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January 16, 2026

City Clerk
City of Saint Paul
15 W Kellogg Blvd
310 City Hall
St. Paul, MN 55102
Contact-council@ci.stpaul.mn.us

Via U.S. Mail
& E-Mail

**Re:** ***Formal Objection to Proposed Road Alignment and Assessment for Pelham Boulevard Reconstruction***

To the City Clerk and Members of the Council Members:

We object to the proposed design and special assessment for the reconstruction of Pelham Boulevard. While we support maintaining our neighborhood's infrastructure, the plan to shift this roadway 14 feet closer to residential properties creates a direct conflict with the City's Special Assessment Policy and introduces an avoidable long-term reduction of the City's already-fragile property tax base.

The alternative, reconstructing the road within its existing footprint, accomplishes the City's infrastructure goals without triggering significant financial, environmental, and safety harms to the City and its residents.

Below, I outline the specific legal and economic violations inherent in the current proposal.

## I. The proposed assessment fails the "Benefit Test"

Under Saint Paul Administrative Code § 60.03, the City is authorized to levy special assessments "only to the extent of the special benefit conferred." Section 60.02 explicitly defines this "special benefit" as the increase in market value of the property. *See id.*

The proposed design, which reduces the residential setback by 14 feet, fails this test. Academic literature and appraisal standards confirm that reducing the distance between a home and a road results in "Proximity Damages," not benefits.

- **Setback & Value Loss:** A foundational study by the Idaho Transportation Department (Stroschein et al., 2005) established that residential property values are highly sensitive to "setback" distance.

The study found that reducing a home's buffer from the street creates measurable value loss due to noise and perceived safety risks.

- **Traffic Volume Discount:** Research published in the *International Journal of Housing Markets and Analysis* (Larsen & Blair, 2014) found that single-family homes adjacent to busy streets (the City has designated Pelham Boulevard as a "collector" street) trade at a discount of approximately 7.8% compared to homes on quiet streets.

By moving the traffic source closer to our homes, the project exacerbates these negative externalities. This results in a *decrease* in market value. Therefore, under § 60.04, the legal limit for our special assessment is $0.

## II. Environmental & Public Health Risks

The proposed design does not merely change a road alignment; it alters the drainage and proximity of a known environmental hazard. The project is adjacent to the Town and Country golf course, and shifting the roadway and its runoff 14 feet closer to homes creates an acute public health risk that must be assessed under Minnesota Rules Chapter 4410.

- **New Medical Evidence (Mayo Clinic/JAMA 2025):** A study published in *JAMA Network Open* (Krzyzanowski, Dorsey, et al., May 2025) utilizing data from the Rochester Epidemiology Project found that individuals living within 1 mile of a Minnesota golf course have a 126% increased risk (2.26x odds) of developing Parkinson's Disease.
- **The Mechanism of Harm:** The study identified pesticide-laden runoff and groundwater contamination as primary drivers of this risk.
- **The Project's Impact:** By moving the impervious surface 14 feet closer to our homes, the City is bringing the collection channel for these golf course chemicals closer to our living spaces. This reduces the vegetative buffer that currently filters this runoff, directly increasing our exposure to the neurotoxins identified in the Mayo Clinic study.

Under Minnesota Rules 4410.1100, this creates "material evidence of the potential for significant environmental effects." While a standard road reconstruction might be exempt, a project that amplifies exposure to carcinogenic or neurotoxic runoff is not.

Because this specific health risk is now documented by peer-reviewed science involving Minnesota residents, a petition signed by just 100 citizens would force the City to undergo the Environmental Assessment Worksheet (EAW) process to study these runoff effects. Reconstructing the road "as-is" (in-place) maintains the current buffer and avoids triggering this specific environmental review liability.

## III. In-Place Reconstruction is The Fiscally Responsible Solution

The City can achieve its goal of "Street Reconstruction" (as defined in § 60.02) without the liability of the shift.

- **Protecting the Tax Base:** Maintaining the current setback preserves the marketability of homes along this corridor, ensuring long-term property tax revenue is not eroded by the "busy road discount" highlighted in the Larsen & Blair study.
- **Validating the Assessment:** A standard reconstruction that improves ride quality *without* encroaching on properties creates a genuine "Special Benefit" for a majority of the properties, allowing the City to levy valid, defensible assessments.

To ensure this project complies with Chapter 60 and avoids unnecessary environmental review costs, we request that the Council:

1. Amend the project scope to reconstruct the road within its current alignment.
2. Retain existing traffic calming measures, including the stop signs adjacent to Desnoyer Park to prioritize safety.

Sincerely,

Shawn Wanta
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Encl. (2)

# Price effects of surface street traffic on residential property



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## Abstract

**Purpose** – The purpose of this study is to gauge and compare the impact of surface street traffic externalities on residential properties. Limited previous research indicates that negative externalities dominate for single-family houses. Our objective is to verify that this result applies to our sample, and to determine if the same result extends to multi-unit rental properties.

**Design/methodology/approach** – Hedonic regression is used to analyze data from 9,680 single-family house transactions and 455 multi-unit rental properties to measure the influence of surface street traffic on the price of the two property types.

**Findings** – Houses located adjacent to an arterial street sold at a 7.8 per cent discount, on average, compared to similar houses located on collector streets. Limiting the analysis to houses adjacent to an arterial street (where traffic counts were available), price and traffic count are negatively related. The results for multi-unit rental dwellings are dramatically different. Multi-unit properties adjacent to an arterial street sold at a 13.75 per cent premium compared to similar properties on collector streets, and when limiting the analysis to properties on arterial streets, no significant relationship was detected between price and traffic volume.

**Originality/value** – This is the first empirical study of the influence of surface street traffic on both single-family houses and multi-unit rental residential property. Evidence is provided that traffic externalities impact the two types of properties quite differently. To the extent that this result applies to other locations, the authors suggest planners may be able to use such information to reduce the negative effect of traffic externalities on residential property associated with changes that will increase traffic flow.

**Keywords** USA, Housing prices, Housing market analysis, Residential property, Submarket delineation

**Paper type** Research paper

## Introduction

Both positive and negative externalities are associated with transportation systems. The negative consequences of vehicular traffic on residential property values such as noise, litter, annoying outside lighting, air pollution, safety concerns and so forth are widely recognized. Real estate and planning literature has described the potential for traffic to decrease house values. There are, however, also positive externalities associated with proximity to traffic. Compared to residential properties on collector streets, properties located on more heavily traveled arterial streets are generally associated with better access to public transportation and other urban amenities, including shopping. An additional positive externality may include better visibility for

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rental properties. The ultimate impact of vehicular traffic on real property values will depend upon the net relative influence of traffic's positive and negative externalities.

Conventional wisdom has long held that negative traffic externalities dominate for residential properties, although empirical support is sparse. An important exception is Hughes and Sirmans' (1992) and (1993) analysis of single-family house transactions in Baton Rouge, Louisiana. Using hedonic regression they concluded that houses on arterial streets sold at a discount compared to similar houses on streets with lower traffic volume. They also found that selling price was negatively related to traffic count for houses located on arterial streets. Their results are consistent with the intuition that negative externalities associated with street traffic outweigh positive externalities for residential properties.

The scarcity of research evaluating the relationship between traffic and residential property values in the two decades since the Hughes-Sirmans studies may be attributable to the intuitive nature of their findings. Yet additional research on this topic is warranted for at least two reasons. One is to investigate the robustness of the Hughes-Sirmans results in light of the potential sensitivity of real estate values to local conditions. An additional, and probably more important, reason is to consider possible differential impacts of traffic externalities on single-family housing compared to multi-family rental housing. If the relative preferences attributable to various traffic externalities are different for single-family and multi-unit residents, the differences in preferences may result in different price effects.

The present study is the first to empirically examine the impact of surface street traffic on the price of multi-family residential properties and to compare that impact with the comparable effects on detached single-family houses. In our study, we find that single-family houses on arterial streets sold, on average, at a discount of 7.8 per cent compared to similar houses located on, less-traveled, collector streets. When the study was restricted to houses on arterial streets, it was discovered that selling price and traffic count were negatively related. A doubling of traffic count was associated with a 2.1 per cent decrease in selling price. The results for multi-unit residential properties are quite different. We find that multi-unit properties located on arterial streets sold at a premium of 13.75 per cent, on average, compared to multi-unit rentals not so situated. When restricting the analysis to multi-unit properties on arterial streets, however, no significant relationship between selling price and traffic count is discovered.

The remainder of the paper is organized in the following order. In the next section, a brief review of the related literature is presented. The third section contains a review of issues which explain why traffic may impact single-family houses and multi-unit rentals differently. The data and methods are described in the fourth section. Empirical results which detail the impact of traffic on the value of both single-family houses and multi-unit residential properties are presented in the fifth section. The paper concludes with a summary and brief discussion of the findings.

*Literature review*

Analysts have long recognized the link between roads and real property values. At least since Ricardo (1817), access has been viewed as an important determinant of land value. According to Ricardo, the value of land further from markets would be discounted because higher transportation costs would be necessary to transport the products of the land to consumers and consumers to the markets. More recently, Tiebout (1956) envisioned a property's value as a function of property-specific characteristics such as size and condition as well as the access to amenities attributable to the property's location. Access to local public services and a variety of other amenities have been shown to influence property value by, among others, Bloomquest *et al.* (1988).

Large transportation systems such as highways, airports, waterways and railroads have been extensively evaluated both before development to consider the advisability of the project and after construction as a retrospective tool for evaluation. The voluminous research regarding transportation systems can be attributable to legislative requirements for environmental impact statements and benefit/cost studies, the substantial investment necessitated by public transportation systems and the importance of the ventures. Nelson (1982) provides a comprehensive review of these early studies. Typically, studies of large-scale transportation projects indicate that substantial benefits are derived from improved access among places. In some cases, markets have been shown to anticipate construction of public transportation systems and capitalize the expected value of these systems into real property prices (Gatzlaff and Smith, 1993; McMillen and McDonald, 2004).

Some studies show that transportation systems may introduce adverse impacts for some properties because of greater contact with undesirable environmental elements such as crime, congestion and so forth. Much of this literature reports estimates of the impact of traffic noise from freeways on residential property values. There is a general acceptance among researchers that externalities from freeway traffic can influence property values across an entire region and, more to the point for the present study, that noise from freeway traffic lowers the value of residential properties, with the impact decreasing as distance from the source increases[1]. Recent examples of such research include a study by Wilhelmsson (2000) of single-family houses in Sweden, a study by Theebe (2004) of properties in The Netherlands, a study of residential units in Korea conducted by Kim *et al.* (2007) and a study focusing on condominiums in Germany by Brandt and Maenning (2011).

In contrast to the numerous studies of national and regional transportation systems and in spite of the ubiquity of residential streets, there is scant empirical literature about local roads. Bagby (1980) was one of the first scholars to consider the impact of local traffic on property values. He compared two neighborhoods in Grand Rapids, Michigan. A young child's death by vehicular accident precipitated the introduction of traffic calming and diversion techniques in the treatment neighborhood. An immediate reduction in traffic resulted. Over the next 27 years, the average price of houses in the subject neighborhood increased. Conversely, the price of houses sold in a matched comparable neighborhood decreased slightly. The author concluded that the change in traffic was the cause of the different price trends and suggested that traffic calming and diverting traffic design can improve property values. While Bagby's methodology is not consistent with modern research practices, his findings suggest that decreased traffic volume increases residential property values.

Conventional wisdom long held that the negative externalities associated with traffic dominate for single-family houses, but convincing empirical support for this notion was lacking until Hughes and Sirmans analyzed 362 single-family house transactions that occurred in Baton Rouge, Louisiana, between January 1985 and December 1989. They used hedonic regression and reported results consistent with intuition. They found that single-family houses located adjacent to arterial streets sold at a 10.9 per cent discount compared to similar properties located on low-traffic streets (Hughes and Sirmans, 1993).

The magnitude of the discount, however, depended on the characteristics of the neighborhood. Each additional 1,000 vehicles in a street's average daily traffic count was associated with a 1.05 per cent reduced selling price for houses on city streets and a 0.54 per cent reduced selling price for houses on suburban streets (Hughes and Sirmans, 1992). Because of the significant variation in local traffic conditions, more confidence in Hughes-Sirmans' findings would be warranted if similar results were found in other locations.

Kawamura and Mahajan (2005) examined the impacts of local traffic along major roads in the Chicago area. They used hedonic price analysis to determine the impact of various traffic conditions on the assessed value of single-family houses. Their findings indicate a "small but statistically significant relationship" between traffic volume and house value. However, they used assessed values, which may only approximate actual market prices. With reference to the relationship between traffic and market value, the assessed valuation may already reflect a bias toward the hypothesis that Kawamura and Mahajan were testing. Specifically, assessors' opinions may already discount properties near heavily traveled streets because appraisal texts and prevailing opinion have advised them to do so. The bias may be reflected in the assessment even if it is not acknowledged by market processes.

## Some pertinent valuation issues

A significant fissure in the literature regarding the impact of traffic externalities is the failure to distinguish between single-family detached houses and multi-family properties. While the same physical externalities that apply to detached houses apply to multi-unit residential rental properties, these same externalities may influence the prices of the two property types differently. The possibility that the multi-family and the single-family detached housing markets respond differently to the presence of traffic suggests some degree of market segmentation.

