Developing a Total Replacement Cost Index for Suburban Office Projects

By

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Submitted to the Department of Architecture in Partial Fulfillment of the Requirements for the Degree of Master of Science in Real Estate Development

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ABSTRACT

Understanding the components of replacement costs for office developments, and how these components combine to create total development costs is essential for success in office real estate development. Surprisingly, the term “replacement cost” does not enjoy a standard definition in the industry. This study explores the components of total replacement cost, and ultimately creates a market-level index industry professionals can utilize when creating or reviewing office development budgets.

Thesis Supervisor: William C. Wheaton
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I. INTRODUCTION

"Prices go up and prices go down, and with each change in the price level the discussion of replacement-cost usage recurs."[1]

Replacement costs in real estate provide industry professionals with a framework to determine the profitability of a project and when development projects should proceed. Replacement costs measure the current acquisition cost in place of historical costs.[2] Also known as "total development costs," replacement costs can help professionals understand whether a particular market is experiencing—or about to experience—a boom or bust within a real estate cycle. To better understand how real estate cycles and replacement costs interrelate, this chapter first discusses what a real estate cycle is, how replacement costs analysis can be used in understanding at what stage in the cycle a real estate market is, and how developing a replacement cost index will assist real estate professionals in understanding the real estate cycle.

A. REAL ESTATE CYCLES

Real estate cycles can be described as the "pattern of periodic over- and underbuilding"[3] caused by the movements in demand, construction starts, vacancies, rents, and asset prices around their long-term trends. Overbuilding is defined as "periods of construction booms in the face of rising vacancies and plummeting demand [that] are a recurring phenomenon in real estate markets."[4] Underbuilding is just the opposite.

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[1] Boer, German, p. 97.
[2] Ingberman, p. 101.
[3] Wheaton, p. 209.
[4] Grenadier (1996), p. 1670.

Many industry experts purport that cycles are caused by the idiosyncrasies of the real estate market, such as long development periods, the costly process of matching buyers and sellers, and the heterogeneity of properties.[5] Many experts also add that irrationality of developers and lenders contribute to the cycles.[6] Irrational developers are typically identified as those who build too late in both the boom and bust periods.[7] Grenadier, however, argues that developers may indeed be acting rationally in periods of overbuilding by incorporating option theory into their decisions. He states—[8]

> "Developers see the market begin to erode. They realize that if it erodes any further, and if any of their competitors begin to build, they will be shut out of the market. Before this comes to fruition, each builds simultaneously in an attempt to avoid preemption. While building in a downturn is harmful to developers, it is less harmful than the alternative of becoming a Follower in a down market."

Grenadier offers an additional *rational* explanation as to why developers seem to overbuild. He states that declining markets on a local level may experience building costs declining at an even faster rate.[9] Thus, overbuilding, and ultimately real estate cycles, may not be a symptom of irrational exuberance, but rather the effect of developers exercising their wait option on a particular project to minimize losses.

Replacement costs can also explain, in part, the cyclical behavior of real estate markets, and ultimately the likely success of a project. Hendershott explains that "given the incentives of developers to build when value rises substantially above replacement costs and not to build when value is low relative to replacement cost, the property market has to be mean reverting."[10] If investors don't incorporate mean reversion into forecasts, they will overvalue properties when prices are already high and undervalue properties when prices are

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[5] David Geltner estimates real estate market cycles to typically last between 10 and 20 years. (Geltner, p. 31)
[6] Grenadier (1996), p. 1670.
[7] Grenadier (1995), p. 95; Hendershott, pp. 67-68; Wheaton, p. 209.
[8] Grenadier (1996), p. 1671.
[9] Grenadier (1996), p. 1671.
[10] Hendershott, p. 68.

low, exaggerating the cyclical swings in office values, and thus in construction and vacancies. When net asset values exceed replacement costs, a development boom lies in the near future; when net asset values are below replacement cots, a development bust is imminent.

Whether developers are acting irrationally or not, real estate professionals continue to often ask the same two questions after each cycle, as posed succinctly by Barras[11]—

- "Why did it go wrong?"
- "How can we avoid it happening again?"

Current economic theory striving to explain the booms and busts of the real estate market employs the "new orthodoxy of 'rational expectations'."[12] According to the theory of rational expectations, it is the inaccurate views of future market conditions that cause systematic errors in the market. One of the most common misconceptions leading to an inaccurate view of the market is backward-looking analysis, or relying too heavily on historical events to predict future prices.

The rational expectations approach assumes that real estate professionals "perfectly understand the equations that govern market behavior and thus make correct forecasts of rents—conditional on a particular realization of the exogenous future demand variable."[13] This assumption poses some real-world challenges. Barras summarizes the limitations of rational expectations theory by outlining that future rent determination—[14]

- depends not only on future market conditions, but also on the heterogeneity of the properties being transacted at a particular time;
- is strongly affected by the longevity of existing and pre-let leases in the market, which will constrain property demand elasticity;

[11] Barras, p. 63.
[12] Barras, p. 64.
[13] Wheaton, p. 215.
[14] Barras, p. 64

- can only be based on indirect indicators of future demand, such as net absorption, and vacancy, which drive the amount of speculative property development;
- requires property developers and investors to be particularly far-sighted given the industries long construction periods;
- will more likely be exposed to unanticipated exogenous shocks given the long construction periods.

Another approach to studying real estate cycles, endogenous cycle theory, examines the process by which an "initial displacement away from the equilibrium growth path [triggers] self-sustaining endogenous cycles."[15] Endogenous cycle theory attempts to explain market behavior by studying the quickness and strength a market exhibits when responding to movement away from equilibrium.[16] This theory predicts that as the cost of adjustment increases, the real estate cycle will persist. In practice, the rational expectations theory and the endogenous cycle theory are each standard approaches to predicting and explaining the dynamics of real estate cycles.

B. REPLACEMENT COSTS

Replacement costs play an essential role when real estate professionals assess a project's feasibility. If a development possesses costs above the projected income, the project should not be built. In the "bust" stage of the cycle, development costs overpower market rents; the "boom" cycle exhibits the opposite characteristic—replacement costs below projected asset prices. A sound understanding of replacement costs, combined with accurate market assessments, will enable the developer to better predict whether the market is experiencing overbuilding or underbuilding, and how feasible a new development project would be.

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[15] Barras, pp. 68-69.
[16] Barras, p. 69.

Reliably calculating replacement costs for a particular develop is the first step in any profitability analysis. Traditionally, developers determine replacement costs by reviewing budgets of past projects, interviewing contractors, and using cost-per Square feet averages.[17] Though essential to the replacement cost calculation, past projects, due to their heterogeneity and limited scope, may not provide appropriate information for future projects. Also, interviewing contractors, though very important, may not be feasible if a developer is considering a wide range of markets in which build. Data providers, such as RSMeans, can provide real estate professionals estimates for construction costs, but only account for the hard costs and selected soft costs, such as engineering fees. Replacement costs, however, involve additional costs such as permitting fees and land costs, and only become meaningful when all of these costs are incorporated. Experienced real estate professionals can artfully combine these resources to create reasonable estimates of project costs, but they also need a reliable benchmark against which they can compare their estimated replacement costs and ultimately to determine whether a boom or bust looms on the real estate horizon.

C. A REPLACEMENT COST INDEX

This thesis aims to create a replacement cost index to enable real estate professionals to better understand replacement costs for a particular development. Comparing projected replacement costs from the index with current asset values enables investors to determine at what stage in the cycle their project will be upon completion. It also allows them to more effectively value possible transactions—net asset values—of existing buildings. Understanding the cycle's stage allows investors to then make critical decisions regarding the proper type, timing, scale, and location of future projects and transactions. The following is

[17] Laughlin.

an example of how replacement costs can imply at what stage the real estate cycle is and how money is quickly lost by misinterpreting the cycle.

> "In suburban Boston, faltering telecom and Internet companies concentrated along famed tech corridor Route 128 and further west and north have left vacancies in some areas near 30%, local brokers say. That hurt struggling telecom-equipment maker Lucent Technologies Inc. when it sold a 500,000-square-foot complex in Marlboro this summer for $27.5 million, or about $55 a foot, a very low price.
>
> "The price is about half of replacement cost and an even bigger discount to what the building would have fetched three years ago during market peaks, says Lisa Campoli, a senior managing director in the Boston office of Insignia/ESG, a New York real-estate services firm that wasn't involved in the sale.
>
> "The buyers were a group of local investors led by Gillespie & Co., of Concord, Mass. Ian Gillespie, a Gillespie principal, acknowledges that market demand is currently nil and unlikely to pick up anytime soon. But at this price, he adds, he isn't worried. 'We can not lease a lick of space for five years and still make a ton of money,' Mr. Gillespie says."[18]

If Lucent had had access to a replacement cost index, it might have been able to create a real estate investment strategy that incorporated market cycle impacts and avoid losing $0.50 of every replacement cost dollar. The replacement cost index, combined with reasonable market forecasts, will enable real estate professionals to do just that.

D. SUMMARY

Embarking on a rigorous study of the relationship between net asset values and total replacement (development) costs for real estate figures to greatly benefit industry professionals in understanding the health of markets in which they work. Reliably predicting replacement costs allows real estate professionals to better understand at what point in the real estate cycle their future projects will be upon completion. Understanding how the real estate cycle affects a project's profitability will then enable developers and investors to make more informed decisions regarding their developments and property transactions.

[18] Starkman.

II. APPROACH

Replacement costs for a development are comprised of the land acquisition price, hard costs, and soft costs. Each of these components may include varying cost inputs based on a particular real estate developer's approach to calculating total replacement costs. This chapter outlines each cost type required to calculate total replacement costs then delineates how data for each category will be gathered.

A. DATA DEFINITIONS

1. LAND ACQUISITION COSTS ("LCs")

Land acquisition costs are the price real estate professionals pay for the raw ground. LCs are complicated by environmental, legal, and structural issues arise.

Environmental issues, whether they are soil contamination or the presence of wetlands, can greatly affect the value of the land based on the amount of costs required to remediate these issues. Remediation costs can render a property undevelopable if the local market rents do not justify the investment.

Legal issues can also affect the value of the property, especially if resolution is not likely. Litigation may result from non-disclosed environmental problems, property line disputes, zoning regulations, and ownership rights, just to name a few. Mitigation costs associated with legal disputes can negatively impact the value of a particular property, and may ultimately prohibit development thereon.

Structural issues refer to the existence of buildings or structures on a site. The price of land may include an implied value of, for example, an uninhabitable building. Isolating the value of the building from the price paid for the raw ground will further ensure that the LCs refer only to the ground and not to the building as well.

Environmental, legal, and structural issues each affect the value of the land differently, but need to be accounted separately for when analyzing the cost of acquiring a property.

2. HARD COSTS ("HCs")

Hard costs include materials, labor, and other costs directly associated with the construction of the building. These costs are all associated with hard (tangible) materials used to construct a building. A developer can touch a curtain wall, walk on the graded site, and see the duct work in a building. Beyond materials costs, the HCs also include fees required for the process, such as building permit, contractor, and developer fees. The following is a sample list of hard costs—[19]

- Site Preparation Costs (e.g., excavation, utilities installation)
- Shell Costs
- Permits
- Contractor Fees
- Construction Management and Overhead Costs
- Materials
- Labor
- Equipment Rental
- Tenant Finish
- Developer Fees

3. SOFT COSTS ("SCs")

Soft costs describe project expenses that do not directly contribute to the physical construction costs, such as engineering, financing, and legal fees. Also included in SCs are the costs to perform environmental, traffic, and other property-related studies. Marketing costs and leasing or sales commissions are also included in this category.

Soft costs are non-standard and unique to each development. Where one project may need to conduct a comprehensive traffic impact analysis, another project may require an

[19] Geltner and Miller, "Commercial Real Estate Analysis and Investments," pp. 776-777.

extensive environmental study and subsequent clean-up; still another project may not need to perform either of these special studies. Also, each proposed structure will possess a unique set of requirements to conform to civil regulations, property topography, and the developer's personal guidance throughout the design and construction process. Ultimately, no two developments will have exactly the same soft costs. For this reason, many published articles place quotation marks around the term "soft costs" to alert readers of the nonexistence of a standard definition for this term.[20]

The pliable definition of soft costs presents challenges to researchers studying replacement costs in real estate. In 1994, for example, Mark Roberts created a replacement cost index for the commercial office market based on F.W. Dodge's office construction database. Building the cost-based model would have required Mr. Roberts to include some factor measuring soft costs. The following excerpt from his thesis describes how he dealt with this issue:

> "The costs not included are engineering and design fees, site preparation, demolition, change orders, and any lease inducements for capital improvements. Estimates for this additional work range from 20% to 40%. Still, if these extra costs are proportional to the "shell" costs of a structure, the movements and changes of the replacement index would hold because of the relative nature of the index."[21]

Due to the difficulty of accurately measuring soft costs, Mr. Roberts justifies not directly including them in his index based on the assumption that movements in hard costs would highly correlate with movements in the few soft cost elements he mentions. This assumption does not account for the possibility of fees not proportionally moving with hard

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[20] Termed "Scare quotes," the Chicago Manual of Style states that the purpose of such quotation marks is to enable the writer to refer to a term without claiming a sense of ownership over it--"this is not my term." (See "The Chicago Manual of Style—15th ed.," The University of Chicago Press: Chicago, 2003, p. 293.)
[21] "Supply-Side Analysis of the Commercial Office Market and a Replacement Cost Index," Roberts, Mark G., Master of Science in Real Estate Development at the Massachusetts Institute of Technology thesis, September, 1994.

costs. For example, brownfield reclamation projects focus on cleaning up environmentally compromised tracts of land and often require extensive investment in environmental studies. Such projects represent just one of the many examples of where high soft costs can, but do not necessarily, imply high hard costs.

