150	–0.0101	0.0145
	(1.1576)	(0.7761)	(–0.4087)	(1.0105)
Deck-Large	0.0127	0.0248	0.0561**	0.0454**
	(1.0065)	(1.2731)	(2.1352)	(3.0625)
Garage-Small	0.0738**	0.1211**	0.0224	0.0528**
	(4.9800)	(4.1899)	(1.0559)	(3.8013)
Garage-Large	0.1154**	0.1445**	0.0832**	0.0460**
	(7.2675)	(4.7379)	(3.3965)	(2.8108)
Porch-Small	0.0332**	0.0389**	0.0120	0.0163
	(2.6389)	(1.9962)	(0.6302)	(1.1652)
Porch-Large	0.0429**	0.0186	0.0222	0.0236
	(3.2400)	(0.9402)	(1.0357)	(1.5621)
Sale Year 1999	0.0647**	0.0884**	0.0898**	0.1312**
	(2.7723)	(2.2858)	(2.9167)	(5.4847)
Sale Year 2000	0.1355**	0.2296**	0.3423**	0.2746**
	(5.5220)	(5.5944)	(9.3656)	(9.3996)
Sale Year 2001	0.2293**	0.3085**	0.5027**	0.4011**
	(8.8978)	(7.8390)	(14.0765)	(14.7889)
Sale Year 2002	0.2924**	0.4285**	0.5883**	0.5603**
	(12.7420)	(11.4544)	(18.0932)	(23.1608)
Sale Year 2003	0.3676**	0.4953**	0.7308**	0.6712**
	(15.7658)	(14.1213)	(22.1995)	(27.7454)
Sale Year 2004	0.5122**	0.6253**	0.7797**	0.7600**
	(21.5832)	(18.4644)	(22.7246)	(32.8114)
Sale Year 2005	0.6244**	0.7255**	0.8802**	0.8589**
	(28.3895)	(20.6101)	(26.6213)	(34.9250)
Sale Year 2006	0.7059**	0.7261**	0.8612**	0.7999**
	(30.4294)	(20.1332)	(26.1725)	(31.2761)
Sale Year 2007	0.6968**	0.7147**	0.7850**	0.7522**
	(29.1600)	(18.0000)	(22.4262)	(26.6658)
Subarea 1.1	0.0910**			
	(4.4589)			
Subarea 1.2	0.2110**			
	(9.3416)			
Subarea 1.3	–0.0062			
	(–0.3908)			
Subarea 2.1		–0.1789**		
		(–8.8005)		
Subarea 2.2		–0.1773**		
		(–6.8976)		
Adjusted *R*-Squared	88.25%	87.85%	93.52%	92.16%
Mean Sale Price	$172,786	$298,740	$227,927	$258,249
Included Observations	475	344	153	314

t-Statistics provided in parentheses.

* Indicates variable is significant at the 90% level.

** Indicates variable is significant at the 95% level.

Table 6 Sample Calculation of Estimated Sale Price for Study Area 2 (A2)

Variable	Assumed Value	Natural Log Transformed Values	Estimated Coefficient	Estimated Effect
Constant	1		9.05516	9.05516
ln*Liveable Area* (in sq. ft.)	2,000	7.6009	0.37005	2.81269
ln*Lot Size* (in acres)	0.75	-0.2877	0.01742	-0.00501
A/C (yes/no)	1		0.05048	0.05048
Age	35		-0.00092	-0.03234
Total Bathrooms	2.5		0.03969	0.09922
ln*Basement Area* (in sq. ft.)	1,000	6.9078	0.03126	0.21595
Deck-Small	1		0.01504	0.01504
Deck-Large	0		0.02480	0
Garage-Small	1		0.12108	0.12108
Garage-Large	0		0.14448	0
Porch-Small	1		0.03894	0.03894
Porch-Large	0		0.01855	0
Study Area 2.1	0		-0.17888	0
Study Area 2.2	0		-0.17732	0
Sale Year 1999	0		0.08843	0
Sale Year 2000	0		0.22960	0
Sale Year 2001	1		0.30849	0.30849
Sale Year 2002	0		0.42848	0
Sale Year 2003	0		0.49534	0
Sale Year 2004	0		0.62529	0
Sale Year 2005	0		0.72548	0
Sale Year 2006	0		0.72609	0
Sale Year 2007	0		0.71470	0
Estimated Natural Log Transformed Value (Sum of Effects)				12.67969
Estimated Value				$321,159