Residents of single-family properties express their preferences directly through offer prices. For residents of multi-family properties, the process through which preferences are expressed is different. The rent they are willing to pay reflects, in part, the value of traffic externalities. Traffic externalities can be capitalized into property values in the form of differences in net revenues to the property owner. Individuals who value access associated with high-traffic volume may be willing to pay higher rents, increasing property value when cash flow valuation is used. Because many locations on busy streets are also near shopping and other amenities, living on a major thoroughfare provides an access advantage to many residents. Also the marketing advantages of multi-family properties located on busy streets may contribute to lower both vacancy rates and advertising costs, further increasing net operating income. Finally, preferences of owners may also be a factor for small rental properties such as duplexes and four-unit properties. This factor, however, seems weaker than the mechanism by which rents affect cash flow because relatively few rental units are owner-occupied.

Significant income differences between owners and renters might contribute to the different price responses to heavy traffic. The medium household income among homeowners is about twice the medium income of renters (USA Census, 2012)[2]. Partly due to preferences and partly due to income, individuals who reside in single-family houses are likely to have greater willingness and ability to avoid negative traffic externalities by living on less busy streets. Thus, the presence of substantial traffic will have a larger negative impact on the price of detached houses.

The lack of access to automobiles also contributes to the segmentation of the rental and owner-occupied housing markets. In the USA, about 3 per cent of homeowners lack access to a car compared to nearly 20 per cent of renters. The incidence of multi-car households is also lower among renters (USA Census, 2012). Thus, residents of multi-family housing are more likely to value non-automobile access to public transportation, near-by shopping and proximity to other public venues. Such access is more likely to be found on high-traffic streets. Consequently, residents in multi-family dwellings lacking easy access to a car may receive positive externalities from locations on busy streets.

Finally, larger building size, multiple-story construction and design features, including security features, may buffer residents of multi-unit properties from some negative traffic externalities. Consequently, on busy streets, residents of some multi-family buildings may experience negative traffic externalities less than individuals living in a single-family house. In addition, single-family house owners may place a lower value on traffic's positive externalities and a greater (negative) value on traffic's negative externalities. The opposite may be true for residents of multi-family dwellings. In any event, given the importance of multi-family rental properties in the housing market, separate consideration of the value impact of traffic externalities on multi-unit residential properties is warranted.

## Data and methods

The study area is the city of Kettering, an inner-ring suburb of Dayton, located in southwestern Ohio. The city has a 2010 mean family income about equal to the national average and a rate of owner occupancy of 64.7 per cent compared to 65.1 per cent for the USA (USA Census Bureau, 2012). There are 250 miles of surface streets within the 18.7 square miles that comprise Kettering. The population of Kettering declined slightly over the study period. In 2010, the population was 56,163 (down 2.3 per cent from 57,502 in 2000) and it contained 27,602 housing units (92.1 per cent of which were occupied). Traffic counts on arterial streets were provided by the Kettering Engineering Department. No traffic count data were available for residential collector streets. Traffic flows remained relatively stable over the study period.

Transaction data for 9,670 single-family houses and 455 multi-unit rental properties that occurred between January 1998 and March 2011, inclusive, were obtained from the Montgomery County, Ohio Auditor's Office. A review of these data revealed that 757 of the house transactions and 109 of the multi-unit rentals involved a parcel which was adjacent to an arterial street[3]. Summary statistics of the variables in the single-family and multi-unit dwelling database are presented in Tables I and II, respectively. Examination of Table II will reveal that multi-family units in the study area are relatively small. In fact, most of the transactions in this study involve two-story, four-unit apartments, including 48 of the 109 transactions on arterial streets and 310 of 346 transactions on collector streets. Finally, the minimum number of bedrooms shown in Table II is not a typographical error. Twenty-one of the observations consist of 6- to 24-unit properties which contain only studio apartments.

Hedonic regression was used to compare the influence of traffic on single-family and multi-family housing. This technique is well established in the literature and has been an important method of valuing and evaluating transportation systems. Theoretically important explanatory variables are typically inserted into regression models of house

**Table I.**
Summary of single-family property characteristics

| Variable | Description | Mean | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| PRICE | Sales price | 130,988 | 71,944 | 25,000 | 1,000,000 |
| HIGH | On an arterial street | 0.078 | 0.27 | 0 | 1 |
| COUNT | 24-hour traffic count | 16,186 | 8,872 | 2,000 | 36,100 |
| AGE | Structure age in years | 47.08 | 13.10 | 0 | 172 |
| BED | Number of bedrooms | 3.01 | 0.65 | 1 | 8 |
| BATH | Number of bathrooms | 1.65 | 0.71 | 1 | 9.5 |
| SQFT | Square feet of living space | 1,692.41 | 880.57 | 396 | 10,571 |
| FIRE | Number of fireplaces | 0.65 | 0.70 | 0 | 7 |
| LOT | Square feet in parcel | 11,420.17 | 8,520.95 | 2,004 | 226,948 |
| COND | Property condition | 6.60 | 0.77 | 3 | 10 |
| FALL | September-November transaction | 0.25 | 0.43 | 0 | 1 |
| WINTER | December-February transaction | 0.17 | 0.37 | 0 | 1 |
| SPRING | March-May transaction | 0.26 | 0.44 | 0 | 1 |
| AIR | Central air conditioning | 0.67 | 0.47 | 0 | 1 |
| FULL | Full basement | 0.40 | 0.49 | 0 | 1 |
| NONE | No basement | 0.49 | 0.50 | 0 | 1 |
| OWN | Owner-occupied | 0.90 | 0.31 | 0 | 1 |

**Notes:** $n$ = 9,670, except for COUNT where $n$ = 757

**Table II.**
Summary of multi-unit rental property characteristics

| Variable | Description | Mean | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| PRICE | Sales price | 525,077 | 1,545,603 | 30,000 | 22,200,000 |
| HIGH | On an arterial street | 0.212 | 0.41 | 0 | 1 |
| COUNT | 24-hour traffic count | 18,452 | 7,964 | 2,200 | 32,300 |
| AGE | Structure age in years | 48.72 | 13.05 | 14 | 71 |
| BED | Number of bedrooms | 11.88 | 32.00 | 0 | 404 |
| LOT | Square feet in parcel | 26,579 | 67,430 | 2,178 | 869,458 |
| SQFT | Square feet in improvement | 6,953 | 15,091 | 2,400 | 259,407 |
| UNITS | Number of in property | 7.07 | 9.88 | 4 | 102 |
| FALL | September-November transaction | 0.28 | 0.45 | 0 | 1 |
| WINTER | December-February transaction | 0.23 | 0.42 | 0 | 1 |
| SPRING | March-May transaction | 0.29 | 0.46 | 0 | 1 |

**Notes:** $n$ = 455, except for COUNT where $n$ = 109

prices or land values, and the size and statistical significance of the regression coefficients are examined. When markets are in equilibrium, the size of each significant estimate reflects the market valuation of the property characteristic. Our first objective was to determine whether traffic externalities significantly impact the selling price of single-family houses. The influence of traffic externalities on the value of multi-unit rental housing was then considered.

Prior to the estimation, the PROC TRANSREG procedure available on SAS (2004) was used to identify the best functional form of the various equations. The results indicate that models for both types of housing are best specified with the extended

Box-Cox transformation, where the natural logarithm of the dependent and all non-binary independent variables is used in place of the respective linear variables.

Following Hughes and Sirmans (1992) and (1993), two separate measures were used to gauge the influence of traffic in this study:

(1) whether or not the street was considered an arterial street by the Kettering Planning Department and

(2) the actual traffic count on those arterial streets.

We follow the precedent set by Hughes and Sirmans (1992) and define an arterial street as a "high-traffic" street. All other streets were defined as "low-traffic" streets. Because both single-family detached housing and multi-family housing are considered, four separate equations were estimated, two for single-family and two for multi-family housing. Equation (1) compares the selling prices of single-family houses located on a high-traffic street with the selling prices of houses otherwise situated. It takes the following form:

$$\begin{aligned}\text{lnPRICE} = {} & \alpha + \beta_1\text{HIGH} + \beta_2\text{lnAGE} + \beta_3\text{lnBATH} + \beta_4\text{lnBED} + \beta_5\text{lnCOND} \\ & + \beta_6\text{lnFIRE} + \beta_7\text{lnLOT} + \beta_8\text{lnSQFT} + \beta_9\text{AIR} + \beta_{10}\text{BRICK} + \beta_{11}\text{FALL} \\ & + \beta_{12}\text{FULL} + \beta_{13}\text{NONE} + \beta_{14}\text{OWN} + \beta_{15}\text{SPRING} + \beta_{16}\text{WINTER} \\ & + \sum_{i=17}^{29} \beta_i\text{YR} + \varepsilon \qquad (1)\end{aligned}$$

In Equation (1), lnPRICE is the natural logarithm of the transaction price, $\alpha$ is the intercept, the $\beta_i$ equals the estimated coefficients and $\varepsilon$ is the error term. HIGH (the variable of interest) equals 1 if the parcel is adjacent to a high-traffic street, otherwise it equals 0. Continuous independent variables are included to control for differences in the structure age in years (lnAGE), the number of bathrooms (lnBATH), the number of bedrooms (lnBED), the condition of the property lnCOND, the number of fireplaces (lnFIRE), the number of square feet in the lot (lnLOT) and the number of square feet of living space (lnSQFT)[4]. AIR equals 1 if the house had central air conditioning, otherwise it equals 0. FULL equals 1 if the house had a full basement, otherwise it is equal to 0, and NONE equals 1 if the house had no basement, otherwise it equals 0. OWN equals 1 if the property was purchased by an owner-occupant, otherwise it is set at 0. SPRING, FALL and WINTER are included to capture any seasonality in selling prices. Each of these variables was assigned a value of 0, unless the transaction occurred in March, April or May, then SPRING was set equal to 1. Similarly, FALL was set at 1 if the transaction occurred during September, October or November; and WINTER was set at 1 if the transaction occurred in December, January or February. The series of YR variables are included to control for market conditions (e.g. interest rates). Each one takes the value of 1 if the transaction occurred in a particular year, otherwise each is set to 0.

The estimate of Equation (2) is restricted to parcels adjacent to an arterial street and is designed to determine whether traffic volume on these streets impacts the selling prices of single-family houses. Equation (2) takes the following form:

$$\begin{aligned}\ln PRICE = {} & \alpha + \beta_1 \ln COUNT + \beta_2 \ln AGE + \beta_3 \ln BATH + \beta_4 \ln BED + \beta_5 \ln COND \\ & + \beta_6 \ln FIRE + \beta_7 \ln LOT + \beta_8 \ln SQFT + \beta_9 AIR + \beta_{10} BRICK + \beta_{11} FALL \\ & + \beta_{12} FULL + \beta_{13} NONE + \beta_{14} OWN + \beta_{15} SPRING + \beta_{16} WINTER \\ & + \sum_{i=17}^{29} \beta_i YR + \varepsilon \end{aligned} \tag{2}$$

where lnCOUNT equals the natural logarithm of the average 24-hour weekday traffic count on the street where the property is located, and all else is as previously defined. Traffic counts were conducted at multiple sites on 17 of the 27 arterial streets. For both single-family houses and multi-unit properties adjacent to one of these streets, the count from the nearest count location was used as COUNT.

To analyze the relationship between traffic externalities and multi-unit residential properties, Equation (3) compares the selling prices of multi-family rental housing located on an arterial street with the selling prices of multi-family rental housing otherwise situated. Equation (3) takes the following form[5]:

$$\begin{aligned}\ln PRICE = {} & \alpha + \beta_1 HIGH + \beta_2 \ln AGE + \beta_3 \ln BED + \beta_4 \ln LOT + \beta_5 SQFT \\ & + \beta_6 \ln UNITS + \beta_7 FALL + \beta_8 WINTER + \beta_9 SPRING \\ & + \sum_{i=10}^{29} \beta_i YR + \varepsilon \end{aligned} \tag{3}$$

where lnUNITS equals the natural logarithm of the number of residential rental units in the property, and all else is as previously defined.

The estimate of Equation (4) is limited to parcels adjacent to an arterial street. Its inclusion in the research design is necessary to determine how traffic volume on major streets impacts the selling prices of multi-family residential rental properties. Equation (4) takes the following form:

$$\begin{aligned}\ln PRICE = {} & \alpha + \beta_1 \ln COUNT + \beta_2 \ln AGE + \beta_3 \ln BED + \beta_4 \ln LOT + \beta_5 SQFT \\ & + \beta_6 \ln UNITS + \beta_7 FALL + \beta_8 WINTER + \beta_9 SPRING \\ & + \sum_{i=10}^{22} \beta_i YR + \varepsilon \end{aligned} \tag{4}$$

where all the variables are as previously defined[6].