The following is a typical base list of soft cost line items, though elements and amounts may vary widely across development projects—[22]

- Loan Fees
- Construction Interest
- Legal Fees
- Soil Testing
- Environmental Studies
- Land Planner Fees
- Architectural Fees
- Engineering Fees
- Marketing Costs (including Advertisements)
- Leasing or Sales Commissions

4. TENANT IMPROVEMENTS ("TIs")

For the purposes of this study, the office TIs will be appropriated to hard costs, as defined in Dr. Geltner's textbook, "Commercial Real Estate and Investments," pages 776-777. TIs accommodate the tenant-specific requirements necessary to use the space and may include the movement of interior walls or partitions, lighting, floor coverings, windows, and more.[23]

Many developers consider TIs to be soft costs due to their discretionary nature. For instance, two tenants in the same building and on the same floor may demand very different fit-outs of their spaces. Also, many tenants pay some portion of the TIs themselves. The high

[22] "Commercial Real Estate Analysis and Investments," Geltner, David M. and Miller, Norman C., South-Western Publishing, 2001, p. 777.
[23] Dictionary of Real Estate Terms, 6th ed., Friedman, Jack P. et. al., Barron's Educational Series, Inc., 2004, p. 449.

variability in costs due to the unique requirements of tenants may reduce the reliability of the hard cost estimates. For this reason, many developers place TI expenses into soft costs. Other developers may split the TI amount, placing the concession amount in the hard cost section and the additional charges unique to each tenant in the soft cost section. Specifically identifying TIs will be essential in producing a reliable estimate of replacement costs, and for consistency's sake, TIs will become distinctly and uniquely part of hard costs.

5. TOTAL DEVELOPMENT COSTS ("TDCs")

TDCs, also known as "Total Replacement Costs," are the sum of the LC, HC, SC, and TI expenditures for a particular development. With clearly defined cost components, this study aims to create a reliable TDC benchmark for major United States real estate markets.

B. GATHERING THE DATA

1. CONDUCT A SURVEY

The driving force behind this study will be a survey to gather actual project-level data from a variety of developers. SC and TIs are difficult—if even possible—to collect since most developers keep such costs confidential. LCs are also difficult to gather from public sources. Project-level HCs are somewhat more available in the public realm, but without the LCs, SCs, and TI values, do little more than estimate the cost of construction. Gathering reliable project-level data for each of these costs will prove essential to creating a TDC benchmark. Beyond these cost measures, additional information for each project will be required to account for fundamental differences such as location, scale, and timing. The next chapter discusses the survey submitted to developers in detail.

2. THIRD-PARTY DATA PROVIDERS

Project-level data from the survey, however, will prove insufficient in creating a reliable TDC index due to the challenge of collecting enough observations to adequately predict costs for a wide range of markets. National data from third-party sources will augment the survey data and diversify away any project mix-driven skewness.

i. HC SOURCED FROM RSMeans

Supplemental HC data will be provided by RSMeans via the "Means Construction Cost Indexes" publication and the "QuickCost Estimator." RSMeans possesses extensive construction cost databases and is often referenced as an industry standard in research and news articles. The "Means Construction Cost Indexes" report is issued quarterly and provides current cost indexes for 316 cities throughout the United States. The January issue also includes historical cost indexes for most of the 316 cities. RSMeans builds an average U.S. national cost index via surveys with contractors, architects, engineers, manufacturers, and other construction-related fields, then creates city-specific factors to estimate costs on the zip-code level.[24] Once the data are updated each quarter, researchers run the RSMeans' proprietary analysis model to provide construction cost estimates for over 100 standard building types in over 700 locations across the United States.[25]

RSMeans' "Means Construction Cost Indexes" enable users to calculate location and time adjustments, as well as comparisons with other cities. For example, to standardize hard costs occurring in different periods to the first quarter of 2006, the following calculation is performed: [YR_A INDEX / YR_B INDEX] x COST IN YR_B = COST IN YR_A).

[24] Facsimile from RSMeans, April 1, 2006.
[25] Facsimile from RSMeans, April 1, 2006.

RSMeans data will enable the creation of a model which can then be adjusted by market. By reporting LCs, SCs, and TIs in terms of HCs, the RSMeans data can also be used to predict values for each of these costs.

The QuickCost Estimator is an online tool RSMeans provides to give professionals a "back-of-the-envelope" type of estimate for hard costs. The estimator provides national and local HC numbers based on building type and size.[26]

ii. LC SOURCED FROM CB RICHARD ELLIS ("CBRE")

LC data acquired from CBRE in includes both transactional land prices and estimated land prices based on regression analysis. Both data sets were provided to me from CBRE, through my advisor. For the estimated data, the description provided in the email from CB states that "the actual data is from CB brokered transactions in the last few years and covers about 40 markets. The regression equation is used to forecast for another 29."[27] The transactional data cover 66 markets and include the average land sales price per acre for both suburban and downtown office transactions. This data set, however, does not differentiate between suburban and downtown locations.

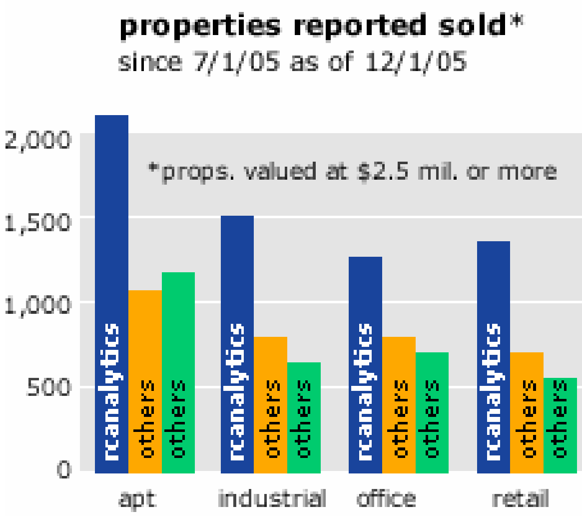
iii. NET ASSET VALUE ("NAV") DATA FROM REAL CAPITAL ANALYTICS ("RCA")

RCA provides transactions data for over 40,000 properties, including apartment, industrial, office, and retail buildings.[28] On their website, RCA states, "Since 2001, we have captured over $1.5 Trillion of sales and financings for significant office, industrial, retail, and

[26] See http://www.rsmeans.com.
[27] Email sent to me from Prof. William Wheaton, July 17, 2006. The regression used to estimate land prices included variables for employment, office sales, and job growth.
[28] See http://www.rcanalytics.com/data.asp.

hotel properties nationwide."[29] In 2005, RCA doubled their inventory, in part, by adding sales of below $5 million.[30] RCA also reports they have assembled the largest data base of properties sold, which is illustrated by the following chart taken from the web site, www.rcanalytics.com.

FIGURE 1: RCA PROPERTY DATA BASE



RCA data were provided by Torto Wheaton Research through my thesis advisor. The data set includes summary per square foot transaction figures for downtown and suburban office buildings for 103 United States cities. Data are divided into two five periods, by market: (1) before 1985, (2) 1985-1989, (3) 1990-1994, (4) 1995-1999, and (5) 2000-2006. Office data for central business districts ("CBDs") are present in 44% of the time periods and suburban office data are present in 72% of the time periods. Most of the reported data occurs in the two most recent periods.

[29] See http://www.rcanalytics.com/data.asp.
[30] See http://www.rcanalytics.com/data.asp.

The RCA data base will provide sound NAV information that, when compared with the Replacement Cost Benchmark, will allow real estate professionals to determine whether a boom or bust is looming on the horizon.

C. USING THE DATA

Once the data have been collected from the survey and third-party sources, I will then be able to create a Total Replacement Cost benchmark for TDCs. The benchmark will be created by first running regressions to estimate LCs, SCs, and TIs, then using the RSMeans HC data to predict TDCs for major United States markets. Once the Total Replacement Cost benchmark is formed, I can then compare these results to the RCA NAV data to predict whether a particular market is facing a boom or bust period. The following chapters outline this process.

IV. SURVEY

No organization currently tracks and publicly releases total replacement costs for real estate developments. In this study, I focused on creating such a benchmark for office and multifamily housing projects by surveying top office development companies throughout the country.[31] The survey asked developers to provide project-specific data on developments completed (but not necessarily started) since 2001. Blending the information into a data set ensured company-specific confidentiality without compromising the accuracy of the information. See Appendix A for a copy of the survey and accompanying cover letter.

Though originally included, the multifamily housing section of the survey will not be examined in this thesis due to insufficient data (17 observations). Running a wide variety of regressions to model multifamily housing did not yield statistically significant results, with the highest attainable R Square value being under 20%. For this reason, analysis into multifamily housing projects was not continued. Thus, this thesis will focus solely on office developments.

A. SURVEY QUESTIONS AND RESPONSES

The survey included 18 project-specific questions, of which 7 required descriptive answers, 3 dealt with the project's size and scale, and 8 related to cost issues. This section defines and outlines each question in the survey. Definitions are taken from the code book included in the survey. The following table lists all 18 survey questions –

[31] Development companies who participated included the Avalon Bay, Boyer Company, John W. Hansen Real Estate, Hines, Liberty Property Trust, Lowe Enterprises, Mullins Company, New Boston Fund, Phoenix Properties, Principal Real Estate Investors, Spaulding & Slye (Jones, Lange, & LaSalle), TC Residential, and TrammellCrow.

FIGURE 2: SURVEY QUESTIONS

(1) MSA
(2) YEAR COMPLETED
(3) DOWNTOWN /SUBURB
(4) CORPORATE/MEDICAL
(5) BUILD-TO-SUIT?
(6) UNION?
(7) SUBGRADE, GARAGE, OR LOT PARKING
(8) LAND SQUARE FOOTAGE
(9) BUILDING SQUARE FOOTAGE
(10) STORIES
(11) LAND ACQUISITION COST (EXCLUDING EXISTING STRUCTURES)
(12) VALUE OF EXISTING STRUCTURES
(13) EXISTING STRUCTURE(S) RENOVATED /DEMOLISHED
(14) REMEDIATION/MITIGATION COST
(15) SOFT COST
(16) HARD COST (EXCLUDING TIS)
(17) TIS
(18) TOTAL DEVELOPMENT COST

1. MSA

Definition: *MSA in which the project occurred. If the project spans into two MSAs, please select the MSA in which the majority of the project is.*

QUESTION

To determine which markets to include, I ranked United States cities by population and number of employees. I then combined these rankings with the Urban Land Institute's ("ULI's") MSAs listed in its book, "ULI Market Profiles 2000: North America."[32] The following table lists the cities which were specifically identified for the survey.

[32] The final year of this publication was 2000.

FIGURE 3: MARKETS REPRESENTED IN THE STUDY

Albuquerque, NM	El Paso, TX	Minneapolis, MN	Salt Lake City, UT
Atlanta, GA	Fort Lauderdale, FL	Nashville, TN	San Antonio, TX
Austin, TX	Fort Worth, TX	New York, NY	San Diego, CA
Baltimore, MD	Fresno, CA	Newark, NJ	San Francisco, CA
Birmingham, AL	Greensboro, NC	Norfolk, VA	San Jose, CA
Boston, MA	Hartford, CT	Oklahoma City, OK	Seattle, WA
Charlotte, NC	Honolulu, HI	Orlando, FL	St. Louis, MO
Chicago, IL	Houston, TX	Oxnard, CA	Stamford, CT
Cincinnati, OH	Indianapolis, IN	Philadelphia, PA	Tampa, FL
Cleveland, OH	Jacksonville, FL	Phoenix, AZ	Toledo, OH
Columbus, GA	Kansas City, MO	Pittsburgh, PA	Trenton, NJ
Columbus, OH	Las Vegas, NV	Portland, OR	Tulsa, OK
Dallas, TX	Los Angeles, CA	Raleigh, NC	Tuscon, AZ
Dayton, OH	Louisville, KY	Richmond, VA	Washington, DC
Denver, CO	Memphis, TN	Riverside, CA	Wilmington, DE
Detroit, MI	Miami, FL	Sacramento, CA	

In addition to the above cities, I provided the survey respondents the flexibility to include projects outside of these markets.

California is the most represented state with 8 cities, followed by Texas with 6 and Florida and Ohio with 5 each. Of the 50 states, 18 do not have cities represented in the study.[33]

RESPONSE

Of the 63 markets targeted for the study, survey responses covered 14. On the East coast, 10 projects in 5 cities were included. Represented Eastern cities included Boston, MA, Baltimore, MD, Hartford, CT, Jacksonville, FL, and Philadelphia, PA; Mid-America was represented by 6 projects in 3 cities. Represented cities included Dallas, TX, Detroit, MI, and Kansas City, MO; Western states had 9 projects in 7 cities. Represented cities included

[33] Non-represented states are Alaska, Arkansas, Idaho, Iowa, Kansas, Louisiana, Maine, Mississippi, Montana, Nebraska, New Hampshire, North Dakota, Rhode Island, South Carolina, South Dakota, Vermont, West Virginia, Wisconsin, and Wyoming.

Denver, CO, Honolulu, HI, Los Angeles, CA, Ogden, UT, Phoenix, AZ, Riverside, CA, and San Diego, CA.[34]

2. YEAR COMPLETED

Definition: *Year in which the project completed.*

QUESTION

The "YEAR COMPLETED" variable does not account for the duration of the project, but only the year in which the project completed. I did not include a "YEAR STARTED" variable to calculate duration of the project because costs associated with time should have been included in the cost variables. In future studies, including a duration component may provide further insight into this research field.

RESPONSE

According to survey data, the average year in which projects were completed was 2004. One project was completed in 2001; one in 2002; five in 2003; five in 2004; six in 2005; and five in 2006. Also, two projects were designated as "underway" by the respondent.