Table 7 Summary of Transmission Line Variables

	Study Area			
	A1	A2	A3	A4
Distance Zones				
Zone 0–75 Meters				
Number of Properties	43	7	20	41
Median Distance	62	62	53	50
Zone 75^{+}–150 Meters				
Number of Properties	63	65	20	55
Median Distance	97	118	103	104
Greater than 150 Meters				
Number of Properties	369	272	113	218
Median Distance	343	371	294	304
Continuous Distance				
Number of Properties	475	344	153	314
Median Distance	275	286	237	228
Encumbrance				
Number of Properties Encumbered	29	32	7	10
Median Sq. Ft. Encumbered	8,527	11,825	7,601	5,707
Median Lot Size of Encumbered Properties	0.50	0.99	0.35	0.33
Median Lot Size of Unencumbered Properties	0.40	0.93	0.21	0.28
Number of Properties with Transmission Structure(s) Visible				
1 Structure Visible	87	69	10	51
2 Structures Visible	71	24	30	61
3 Structures Visible	23	8	13	29
4 Structures Visible	6	0	14	15
More than 4 Structures Visible	2	0	13	1

Table 8 **Zone Distance Model**

	Study Area			
	A1	**A2**	**A3**	**A4**
Model 1: Distance Zone Model				
Zone 0–75 Meters	-0.0226	-0.0874	0.0131	-0.0055
	(-1.2734)	(-1.6429)	(0.5278)	(-0.3159)
Zone 75^+–150 Meters	0.0041	-0.0388*	0.0069	0.0237
	(0.2768)	(-1.9251)	(0.2443)	(1.5212)
Model 2: Distance Zone Model & Encumbrance				
Zone 0–75 Meters	-0.0179	-0.0539	0.0306	0.0050
	(-0.8636)	(-1.0068)	(1.0550)	(0.2711)
Zone 75^+–150 Meters	0.0056	0.0012	0.0064	0.0257
	(0.3666)	(0.0492)	(0.2280)	(1.6495)
Encumbrance	-0.0012	-0.0113**	-0.0061	-0.0073*
	(-0.4387)	(-3.1867)	(-1.1684)	(-1.7323)
Model 3: Distance Zone Model & Encumbrance & Number of Structures Visible				
Zone 0–75 Meters	-0.0283	-0.0697	0.0151	-0.0019
	(-1.1314)	(-1.2515)	(0.4562)	(-0.0832)
Zone 75^+–150 Meters	-0.0034	-0.0122	-0.0033	0.0206
	(-0.1776)	(-0.4561)	(-0.1120)	(1.1312)
Encumbrance	-0.0014	-0.0113**	-0.0073	-0.0078*
	(-0.5065)	(-3.1996)	(-1.3663)	(-1.8018)
Number of Structures Visible	0.0055	0.0139	0.0069	0.0038
	(0.7434)	(1.0312)	(0.9784)	(0.5519)
Model 4: Distance Zone Model & Encumbrance & Weighted Number of Structures Visible				
Zone 0–75 Meters	-0.0170	-0.0681	0.0218	0.0011
	(-0.6796)	(-1.2174)	(0.6204)	(0.0479)
Zone 75^+–150 Meters	0.0062	-0.0117	0.0023	0.0231
	(0.3355)	(-0.4224)	(0.0792)	(1.3250)
Encumbrance	-0.0012	-0.0114**	-0.0068	-0.0076*
	(-0.4281)	(-3.2124)	(-1.2424)	(-1.7606)
Weighted Number of Structures Visible	-0.0001	0.0034	0.0009	0.0006
	(-0.0621)	(0.8760)	(0.4443)	(0.3291)

t-Statistics provided in parentheses; *p*-values available from authors upon request.