## Results

The results of the single-family models are summarized in Tables III and IV, and the results of the multi-family property models are summarized in Tables V and VI. Before reviewing each table separately, the most significant conclusion of the study is evident from a comparison of the results. The influence of traffic volume on the value of single-family houses and multi-family housing units is dissimilar, suggesting the two markets are segmented. With regard to location on an arterial street, decreased property values were found among single-family houses. This finding is consistent with

| Variable | Parameter estimate | Standard error | $t$ value | $p > t$ |
|---|---|---|---|---|
| Intercept | 6.09598 | 0.06450 | 94.51 | < 0.0001 |
| HIGH | −0.08165 | 0.00635 | −12.85 | < 0.0001 |
| lnAGE | −0.07178 | 0.00471 | −15.23 | < 0.0001 |
| lnBATH | 0.11205 | 0.00705 | 15.89 | < 0.0001 |
| lnBED | 0.03167 | 0.00913 | 3.47 | 0.0005 |
| lnCOND | 1.22768 | 0.02339 | 52.48 | < 0.0001 |
| lnFIRE | 0.09009 | 0.00543 | 16.61 | < 0.0001 |
| lnLOT | 0.14368 | 0.00526 | 27.31 | < 0.0001 |
| lnSQFT | 0.26954 | 0.00798 | 33.78 | < 0.0001 |
| FALL | −0.00695 | 0.00449 | −1.55 | 0.1213 |
| WINTER | −0.01820 | 0.00514 | −3.54 | 0.0004 |
| SPRING | −0.01327 | 0.00445 | −2.98 | 0.0029 |
| AIR | 0.01857 | 0.00395 | 4.70 | < 0.0001 |
| FULL | 0.01511 | 0.00600 | 2.52 | 0.0119 |
| NONE | −0.02886 | 0.00614 | −4.70 | < 0.0001 |
| OWN | 0.02009 | 0.00565 | 3.56 | 0.0004 |
| YR99 | 0.05064 | 0.00776 | 6.52 | < 0.0001 |
| YR00 | 0.07198 | 0.00797 | 9.03 | < 0.0001 |
| YR01 | 0.09978 | 0.00794 | 12.57 | < 0.0001 |
| YR02 | 0.11418 | 0.00797 | 14.32 | < 0.0001 |
| YR03 | 0.15824 | 0.00779 | 20.31 | < 0.0001 |
| YR04 | 0.18178 | 0.00784 | 23.18 | < 0.0001 |
| YR05 | 0.23603 | 0.00871 | 27.11 | < 0.0001 |
| YR06 | 0.26319 | 0.00869 | 30.27 | < 0.0001 |
| YR07 | 0.24911 | 0.00897 | 27.76 | < 0.0001 |
| YR08 | 0.17601 | 0.00939 | 18.73 | < 0.0001 |
| YR09 | 0.13418 | 0.00946 | 14.18 | < 0.0001 |
| YR10 | 0.11427 | 0.00972 | 11.75 | < 0.0001 |
| YR11 | −0.00816 | 0.02167 | −0.38 | 0.7064 |

**Notes:** $n = 9{,}670$; $F$ value $= 1616.56$; $p > F < 0.0001$; Adjusted $R^2 = 0.8289$

**Table III.** Equation (1) regression results: single-family houses

conventional wisdom and previous literature. In contrast, such locations increased value among multi-family properties. With regard to traffic count on arterial roads, there was a clear negative relationship between traffic count and single-family house price, again consistent with expectations and previous research. Among multi-family residences adjacent to an arterial street, the coefficient was negative, but the relationship was not statistically significant.

*Single-family houses*

Examination of Table III, where the regression results for Equation (1) are summarized, will reveal that the data fit the model well. The $F$ statistic is highly significant; the adjusted $R^2$ indicates that the model explains 82.89 per cent of the variation in house price. All but two of the 29 explanatory variables are significant at the 99 per cent confidence level.

Of particular interest, the results indicate that single-family houses on or adjacent to an arterial street sell for significantly less than similar houses that are not so situated.

| Variable | Parameter estimate | Standard error | $t$ value | $p > t$ |
|---|---|---|---|---|
| Intercept | 5.24603 | 0.36244 | 14.47 | < 0.0001 |
| lnCOUNT | −0.02145 | 0.01165 | −1.84 | 0.0661 |
| lnAGE | −0.00096 | 0.04288 | −0.02 | 0.9821 |
| lnBATH | 0.11014 | 0.03385 | 3.25 | 0.0012 |
| lnBED | −0.00814 | 0.04146 | −0.020 | 0.8444 |
| lnCOND | 1.06406 | 0.11279 | 9.43 | < 0.0001 |
| lnFIRE | 0.05867 | 0.02455 | 2.39 | 0.0171 |
| lnLOT | 0.18557 | 0.01796 | 10.34 | < 0.0001 |
| lnSQFT | 0.32382 | 0.03791 | 8.54 | < 0.0001 |
| FALL | −0.00095 | 0.02125 | −0.04 | 0.9643 |
| WINTER | −0.01355 | 0.02231 | −0.61 | 0.5437 |
| SPRING | 0.01083 | 0.02105 | 0.51 | 0.6069 |
| AIR | 0.02331 | 0.01934 | 1.21 | 0.2285 |
| FULL | 0.05986 | 0.02714 | 2.21 | 0.0277 |
| NONE | 0.02126 | 0.02792 | 0.76 | 0.4467 |
| OWN | 0.01650 | 0.02600 | 0.63 | 0.5258 |
| YR99 | 0.11971 | 0.03557 | 3.375 | 0.0008 |
| YR00 | 0.16667 | 0.03757 | 4.44 | < 0.0001 |
| YR01 | 0.14889 | 0.03688 | 4.04 | < 0.0001 |
| YR02 | 0.17859 | 0.03506 | 5.09 | < 0.0001 |
| YR03 | 0.27056 | 0.03676 | 7.36 | < 0.0001 |
| YR04 | 0.23750 | 0.03594 | 6.61 | < 0.0001 |
| YR05 | 0.29188 | 0.03996 | 7.30 | < 0.0001 |
| YR06 | 0.35375 | 0.04152 | 8.52 | < 0.0001 |
| YR07 | 0.33232 | 0.04528 | 7.34 | < 0.0001 |
| YR08 | 0.25669 | 0.04248 | 6.04 | < 0.0001 |
| YR09 | 0.19417 | 0.04358 | 4.46 | < 0.0001 |
| YR10 | 0.15049 | 0.04167 | 3.61 | 0.0003 |
| YR11 | 0.30351 | 0.11084 | 2.74 | 0.0063 |

**Notes:** $n = 757$; $F$ value = 67.00; $p > F < 0.0001$; Adjusted $R^2 = 0.7057$

**Table IV.**
Equation (2) regression results: single-family houses

This result is consistent with the findings of Hughes and Sirmans (1992), (1993). The parameter estimate for HIGH of −08116 is significant at the 99 per cent confidence level. Following Kennedy (1981), the percentage change in house price (g) due to the property's high-traffic location can be calculated as follows:

$$g = \left[\exp\left(\beta - \frac{1}{2}\mathrm{var}(\beta)\right) - 1\right] * 100 \quad (5)$$

where $\beta$ is the estimate of a binary variable coefficient and var($\beta$) is the variance of $\beta$. Applying the regression results to Equation (5) indicates that, on average, single-family houses adjacent to an arterial street sold for 7.8 per cent less compared to similar properties on collector streets. This means, for example, that a house located on a high-traffic street that sold for the mean price in our database, \$130,988, would be expected to sell for \$142,069 if it were adjacent to a collector street.

Examination of Table IV, where the results of the estimate of Equation (2) are summarized, reveals the impact of traffic count on single-family house price. Again, the

| Variable | Parameter estimate | Standard error | $t$ value | $p > t$ |
|---|---|---|---|---|
| Intercept | 6.22930 | 0.70906 | 8.79 | < 0.0001 |
| HIGH | 0.13049 | 0.05739 | 2.27 | 0.0235 |
| lnage | −0.49052 | 0.08450 | −5.81 | < 0.0001 |
| lnBED | 0.17552 | 0.04167 | 4.21 | < 0.0001 |
| lnLOT | 0.11751 | 0.03164 | 3.71 | 0.0002 |
| lnSQFT | 0.70952 | 0.07911 | 8.97 | < 0.0001 |
| lnUNITS | 0.16480 | 0.07308 | 2.26 | 0.0246 |
| FALL | 0.02294 | 0.06547 | 0.35 | 0.7262 |
| WINTER | 0.03286 | 0.06812 | 0.48 | 0.6298 |
| SPRING | 0.05569 | 0.06477 | 0.86 | 0.3904 |
| yr99 | −0.22800 | 0.12289 | −1.86 | 0.0642 |
| yr00 | −0.04171 | 0.12532 | −0.33 | 0.7394 |
| yr01 | 0.06972 | 0.11827 | 0.59 | 0.5558 |
| yr02 | 0.04408 | 0.11991 | 0.37 | 0.7133 |
| yr03 | 0.16848 | 0.12767 | 1.32 | 0.1877 |
| yr04 | 0.20481 | 0.10476 | 1.95 | 0.0512 |
| yr05 | 0.52379 | 0.11220 | 4.67 | < 0.0001 |
| yr06 | 0.23560 | 0.12467 | 1.89 | 0.0595 |
| yr07 | 0.08814 | 0.11444 | 0.77 | 0.4416 |
| yr08 | 0.07190 | 0.11893 | 0.60 | 0.5458 |
| yr09 | 0.12280 | 0.17911 | 0.69 | 0.4933 |
| yr10 | −0.25390 | 0.16193 | −1.57 | 0.1176 |
| yr11 | 0.16237 | 0.13384 | 1.21 | 0.2257 |

**Notes:** $n = 455$; $F$ value $= 62.26$; $p > F < 0.0001$; Adjusted $R^2 = 0.7480$

**Table V.** Equation (3) regression results: multi-unit rental properties

$F$ statistic indicates that the data fit the model well and the adjusted $R^2$ indicates that the model explains 70.57 per cent of the variation in house price. The signs and significance of the control variables are similar to those shown for Equation (1) in Table III. Seventeen of the explanatory variables are significant at the 99 per cent confidence level and another two are significant at the 95 per cent level.

Of particular interest, the variable measuring traffic count, lnCOUNT, has the expected negative sign and is significant at the 90 per cent confidence level. With a logarithmic model, for continuous independent variables such as lnCOUNT, the parameter estimate allows us to calculate the expected percentage change in the dependent variable, given a percentage change in the independent variable. The parameter estimate for lnCOUNT of −0.02145 indicates that a doubling of the traffic count from any particular level would reduce the selling price by 2.145 per cent. To illustrate, consider a street with daily traffic count of 5,000 vehicles. A proposed street widening to accommodate 50 per cent more traffic would decrease the expected selling price of any house on the street by 1.0725 per cent. The expected selling price of our mean-valued house, for example, would be expected to decrease from 130,988 to $129,598.

*Multi-unit properties*

Tables V and VI show the regression results of Equation (3) and (4), respectively. In both models, the $F$ value is highly significant. The adjusted $R^2$ indicates the independent variables explain 74.8 per cent of the variation in the dependent variable in Equation (3),

**Table VI.**
Equation (4) regression results: multi-unit rental properties

| Variable | Parameter estimate | Standard error | $t$ value | $p > t$ |
|---|---|---|---|---|
| Intercept | 7.24975 | 2.78159 | 2.61 | 0.0108 |
| lnCOUNT | −0.20192 | 0.13101 | −1.54 | 0.1269 |
| lnAGE | −0.35278 | 0.25845 | −1.37 | 0.1758 |
| lnBED | 0.07860 | 0.09269 | 0.85 | 0.3987 |
| lnLOT | 0.23802 | 0.09316 | 2.55 | 0.0124 |
| lnSQFT | 0.65120 | 0.29081 | 2.24 | 0.0277 |
| lnUNITS | 0.21773 | 0.22153 | 0.98 | 0.3284 |
| FALL | 0.25989 | 0.21707 | 1.20 | 0.2344 |
| WINTER | 0.55593 | 0.24127 | 2.30 | 0.0236 |
| SPRING | 0.28680 | 0.22757 | 1.26 | 0.2110 |
| YR99 | −0.79464 | 0.35454 | −2.24 | 0.0276 |
| YR00 | −0.42647 | 0.39467 | −1.08 | 0.2829 |
| YR01 | −0.00525 | 0.37627 | −0.01 | 0.9889 |
| YR02 | −0.12189 | 0.35695 | −0.34 | 0.7336 |
| YR03 | −0.36260 | 0.44741 | −0.81 | 0.4199 |
| YR04 | −0.12986 | 0.35042 | −0.37 | 0.7119 |
| YR05 | 0.33152 | 0.34399 | 0.96 | 0.3378 |
| YR06 | −0.08554 | 0.36997 | −0.23 | 0.8177 |
| YR07 | −0.38750 | 0.42961 | −0.90 | 0.3696 |
| YR08 | −0.30503 | 0.49517 | −0.62 | 0.5395 |
| YR10 | −0.41313 | 0.77104 | −0.54 | 0.5935 |
| YR11 | −0.12857 | 0.39366 | −0.33 | 0.7448 |

**Notes:** $n = 109$; $F$ value = 15.13; $p > F < 0.0001$; Adjusted $R^2 = 0.7331$

where location on an arterial street (HIGH) was the variable of particular interest. In Equation (4), where traffic count (lnCOUNT) was used to measure the effect of traffic externalities, 73.31 per cent of the variation in the dependent variable was explained.

The results in Table V indicate that location on or adjacent to an arterial street positively affects multi-unit rental property selling price. The estimate for HIGH of 0.13049 is significant at the 95 per cent confidence level. Using this estimate, Equation (5) indicates that multi-unit properties located adjacent to an arterial street sold, on average, for a 13.75 per cent premium compared to similar properties on low-traffic streets. In addition, the estimate for lnUNITS indicates that the price effect is positively related to the number of dwelling units in the property. The estimate of 0.1648 for lnUNITS means, for example, that an 11-unit property would be expected to sell for 1.648 per cent more than a similar ten-unit property.

Unlike the situation for single-family houses, with HIGH as our measure of traffic influence, no seasonality in the selling price of multi-unit residential properties was detected as indicated by the insignificant estimate for FALL, WINTER and SPRING. In addition, examination of the estimates for the YR variables suggests that inclusion of a continuous variable to account for market conditions would not have been very effective. In this estimate, multi-unit properties' selling prices were significantly higher in 2004, 2005 and 2006 compared to 1998 (the holdout year), but for all other years, there was no significant difference in selling price compared to the holdout year. Finally, examination of Table VI will reveal no significant relationship between lnCOUNT and multi-unit property price.