3. DOWNTOWN / SUBURB

Definition: *Location within the MSA. "Downtown" is defined as a particular MSA's central business district, or a city's concentration of retail or commercial real estate. The "Suburb" value represents any location not in a central business district.*

QUESTION

Designating a project's location between the downtown and suburban areas enables the survey to account for differences in building construction types and costs, land values, densities, and other intra-MSA location factors. Downtown projects tend to have higher FARs, for example, than do suburban projects.

[34] Ogden, UT was not included in the directly targeted MSA list, but data for two projects were provided. For this reason, though only 14 cities from the survey were represented in the original MSA list, data for a total of 15 different cities were provided.

RESPONSE

Twenty-two (88%) of the submitted projects were suburban. The under-representation of downtown projects will most likely affect the statistical model's ability to estimate TDCs for downtown projects.

4. CORPORATE / MEDICAL

Definition: *Corporate refers to a traditional office space; medical office refers to buildings used by medical or dental professionals.*

QUESTION

Traditional corporate office developments do not include many of the enhancements required by medical office buildings. Medical office building developments often include very specialized equipment and space to house such equipment. For example, dental offices often include extensive plumbing work to incorporate the need to equip each operatory with a water pick and sink. Both doctors and dentists need X-ray rooms and all the associated equipment required to operate them. Perhaps the only specialized equipment corporate offices enjoy are computer-related, such as e-mail servers or mainframes. Because the needs of each office type differ dramatically, identifying each project as either corporate or medical will account for such differences.

RESPONSE

Corporate projects represented 14 (56%) of the total number of projects submitted. The remaining 11 projects were designated as "Medical," one of which was a biotechnology office development. The Medical office projects were concentrated with two companies providing data for 8 of the 11 developments.

One respondent provided data for a biotechnology office project. After speaking with the developer regarding the project's specific attributes, I designated this project as a medical office development. Though biotechnology offices differ greatly from medical offices, the common link is the unusually high expenses associated with them as compared to traditional corporate offices.

5. BUILD-TO-SUIT?

Definition: *Yes ("Y") confirms that the development was a build-to-suit project, and No ("N") refers to all other designations.*

QUESTION

Building a development on speculation can drastically increase its cost and risk, whereas a Build-to-Suit ("BTS") project can do just the opposite. When working on a BTS project, the developer already has a tenant and can work closely with the client to cater to each reasonable need. With speculation builds, the developer often builds generic projects to increase their appeal to a wider market. Customization of the space comes only after a tenant has committed to the project. Retrofitting customizations, instead of incorporating them into the original plans, increases costs. BTS projects enjoy the advantage of knowing what needs the tenant has and how to plan for issues that may arise by meeting those needs. Speculative projects do not enjoy this luxury. The inherent difference in risks associated with BTS and speculative projects requires this variable to be included in this study.

RESPONSE

BTS projects represented 40% (10) of the total projects submitted by respondents with non-BTS representing the remaining 15 projects.

6. UNION?

Definition: *Designates whether the project utilized union or non-union workers.*

QUESTION

Union labor increases the cost of development. According to Matt Jensen of the Boyer Company, union labor can increase project costs 10% to 20%.[35] For this reason, a variable to account for union labor is included.

RESPONSE

Of the 25 represented projects, 17 (68%) were non-unionized. Unionized projects, according to the survey sample, mostly occurred with medical office building projects.

7. SUBGRADE, GARAGE, OR LOT PARKING

Definition: *Subgrade parking refers to underground parking; Garage parking refers to a parking terrace; Lot parking refers to at-grade, open-air parking.*

QUESTION

Subgrade and garage parking can both increase the cost of development, with subgrade parking increasing it the most. Subgrade parking exposes the developer to underground risks that are often difficult to assess until digging has begun; though garage parking avoids many of the subterranean risks, building a parking structure also increases costs; lot parking is the least expensive, but uses more land than the other two scenarios. Downtown projects are more likely to have subgrade or garage parking, whereas suburban projects are more likely to have lot parking.

According to RSMeans' "QuickCost Estimator," the national average for underground parking is $58.30 per square foot, whereas the national average for garage

[35] Telephone conversation, July 27, 2006.

parking is currently $50.77 per square foot.[36] Nationally, underground parking is 15% more expensive garage parking, but these figures can vary widely depending on soil conditions. The price for surface parking can be as low as $31.00 per square foot and, depending on the market, even lower.[37] Given the variability in costs among the three major parking categories, this question was included in the survey.

RESPONSE

The vast majority of the sampled projects utilized surface parking (84%). One project involved subgrade parking (4%), and three projects included garage parking (12%).

8. LAND SQUARE FOOTAGE

Definition: *Total gross square footage of parcel. Remember that there are 43,560 square feet per acre.*

QUESTION

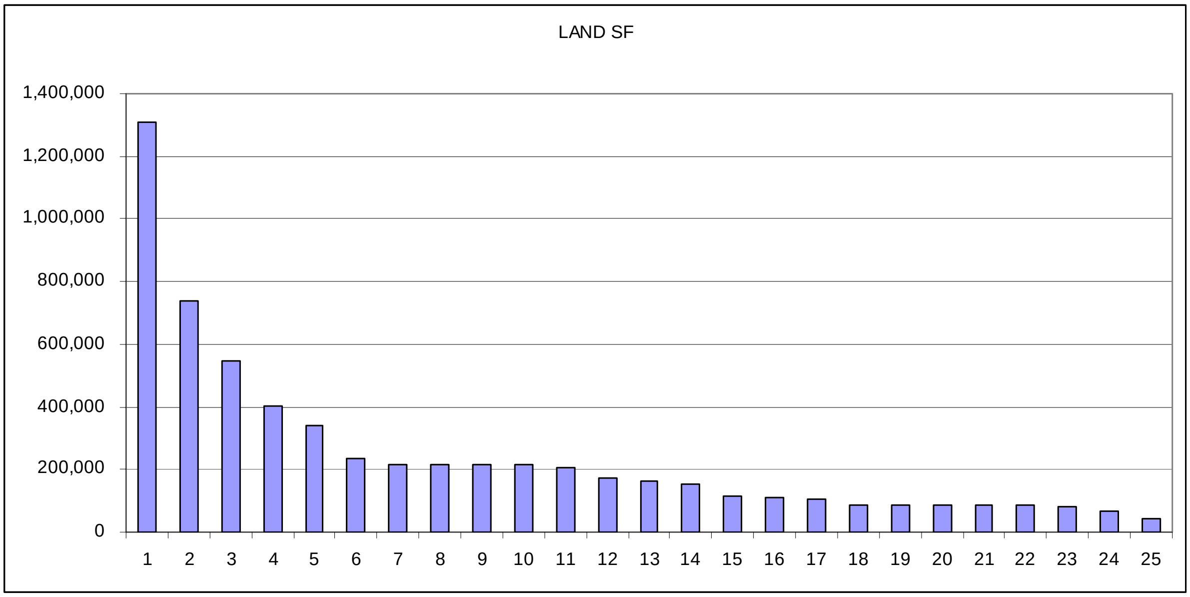
Including a question on the size of the parcel being developed provided key information for calculating the FAR of each development. Typically in terms of acres, the survey requested that the respondents report this number in terms of square feet.

RESPONSE

Land acreage varied from as little as 0.96 acres to as large as 30 acres. The average parcel size in the sample was 5.59 acres and the total sum of reported land square footage was 6,092,131. The following chart shows the distribution of the surveyed land square footage—

[36] http://www.rsmeans.com/calculator/index.asp (based on a 100,000 square foot facility). These values only consider the hard construction costs and do not include land acquisition and other costs.
[37] http://dcrp.ced.berkeley.edu/students/rrusso/parking/Developer%20Manual/Costs/data_on_costs.htm

FIGURE 4: DISTRIBUTION OF SURVEY LAND SQUARE FOOTAGE



9. BUILDING SQUARE FOOTAGE

Definition: *Total gross square footage of the structure. Again, remember that there are 43,560 square feet per acre.*

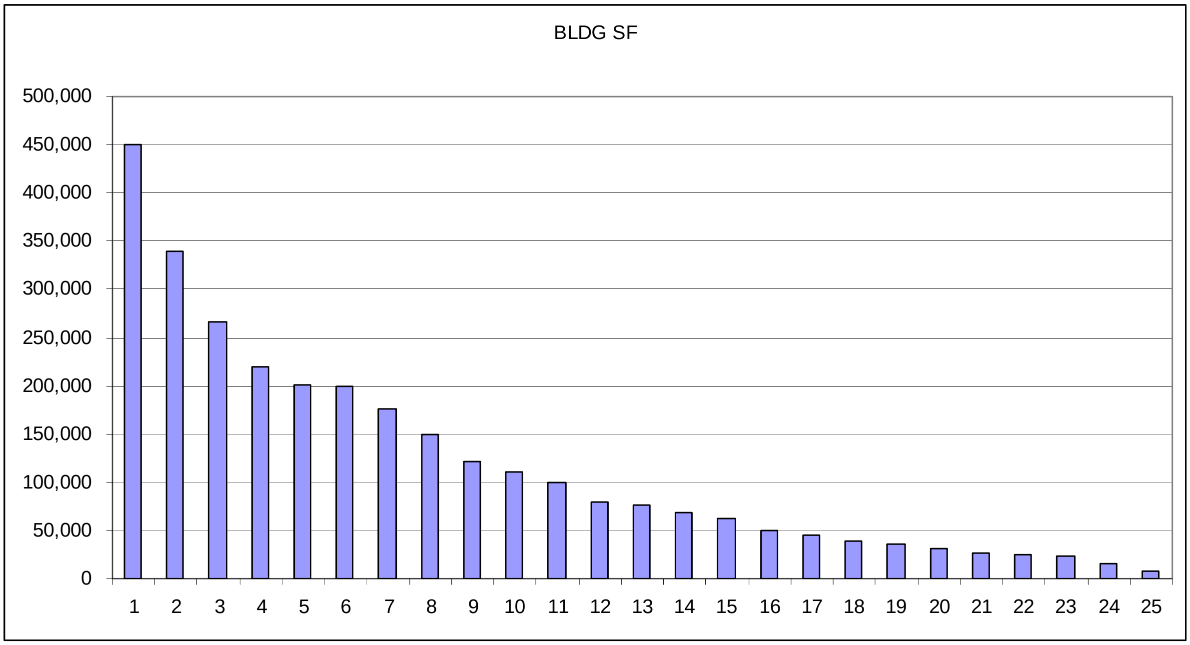
QUESTION

Building square footage provided information necessary to standardize cost data on a square foot basis. Hard costs, soft costs, tenant improvements, and total development costs are all reported in this manner. Also, dividing this variable by land square footage yields the FAR for each development.

RESPONSE

Building square feet ranged from 8,156 to 450,000, with a sample average of 124,480. The total building square feet reported in the survey was 2,924,196, implying a weighted average FAR of 1.45. The following figure provides a summary of these data—

FIGURE 5: BUILDING SQUARE FOOTAGE



10. STORIES

Definition: *Number of stories in the structure.*

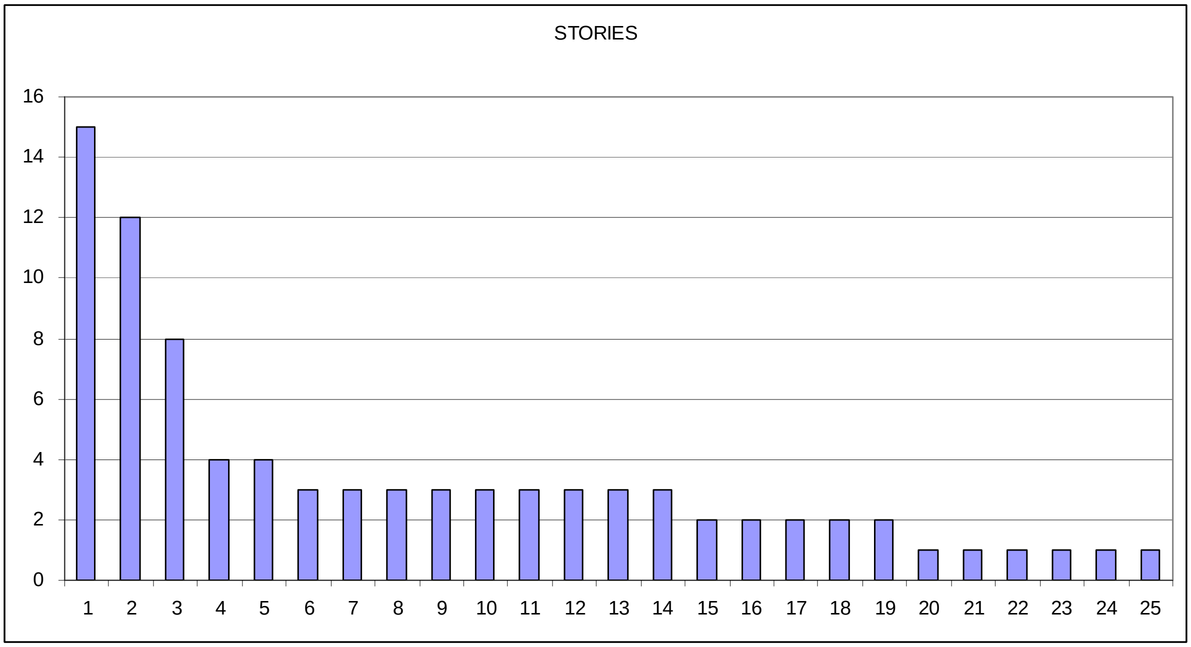
QUESTION

The purpose of this question was to provide information in understanding floor plate sizes and to get a better sense of the scale of each project. This variable was not used in modeling the data.