* Indicates variable is significant at the 90% level.

** Indicates variable is significant at the 95% level.

line corridor on sale price. The only exception is A2 in the continuous distance specification. In Models 1, 3, and 4, the distance variable is negative for A2 and statistically significant at either the 95% or 90% level. However, further analysis reveals that the distance variable of Model 1 becomes insignificant once encumbrance is accounted for (in Table 9, see Model 2 for A2). Further, even though both Models 3 and 4 show a significant distance effect, Model 3 also shows an unexpected positive effect of structure visibility. A possible interpretation is that although encumbrance clearly has a negative effect, the combination of greater distance and more structures visible may imply long views and the positive value of the long views may outweigh any negative effects of the HVTLs. The only other remaining distance variable with a statistically significant value–Zone 75^+–150 Meters in Model 1 for A2 (Table 8) –also becomes insignificant once encumbrance is added to the model (Zone 75^+–150 Meters in Model 2 for A2).

Encumbrance. The only variable that appears to have any kind of systematic effect is the encumbrance variable, which for A2 and A4 is of the expected sign in both the Zone Distance and Continuous Distance models and is statistically significant at either the 90% or 95% level. However its magnitude is generally small. For example, for A2 the reported coefficient on

Table 9 Continuous Distance Model

	Study Area			
	A1	**A2**	**A3**	**A4**
Model 1: Distance Zone Model				
Continuous Distance	0.0008	0.0351**	-0.0116	-0.0034
	(0.1030)	(2.7181)	(-0.9393)	(-0.4711)
Model 2: Distance Zone Model & Encumbrance				
Continuous Distance	-0.0031	0.0157	-0.0214	-0.0091
	(-0.3772)	(1.0921)	(-1.5094)	(-1.1699)
Encumbrance	-0.0027	-0.0099**	-0.0071	-0.0087**
	(-1.0350)	(-2.9613)	(-1.3956)	(-2.0392)
Model 3: Distance Zone Model & Encumbrance & Number of Structures Visible				
Continuous Distance	-0.0016	0.0327*	-0.0153	-0.0057
	(-0.1378)	(1.8681)	(-0.8046)	(-0.5704)
Encumbrance	-0.0028	-0.0101**	-0.0075	-0.0090**
	(-1.0475)	(-3.0395)	(-1.4443)	(-2.0834)
Number of Structures Visible	0.0014	0.0240*	0.0038	0.0036
	(0.1875)	(1.6896)	(0.4749)	(0.5332)
Model 4: Distance Zone Model & Encumbrance & Weighted Number of Structures Visible				
Continuous Distance	-0.0085	0.0293*	-0.0220	-0.0078
	(-0.7440)	(1.7083)	(-1.1501)	(-0.7928)
Encumbrance	-0.0025	-0.0104**	-0.0070	-0.0088**
	(-0.9308)	(-3.1019)	(-1.3383)	(-2.0471)
Weighted Number of Structures Visible	-0.0014	0.0057	-0.0001	0.0004
	(-0.6849)	(1.4415)	(-0.0500)	(0.2160)

t-Statistics provided in parentheses; *p*-values available from authors upon request.

* Indicates variable is significant at the 90% level.

** Indicates variable is significant at the 95% level.

the encumbrance variable in Continuous Distance Model 2 (Table 9) implies an effect of approximately $3,000 for a property with 12,000 square feet encumbered and a sale price of $300,000.[21]

Visibility. With respect to the impact of visibility of the transmission tower, the results did not indicate any systematic impact with respect to sign or magnitude.[22] As previously discussed, the only time when the visibility variable was statistically significant, the sign of the coefficient was positive.