## Summary and discussion

There are advantages and disadvantages external to a residential property itself associated with location adjacent to busy surface streets. In the present study, the values associated with these externalities differ between residents who reside in single-family dwellings and residents of multi-family dwellings. Location on an arterial street appears to have more negatives than positive benefits for people living in single-family residences. In our study, the value of a detached single-family house located on an arterial street is significantly less, 7.8 per cent, on average, than similar houses otherwise located. Also, as traffic volume on arterial streets increases, the value of single-family houses declines.

Conversely, the prices of multi-family housing suggest that the advantages of location on an arterial street outweigh the disadvantages for the residents of these properties. Multi-unit housing located adjacent to an arterial street was associated with 13.75 per cent higher, on average, sale price. As traffic count on arterial streets varied, however, the effect of traffic externalities on multi-family housing was not statistically significant. This finding combined with the price consequences of location on an arterial street suggests that beyond some level of traffic volume, advantages of access may be offset by the increased negative externalities. In the city examined in this study, all but a few parts of the arterial streets had nearby bus stops, leading to the speculation that access to public transportation may be a particularly valuable externality for some apartment dwellers living in inner suburbs.

It is informative to compare the single-family house results of the present study with the other major published empirical study on topic. In Hughes and Sirmans' (1992) study, each additional 1,000 vehicles in a street's average daily traffic count reduced the price of houses on a suburban street by 0.54 per cent and by 1.05 per cent for houses on a city street. Hughes and Sirmans used a linear model in their study, whereas the present study used a logarithmic form, making a direct comparison of the results problematic. In general, our results are consistent with theirs, but when focusing on house values and traffic flow levels around the mean in the present study, the property value decrease associated with marginal increases in traffic are smaller than that observed by Hughes and Sirmans. The difference in the traffic impact between the two studies reinforces the importance of local environments in determining the impact of traffic on house price.

The results of the present study regarding multi-family properties have important policy implications. The current practice of zoning multi-family housing near busy streets seems to be a reasonable, value-maximizing practice. Our findings suggest that residents of multi-family units place a higher value on positive traffic externalities and experience less disutility from negative traffic externalities than residents of single-family properties. The opposite appears to be the case for single-family house residents. When expanding roads, planners should recognize that increased traffic flow along areas with substantial multi-family housing is likely to generate fewer net negative and perhaps net positive externalities compared to expansions in areas predominated by single-family homes. In some cases, well-designed traffic expansion may help maintain or enhance property values. Planners should also recognize that along with road expansion, steps can be taken to leverage the positive externalities associated with traffic such as improving convenience to public transportation and enhancing pedestrian access to shopping.

Land use changes are also likely to accompany changes in traffic patterns. If the value of single-family houses declines due to increased traffic, while the value of multi-family units in the same area increases, there will be pressure to convert property dedicated to single-family use to multi-family. The transitional process may be first associated with conversions from owner-occupied single-family units to single-family rental units. The adaptation from single-to multi-unit use may be a slow process because of rigidities in the markets and resistance from some property owners to zoning changes. The transition process may include modification of single-family properties to accommodate multiple households, and physical deterioration sometimes accompanies this process. Price changes are likely to precede obvious construction changes. Managing areas of transition through building code enforcement and zoning policies is another challenge for planners and a possible opportunity for developers.

## Notes

1. Noise, however, is not the only negative externality that vehicular traffic may impose on nearby residential properties. Other undesirable elements associated with vehicular traffic include increased air pollution, litter, unwanted light at night and collisions with property, animals or people. Because these other negative externalities may be associated with noise, noise might have served as a proxy for a variety of negative traffic effects.
2. There is sufficient overlap between renter/resident of multi-unit properties on the one hand and homeowner/single-family resident on the other to use income differentials between renters and owners to support the segmentation of markets along these lines.
3. Of the 757 single-family house observations, 673 classified as "high-traffic" were parcels that fronted an arterial street. Either the side or back of the parcel was adjacent to the arterial street for the other 84 "high traffic" single-family house observations. All but 15 of the multi-unit, high-traffic properties fronted the arterial street.
4. The variable COND was derived from the property condition rating assigned by appraisers at the auditor's office, who rated each property's condition from "excellent" to "poor." To operationalize these ratings, the researchers converted the ratings to a numerical value with average condition assigned a value of 6. As indicated in Table I, assigned values ranged from 10 to 3 (in half-point increments) for the best-to worst-rated properties in the database.
5. An important explanatory variable of rental housing value is the net cash flow the property generates. Unfortunately, this information was unavailable. While the traffic variables may capture some of this effect, other aspects of net operating income will be captured in the error terms of Equations (3 and (4).
6. There is no YR09 variable in Equation (4) because no transactions involving multi-unit properties adjacent to an arterial street occurred in 2009.

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AN IDAHO STUDY FOR THE IDAHO DEPARTMENT OF TRANSPORTATION

# VALUATION OF INDIRECT LOSSES DUE TO PROXIMITY DAMAGES ON RESIDENTIAL PROPERTY IN IDAHO

## N04-03
## KLK465

NIATT

University of Idaho


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**Date: August 13, 2003**



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## Executive Summary

### Valuation of Indirect Losses Due to Proximity Damages on Residential Property in Idaho

Statewide transportation planning needs require forecasting and assessing property damages that result from a road project. As the traffic flow and traffic demands in Idaho change, the Idaho Transportation Department continuously evaluates transportation elements of comprehensive plans, determines impacts of proposed land use changes, and determines the transportation needs for the state. Meeting transportation needs often requires building or widening roadways, which necessitates that the state exercise their eminent domain right, the right to take private property for a public use upon payment of just compensation.

Two basic forms of damages have been identified in eminent domain litigation: the taking of the physical property; and concluded hypothetical damages occasioned by the taking to the remainder—the remaining land and improvements as they exist at a point in time after the road project has been completed. The problem in the past has been that the methods used to estimate the value of these damages employed limited comparable data, usually three to five direct comparisons, with subjective adjustments applied based on experience and arbitrary judgment.

In this study, a six region forecasting model was developed to explain residential property values in Idaho based on multivariate regression analysis. The model uses factors, or characteristics that commonly affect the sales price of a home, and less common characteristics such as street-traffic classification and setback from the street or road, to conclude what portion of home value is attributable to proximity and to street-traffic classifications.

A multi-regional or state wide model was developed and tested, as were separate models for each region. The regions from which data were collected and analyzed are: the Idaho Falls region, the Pocatello region, the Boise region, the Lewiston region, the Moscow region, and the Coeur d'Alene region. The statewide model, which incorporates statstically estimated adjustments for each region, was the strongest and most complete model. With it, statistically reliable as-is and hypothetical estimates of residential property values can be calculated within the tested regions statewide for residential properties that have been or will be affected by damages associated with designing new routes or widening existing streets and roads. The model will also assist in providing more quantative benchmarks for assessing whether damages have even occured at all.

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Figure 1. Map of the State of Idaho

**Introduction**

Idaho's transportation system is comprised of about 60,000 miles of road, about 4,000 bridges, 1,900 miles of rail lines, 125 public airports, and the Port of Lewiston. Of Idaho's 58,588 miles of roads, approximately 9 percent, or 5,000 miles, are state–controlled, while 40 percent are federal. Of the total miles of non-federal rural roads, 14 percent are state, 44 percent are county, less than one percent are township, and 42 percent are municipal and other. The state highway system accounts for 54 percent of the state's vehicle miles of travel, while 41 percent of vehicle miles of travel occur on the interstates. From 1984 to 1998, vehicle miles of travel on the state highway system has increased more than 63 percent (*Idaho's Transportation System Defined*).

As the demands of the traveling public in Idaho change, traffic flow and traffic demands in Idaho change. As a result, the Idaho Transporation Department (ITD) is responsible for developing a 20-year long-range plan as well as the 3-year State Transportation Improvement Program (STIP). Working under the supervision of a Governor Appointed Board, ITD has six planning districts that work with a variety of transportation planning organizations and groups, including six regional planning and development organizations. Meeting the state's transportation needs often requires widening roadways or designing new routes, which necessitate that the state exercise their eminent domain right. Eminent domain is the right of the state to take private property for a public use upon payment of just compensation.

In *Real Estate Valuation In Litigation* second ediition, (1995), James Eaton identifies two basic forms of damages in eminent domain litigation. One is the taking of the physical property. The other is the concluded damages occasioned by the taking to the remainder parcel. The amount of damages is determined by computing values concluded by doing an appraisal on the property in its present state ("as-is") and an assumed or supposed ("hypothetical") value of the property at a point in time after the road project has been completed (chapter 14).

The Idaho Department of Transportation spends a great deal of taxpayer money to compensate residential property owners for estimates of residual property damage resulting from a road project. More specifically, measuring damages caused by the remainder's proximity to the improvement being constructed, e.g., a highway, has not been empirically examined on a statewide or regional level, and the relationship between estimates for just compensation for anticipated damages and the actual loss of market value to the residential property has not been empirically identified.

In 1997, the right of way division of ITD organized a task force to consider the parameters of a comprehensive study in an effort to develop consistency and reliability in concluding residential property proximity damages. After three years of gathering studies and literature from federal agencies and other state transportation departments, the task force contacted the Univesity of Idaho Agricultural Economics and Rural Sociology Department requesting a proposal to complete the study for Idaho. In November 2000, the grant was issued and administered through NIATT, National Institute for Advanced Transportation Technology, the transportation engineering division of the Unversity of Idaho.

The Idaho Transporation Department is the lead agency for the research project with a five-member technical oversight committee. The committee members include:

- Doyle Pugmire, Appraisal Coordinator, ITD
- Leonard Hill, Right of Way Manager, ITD
- Rick Machmeier, Right of Way, Appraisal Review, ITD
- Scott Frey, FHWA
- Karl Vogt, Attorney General's Office, ITD

**Problem Statement: The Real Property Aquisition Appraisal Process.**

It has become essential for real estate appraisers to use a standard definition of "Proximity Damage" as well as a standard formula in the value computations in order to avoid subjective and flawed estimates of value.

"There are many perspectives that lend themselves for proximity study… its physical or environment affects, its social affects,its health affects, etc." (p. 2) *The Appraisal Journal*, *Transportation Research Record*, *Right of Way Journal,* and *Real Estate Valuation in Litigation* provide extensive information on the valuation process of typical and atypical properties, as well as complex and noncomplex appraisals. These publications describe regulations for eminent domain appraisals, following *Uniform Standards of Professional Appraisal Practice* and *Uniform Appraisal Standards for Federal Land Acquisitions.*

While appraisers do not conclude just compensation, they are required to measure the diminution in value based on material facts and circumstances that would influence a buyer or seller. (Eaton, 1995, p. 20) The Federal Highway Administration appraisal guidelines outline technique and methodology, which state:

> The ***sales comparison approach*** should be developed and relied upon whenever there is adequate market data.
>
> The approach shall include adequate research to identify all pertinent similar properties for which sales, listings, or rental data are available.
>
> All comparable information will be confirmed by the buyer, seller, broker or other person having knowledge of the price, terms and conditions or the reason for not so confirming shall be stated.
>
> Significant adjustments for similarities and dissimilarities such as time, location, physical and economic characteristics, and motivation for the transaction shall be individually explained.
>
> Substantial lump sum adjustments that cannot be quantitatively or qualitatively supported are not acceptable.

Using the specific methods defined by the Federal Highway Administration appraisal guidelines, it becomes evident that proximity damages have a discernable affect on property values.

Proximity damages are specifically defined as “[a]n element of severance [compensable] damages that is caused by the remainder’s proximity to the improvement being constructed, e.g., a highway; may also arise from proximity to an objectionable characteristic of a site or improvement, e.g., dirt, dust, noise, vibration.” (Eaton, 1995, p. 314) Distinguishing proximity damages from other factors that effect value, e.g., square footage, condition, effective age, room count, lot size, are ideally concuded by measuring properties with identical or similar features. It is near impossible to find recently sold properties that are substantially the same, with exception to proximity to the characteristics that create dirt, dust, noise, and vibration. As a consequence, the direct sales comparison technique is highly limited in these types of appraiser problems.

**Literature Review**.

The major studies that have been performed with respect to proximity damages focused primarily on “comparison control” research method and “before and after” research method. Initial studies employed several other methodologies. One study conducted in the late 1970’s addressed multiple regression process with proximity as one of the variables. All of the material surveyed consisted of studies researching the socioeconomic impacts of freeway projects. Private research firms for the State of California, and the State of Washington transportation department conducted two of the studies reviewed. Six additional studies that were evaluated for methodology were research papers presented to the California Transportation Board. Most of the publications were from the 1970 to 1980 era, a period of high growth and progressive transportation modifications, primarily in freeway design and construction, including integration with existing housing developments.

Most of the studies conducted found an absence of a reliable predictive model to approximate damages, likely caused by a number of factors. However, these studies do point to recurring patterns in the effects of freeways on residential property values. Most of the studies completed were "comparison control" method in which an impact area adjacent or close to a freeway was compared to a control area farther removed from the freeway.

Professional research material was reviewed for additional information. *Appraisal Journal* is a professional journal that discusses new valuation methods, and current concerns and developments in the field of real estate appraising. It often references the appraisal of atypical and complex properties and methods. It does not address the problem of proximity valuation, but does recommend use of before and after valuation techniques for appraisal problems for which no market indicators exist.