RESPONSE

The tallest building represented in the survey was 15 stories and the smallest was 1 story. The average building height in the sample was 4 stories, with the most common building height (mode) was 3 stories. Three buildings rose above 5 stories.

FIGURE 6: STORIES



11. LAND ACQUISITION COST ("LC")

<u>Definition:</u> *Total cost to purchase the land parcel, excluding the value of any existing structures.*

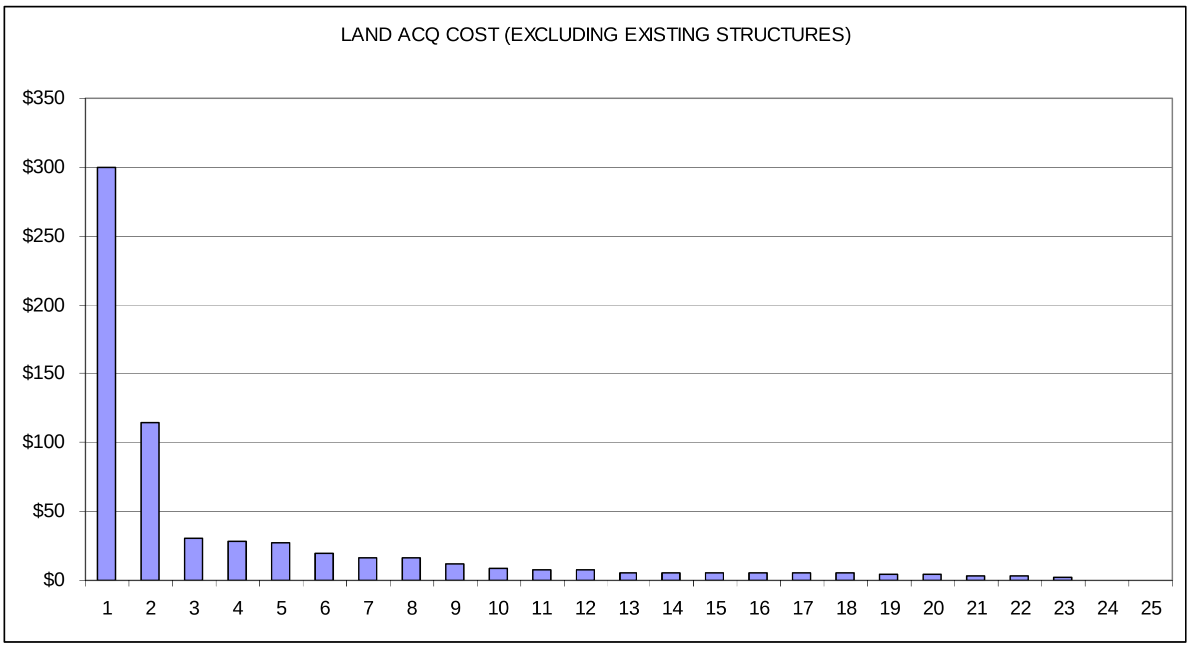
QUESTION

LC represents the first of three essential components to estimating total replacement costs. This question attempts to capture the price of raw ground the respondents paid for the development. For this reason, the value of existing structures, remediation costs, and mitigation costs were excluded from this variable.

RESPONSE

Land acquisition values range from $0.00/land sf to $300/land sf, with an average LC of $26/land sf. Some projects enjoyed zero land acquisition costs. According to one survey respondent, zero land acquisition costs often occur when the government gifts the land to the developer in an effort to spur economic development in a particularly blighted area. In only one observation did an existing building come attached to the land acquisition—it was demolished. Removing the two observations with $0 LC yields an average LC of $27/land sf.

FIGURE 7: LAND ACQUISITION COSTS PER SQUARE FOOT



12. VALUE OF EXISTING STRUCTURES

Definition: *Market value of existing structures (e.g., buildings, parking terraces, etc.).*

QUESTION

Some land parcels may actually have existing buildings which the developer must decide to either renovate or demolish. The land purchase price often includes the current market value for the standing building. For this reason, the survey requested that the raw ground value and the existing structure value be separated.

RESPONSE

Of the 25 responses, only one project involved an existing structure, valued at $500,000.

13. EXISTING STRUCTURE(S) RENOVATED / DEMOLISHED

Definition: *Designation as to whether the building was demolished or renovated.*

QUESTION

Given that a land parcel did have an existing structure, knowing whether that structure was demolished or renovated enhances the study's ability to understand total development costs. Renovating a building can include anything from fortifying the foundation to gutting everything but the building's shell to updating the structure's exterior. Renovating a building is more complicated and time consuming than simply demolishing it. That said, a renovated building may also provide added value that a new building may not. The dichotomy of costs and complexity between demolishing and renovating a building justifies that this data clarification be included in the survey.

RESPONSE

The developer whose project had an existing structure chose to demolish it.

14. REMEDIATION / MITIGATION COST

Definition: *Cost of remediation and mitigation efforts for the project.*

QUESTION

In an effort to keep the project data as comparable as possible, the survey requested that respondents isolate any remediation or mitigation costs associated with the development. Certain projects may face unusual environmental issues that require an abnormal investment to clean. Other projects may become mired in litigation that may last years. Such irregular costs do not represent the "typical" development scenario towards which this study strides. Isolating these costs will provide more comparable data across observations, and ultimately more reliable regression results.

RESPONSE

Remediation and Mitigation Costs occurred in five projects and ranged from just over $100,000 to $2,000,000. The average cost for this category was $691,000. These costs occurred in California, Massachusetts, and Michigan.

15. SOFT COSTS ("SCs")

Definition: *Sum total of Loan Fees, Construction Interest, Legal Fees, Soil Testing, Environmental Studies, Land Planner Fees, Architectural Fees, Engineering Fees, Marketing Costs (including Advertisements), Leasing or Sales Commissions, and other fees or costs not attributed to hard or land costs.*

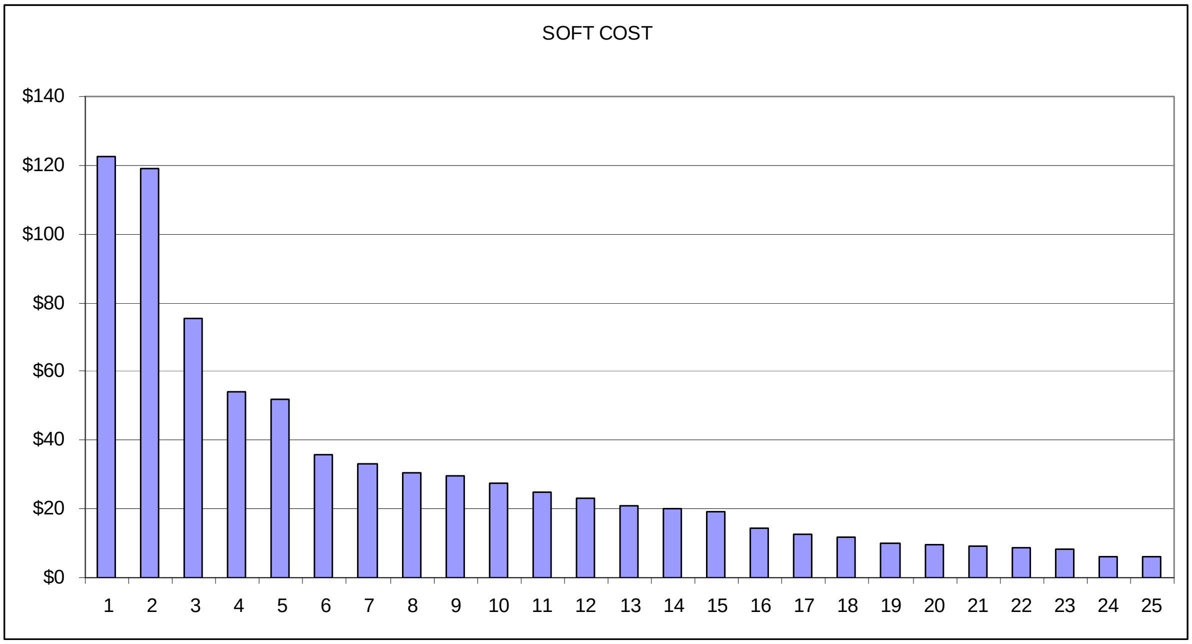
QUESTION

This broad definition of soft costs includes many costs that are often difficult to estimate, such as environmental studies. Loan fees and construction carrying costs are also included in this figure to provide a more comprehensive estimate of the actual costs to develop a land parcel.

RESPONSE

Reported Soft Costs ranged from $6/bldg sf to $123/bldg sf, with a survey average of $32/bldg sf. Soft Costs averaged 29% of Hard Costs, ranging from 9% to 70%. The following chart illustrates the distribution of Soft Costs per building square foot among the projects.

FIGURE 8: SOFT COSTS PER SQUARE FOOT



16. HARD COSTS ("HCs") – EXCLUDING TIs

Definition: *Sum total of Site Preparation Costs (e.g., excavation, utilities installation), Shell Costs, Permits, Contractor Fees, Construction Management and Overhead Costs, Materials, Labor, Equipment Rental, Developer Fees, and other costs directly attributed to the actual construction of the structure. THIS AMOUNT DOES NOT INCLUDE TENANT IMPROVEMENT EXPENDITURES.*

QUESTION

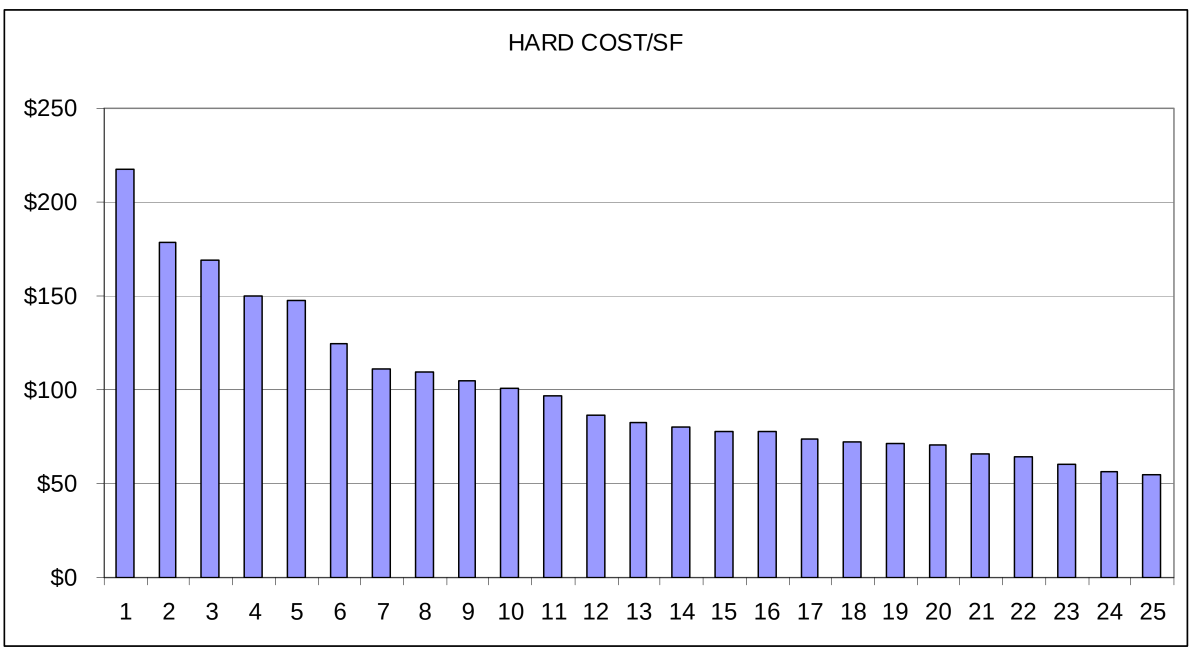
Hard Costs drive this analysis and enable Land Costs, Soft Costs, and Tenant Improvements to be estimated. HCs themselves are also a key component in the calculation of total development costs. Because industry HC numbers from data providers such as RSMeans are readily available, comparing response data with these venders will prove essential when testing the validity of the model. Soft Costs and Tenant Improvements do not enjoy this luxury, and Land Costs do only on a limited basis.

RESPONSE

Submitted Hard Costs per square foot ranged from $55/bldg sf to $217/bldg sf, with an average amount of $102/bldg sf. According to RSMeans, the national average for HCs/bldg sf for the survey project mix was $111.66.[38]

Based on the survey definition, medical and biotechnology office developments tended to have the highest HCs per square foot, despite their suburban locations. Downtown developments also experienced higher-than-average hard costs per square foot, but not as high as the non-corporate office projects. As expected, primary markets such as Los Angeles, California, and Boston, Massachusetts, tended to experience higher hard costs per square foot than secondary markets like Denver, Colorado, and Jacksonville, Florida.

FIGURE 9: HARD COSTS PER SQUARE FOOT



[38] Using the RSMeans QuickCost Estimator, I input location, story, and square footage information and applied the median value for each project. See http://www.rsmeans.com/calculator/index.asp (accessed August 3, 2006) for more information.