Other Hypotheses Tested

Two other hypotheses were offered that can be examined with the data collected in this study. First, it was suggested that property values would be particularly vulnerable to HVTL effects in a down market. Second, it was suggested that higher-valued properties would be more vulnerable to HVTL effects than lower-valued properties.

Effect in Market Downturn. Looking back at the coefficients on the sale year variables for 2006 and 2007 in Table 5, the market downturn appears to have affected the four study areas quite differently. Study Area 1 still experienced a significant increase in real estate values in 2006 and experienced a slight drop in 2007. Study Area 2 properties leveled off in 2005 with only a nominal change between 2005 and 2006 and a small drop in 2007. However, the two areas south of Boston, Study Areas 3 and 4, clearly peaked in 2005 with significant drops in values between 2005 and 2007.

Therefore, the study investigated whether there was any evidence that property values were more sensitive to HVTL effects in 2006 and 2007 for Study

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[21] The coefficient of –0.0099 can be interpreted as the percentage change (i.e., approximately –0.01%) of a 1% change in encumbrance. Therefore, assuming a sale price of $300,000 and an encumbrance of 12,000 square feet, a 1-square-foot change in encumbrance would correspond to a –$0.25 change in sale price (0.25 = $30.00/120).

[22] Theory would suggest that the distance and visibility variables should be entered multiplicatively implying the effect of each depends on the value of the other. This was tried but had no effect on the results.

Areas (A3) and Study Area 4 (A4), i.e., the areas which experienced significant market softening. The hypothesis was that the effect of the encumbrance, proximity, and visibility variables would be more pronounced in these two years of falling market values. This was tested by adding interaction terms for sale years 2006 and 2007 with each of the transmission line variables shown in Table 9.[23]

The encumbrance variable and the encumbrance interaction term were both negative for A3, but not statistically significant. Since there were only two encumbered properties that sold in 2006 and 2007 in A3, no reliability can be attached to these results; the same situation existed for A4. The encumbrance variable stayed significant at the 95% level (similar in magnitude as in Table 9). However, the interaction term testing for the down-market effect was insignificant and since there was only one encumbered property transacted in the 2006–2007 period, no reliability can be attached to this result either. The remaining coefficients on the transmission line variables and the interaction variables were not significant at any conventional level of significance. Thus, there is no evidence here to support the hypothesis of greater vulnerability of values to HVTL effects in a down market, but it has to be recognized that the number of observations on the key transmission line variables is small for just two sale years and more observations over a longer period would yield a more definitive result.

Effects on Higher-Valued Properties. The second hypothesis often suggested is that higher-valued properties would be more vulnerable to transmission line effects than lower-valued properties. To investigate this, all of the models shown in Tables 8 and 9 were reestimated based on observations that fell above the median sale price in their sales year. The results showed the same pattern of lack of statistical significance for the HVTL variables as in Tables 8 and 9; this supports the conclusion that the higher-valued properties show no greater sensitivity to HVTL variables than lower-valued properties.

Finally, since almost all of the anticipated 345-kV line construction that motivated this study will take place in existing transmission corridors, a couple of questions remain. First, is it possible to say anything about the incremental effect of a corridor upgrade? Second, and perhaps related, is it possible that there would be short-term proximity and visibility effects but that these would dissipate over time?[24] The first question does not seem relevant here. Since all of the sales studied here are in the vicinity of the corridor configuration that will exist after the upgrade, and since there are no proximity or visibility effects, it is hard to see how there could be upgrade effects.

This study, however, does not eliminate the possibility that the upgrade might induce short-term effects that would dissipate over time. The data represent situations where the existing HVTL corridor has been in place for some time, so, it can be said with some confidence that there are no permanent property value effects of the corridor due to proximity or visibility. However, this does not rule out a temporary effect. Therefore, a useful complement to this study might look at the history of a corridor over a period that includes a pre-upgrade period, an announcement and construction period, and then a post-upgrade period.