The national refereed journal, *Right of Way Journal* provided more background to the problem of residential proximity damages than any other available source. An article based on a speech presented to the International Right of Way Association International Seminar in Baltimore, Maryland on June 17, 1998, cites the process derived by Salt Lake City's Property Management Department, based on a study conducted in a portion of the city. The findings can be summarized as follows:

> The council compared a selection of properties that had sold, been subject to a taking, and then resold.
>
> In addition to the traditional components of an appraisal, the appraisers for this study did a comparison in the before and after, and included a residential front yard proximity study report. Values on intrinsic damages derived from the market were concluded from the before and after comparison of value.
>
> The appraisers did consistently find a decrease in the market value of the properties in the after condition, or when the distance between the residential property and the road decreased. Damages were expressed in the form of a percentage of the before value.[1]

[1] It should be noted that the street-traffic classification co-efficient in the Salt Lake City study remained constant, and that the location of the house with respect to the distance from the road varied. In the model presented in this report, the distance from road variable and the street-traffic classification variable both vary.

A query was made by ITD in 2001 with all State Transportation Departments. Responses to the query showed that no study has yet been performed that uses research multivariate regression analysis to estimate the market value of road characteristics (expressed as independent variables) as they affect the sales price of a residential property (the dependent variable). Multivariate regression analysis involves selecting independent variables (I.V.'s) that, when working together, create an outcome (the dependent variable). As an example, a 1,500 square-foot (first I.V.) above average quality construction home (second I.V.) with three bedrooms (third I.V.), two bathrooms (fourth I.V.) and a two-car garage (fifth I.V.) sitting on a 7,000 square foot lot (sixth I.V.) with a fifty-foot set-back from a road (seventh I.V.) with 500 to 1,000 cars per day (eighth I.V.) located in Moscow, Idaho (ninth I.V.) creates a value of $137,000 (the dependent variable). The independent variables selected, and their reliability of predicting values, are selected by using statistical processes discussed later in the Methods section.

**Objectives**

Compensation for proximity damages (reduced value of the remaining property after a road is built or widened) is based on the assumption that the value of residential property is diminished as a direct result of proximity to a high traffic road. The methods being used to estimate the values of these damages employ limited comparable data, usually three to five direct comparisons, and subjective adjustments based on perception and arbitrary judgment. An objective study based on a method in which numerous home sales are identified in an impact area adjacent or close to a high traffic road, and numerous home sales away from high traffic impact areas is needed to emperically conclude if damages do exist, and to quantify such damages.

The general objective of this research was to determine what features or characteristics of roads, if any, affect the sale prices of adjacent residential properties, and to quantify such effects. Specific objectives of this study are:

1. Identify significant independent variables that affect the values of single-family homes in major population regions of Idaho, in order to isolate road related factors.

2. Evaluate models of value of single family homes for different regions of Idaho, relative to models for the state as a whole to determine what model or models could be most useful to estimate single family residential property values throughout Idaho.

3. Evaluate any empirical evidence of road effects to conclude a standardized method for applying damage measurement in analyzing estimated losses of market value due to road projects.

**Setting: The State of Idaho.**

The following is a brief overview of the geographic information and demographics of Idaho[2]

**10 largest cities by population (2000):**

Boise, 85,787; Nampa, 51,867; Pocatello, 51,466; Idaho Falls, 50,730; Meridian, 34,919; Coeur d'Alene, 34,514; Twin Falls, 34,469; Lewiston, 30,904; Caldwell, 25,967; Moscow, 21,291

**Land area:** 82,747 sq mi. (214,315 sq km)

**Geographic center:** In Custer Co., at Custer, SW of Challis

**Number of counties:** 44, plus small part of Yellowstone National Park

**Largest county by population and area:** Ada, pop. 312,337 (2001); Idaho, 8,485 sq mi.

**State forests:** 881,000 ac.

**State parks:** 27 (43,000+ ac.)

**2001 resident population est.:** 1,321,006

**2000 resident census population (rank):** 1,293,953 (39). **Male:** 648,660 (50.1%); **Female:** 645,293 (49.9%). **White:** 1,177,304 (91.0%); **Black:** 5,456 (0.4%); **American Indian:** 17,645 (1.4%); **Asian:** 11,889 (0.9%); **Other race:** 54,742 (4.2%); **Two or more races:** 25,609 (2.0%); **Hispanic/Latino:** 101,690 (7.9%). **2000 population 18 and over:** 71.5%; **2000 population 65 and over:** 11.3%; **median age:** 33.2.

Idaho is the 13th largest state in the U.S. in land area, 11th smallest in population, and 11th least densely populated. Approximately 73 percent of Idaho's population and jobs, and just under 100

[2] Though popularly believed to be an Indian word, "Idaho" is an invented name whose meaning is unknown.

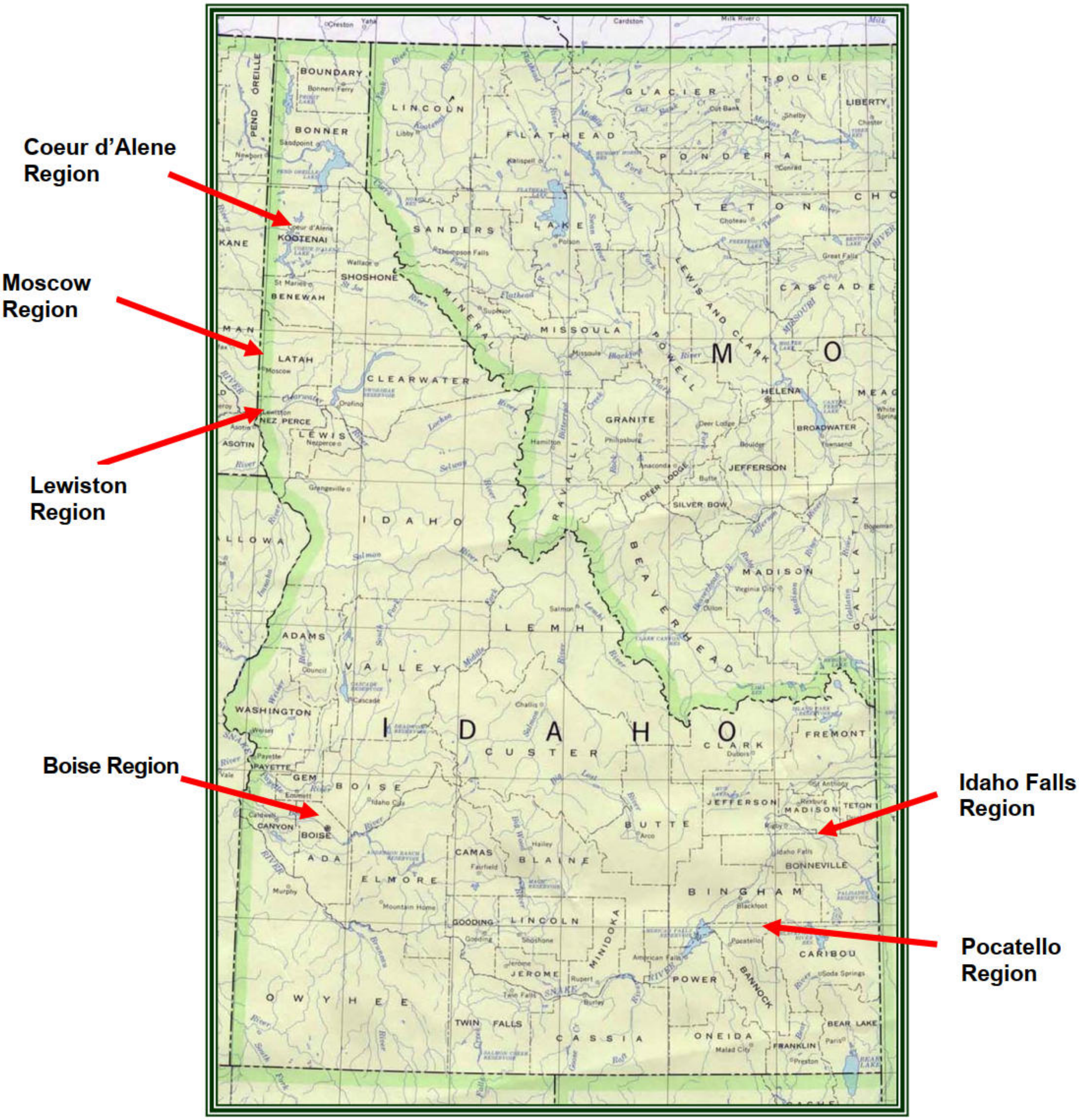
percent of the land, is non-urban. Approximately 94 perent of Idaho's roads are rural. Federally owned lands amount to 62 percent of the state's land area.

12 percent of the state's jobs are in the rural agriculture sector, and 1 percent are the mining sector. Most jobs in Idaho's rural areas are in sectors also common in urban areas: construction, transportation and utilities (12 percent); manufacturing (15 percent); business and trade (26 percent); and services and government (34 percent). (Idaho's Transportation System Defined)

This study concentrated on the following six major population centers in Idaho: (Figure 1)

1. **The greater Pocatello - Bannock County region**
2. **The greater Idaho Falls - Bonneville County region**
3. **The greater Boise – Ada County region**
4. **The greater Lewiston - Nez Perce County region**
5. **The greater Moscow - Latah County region**
6. **The greater Coeur d'Alene - Kootenai County region**

**Figure 2. Identification of Major Idaho Population Centers**



**The Model.**

The general model used in this study is a multivariate regression model with residential property value as the dependent variable. Independent variables considered in the study are possible factors explaining residential property values. These variables were specified based on two criteria, as follows:

1. Variables generally considered to be consistent factors that affect residential property values in the direct comparison approach appraisal method, under typical sales conditions with a typically motivated purchaser and seller, and
2. Variables concluded to impact value related to road proximity, based on review of forty to fifty proximity damage files at the Idaho Transportation Department.

General sources of data on specified variables were:

1. Real estate mutliple listing service (MLS) information from each of the six regions of Idaho considered in this study.
2. County assessors' field sheets and computer data bases where MLS data were not complete.
3. Idaho Transportation Department (ITD), COMPASS, Ada County Highway District, and local traffic engineering departments' traffic count data. These data were collected according to the street-traffic count classifcations shown in Table 1.
4. On-site inspections of each property considered.

| Table 1. ***Street-Traffic Count Classification*** | | | |
|---|---|---|---|
| **Model Identificaiton** | **Classification** | **Street Use** | **Traffic Count** |
| Base Case | Local-A | Residential | 0-100 cars per day |
| 1 | Local-B | Residential | 101-500 cars per day |
| 2 | Local C | Residential | 501-1000 carps per day |
| 3 | Collector | Traffic Circulation | 1001-5000 cars per day |
| 4 | Minor/Rural Arterial | Through-travel, leaving, entering | 5,000-10,000 cars per day |
| 5 | Principal Arterial* | Through-travel | 10,000+ cars per day |

*Interstates are included in this classification.

The *Federal Highway Guide for Functional Highway Classification* notes that area definitions for urban and rural areas have fundamentally different characteristics as to density and types of land use, density of streets, and highway networks. Since data for this study were collected in areas of greater than 5,000 population, urban classifications apply. [3] COMPASS and Federal Highway street classification information was correlated with traffic count data obtained from ITD, Ada County Highway District, and local traffic engineering departments.

A list of independent variables analyzed and the general source of data for each of these variables were presented in Table 2. Data were collected on about 1,800 MLS listed residential home sales that represent about 10 percent of the market for the period analyzed (1998 through mid - 2002).

[3] The word "road" may be interchangebly used with "street" within the report, both having the same meaning. COMPASS and the Federal Highway Administration also use the term "street" and "road" interchangeably within their publications.

Table 2. Variables Analyzed and General Data Sources for Each Variable*

| Variable | General Data Source |
|---|---|
| Date of Sale | MLS Data Sheets |
| Year built | MLS Data Sheets and Assessor |
| Effective age | On-site inspections and MLS |
| Quality of consturction | On-site inspections |
| Gross Living Area | MLS Data Sheets |
| Above Grade Bedroom Count | MLS Data Sheets |
| Above Grade Bathroom Count | MLS Data Sheets |
| Total Basement Square Feet | MLS Data Sheets |
| Basement Square Feet Finished | MLS Data Sheets |
| Heating System | MLS Data Sheets |
| Cooling System | MLS Data Sheets |
| Number of Fireplaces | MLS Data Sheets |
| Patios/Decks | MLS Data Sheets |
| Fencing | MLS and on- site inspections |
| Automatic Sprinkling System | MLS Data Sheets |
| Shops & Outbuildings | MLS and on-site inspections |
| Car Storage (includes garages and carports) | MLS and on-site inspections |
| Lot Size | MLS Data Sheets and Assessor |
| Zoning | MLS Data Sheets and City P & Z |
| Location | MLS and On-Site Inspections |

Table 2, continued

| *Variable* | *General Data Source* |
|---|---|
| | |
| Setback of house from road (curb to living area) | On-site Inspection – measurement using measuring wheel |
| Fronts/backs to road* | On-site inspection |
| Traffic Count** | ITD, ACHD, local traffic data |
| Speet Limit** | On-site Inspection |
| Number of lanes** | On-site Inspection |
| Road Classification | On-site Inspection |

*See setback explanation following.