17. TENANT IMPROVEMENTS ("TIs")

Definition: *Tenant Improvement costs. Typically part of hard costs, these costs refer to improvements necessary to make the space ready for tenant occupancy.*

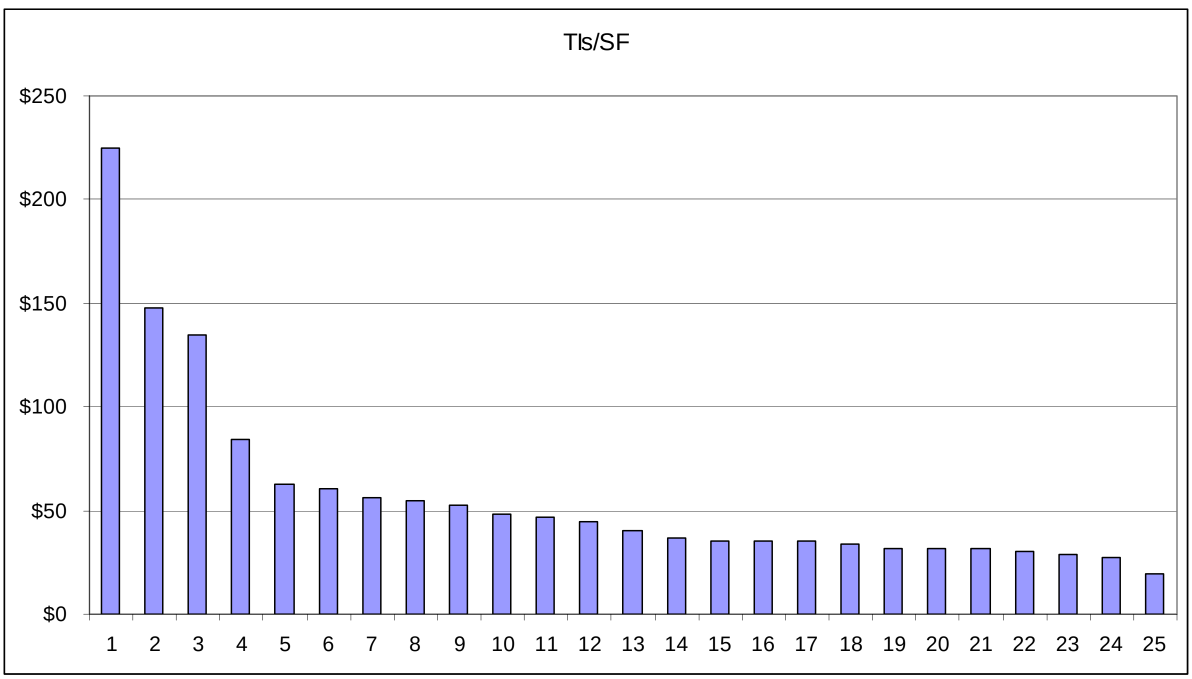
QUESTION

Tenant Improvements represent the final cost component in the survey. Depending on the developer, TIs can either be attributed to Soft Costs or Hard Costs. For this reason, the survey requested that respondents isolate these costs to ensure a fair comparison among the various cost variables.

RESPONSE

TI expenditures ranged from $20/bldg sf to $225/bldg sf, averaging $57/bldg sf. As a fraction of Hard Costs, TIs averaged 49%, ranging from 13% to 85%. The two outlying observations excluded from the analysis exhibited excessive TI costs, with amounts as a fraction of Hard Costs being 180% and 260%. Removing these observations from the analysis reduces the average TI expenditure to $46/bldg sf.

FIGURE 10: TENANT IMPROVEMENTS PER SQUARE FOOT



18. TOTAL DEVELOPMENT COSTS ("TDCs")

Definition: *Sum of Land Acquisition, Soft, and Hard Costs.*

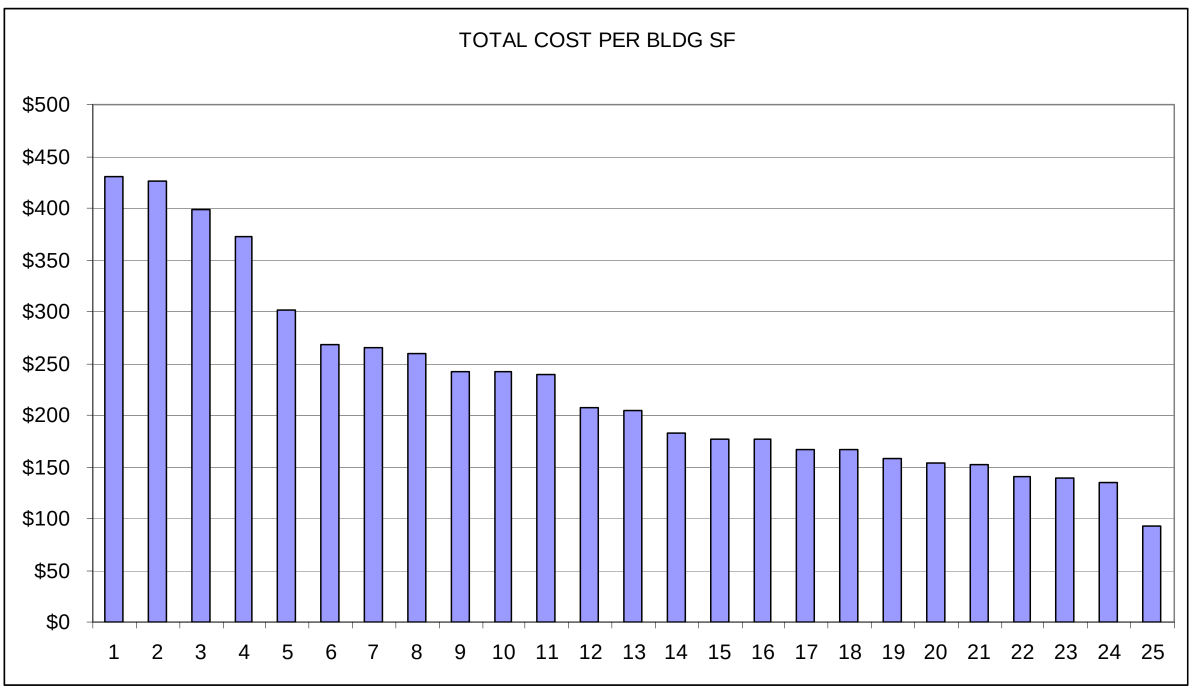
QUESTION

Total Development Costs represent the ultimate purpose of this thesis. Gaining a deeper understanding of TDCs will enable real estate professionals to more effectively determine when, where, and what development projects to pursue.

RESPONSE

Total Development Costs ranged from $93/bldg sf to $431/bldg sf and averaged $228/bldg sf. Incorporating the complete set of these cost figures into this study is what makes it unique to the existing literature.

FIGURE 11: TOTAL DEVELOPMENT COSTS



SUMMARY STATISTICS

The following table summarized the statistics for each question represented in the survey. Questions (12) and (13) are not included in this table because only one project had an existing building valued at $500,000 that it demolished. Also, all costs are on a square footage basis, with Land Acquisition Costs in terms of Land Square Footage and all other costs but Remediation/Mitigation Costs presented in terms of building square footage. Remediation/Mitigation Costs are reports in gross terms.

FIGURE 12: SURVEY DATA SUMMARY STATISTICS

NON-NUMERIC DATA SUMMARY

	DNTN	**%DNTN**	**SUB**	**%SUB**		
(3) DOWNTOWN /SUBURB	3	12%	22	88%		
	CORP	**%CORP**	**MED**	**%MED**		
(4) CORPORATE/MEDICAL	14	56%	11	44%		
	BTS	**%BTS**	**NON-BTS**	**%NON-BTS**		
(5) BUILD-TO-SUIT?	15	60%	10	40%		
	UNION	**%UNION**	**NON-UNION**	**%NON-UNION**		
(6) UNION?	8	32%	17	68%		
	SUBGRADE	**%SUBGRADE**	**GARAGE**	**%GARAGE**	**LOT**	**%LOT**
(7) SUBGRADE, GARAGE, OR LOT PARKING	1	4%	3	12%	21	84%

NUMBERIC DATA SUMMARY

	MAX	**MIN**	**MEAN**
(2) YEAR COMPLETED	2006	2001	2004
(8) LAND SQUARE FOOTAGE	1,306,800	41,818	243,685
(9) BUILDING SQUARE FOOTAGE	450,000	8,156	124,480
(10) STORIES	15	1	4
(11) LAND ACQUISITION COST	$300	$0	$26
(14) REMEDIATION/MITIGATION COST	$2,000,000	$115,503	$783,901
(15) SOFT COST	$123	$6	$32
(16) HARD COST (EXCLUDING TIS)	$217	$55	$102
(17) TIS	$135	$20	$57
(18) TOTAL DEVELOPMENT COST	$431	$93	$220

D. DEVELOPER SELECTION PROCESS

Sources used to create a list of developers include Commercial Property News's ("CPN's") "Annual Guide of Top Real Estate Developers – 2006," and MIT Center for Real Estate's Industry Partner and Alumni Lists. Based on these data sources, I created an initial list of 52 development companies that met the requirements for the survey. Of the 52 companies, 25% had at least 50% of their current outstanding projects in office developments; 37% did not have any current office projects, but rather functioned strictly in the multifamily housing market. As noted earlier, the multifamily housing section of this thesis was scratched. In all, almost 60% (30) developers targeted in the survey were involved in some type of office project. Appendix B provides a complete list of developers, their percent of current projects in multifamily and office developments, and in which regions they typically operate.

The first surveys were e-mailed to companies beginning on June 7, 2006 and continued to be e-mailed throughout June and July. Return responses were received beginning in mid-June and then throughout the rest of June to mid-July. In the end, 25 office projects were submitted by the 9 office developers.

The greatest challenge for the survey was to receive enough responses to create a large enough project-level database to produce reliable cost variable estimates. Of the original 50+ development companies targeted and contacted, only 9 sent responses back. The chosen media to interact with developers were telephone and e-mail. Initial contact was usually via the telephone, followed by telephone and e-mail correspondence. Follow-up correspondence occurred at least on a weekly basis, and often multiple times per week, depending on the progress of the survey. All documents were sent and received via e-mail. Also, most data clarifications were handled via e-mail. Utilizing e-mail enabled a more accurate documenting of the entire survey process.

The low response rate can be attributed to three major factors: data too difficult to gather, legal issues, and no centralized data tracking system. Each development company, as one would suppose, tracks development costs differently. Some include, for example, tenant improvements in soft costs, while others include such expenses in hard costs. Permitting fees are often included in soft costs, but a significant number of companies attribute such expenses to the land acquisition cost. As a result, some developers faced a significant amount of time commitment to fill out the survey property, if it were even possible. Such cases greatly limited the number of possible observations a respondent would feasibly be able to provide.

The second factor limiting the number of received observations was legal issues. Despite masking the data, some developers still remained concerned divulging their data. Often consulting with their respective legal teams, these developers decided not to participate, but were willing to discuss general replacement cost topics over the telephone. In one case, the developer's legal team advised that person not to participate in the study because the company considered their advanced understanding of replacement costs to be a competitive advantage in the market place.

The final—and perhaps the most significant—factor contributing to the low response rate was the decentralized nature of development companies, global and local. As noted above, though 9 of the originally targeted 50+ companies participated, I often corresponded with multiple individuals of the same company in varying regions of the country. Because many companies did not possess a centralized data base of project-level information that could be easily accessed, I needed to contact individuals on an office-by-office basis to retrieve data. This greatly inhibited the data collection process because though one individual within a company would be interested in participating, other individuals were not. In some cases, a company may have, for example, 20 viable projects for the survey, but due to informational decentralization, only a fraction of these projects would be submitted. Further research on this topic might consider focusing on only one large development company or contacting financial institutions which lend to real estate developers.

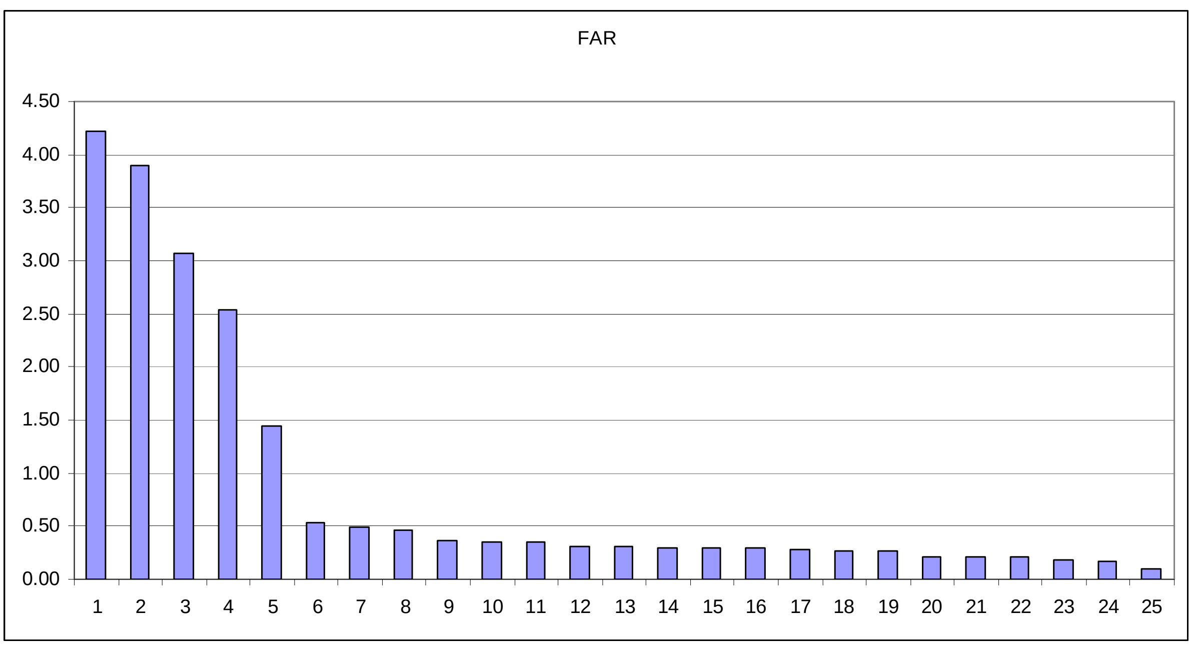
E. KEY RATIOS

Additional statistics for the FAR, LC/HC * FAR, SC/HC, and TI/HC ratios were calculated based on data from the survey sample. The latter three ratios will become dependent variables for regressions used to model development costs for each of the 63 targets markets.