Conclusions

The research reported here investigates the effect of existing 345-kV transmission lines in Connecticut and Massachusetts on the value of properties sold over the period 1998–2007. Extra care has been taken in the research to account for encumbrance, proximity, and visibility effects. There are obvious relationships among the three variables, and if each is not considered, the effects of one could be mistakenly attributed to another. In particular, encumbrance effects could be mistakenly interpreted as proximity effects if both are not considered.

In the four study areas examined here, there is no evidence of systematic effects of either proximity or visibility of 345-kV transmission lines on residential real estate values. Encumbrance of the transmission line easement on adjoining properties does appear to have a consistent negative effect on value, although the statistical significance with which it is measured varies. The hypothesis that property values are more vulnerable to transmission line effects in a down market also is considered; although no evidence

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[23] The down-market hypothesis could not be tested with the zone distance models as there were not a sufficient number of transactions in each of the two distance zones; therefore, the hypothesis was only tested on the continuous distance model.

[24] Colwell (1990) in a study in Illinois based on data from the 1970s finds small proximity effects, but also finds that the effects dissipated over the 10 or so years of sales that he studied. The transmission line in question, however, had been in place for several years prior to the study period. Most on point is the study by Ignelzi (1991), which finds small proximity effects following an upgrade, but that the effects disappeared after 4–5 years.

supports that proposition that there are greater effects in a down market, the number of observations in the relevant period is small. Finally, the hypothesis that higher-valued properties are more vulnerable to transmission line effects is considered; again, the data provides no support for that hypothesis.

The professional literature cited, combined with the results reported here, support the position that a presumption of material negative effects of HVTLs on property values is not warranted. An opinion supporting HVTLs effects would have to be based on market data particular to the situation in question and could not be presumed or based on casual, anecdotal observation. It is fair to presume that the direction of the effect would in most circumstances be negative, but the existence of a measureable effect and the magnitude of such an effect can only be determined by empirical analysis of actual market transactions.

James A. Chalmers, PhD, has a PhD in economics and is a certified general real estate appraiser in Arizona. During 1990–2002, he led the real estate damages practice at Coopers & Lybrand and, after its merger, at PricewaterhouseCoopers (PwC). Since retiring from PwC in 2002, he continues to consult in the area of real estate damages as the principal of Chalmers & Associates, LLC, located in Billings, MT. **Contact: jameschalmers@vcn.com**

Frank A. Voorvaart, PhD, is a vice president with the Dallas office of Analysis Group, where he specializes in real estate litigation consulting. He has evaluated class certification criteria and property value diminution claims in residential class action litigation, and also has evaluated the validity and applicability of experts' valuation methodologies to determine damages to real estate on a classwide basis. **Contact: T 214-523-1417; fvoorvaart@analysisgroup.com**

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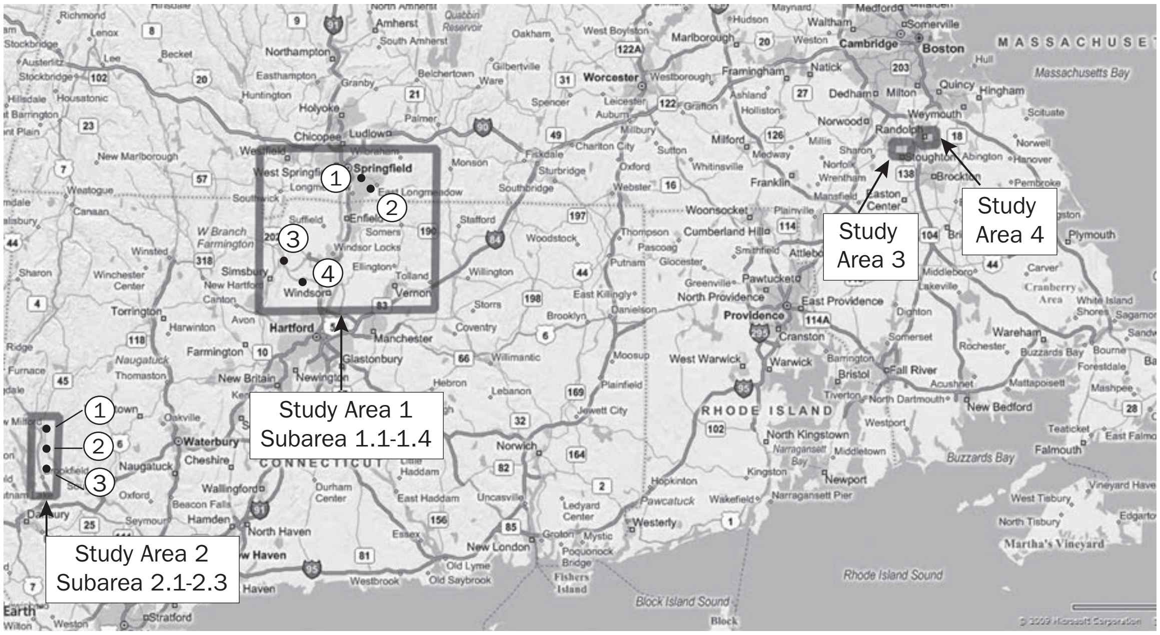
Appendix 1