**Traffic count, speed limit, and number of lanes data are used to conclude the overall road classification

All of the variables included in the study are considered to be in excess of *Uniform Standards of Professional Appraisal Practise* and *Uniform Appraisal Standards for Federal Land Acquisitions* requirements. Additional data collected and on file include: Addresses, legal descriptions where available, MLS reference numbers, dates of sales, tax parcel numbers (when made available in the MLS data), financing, sales concessions, list prices, and number of days on market.

The meanings of most of the variables specified in Table 2 are stright forward. However, the following variables deserve additional explanation:

- Setback of home from the road. An onsite inspection was made for each property to measure the distance, in feet, of the home set-back from the road travelway. If there was more than one road abutting the site, the road with the most proximity characteristics was used as the measuring point, measuring to the front, side, or back as it applied.

- Effective age. Onsite inspection and specific property information garnered from realtor comments on the MLS data sheet were used to conclude the effective age of the home. Specific information such as a new roof, new carpets, new heating system, new kitchen cabinets,etc. were accounted for in concluding the effective age of the home. Condition was originally considered as a separate variable, but was found to be highly correlated with effective age, indicating that condition is often inherent in effective age, causing multicollinearity, and was thus eliminated as an independent variable.

- Quality of Construction Classification. The quality of construction of the home is based on classifications used by the Oregon Cost Manual, correlating classes 1-8 to “below average,” “average,” “above average,” and “good.” Oregon Cost Manual class 8 homes are considered to be excellent quality construction homes and were not used in any of the models. Oregon Cost Manual classifications of construction are included in the Appendix, H through L. Parameters for construction quality are, from the Oregon Cost Manual:

  Classes 1 and 2 = “Below Average” Construction Quality

  **Class 1 Description**: Structures in this class are built at low cost in keeping with the overall simple design and modest construction. Emphasis is on basic shelter. These houses fall far short of sound minimum building standards.

  The structures often lack a planned design. Building additions are common and may contain materials not compatible with the original construction, resulting in a poor plan and/or appearance. Undersized or overspaced structural members are common, leading to sagging and buckling of the building. Some desirable service features are either lacking or of minimal quality. Interior components may consist of one small bedroom, one small bath, and a combination kitchen, dining room and iiving room.

  These dwellings usually are found in older deteriorating urban neighborhoods, in remote recreation areas, or in areas that lacked building code requirements.

  **Class 2 Description**: Buildings in this class provide modest low-cost housing. These structures fall below current building code requirements for overall construction. Emphasis is on space, instead of style, design, appeal, or functional utility.

The design is usually a simple rectangle with very plain features. Many dwellings have poorly adapted additions or enclosures of porch areas. Interior and exterior cover materials are plain and inexpensive. One bathroom is standard with low grade fixtures. The quality of workmanship and materials is generally not product of skilled labor.

Classes 3 and 4 = “Average” Construction Quality

**Class 3 Description**: Houses in this class are generally built to meet the specifications of government financing programs (FHA and FmHA). Emphasis is on functional utility rather than styling. These homes just meet the current minimum building code.

A simple rectangular shape is most common. Exterior dimensions are usually in multiples of four feet to minimize waste of building materials. There is no exterior ornamentation. Front entries typically open directly into the living area. Interior features are plain and economical. Bathrooms feature economy grade fixtures. Appliances may or may not be built in, and are the most affordable on the market. The overall concept is to provide housing for the economy market.

**Class 4 Description**: These residences were generally built by contractors following a stock plan. Emphasis is still on functional utility. However, these homes can have some styling features such as hardwood floors, brick veneer or other ornamentation.

The quality of materials and workmanship is fair. Usually the front exterior is designed to provide some curb appeal while other exterior walls are plain. Windows, doors, plumbing and heating are normally comprised of “competitive” grade materials. The class 4 home will have modest entry way. Bathroom fixtures will be of fair quality. Built in appliances will be of fair quality, and the quantity will depend on the floor plan. Service features such as cabinetry, electrical outlets and lighting are basic but not numerous.

Class 5 = “Above Average” Construction Quality

**Class 5 Description**: These buildings constitute an average quality home, built for speculation, or on order by the volume builder. The dwellings reflect poplular combinations of styling, design, functional utility, and convenience of floor plan. These homes are acceptable to a broad portion of the market.

Exterior ornamentation such as brick veneer, railings, or cornice trim may be present. These homes will have a larger entry area, often multi-storied, with some type of outside window area to give an even more expansive feeling. Typically, windows will be larger and more numerous, with accent windows being common. Bathroom fixtures will be of average quality and may include china lavatories, and entry level designer faucets. Built in appliances often include separate ovens and cooktops. Interior features may consist of a small amount of average qualtiy hardwood paneling, or painted or stained wainscoating.

Classes 6 and 7 = “Good”

**Class 6 Description**: These dwellings provide housing with emphasis on convenience of floor plan and overall attention to appearance detail. Care is taken to achieve attractive architectural balance in terms of period or classic architectural style and design. The effect often is evidenced by greater irregularity of exterior shape and roof design.

Workmanship and materials are of good quality. The exterior of the house has ample ornamentation, such as good qualtiy brick veneer or similar styling features. Windows will be of wood clad quality and design. Entry areas will be ample in size and geight, with good quality hardwood or tile floor cover. Baths feature good quality fixtures that may include designer characteristics. Appliances will often include double ovens, built in microwaves, downdraft cooktops, and trash compactors. Millwork and trim will be of good qualtiy painted or stained hardwood, or comparable materials. Interior wall finishes are of good quality.

**Class 7 Description**: These residences are custom built. They usually are designed by professional home planners and built by specializing contractors, possibly under architectural supervision. Special effort is made to bring out good styling and design features most outwardly noticeable in the exterior wall, roof and interior construction detail. Care has been taken to ensure convenience in floor plans, window placement, built-ins and adaptation of the house to the site.

All materials and labor are of better quality. The front of the house usually has large amounts of better quality brick veneer or other comparable materials with similar styling features and ornamentation. Windows are usually of wood and constructed to integrate with the design of the house. The entry way will be large with raised ceiling heights, and hardwood, tile, or marble floor cover. Three formal rooms off the entry are common in this class house. Special interior detail may include ample quantity of built-ins, solid core raised panel doors, and better quality designer plumbing fixtures in the kitchen and baths.

**Class 8 Descrition** = not used in the study, but included in the report for clarification.

These homes are the best quality custom dwellings. They are professionally designed by an architect and constructed by well-qualified specialized builders, to the individual desires of a client owner. The architect and contractor maintain quality control throughout construction. Design is not primarily governed by cost consideration and may feature special wall and roof designs to achieve a particular classic style or period effect. Spacious entryways, lofted ceilings and varied floor levels are common. Materials and workmanship are of superior quality. Care is taken to ensure optimum site adaptation. Great attention to detail will be found throughout these structures. The kitchen and baths feature the best quality plumbing fixtures. Interior trim is decorative and intricate. Lighting systems and windows are custom designed to enhance interior features or create special effects. A large number of custom built features and convenience items generally are present. These residences typically give a sense of grandeur. Due to the unlimited range of this class of house, the factor book only reflects the very beginning of the cost scale.

**Data:**

1,800± residential home sales that represent approximately 10% of the market for the period covered were selected from the multiple listing services that cover the six regions of Idaho considered in this study. In addition, some home sales on major and minor arterials and on connectors were specifically selected for comparison. The parameters of the study include $40K to $600K homes that have sold in the greater area of the six identified regions of Idaho between 1998 and 2003 – the time parameters depended on the relative volume of home sales in each area. The Boise, Coeur d'Alene, Moscow, and Lewiston regions have higher sales volumes, allowing for a narrower time range. The data were initially entered into an Access data base. The following five figures demonstrate the information that was entered for the 1,800± homes.

Figure 3. Primary Data

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MLS** | 9704757 | | | | | | |
| **Address** | 9766 Martingale | **City** | Boise | **State** | ID | **Zip** | 83709 |
| **Tax Parcel No.** | 2114100105 | **Subdivision** | Edmonds Cooper | | | | |

| | | | |
|---|---|---|---|
| **List Price** | $114,900.00 | **Leasehold/Fee Simple** | Fee Simple |
| **Sale Price** | $114,900.00 | **Year Built** | 1974 |
| **Financing** | Conventional | **Effective Age** | 20 |
| **Sales Concessions** | $0.00 | **Functional Utility** | Typical |
| **Date of Sale** | 9/30/98 | **Price/Gross Living Area** | $96.07 |
| **Days on Market** | 554 | | |

**Close Form**

Figure 4. Building Description

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MLS** | 9704757 | | | | | | |
| **Address** | 9766 Martingale | **City** | Boise | **State** | ID | **Zip** | 83709 |
| **Tax Parcel No.** | 2114100105 | **Subdivision** | Edmonds Cooper | | | | |

| | | | |
|---|---|---|---|
| **Design and Appea** | Split Level | **Above Grade Bathroom Coun** | 2 |
| **Quality of Construction** | Average | **Basement Square Footage Finished** | 1196 |
| **Condition** | Average | **Basement Square Footag** | 1196 |
| **Gross Living Area** | 1196 | | |
| **Above Grade Total Room Coun** | 5 | **Garage/Carport:** | Garage |
| **Above Grade Bedroom Coun** | 4 | **No. Cars** | 2 |

**Close Form**

Figure 5. Amenities

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MLS** | 9704757 | | | | | | |
| **Address** | 9766 Martingale | **City** | Boise | **State** | ID | **Zip** | 83709 |
| **Tax Parcel No.** | 2114100105 | **Subdivision** | Edmonds Cooper | | | | |

| | |
|---|---|
| **Heating** | Gas Forced Air |
| **Cooling** | CAC |
| **Fence** | Full |
| **Automatic Sprinkler Syste** | Full |
| **Patio/Deck** | None |
| **No. Fireplaces** | 2 |
| **Outbuildings** | None |

**Close Form**

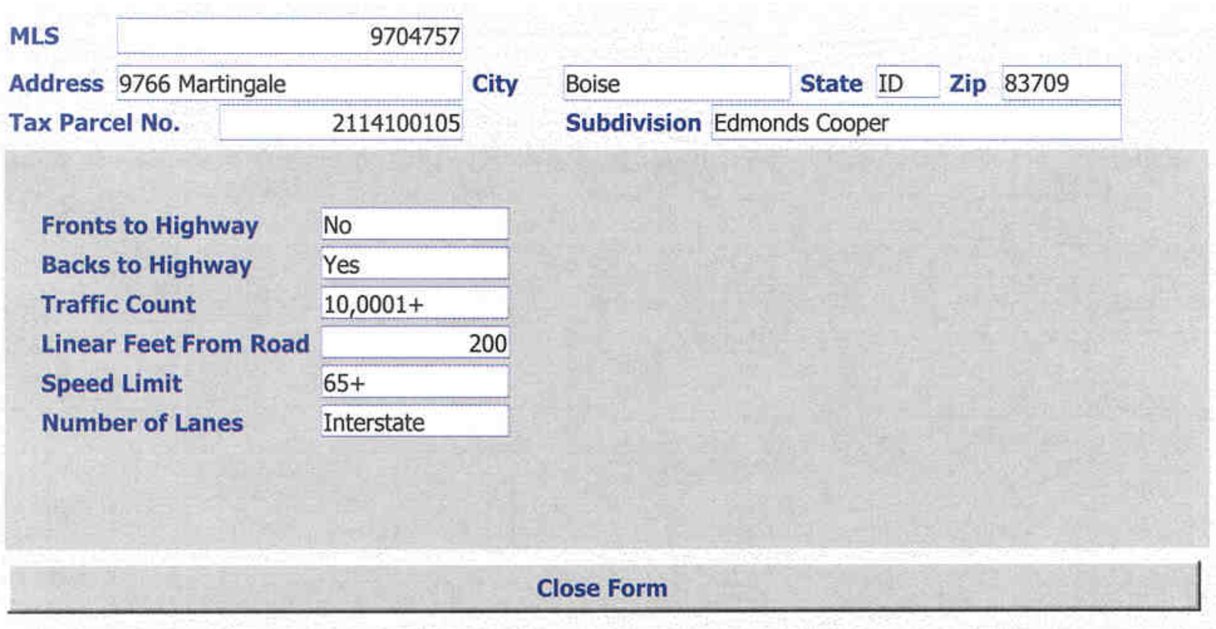
Figure 6. Land Description

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MLS** | 9704757 | | | | | | |
| **Address** | 9766 Martingale | **City** | Boise | **State** | ID | **Zip** | 83709 |
| **Tax Parcel No.** | 2114100105 | **Subdivision** | Edmonds Cooper | | | | |

| | |
|---|---|
| **Lot** | 21 |
| **Block** | 1 |
| **Lot Square Footage** | 40075 |
| **Location** | Suburban |
| **View** | Neighborhood |
| **Zoning** | R1 |

**Close Form**

Figure 7. Road Data


MLS 9704757
Address 9766 Martingale City Boise State ID Zip 83709
Tax Parcel No. 2114100105 Subdivision Edmonds Cooper

| | |
|---|---|
| Fronts to Highway | No |
| Backs to Highway | Yes |
| Traffic Count | 10,0001+ |
| Linear Feet From Road | 200 |
| Speed Limit | 65+ |
| Number of Lanes | Interstate |

Close Form

The data were transferred to an Excel spread sheet and statistical analysis was performed using MiniTab Statistical Software Package. MINITAB® is used by over 400 universities world-wide and companies such as GE, 3M, Ford Motor Company, and leading Six Sigma consultants rely on MINITAB to make data-driven decisions. MINITAB includes: basic and advanced statistics, regression and ANOVA, SPC, DOE, reliability analysis, power and sample size, time series and forecasting, and Gage R&R.