1. FLOOR-TO-AREA RATIO ("FAR")

The FAR is calculated by dividing (9) BUILDING SQUARE FOOTAGE by (8) LAND SQUARE FOOTAGE for each project. FAR ranged from 0.09 to 4.22, with an average of 0.90 and a weighted average of 1.45.

FIGURE 13: FAR

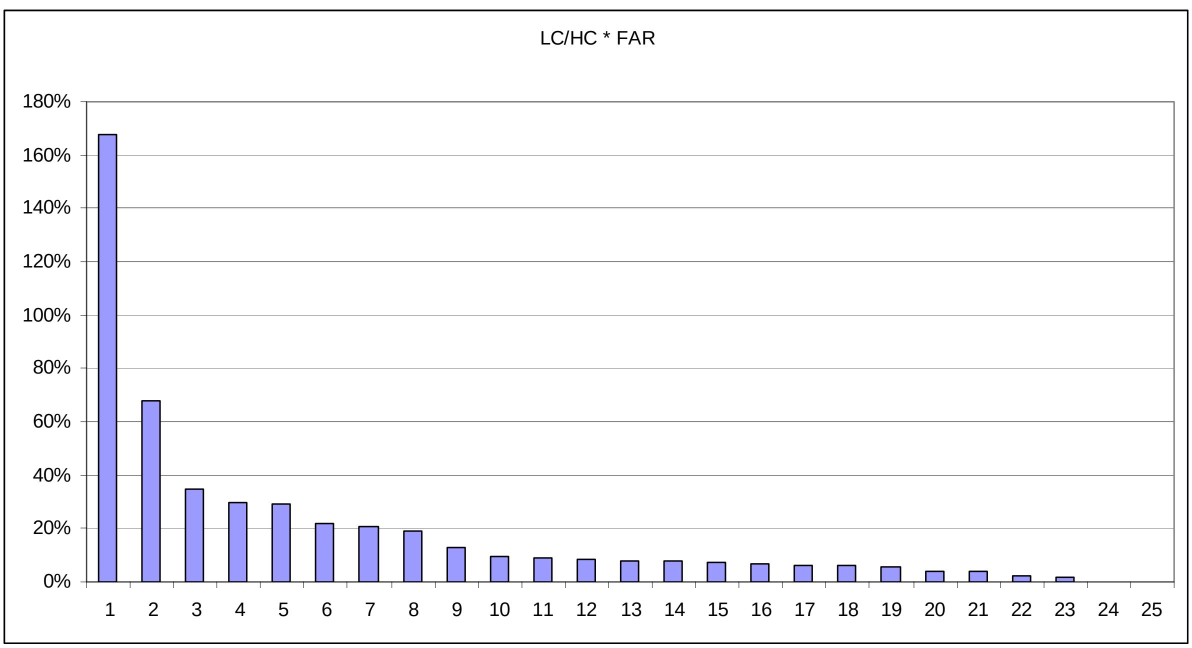


2. LAND-TO-HARD COST (“LC/HC”) * FAR RATIO

The LC/HC * FAR ratio is comprised of (11) LAND ACQUISITION COST, (8) LAND SQUARE FOOTAGE, (16) HARD COST, and (9) BUILDING SQUARE FOOTAGE, and FAR. The “LC” portion of the ratio is (11) / (8) and describes the land cost per square foot of land; the “HC” portion is (16) / (9) and provides a hard cost measure based on building square feet. The LC/HC ratio can also be rewritten as [Land Costs/Hard Costs * FAR]. In this format, the LC/HC ratio provides a measure for Land Costs in terms of Hard Costs, adjusted by each project’s density. Adjusting LC/HC by FAR accounted for the varying densities of the survey’s projects.

The highest ratio value for LC/HC * FAR was 168%, the low was 0% (some developers did not pay for land), and the average was 20%. The following chart illustrates the data’s distribution.

FIGURE 14: LC/HC * FAR



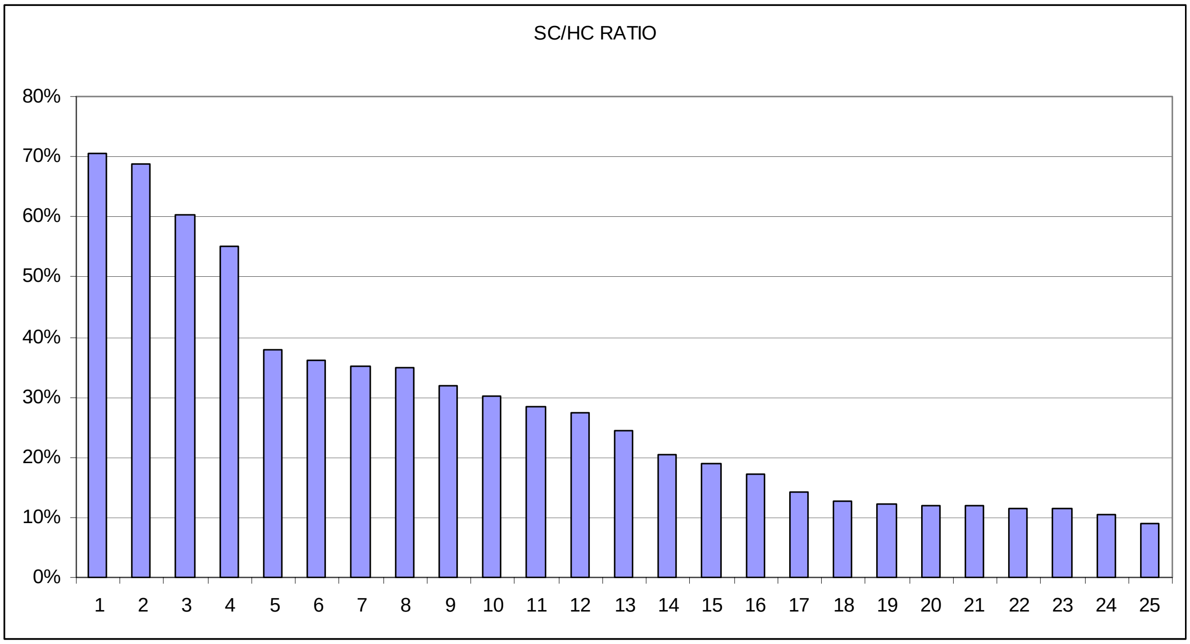
Removing the two outliers (168% and 68%) drops the average LC/HC * FAR amount to 12%. If a development requires $1,000,000 in HCs, then, given the survey sample and an FAR of 1.0, one should expect to pay $120,000 for the land. If the FAR is 5.0, say for a CBD project, then the LC would be [$600,000 = 12% * $1,000,000 * 5.0]. Increasing the FAR from 1.0 to 5.0 increases the final ratio of LC/HC from 12% to 60%. Suburban projects should expect LC to be closer to 12% and CBD projects should expect this amount to be higher, perhaps even up to 60%.

Remember that the above ratio differs from the total land and cost values not adjusted for land and building square feet. According to the survey data, total land costs divided by total hard costs are 32%.

3. SOFT COST-TO-HARD COST ("SC/HC") RATIO

The SC/HC ratio is comprised of (15) SOFT COST divided by (16) HARD COST. Placing SC in terms of HC will enable the statistical model to leverage RSMeans HC data to estimate soft costs. The maximum ratio from the survey data was 70%, the minimum 9%, and the average was 28%. The following chart illustrates this ratio's distribution.

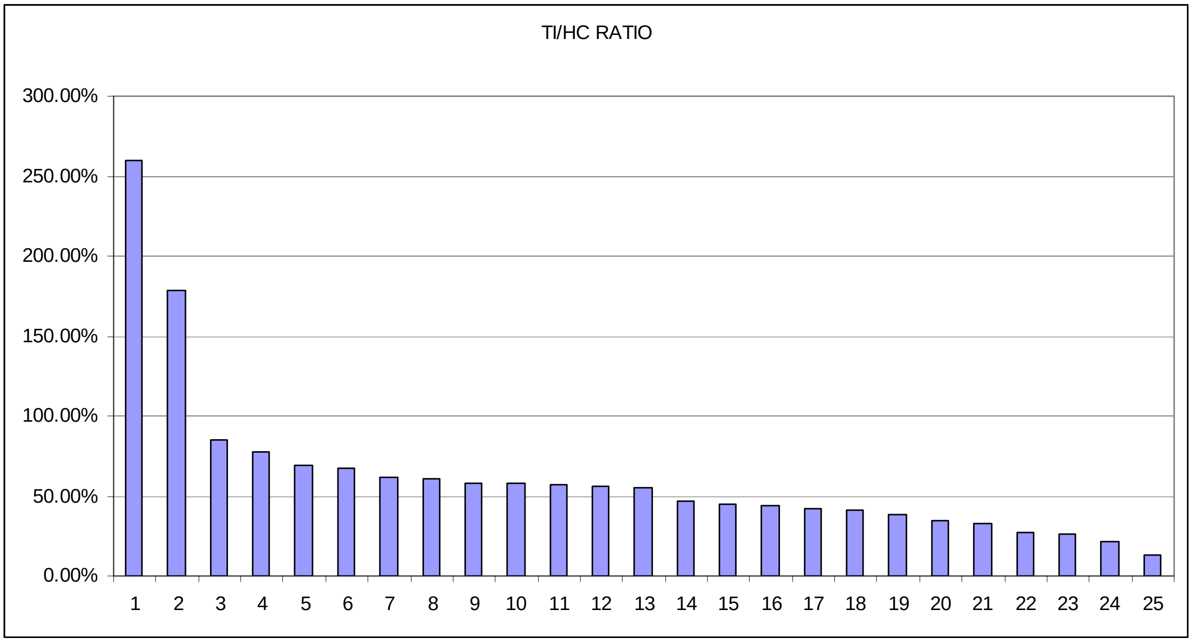
FIGURE 15: SC/HC RATIO



4. TENANT IMPROVEMENT-TO-HARD COST ("TI/HC") Ratio

The TI/HC ratio is created by dividing (17) TIs by (16) HARD COST. Similar to the SC/HC ratio, placing TIs in terms of HCs will enable the statistical model to predict TIs for each represented market in the study. The maximum value for this ratio was 260%, the minimum was 13%, and the average was 62%. For modeling purposes, the two highest values (260% and 180%) were removed from the analysis. The following chart illustrates the distribution for this ratio.

FIGURE 16: TI/HC RATIO



KEY RATIO SUMMARY STATISTICS

The following table summarizes the maximum, minimum, and mean values for each of the key ratios outlined in this section.

FIGURE 17: KEY RATIO SUMMARY STATISTICS

KEY RATIO SUMMARY STATISTICS	MAX	MIN	MEAN
FAR	4.22	0.09	0.90
LC/HC * FAR	168%	0%	20%
SC/HC	70%	9%	28%
TI/HC	260%	13%	62%

IV. REGRESSION ANALYSIS

To create a benchmark that can be used to estimate total replacement costs in major metropolitan areas, I created three regression equations based on the LAND COST / HARD COST * FAR ("LC/HC * FAR") ratio, SOFT COST/HARD COST ("SC/HC") ratio, and the TI/HARD COST ("TI/HC") ratio as dependent variables. By placing Hard Costs in each of the dependent variable values, I can leverage the existing data on Hard Costs to estimate Soft Costs and TI expenditures.

Despite the limited number of observations for office developments, an analysis anchored in Hard Costs could be reasonably performed using regression analysis. Regressions were performed to estimate LCs, SCs, and TIs. I then applied regression results used to predict LCs, SCs, and TIs to an expanded list of cities for which RSMeans provided hard cost data and CBRE land price transactions. This enabled the calculation: [TDCs = LCs + SCs + TIs + HCs].

Linear regression analysis is a standard form of statistical modeling utilized to describe the relationship between a dependent (response) variable and posited independent (exogenous) variables. Coefficients, or estimators, result from the creation of the equation which best "fits" the data. The basic assumptions associated with regression analysis relate to the minimization and consistency of the error term[39]--

- Expected value of the error term is zero;
- Exogenous variables are non-random and linearly independent;
- Variance of the error term is the same for each observation (homoscedasticity);
- Error terms for each observation are not autocorrelated.

[39] See http://elsa.berkeley.edu/sst/regression.html.

In analyzing the data for linear independence between independent variables, the strongest relationship exists between hard costs and total development costs (83%). The following correlation matrix provides the remaining results—

FIGURE 18: VARIABLE CORRELATION MATRIX

	LAND SF	*BLDG SF*	*FAR*	*LAND ACQ COST/ BLDG SF*	*SOFT COST/ BLDG SF*	*HARD COST/ BLDG SF*	*TIs/ BLDG SF*	*TOTAL COST/ BLDG SF*
LAND SF	100%							
BLDG SF	61%	100%						
FAR	-31%	51%	100%					
LAND ACQ COST/BLDG SF	18%	36%	9%	100%				
SOFT COST/BLDG SF	-14%	55%	65%	39%	100%			
HARD COST/BLDG SF	-32%	17%	46%	34%	68%	100%		
TIs/BLDG SF	-22%	-12%	20%	1%	6%	57%	100%	
TOTAL COST/BLDG SF	-31%	22%	47%	49%	71%	83%	48%	100%

As shown above, the correlations between the relevant variables imply that the least squares method assumptions will not be violated.

Results from the regression analysis were applied to the RSMeans Hard Cost Index and an average land price to generate total replacement cost estimates for the 63 MSAs identified above.