Study Area and Subarea Locations

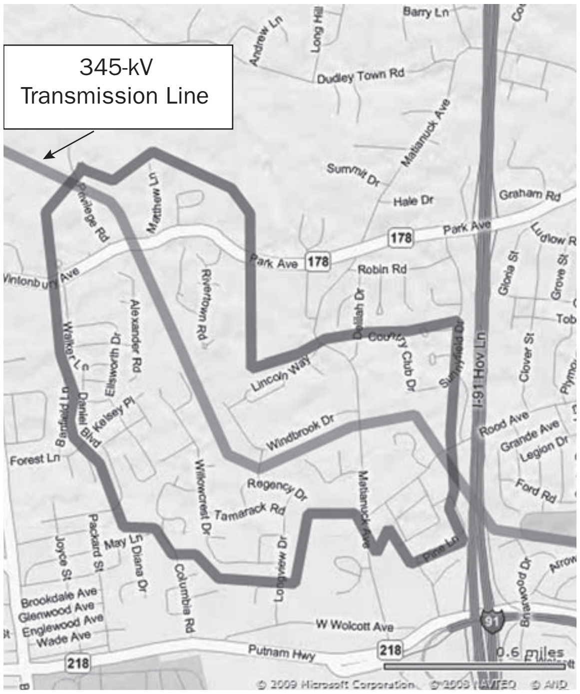


Study Area 1: Subarea 1.1

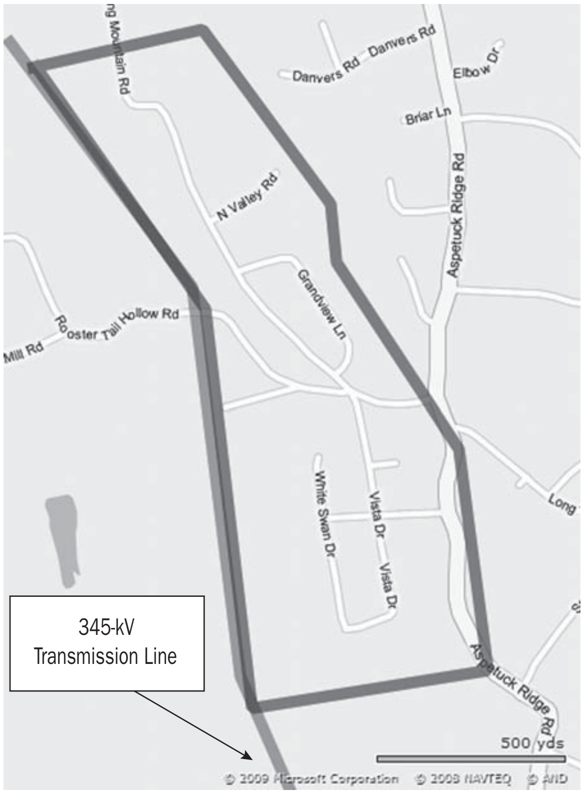
Study Area 1: Subarea 1.2

Study Area 1: Subarea 1.3

Study Area 1: Subarea 1.4