**How The Model Works**

The variables were selected as predictors of the value of a residential property in each city. The focus of the study is on road characteristic variables, however, all factors considered to influence value were included to develop a more effective model. The goal of using multivariate regression analysis is to isolate those effects being studied from the larger bundle of characteristics that cause home values to increase or decrease. The value of these individual characteristics, that as a whole explain most of the variability in sales price, are expressed in terms of coefficients, i.e. square feet of gross living area, square feet of basement, square feet of finished basement, effective age of dwelling, quality of construction and so forth.

The variables representing the base case for categorical variables are specified following each model, i.e. Boise and Moscow are the base case in the state model and require no adjustment for location. All other locations required a corresponding (-) adjustment for their respective location. "Local –A" Street Classification indicates a residential street with a traffic count of 1-100 cars per day and is the base case, requiring no adjustment. All other catetories require a corresponding adjustment as follows:

The original structure of the Road Classification variable was in categories of 0-100 cars per day, 101-500, 501-1000, 1001-5000, 5001-10,000, and 10,001+. This categorization caused problems for the Idaho Falls, Pocatello, Lewiston, Coeur d'Alene, Moscow, and Boise regression analysis. These categories exhibited multicollinearity[4] with many other variables, and removing variables from the analysis resulted in large biased estimators for the traffic count categories; another problem encountered was an incongruent pattern in coeffecient values and category significance. A solution was found by re-categorizing the road classifications for each city until logical and significant coefficients were obtained. For the Idaho model, all road classification categories were significant as originally identified and no re-categorization was necessary. For the Lewiston model, street-traffic count classification was deemed insignificant as a determinant of sales price at every possible combination of the street-traffic count classification variable.

Multicollinearity present in any of the models was dealt with by either re-categorization techniques, as well as consolidation of many road factors into just two variables: distance of the house from the road or street, and road classification (see Table 1). It was found that characteristics

[4] Multicollinearity is a statistical term that means two independant variables are highly correlated and exhibiting highly similar effects on the dependent variable (sales price).

such as number of lanes and speed limit were highly correlated with the street-traffic count classifications, resulting in large biased estimators.

Because some road factors are inherent in the existence of other road factors, the logical correction for multicollinearity and/or insignificance was to remove one of the variables (usually the one that was least significant). This was also justified by the insignificance of number of lanes and speed limit as predictors of sales price. For example, a typical home buyer would not likely separate the unappealing attributes of high traffic from the number of lanes or speed limit the road has. These characteristics are generally considered together as one attribute of the property. In the same respect, regression analysis cannot separate the affect on value that traffic count, speed limit and number of lanes have *separately*. However, the damages from these road characteristics are captured in whole by the road classification which accounts for the traffic count variable, likely because changes in the number of lanes and/or speed limit of a road result from changes in a road classification and traffic count.

**REGIONAL MODELS**

For Pocatello, initial results yielded a significant setback variable for values of 60 linear feet from road and less. However, further research indicated that the significance of the road classification variables, as grouped in the model shown in Appendix A, are directly dependent on the exclusion of setback as an indicator of value. In essence, the value contained in setback is being captured by the road classification variables and is thus intrinsically included in the model. Similar results appeared in all individual Idaho regional models, however the setback variable and road classification variables were individually significant in the Idaho State Model. This is likely explained by the fact that the Idaho State Model contained sufficient data to be able to recognize the variation in the model for each variable, while the individual regional models were not able to recognize the variation.

The setback variable in the Boise Regional model does not hold a high level of significance as a predominant factor affecting the sales price of a Boise residential property; also, it only applies to setbacks of 150 feet or less. By including the setback variable, the significance level for the road classification of "Local-B, 101 – 1000" falls as compared to the model where setback is excluded. The setback and road classification variables are inter-related due to the intrinsic nature of road characteristics, which are often considered a bundle of features that affect a home in similar ways.

In the Lewiston Regional model the traffic count variable was re-categorized in every possible ordinal combination, but no statistically significant relationship between the traffic count variable and sales price could be established. A potential reason for this is simple lack of dissimilar observations in the dataset. However, the model predicts that setback does influence the value of a home in Lewiston up to 100 linear feet, after which an increase in setback no longer attributes to an increase in the value of the home. Lewiston is also the only region that placed significance on "shop" values.

As in the Lewiston Regional model, the Moscow Regional Model road classification variable was re-categorized in every possible ordinal combination, with marginal significance at the classifications of 'Local-A and Local-B, below 10,000 cars per day' and 'Collector, Minor/Rural Arterial, and Principal Arterial, above 1,000 cars per day.' The model did not indicate setback as a significant variable, and as explained in the Pocatello region model, appears to be intrinsic in the road classification co-efficient.

Additional regional anomolies occurred in properties in the Fort Russell District of Moscow which are on the historical registry, are generally larger, better quality homes that are highly sought after within the Moscow real estate market. Turnover is low within the district, with values increasing at a higher rate than the average rate. The indicator variable was included to account for any differences that occur in sales price that are the direct effect of the property being located within the Fort Russell district of Moscow.

Again, the road classification variable in the Coeur d'Alene Regional Model was re-categorized in every possible ordinal combination, but no statistically significant relationship between this variable and sales price could be established. Setback does influence the value of a home in Coeur d'Alene up to 100 linear feet, after which an increase in setback no longer attributes to an increase in the value of the home.

Property values in Coeur d'Alene are greatly a function of location, specifically proximity to Lake Coeur d'Alene, golf courses, views of the mountains and lake, and locations within gated communities. Because evidence of explicit differences in value exist with respect to locations in the greater Coeur d'Alene area, an indicator variable was assigned to and reserved for those homes in the most excellent locations of Coeur d'Alene. Homes in this category tended to represent the highest valued homes within the area, with views and/or ammenities not common to the greater market. The coefficient was highly statistically significant as a predictor of sales price.

Figure 8. COMBINED CITY REGIONS

IDAHO MODEL

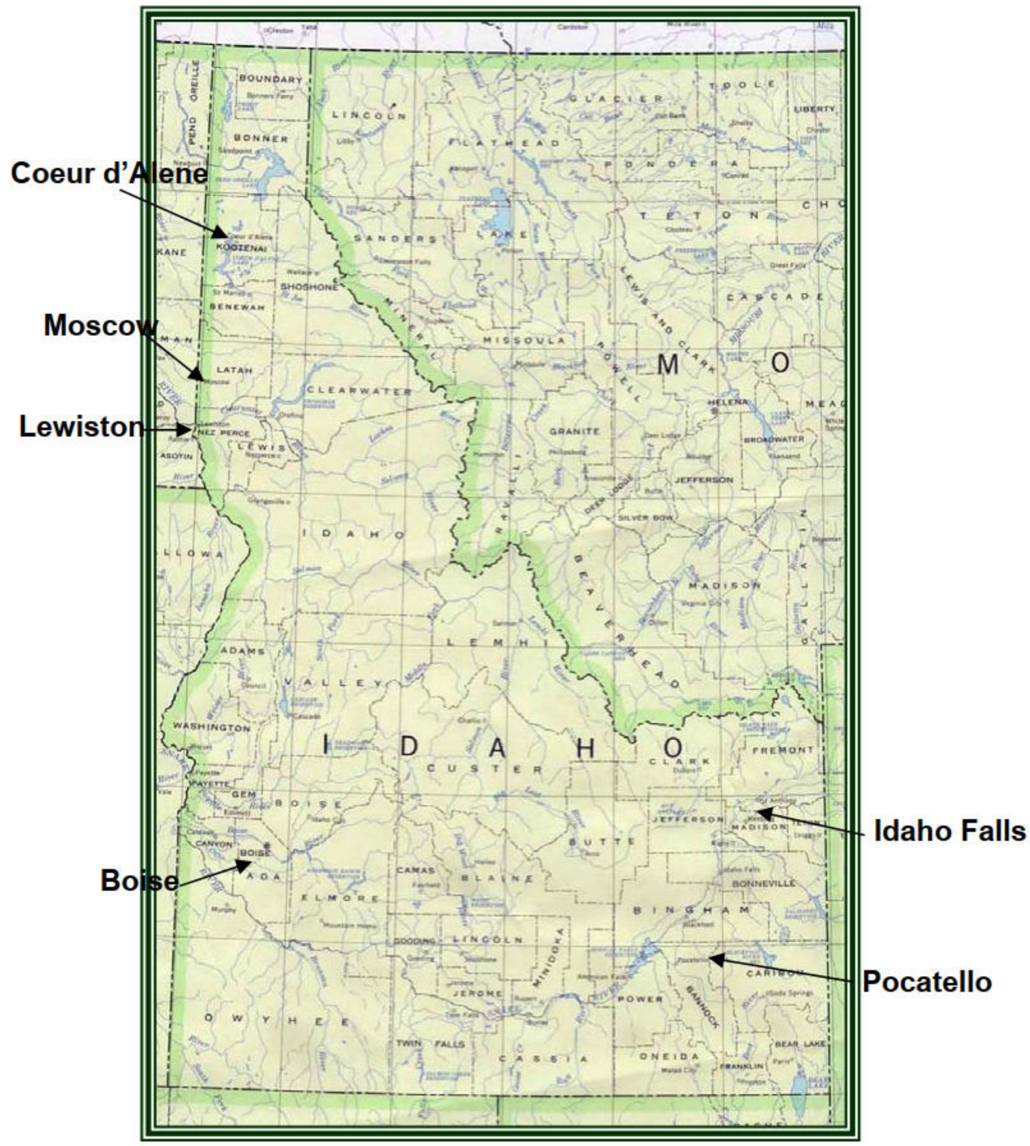


**Table 3. RESULTS OF THE IDAHO MODEL**

LN Sales Price = 6.97 - 0.0133 Effective Age + 0.466 LN Gross Living Area - 0.0121 Above Grade Bedroom Count + 0.0384 Above Grade Bathroom Count + 0.0610 LN Basement Square Footage Finished + 0.0353 Natural Log Basement Square Footage + 0.0712 No. Car Storage + 0.0754 LN Linear Feet From Road - 0.0253 'Local-A,101 - 500 TC' - 0.0377 'Local-B, 501 – 1,000 TC' - 0.0617 'Collector, 1,001 – 5,000 TC' - 0.0742 'Minor/Rural Arterial, 5,001 – 10,000 TC' - 0.152 'Principal Arterial, 10,001+ TC' + 0.0705 LN Lot Size - 0.162 Coeur d'Alene - 0.340 Idaho Falls - 0.209 Lewiston - 0.296 Pocatello + 0.0419 Above Quality Construction + 0.238 Good Quality Construction

| Predictor | Coefficient | SE Coefficient | T | P |
|---|---|---|---|---|
| Constant | 6.972 | 0.1937 | 36.00 | 0.000 |
| Effective Age | -0.0133059 | 0.0008254 | -16.12 | 0.000 |
| LN Gross Living Area | 0.02872 | 0.46552 | 16.21 | 0.000 |
| Above Grade Bedroom Count | -0.012134 | 0.009537 | -1.27 | 0.204 |
| Above Grade Bathroom Count | 0.03841 | 0.01369 | 2.81 | 0.005 |
| LN Basement Square Footage Finished | 0.06096 | 0.01114 | 5.47 | 0.000 |
| LN Basement Square Footage | 0.03533 | 0.01891 | 1.87 | 0.062 |
| No. Car Storage | 0.071165 | 0.009611 | 7.40 | 0.000 |
| LN Linear Feet From Road | 0.07538 | 0.02474 | 3.05 | 0.002 |
| *Local A, 101-500 TC | -0.0253 | 0.01936 | -1.31 | 0.192 |
| *Local B, 501-1,000 TC | -0.03769 | 0.02113 | -1.78 | 0.075 |
| *collec, 1,001-5,000 TC | -0.0617 | 0.02148 | -2.87 | 0.004 |
| *M/R Arterial, 5,001-10,000 TC | -0.07419 | 0.02641 | -2.81 | 0.005 |
| *Princ Arterial, 10,000 + TC | -0.15233 | 0.02637 | -5.78 | 0.000 |
| LN Lot Size | 0.07051 | 0.01009 | 6.99 | 0.000 |
| *Coeur d'Alene | -0.16155 | 0.03069 | -5.26 | 0.000 |
| *Idaho Falls | -0.33966 | 0.02635 | -12.89 | 0.000 |
| *Lewiston | -0.20863 | 0.02882 | -7.24 | 0.000 |
| *Pocatello | -0.29591 | 0.02621 | -11.29 | 0.000 |
| *Above Quality Construction | 0.04193 | 0.01289 | 3.25 | 0.001 |
| *Good Quality Construction | 0.23843 | 0.03362 | 7.09 | 0.000 |

S = 0.1662 R-Sq = 87.1% R-Sq(adj) = 86.8%

The variables with asterisks represent the presence or absence of that attribute. The coefficient is multiplied by 1 if the home has the attribute, otherwise 0. As with the other individual Idaho regional city models, "Good Construction Quality" is a categorization that was assigned to only Class 6 and 7 homes based on the Oregon Cost Manual. The road classification variables were all significant in their original categorizations. Setback is significant at values of less than 100 linear feet from the road.

Each city-region was given an indicator variable to test for differences in sales price due to which city the home is located in, where Boise was the original base case. After it was determined that home prices in Moscow are not significantly different from those of Boise, the base case was re-defined to include both the Moscow and Boise sample. In use, the property should acquire the indicator variable value for that city or region in which it is most closely related, either in market association or geographic location.