A. REGRESSION I: ESTIMATION OF LAND COSTS

Land cost estimation begins by first running a linear regression based on survey data, then applying the resulting ratio to the RSMeans hard cost index value for each market. The dependent variable, "(LC / HC) * FAR," places land costs in terms of hard costs, then adjusts this ratio for the density. Using the ratio instead of actual reported land acquisition numbers eliminates the need to add dummy variables for years or to inflate reported numbers to 2006 values. Given the small size of the data set, including these additional variables would increase the chances of incurring a spurious regression. Adjusting for density essentially "weights" the ratio to properly account for this factor across observations. The regression equation is as follows—

$$(LC/HC)^{*} FAR = a + b_1 BLDG\ SF + b_2 HCindex \quad (1)$$

, where a is the intercept, b_x is the estimated coefficient for each variable, and the error term is assumed to be zero. The variables are defined as follows—

- BLDG SF: Total gross square footage of the structure.
- HCindex: 2006 RSMeans standardized city index divided by the 30-city national average value.[40]

Results from this regression are the following—

FIGURE 19: (LC/HC) * FAR Regression Results

SUMMARY OUTPUT

Regression Statistics	
Multiple R	55%
R Square	30%
Adjusted R Square	23%
Standard Error	9%
Observations	21

	Coefficients	*Standard Error*	*t Stat*
Intercept	(0.01)	16%	(0.09)
BLDG SF	0.0000005	0.00002%	2.74
2006 HC % OF NATIONAL INDEX (156.2)	0.08	16%	0.53

Regression I yields a relatively low R Square value of 30% and a standard error of 9%, based on 21 survey observations. In addition to the two observations being eliminated for exorbitant TI expenditures, I eliminated two projects which exhibited outlying values for the LC/HC ratio.

[40] Means Construction Cost Indexes, Jan 2006, p. 1

The coefficient for the BLDG SF variable is significant and exhibits a positive sign. This result implies that as the size of the building increases, more money will be spent on acquiring the land. For example, a 250,000 square foot building will increase the LC/HC ratio by [13% = 0.0000005 x 250,000].

Though the 2006 RSMeans National HC Index variable is insignificant, its positive sign suggests that as hard costs increase, so do land costs. The purpose of the RSMeans Index variable is to account for the variation in hard costs due to city-specific factors. For example, of the 23 listed projects, 15 were built in cities with RSMeans indexes above the national average of 156.2.

B. REGRESSION II: ESTIMATION OF SOFT COSTS

The process of estimating soft costs consists of two steps: (1) estimation of the SC/HC ratio and (2) application of the ratio to a hard cost benchmark value, adjusted by MSA. As in Regression I, a ratio is utilized to reduce the number of independent variables.

The regression equation yielding the most significant results was—

$$SC/HC = a + b_1 BLDG\ SF + b_2 HC\_2006 + b_3 DUM(D\ v\ S) + b_4 DUM(C\ v\ N) + b_5 DUM(BTS\ v\ N) + b_6 DUM(U\ v\ N) + b_7 HCindex \qquad (2)$$

where a is the estimated intercept, b_x the estimated coefficient for each variable, and the error term is assumed to be zero. The variables are defined as follows—

- BLDG SF: Total gross square footage of the structure.
- HC_2006: Reported survey data, per building square foot, grown to 2006 using the RSMeans city-specific growth rate. Hard Costs in this survey are defined as the "Sum total of Site Preparation Costs (e.g., excavation, utilities installation), Shell Costs, Permits, Contractor Fees, Construction Management and Overhead Costs, Materials, Labor, Equipment Rental, Developer Fees, and other costs directly attributed to the actual construction of the structure. THIS AMOUNT DOES NOT INCLUDE TENANT IMPROVEMENT EXPENDITURES."

- DUM(D v S): Location within the MSA. "Downtown" ("D") is defined as a particular MSA's central business district, or a city's concentration of retail or commercial real estate. The "Suburb" ("S") value represents any location not in a central business district.
- DUM(C v N): Corporate ("C") refers to a traditional office space; Non-corporate ("N") refers to buildings which require large amounts of unique costs such as medical, dental, and biotechnology buildings.
- DUM(BTS v N): Designates whether the project was "build-to-suit"
- DUM(U v N): Designates whether the project utilized union or non-union workers. The coefficient is multiplied by a market-specific union labor factor, calculated based on the United States Bureau of Labor Statistics union affiliation data. [41]
- HCindex: 2006 RSMeans standardized city index divided by the 30-city national average value.[42]

Results from this regression are the following—

FIGURE 20: SC/HC REGRESSION RESULTS

SUMMARY OUTPUT

Regression Statistics	
Multiple R	83%
R Square	69%
Adjusted R Square	55%
Standard Error	13%
Observations	23

	Coefficients	*Standard Error*	*t Stat*
Intercept	-14%	29%	(0.47)
BLDG SF	0.00008%	0.00003%	3.05
HC/SF IN YEAR 2006	0.1%	0.1%	0.83
DUM - D (1)/S (0)	-17%	12%	(1.44)
DUM - CORP (0)/NON (1)	-8%	7%	(1.15)
DUM - BTS (1)/NON (0)	-9%	6%	(1.40)
DUM - UNION (1)/NON (0)	6%	9%	0.75
2006 HC % OF NATIONAL INDEX (156.2)	31%	29%	1.07

[41] http://www.bls.gov/news.release/union2.toc.htm, accessed August 2, 2006. Tables 3 and 5 provide Union affiliation by occupation and by state, respectively. The market-specific factor was calculated by multiplying the national union construction affiliation (13.1%) by the ratio of state-to-national union affiliation percentages (ST% / 12.5%). The Union coefficient from the regression was then multiplied by the market-specific factor to estimate the Union impact on the SC/HC and TI/HC ratios.

[42] Means Construction Cost Indexes, Jan 2006, p. 1

Equation (2) yields an R Square of 69%, meaning that it explains almost 70% of the variation in the data. Due to the small data set of only 23 observations, the value of the adjusted R Square is 55%, almost 15 percentage points lower. BLDG SF represents the only variable significant at the 95% confidence level. The coefficient for BLDG SF estimates a 0.8% increase in the SC/HC ratio for every 10,000 gross building square feet.

The signs for the remaining variables provide further understanding of how each affects the SC/HC ratio. The proxy variables for downtown (-17%), non-corporate (-8%), and build-to-suit (-9%) project characteristics imply increases in hard costs disproportionate to soft costs. In contrast, unionized projects increase the SC/HC ratio by 6%, implying a disproportionate increase in soft costs relative to hard costs when union workers are utilized for a project.

The final independent variable, the RSMeans MSA-to-National Average Ratio, exhibits a 31% coefficient value that contributes to determining the SC/HC ratio. According to the regression results, cities with high hard costs will also have a disproportionate increase in soft costs. This can be explained, in part, due to the inherent project complexity in these more expensive areas. Larger cities tend to have longer permitting periods, higher salaries for both the developers and engineers, and countless other factors contributing to the higher soft costs in proportion to the hard costs.

F. REGRESSION III: ESTIMATION OF TI EXPENDITURES

Estimating TIs follows a similar two-step methodology as the estimation of Soft Costs. The first step involved creating a TI/HC dependent variable then regressing it against variables to account for building size, location (downtown v. suburb), corporate or non-corporate building type, the unionized work force, and the RSMeans Hard Cost Index. Using the regression results, TI expenditures can then be calculated for each market covered in the RSMeans annual report.

The equation is as follows—

$$TI/HC = a + b_1 BLDG\ SF + b_2 DUM(D\ v\ S) + b_3 DUM(C\ v\ N) + b_4 DUM(U\ v\ N) + b_5 HCindex \qquad (3)$$

where a is the estimated intercept, b_x the estimated coefficient for each variable, and the error term is assumed to be zero. The variables are defined as follows—

- BLDG SF: Total gross square footage of the structure
- DUM(D v S): Location within the MSA. "Downtown" ("D") is defined as a particular MSA's central business district, or a city's concentration of retail or commercial real estate. The "Suburb" ("S") value represents any location outside a central business district.
- DUM(C v N): Corporate ("C") refers to a traditional office space; Non-corporate ("NC") refers to buildings which require large amounts of unique costs such as medical, dental, and biotechnology buildings.
- DUM(U v NU): Designates whether the project utilized union or non-union workers. As in Regression II, the coefficient is multiplied by a market-specific union labor factor, calculated based on the United States Bureau of Labor Statistics union affiliation data.
- HCindex: 2006 RSMeans standardized index by city or MSA.

Results from this regression are the following—

FIGURE 21: TI/HC REGRESSION RESULTS

SUMMARY OUTPUT

Regression Statistics	
Multiple R	76%
R Square	58%
Adjusted R Square	46%
Standard Error	13%
Observations	23

	Coefficients	*Standard Error*	*t Stat*
Intercept	28%	30%	0.91
BLDG SF	0.00004%	0.00003%	1.30
DUM - D (1)/S (0)	-11%	12%	(0.92)
DUM - CORP (0)/NON (1)	29%	7%	4.41
DUM - UNION (1)/NON (0)	-16%	8%	(2.11)
2006 HC % OF NATIONAL INDEX (156.2)	11%	29%	0.36

Equation (2) yields an R Square of 58% and an adjusted R Square of 46%. These findings are less than those from equation (1), but still provide valuable insights given the small data set from which these coefficients were derived.

The variables accounting for the purpose of the office project (Corporate v. Non-corporate use) and for union labor both provide statistically significant results at the 95% confidence level. Corporate v. Non-corporate uses should reasonably affect the ratio of TI/HC because non-corporate uses, such as medical and dental offices, require a specialized equipments, designs, and materials unique to their respective fields. For example, dentists require X-ray machines, operatories and extensive plumbing and duct work that a traditional corporate use would not.

Hiring union labor, according to results from Equation (2), reduces the TI/HC ratio. This is because the added labor cost decreases the funds available for finish work and other

TI expenditures. Prevailing market rents often do not justify the same level of TI expenditure as the non-union projects. The added costs associated with union labor cause developers to trim TI expenditures to successfully compete in the market place.

BLDG SF, Downtown v Suburban, and the RSMeans Index percentage measure were all insignificant at the 95^{th} percentile, so I will limit the interpretation of these variables to the signs of the coefficients.

The positive coefficient sign for the BLDG SF variable implies a slightly positive elastic relationship between the TI/HC ratio and the size of the building. For every 10,000 square feet of building, the TI/HC ratio increases by 0.4%. As building size increases, this variable can quickly become a significant factor, as one would expect.

The Downtown v. Suburban variable coefficient is negative, implying that fewer TIs per US Dollar of hard costs are spent in the central business district than in the suburbs. TIs are a market-specific determination and are often negotiated on a tenant-by-tenant basis. One possible explanation for this result is that suburban developers can afford to offer tenants a higher TI allowance due to lower land costs. It may also be the case that suburban developers *must* offer tenants higher TI allowances to draw them out of the central business district (downtown). On the flip side, given market conditions, downtown developers are unable/not required to offer as many TI allowances. Balancing land costs with tenant incentives may also limit the amount downtown developers can offer in TI allowances relative to suburban developers. A tenant may also place more value on locating within the downtown and be willing to accept lower TI allowances to do so. Finally, if more of the TIs are assumed by the tenant, these expenditures will not be accounted for as the TI expenses to the developers.

Thus, just because the TI allowance is lower does not imply that the finished product is of lower quality.

The final variable is the RSMeans Index MSA-to-National Average comparison ratio, which yields a positive sign. In more expensive markets, such as New York City, the costs of the materials used in tenant improvements would naturally be higher than in less expensive markets, such as Salt Lake City. The positive correlation, then, between the Index Ratio and the TI/HC ratio, is reasonable to expect.

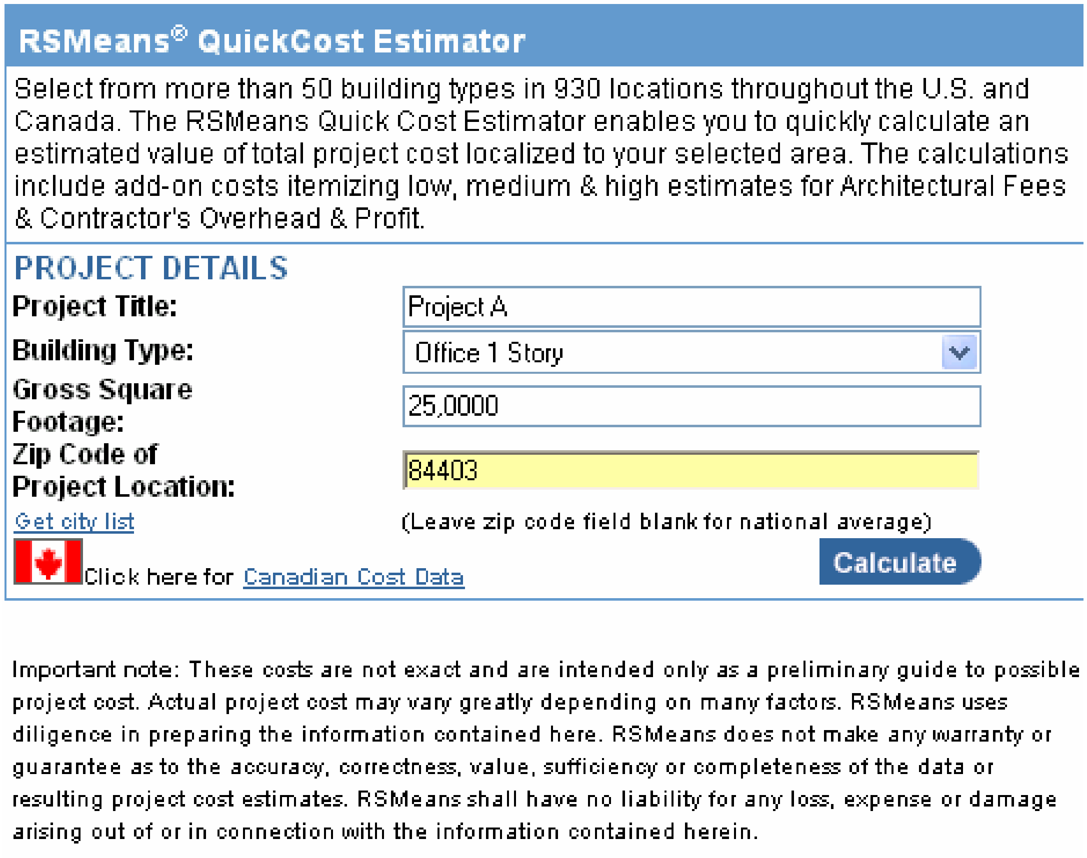
V. REASONABLENESS OF RESULTS

This chapter aims to test the validity of the regression results by comparing them to real-world data. The first section will consider the correlation between the HCs reported in the survey and HCs predicted by RSMeans using the QuickCost Estimator. I will also examine the relationship between the model's predicted HCs and RSMeans estimates. The final section of this chapter involves studying the correlation between surveyed land costs compared with the RSMeans data, the CB data sets, and the RCA data.