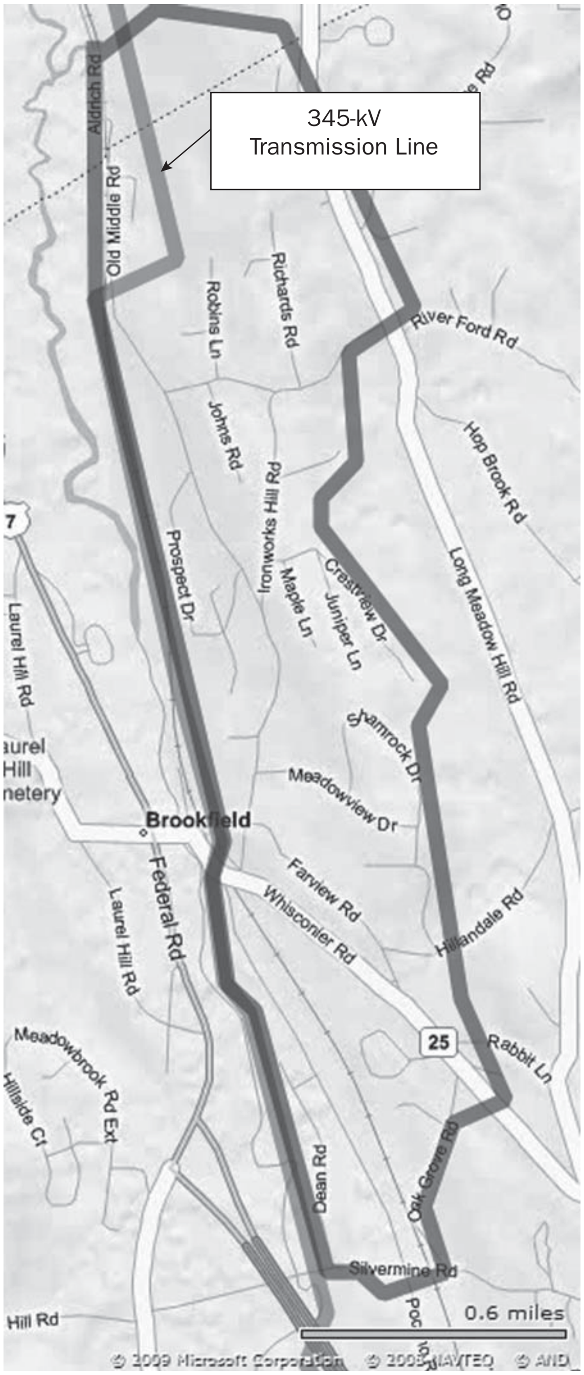


Study Area 2: Subarea 2.1



Study Area 2: Subarea 2.2

Study Area 2: Subarea 2.3



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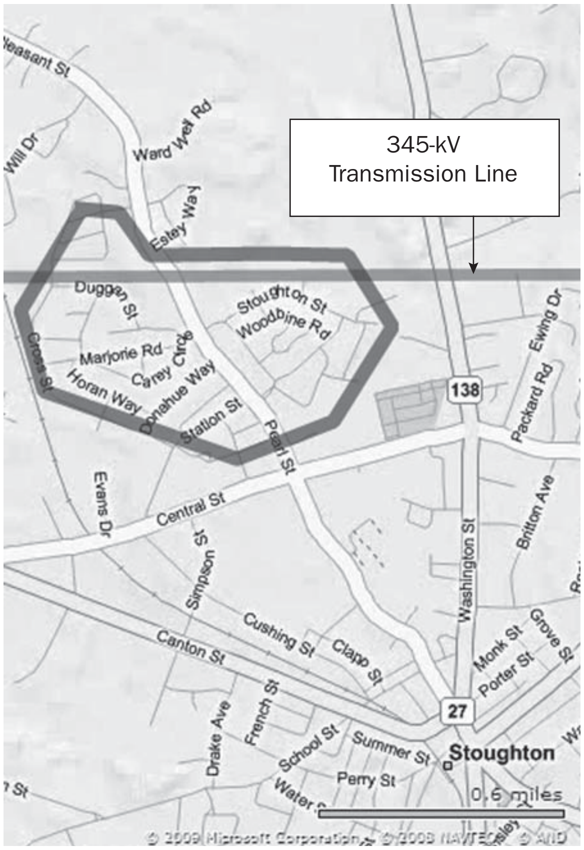