In the above model, dependent variables and some independent variables are expressed in natural logarithm form. Transformation of some variables to this format is necessary to meet the assumptions of Ordinary Least Squares Regression, namely that there cannot be non-linear relationships or non-constant variance between the residential versus fitted values. However, in normal form, there is a non-linear relationship between sales price and multiple independent variables. The independent variables requiring the natural logarithm transformation are those scalar variables that have high ranges of value.

For those independent variables requiring the transformation (denoted by LN preceding that variable's name), the coefficient represents the percentage change in sales price given a *one percent* change in the value of the variable. For all other variables, the coefficient represents the percentage change in sales price given a *one-unit* change in the variable. For indicator variables, the coefficient represents the percentage change in sales price if that attribute does exist. For example, the predicted value of a home declines by 15.23% if it is located on a Principal Arterial or Interstate with over 10,000 traffic count per day as compared to a home located on a Local-A street, with 0-100 traffic count.

The following table demonstrates how the model works. The home being tested is a good quality, one story 1990's era home and is located in Boise, Idaho. Variables of interest are shown in the "Specific Variables of the Subject Property" column.

It is important to note that any extenuating factors that highly affect the value of the property in the before condition and are not specified in the model may need to be accounted for. An example would be a guesthouse located on the property, or a swimming pool. This would be accounted for in the "Other Adjustments" category in the model.

Table 4.  Model Input and Results

**IdahoTransportation Department**
**Proximity Damages Determination**

| | |
|---|---|
| Appraised Value - In the before: | $125,000 |
| % Contributable to Land: | 20% |
| % Contributable to Improvements: | 80% |
| Effective age of house: | 5 |
| Gross Living Area: | 1350 |
| GLA Bedroom count: | 3 |
| GLA Bathroom count: | 2 |
| Basement Square Footage Total: | 0 |
| Basement Square Footage Finished: | 0 |
| Number Car Storage: | 2 |
| Construction Quality: | Good |
| Lot Size in Square Footage: | 22500 |
| Region: | Boise |
| Linear Feet from Road (Before): | 150 |
| Road Classification (Before): | 1001-5000 cars per day |
| Linear Feet from Road (After): | 70 |
| Road Classification (After): | 5001-10000 cars per day |

| Results | |
|---|---|
| Appraised Value in the Before | $125,000 |
| Concluded Model Value In the Before | $ 121,134 |
| Reconciliation of Values | $ 3,866 |
| Adjusted Model Value in the Before | $ 124,939 |
| Adjusted Model Value in the After | $ 116,499 |
| Concluded Proximity Damages: | $ 8,440 |
| Damages as a percent of value in the Before | 6.75% |
| Portion of Damages Attributable to Land: | $ 1,688 |
| Portion of Damages Attributable to Improvements: | $ 6,752 |

This example is a 3 bedroom, 2 bath 1,350 SF home located in Boise on a 22,500 SF lot with an effective age of 5 years and good quality construction.  The home is currently located 150 feet from a road  that has a classification of 1001-5000 cars per day.  The road project will create a setback of 70 feet and a road classification* change.  In the example used, this home would suffer 6.75%, or $8,440 due to proximity damages.

*Note:  The road classification in the model is categorical data, not scalar data; meaning the road is identified by category rather than by the specific number of cars per day.

The following tables show how the values are concluded in the above example.

## Table 5. Model Calculations

| **BEFORE** | General Variable Needing Log Form | Model Coefficients | Specific Variable Of Subject Property | Converting Column D to LN Format (Where Specified in Column B) | Coefficient *Variable (Column C*Column E) |
|---|---|---|---|---|---|
| Constant | | 6.972 | | | 6.972 |
| **Effective Age** | | **-0.0133059** | **5** | **5** | **-0.0665295** |
| LN GLA | X | 0.46552 | 1350 | 7.207859871 | 3.355402927 |
| Above Grade BR Count | | -0.012134 | 3 | 3 | -0.036402 |
| Above Grade BA Count | | 0.03841 | 2 | 2 | 0.07682 |
| LN BSMT SF Fin | X | 0.06096 | 1 | 0 | 0 |
| LN BSMT SF | X | 0.03533 | 1 | 0 | 0 |
| No. Car Storage | | 0.071165 | 2 | 2 | 0.14233 |
| LN Sample Setback | X | 0.07538 | 150 | 5.010635294 | 0.377701688 |
| 100-500 | | -0.0253 | 0 | 0 | 0 |
| 501-1000 | | -0.03769 | 0 | 0 | 0 |
| 1001-5000 | | -0.0617 | 1 | 1 | -0.0617 |
| 5000-10,000 | | -0.07419 | 0 | 0 | 0 |
| 10,001+ | | -0.15233 | 0 | 0 | 0 |
| LnLotSize | X | 0.07051 | 22500 | 10.02127059 | 0.706599789 |
| CDA | | -0.16155 | 0 | 0 | 0 |
| IF | | -0.33966 | 0 | 0 | 0 |
| Lewiston | | -0.20863 | 0 | 0 | 0 |
| Pocatello | | -0.29591 | 0 | 0 | 0 |
| **Above Quality** | | **0.04193** | **0** | **0** | 0 |
| Good Quality | | 0.23843 | 1 | 1 | 0.23843 |
| | | | | **Summed Results:** | **11.7046529** |
| | | | | Exponent of Summed Results (Value): | $ 121,134.03 |

## Table 6. Model Adjustment to Appraiser's Value

| **BEFORE, ADJUSTED** | General Variable Needing Log Form | Model Coefficients | Specific Variable Of Subject Property | Converting Column D to LN Format (Where Specified in Column B) | Coefficient *Variable (Column C*Column E) |
|---|---|---|---|---|---|
| **Constant** | | **6.972** | | | **6.972** |
| Effective Age | | -0.0133059 | **5** | 5 | -0.0665295 |
| **LN GLA** | **X** | **0.46552** | **1350** | **7.207859871** | 3.355402927 |
| Above Grade BR Count | | -0.012134 | **3** | 3 | -0.036402 |
| Above Grade BA Count | | 0.03841 | **2** | 2 | 0.07682 |
| LN BSMT SF Fin | X | 0.06096 | **1** | 0 | 0 |
| LN BSMT SF | X | 0.03533 | **1** | 0 | 0 |
| No. Car Storage | | 0.071165 | **2** | 2 | 0.14233 |
| LN Sample Setback | X | 0.07538 | **150** | 5.010635294 | 0.377701688 |
| 100-500 | | -0.0253 | **0** | 0 | 0 |
| 501-1000 | | -0.03769 | **0** | 0 | 0 |
| 1001-5000 | | -0.0617 | **1** | 1 | -0.0617 |
| 5000-10,000 | | -0.07419 | **0** | 0 | 0 |
| 10,001+ | | -0.15233 | **0** | 0 | 0 |
| LnLotSize | X | 0.07051 | **22500** | 10.02127059 | 0.706599789 |
| CDA | | -0.16155 | **0** | 0 | 0 |
| IF | | -0.33966 | **0** | 0 | 0 |
| Lewiston | | -0.20863 | **0** | 0 | 0 |
| Pocatello | | -0.29591 | **0** | 0 | 0 |
| Above Quality | | 0.04193 | **0** | 0 | 0 |
| Good Quality | | 0.23843 | **1** | 1 | 0.23843 |
| | | | | Summed Results: | 11.7046529 |
| | | | | Exponent of Summed Results (Value): | $121,134.03 |
| Other Adjustments, Dollar Value | | | $3,866 | Other Items | 0.030927753 |
| | | | | New Sum: | 11.73558066 |
| | | | | Exponent of Total (Total Value) | 124938.9701 |

Table 7. Adjusted Value In the "After"

| **AFTER** | General Variable Needing Log Form | Model Coefficients | Specific Variable Of Subject Property | Converting Column D to LN Format (Where Specified in Column B) | Coefficient *Variable (Column C*Column E) |
|---|---|---|---|---|---|
| Constant | | 6.972 | | | 6.972 |
| Effective Age | | -0.0133059 | 5 | 5 | -0.0665295 |
| LN GLA | X | 0.46552 | 1350 | 7.207859871 | 3.355402927 |
| Above Grade BR Count | | -0.012134 | 3 | 3 | -0.036402 |
| Above Grade BA Count | | 0.03841 | 2 | 2 | 0.07682 |
| LN BSMT SF Fin | X | 0.06096 | 1 | 0 | 0 |
| LN BSMT SF | X | 0.03533 | 1 | 0 | 0 |
| No. Car Storage | | 0.071165 | 2 | 2 | 0.14233 |
| LN Sample Setback | X | 0.07538 | 70 | 4.248495242 | 0.320251571 |
| 100-500 | | -0.0253 | 0 | 0 | 0 |
| 501-1000 | | -0.03769 | 0 | 0 | 0 |
| 1001-5000 | | -0.0617 | 0 | 0 | 0 |
| 5000-10,000 | | -0.07419 | 1 | 1 | -0.07419 |
| 10,001+ | | -0.15233 | 0 | 0 | 0 |
| LnLotSize | X | 0.07051 | 22500 | 10.02127059 | 0.706599789 |
| CDA | | -0.16155 | 0 | 0 | 0 |
| IF | | -0.33966 | 0 | 0 | 0 |
| Lewiston | | -0.20863 | 0 | 0 | 0 |
| Pocatello | | -0.29591 | 0 | 0 | 0 |
| Above Quality | | 0.04193 | 0 | 0 | 0 |
| Good Quality | | 0.23843 | 1 | 1 | 0.23843 |
| | | | | Summed Results: | 11.63471279 |
| | | | | Exponent of Summed Results (Value): | 112951.3855 |
| Other Adjustments, Dollar Value | | | $3,866 | Other Items | 0.030927753 |
| | | | | New Sum: | 11.66564054 |
| | | | | Exponent of Total (Total Value) | 116499.2997 |

The conclusions of the calculations in Tables 5, 6 and 7 relate to the "Results" section shown in the right hand side of Table 4. It is important to note that any extenuating factors that highly affect the value of the property in the before condition that are not common and thus are not specified in the model. Reconciliation in this form utilizes common calibration techniques to account for extreme differences between actual and predicted values.

## Conclusion

Many variables in the general method of residential property values used in this study were consistently significant among all cities, while other variables, such as the presence of a shop, were significant in some areas and not in others. The general theme of the street-traffic count classification variables was significance of either street-traffic count classifications or setback, but not both. Other road variables, including number of lanes and speed limit, were likely captured by street-traffic count classifications, and were not significant on their own.

The Idaho Model adequately represents the general housing characteristics affecting all areas in the state. The original sample size is approximately 1,800± homes in total, representing a very good sampling of the total number of residential homes within the state, capturing ranges in size, quality, age, room count, and lot size up to 5 acres. Both setback and the street-traffic count classification variables were significant in the Idaho Model, where value was sufficently captured in part due to the variation and the large aggregate number of observations in the whole state.

Evaluation of this model for the purposes of the Idaho Transportation Department shows a need for compensation to homeowners for intrinsic damages to property resulting from any decreases in the setback value and/or increases in traffic count. Other compensation to homeowners will be in the traditional form of actual land lost.

The R-squared value of the All Cities Idaho Model is 87.1%. According to this model, 87.1% of the variation in sales price of the home is explained by variation in the variables listed in the equation. Approximately 12.9% of the variation in sales price is unexplained by this model. This is consistent with all individual regional city models. Through regression analysis, the researchers have derived, with notable accuracy, the factors that affect residential value within the six combined regions of Idaho. Using this technique, many factors have been isolated that affect value by including them in the model. By having the dependent variable be the selling price of the home instead of damages incurred, we have derived a solid equation that is less arbitrary and more apt to account for differences in property types.

Deliberate time and care have been taken to assure that this study meets the guidelines of Uniform standards of Professional Appraisal Practice Standard 6, Mass Appraisal Development and Reporting. The complete form of Standard Six is in the Appendix M section of this report.

Finally, the researchers have been aware of, and continue to make deliberate efforts to ensure that the study possess techniques that meet the "Daubert/Kumho" court test. In the Law Seminars International presentation given at the Boise Eminent Domain and Inverse Condemnation seminar in March 2003, Daniel R. Front of Holland & Hart LLP, Denver, Colorado identified four nonexclusive factors to consider in exercising the trial judge's "gatekeeping" obligation.

> In Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579, 589 (1993), the United States Supreme Court held that Fed. R. Evid. 702 imposes a special obligation upon a trial judge to ensure that expert testimony is not relevant, but reliable. In Daubert, the Supreme Court identified four nonexclusive factors to consider in excercising this "gatekeeping" obligation: (1) whether a theory or technique can be and has been tested; (2) whether it has been subjected to peer review and publication; (3) whether, in respect to a particular technique, there is a high known or potential rate of error and whether there are standards controlling the technique's operation; and (4) whether the theory or technique enjoys general acceptance within a relevant scientific community. (Effective Use of Experts Including Daubert/Kumho Challenges p. 1)

At the time of this publication, the University of Idaho College of Agricultural and Life Sciences is sponsoring an ITD Proximity Damages Model Methods and Applications 8-hour course in Idaho Falls, Moscow, and Boise to instruct ITD fee and staff appraisers on methodology and applications of the model; and is in the process of submitting a professional article for publication in the Appraisal Institute Journal, ASFMRA Journal, and International Right of Way Association. *Valuationn Modeling for Appraisal Application lecture notes are included in the appendix.*

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