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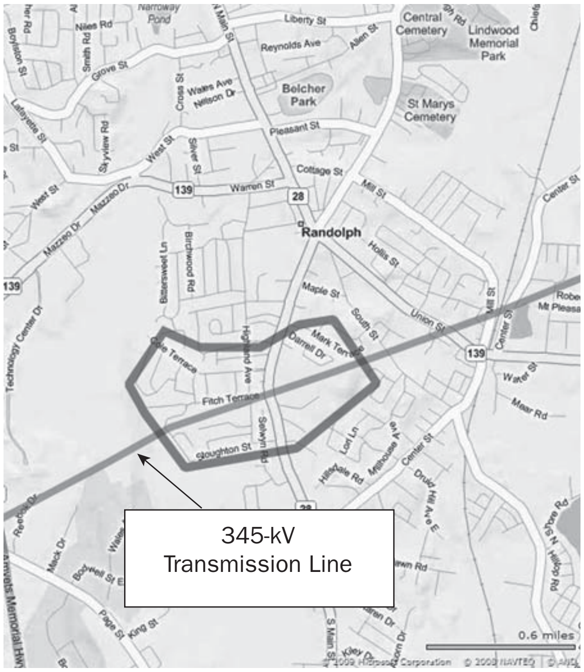

Appendix 2

Descriptive Statistics by Study Area

	Study Area			
Property Characteristic	**A1**	**A2**	**A3**	**A4**
Liveable Area (in sq. ft.)				
Mean	1,386.54	1,696.32	1,205.18	1,448.93
Median	1,288.00	1,500.00	1,144.00	1,346.00
Standard Deviation	363.98	678.62	307.85	478.05
Lot Size (in acres)				
Mean	0.4787	1.0542	0.2684	0.2936
Median	0.4140	0.9300	0.2180	0.2778
Standard Deviation	0.3978	0.9518	0.1476	0.1113
A/C				
Percent of Properties with A/C	25.05%	24.42%	23.53%	35.35%
Age				
Mean	34.20	37.24	50.07	46.78
Median	31.00	34.00	52.00	45.00
Standard Deviation	15.29	3.36	12.23	25.39
Total Bathrooms				
Mean	1.83	1.99	1.36	1.61
Median	2.00	2.00	1.00	1.50
Standard Deviation	0.56	0.76	0.55	0.71
Basement (in sq. ft.)				
Mean	793.85	975.87	384.40	867.82
Median	802.00	943.00	0.00	864.00
Standard Deviation	378.18	403.66	466.59	394.58
Deck (in sq. ft.)				
Number of Properties with Deck	295.00	240.00	43.00	178.00
Mean	204.53	312.21	219.33	168.74
Median	168.00	264.00	210.00	144.00
Standard Deviation	123.23	206.93	118.45	116.41
Garage (in sq. ft.)				
Number of Properties with Garage	393.00	316.00	53.00	170.00
Mean	452.67	470.23	335.72	440.16
Median	484.00	506.00	275.00	511.50
Standard Deviation	136.07	174.18	121.24	136.03
Porch (in sq. ft.)				
Number of Properties with Porch	225.00	152.00	87.00	176.00
Mean	138.12	166.41	128.86	128.98
Median	102.00	134.00	144.00	120.00
Standard Deviation	120.68	152.40	78.16	91.49