A. HC ANALYSIS

The first step in comparing the HC values in the survey with those from RSMeans was to gather comparable values from RSMeans. To do this, I utilized the median value per square foot reported by the QuickCost Estimator for each project in the sample. This process included inputting the number of stories, the building square feet, and the MSA from each project in the sample into the QuickCost Estimator to find the RSMeans cost estimate for each project as of 2006. For example, if a project in the survey was 1-story, 25,000 square feet and in the Ogden-Clearfield, UT, MSA, I input these figures into the Estimator. The following screenshot provides illustrates how this was performed.

FIGURE 22: RSMeans QUICKCOST ESTIMATOR INPUT SCREENSHOT


RSMeans® QuickCost Estimator

Select from more than 50 building types in 930 locations throughout the U.S. and Canada. The RSMeans Quick Cost Estimator enables you to quickly calculate an estimated value of total project cost localized to your selected area. The calculations include add-on costs itemizing low, medium & high estimates for Architectural Fees & Contractor's Overhead & Profit.

PROJECT DETAILS

Project Title:	Project A
Building Type:	Office 1 Story
Gross Square Footage:	25,0000
Zip Code of Project Location:	84403
Get city list	(Leave zip code field blank for national average)

Click here for Canadian Cost Data

Calculate

Important note: These costs are not exact and are intended only as a preliminary guide to possible project cost. Actual project cost may vary greatly depending on many factors. RSMeans uses diligence in preparing the information contained here. RSMeans does not make any warranty or guarantee as to the accuracy, correctness, value, sufficiency or completeness of the data or resulting project cost estimates. RSMeans shall have no liability for any loss, expense or damage arising out of or in connection with the information contained herein.

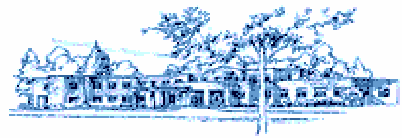
Clicking the “Calculate” button on the screen produces the following report—

(See next page.)

FIGURE 23: RSMeans QUICKCOST ESTIMATOR REPORT

RSMeans QuickCost Estimator

Project Title:	Project A
Model:	Office 1 Story
Construction:	Wood Siding / Wood Truss
Location:	OGDEN, UT
Stories:	1
Story Height (l.f.):	12
Floor Area (s.f.):	250,000
Data Release:	2006
Wage Rate:	Union
Basement:	Not included



Costs are derived from a building model with basic components. Scope differences and market conditions can cause costs to vary significantly.

Cost Ranges	Low	Med	High
Total:	$13,979,700	$15,533,000	$19,416,250
Contractor's Overhead & Profit:	$3,494,925	$3,883,250	$4,854,063
Architectural Fees:	$914,925	$1,016,584	$1,270,729
Total Building Cost:	**$18,389,550**	**$20,432,834**	**$25,541,042**

Do You Need a More Comprehensive Estimate With Current Cost Data and Your Own Detailed Project Specifications?

Access the Custom Cost Estimator, a paid subscription service, to reference a comprehensive library of square foot models updated and localized for the United States to create a customized online estimate specific to your individual project! - **All from RSMeans, *The Industry Source!***

[click here to view a sample report]

Important note: *These costs are not exact and are intended only as a preliminary guide to possible project cost. Actual project cost may vary greatly depending on many factors. RSMeans uses diligence in preparing the information contained here. RSMeans does not make any warranty or guarantee as to the accuracy, correctness, value, sufficiency or completeness of the data or resulting project cost estimates. RSMeans shall have no liability for any loss, expense or damage arising out of or in connection with the information contained herein.*

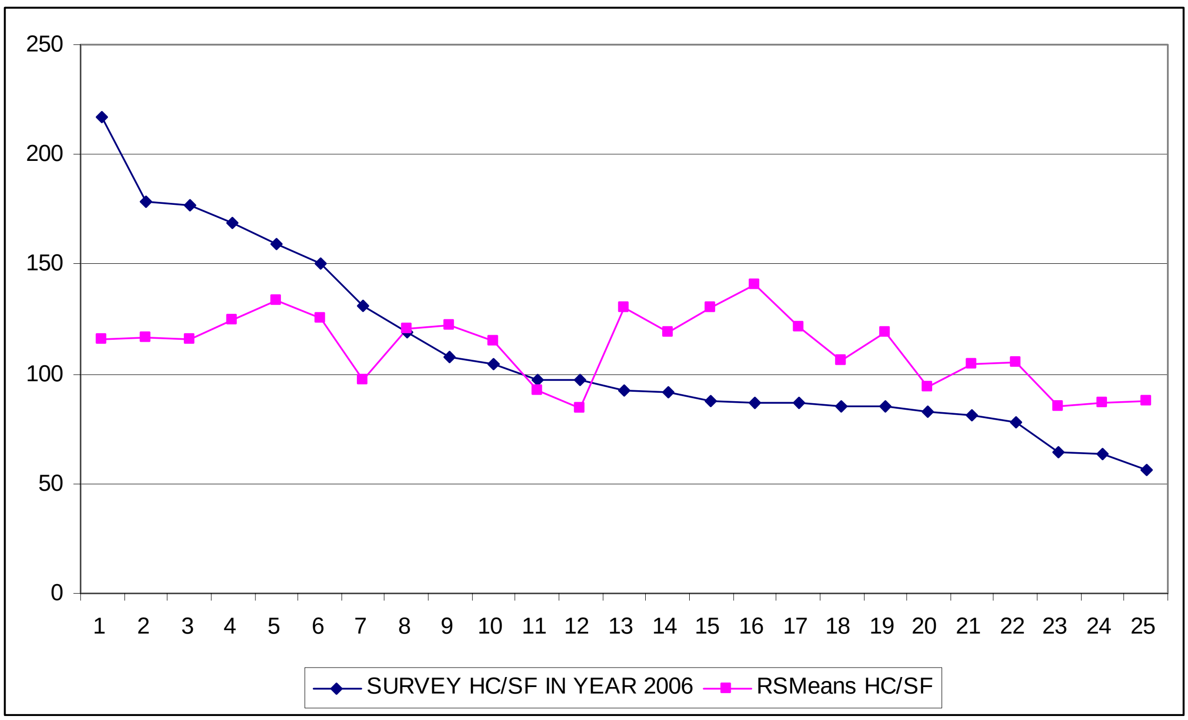
From the above report, I took the median "Total Building Cost" value and subtracted the Architectural fees (in the survey, these fees were included in SCs) to arrive at an estimated HC value for each project. In this example, the hard costs would be [$19,416,250 = $20,432,834 – 1,016,584]. Because these values are in 2006 terms, the next step involved using the RSMeans index to adjust project HC values from their completion date to 2006 US$.

Comparing the HC values and the corresponding RSMeans values showed that despite the high variation, on average the two HCs were fairly close. The average of the ratio of Survey HC-to-RSMeans HC was 98%, with a standard deviation of 33%. The following table and chart summarize this comparison. Data for the chart were organized in descending order of the Survey's HCs, while maintaining the proper relationship with the RSMeans data.

FIGURE 24: COMPARISON OF SURVEY HCs AND RSMeans HCs

	SURVEY HC/SF IN YEAR 2006	RSMeans HC/SF	SURVEY HC / RSMeans HC
MEAN	$110.09	$111.66	98%
MAXIMUM	$217.37	$140.53	188%
MINIMUM	$56.48	$84.31	62%
STDEV	$41.93	$16.35	33%

FIGURE 25: GRAPH OF SURVEY AND RSMeans HCs



By organizing the Survey HC data from largest to smallest, the chart reveals how RSMeans data tend to underestimate high costs and over-estimate low costs. Averaging the data cancels out these over- and underestimations to yield an aggregated value close to the average of the actual data's average. In fact, the correlation between the two variables is only 39%.

I next regressed the actual project HCs, adjusted to 2006, against the predicted RSMeans median values. The results from this regression are as follows—

FIGURE 26: SURVEY HC REGRESSION

SUMMARY OUTPUT

Regression Statistics	
Multiple R	39%
R Square	15%
Adjusted R Square	12%
Standard Error	39.4
Observations	25

	Coefficients	*Standard Error*	*t Stat*
Intercept	-1.68	55.6	-0.03
RSMeans HC/SF	1.00	0.5	2.03

The R Square value is only 15%, but the RSMeans HC/SF coefficient of 1.00 is significant at the 95th percentile. According to this regression's results, for every $1 increase in the RSMeans estimate, HC for the project are also expected to increase by $1.00. Given the negative value for the Intercept coefficient, it seems that this statistical model will tend to predict slightly lower costs than will RSMeans (e.g., if RSMeans HCs = $100 per square foot, the model will predict actual hard costs to be $98.32 per square foot [$98.32 = -$1.68 + (1.00 * $100]).

Though other factors will undoubtedly contribute to the determination of HCs, this regression reveals the apparent reliability of the RSMeans data in predicting HCs. Referring to the chart above, this conclusion is based on interpreting the averages of the data rather than a specific project-to-project comparison.

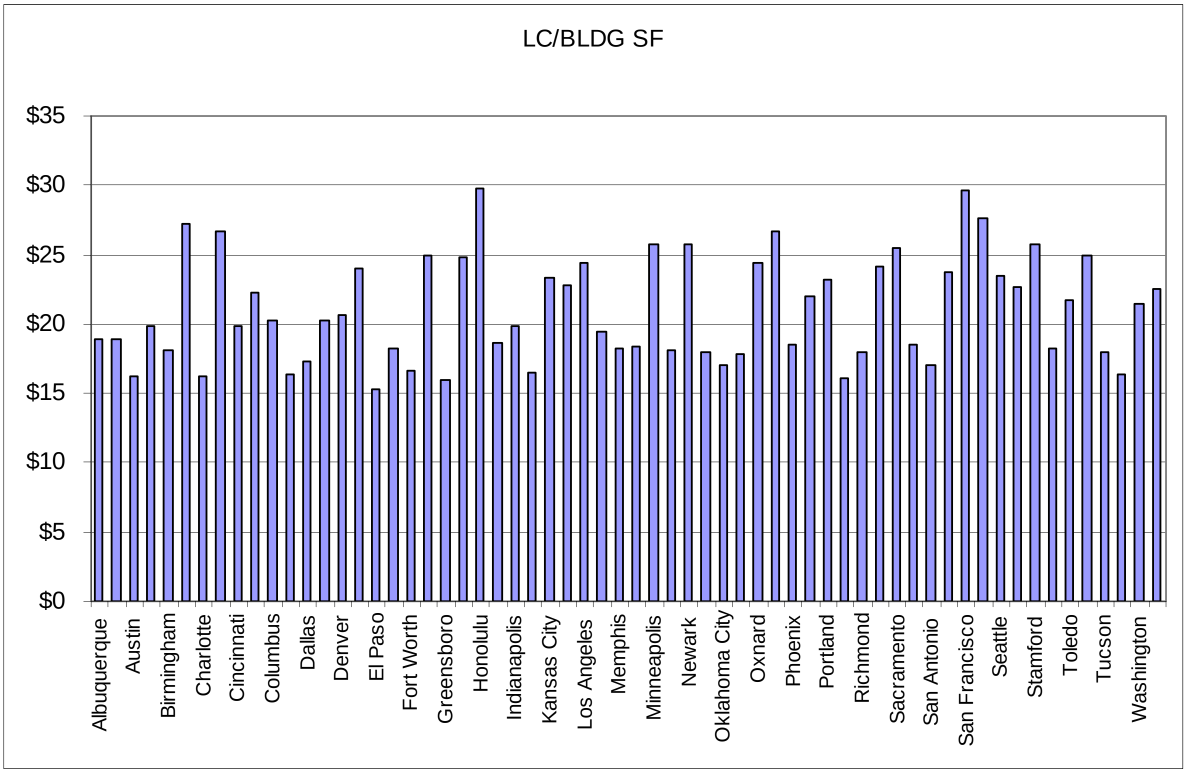
B. LC ANALYSIS

The Land Cost analysis focuses on deriving a reliable suburban land acquisition value by combining land cost data from three sources: (1) LC/HC * FAR regression (Regression I) forecasted data, (2) CB transaction data, and (3) CB-predicted data. Each of these sources approaches land costs from very distinct avenues, and their consilience will provide the most comprehensive valuation given the information available for this study. Due to the survey's limited number of downtown observations (2), only suburban LCs will be considered.[43]

Regression I derived land data will only be applied to suburban projects due to limitations in the survey data set. Assuming an FAR of 1.0, the LC/BLDG SF is calculated by multiplying the regression equation result by HC, then dividing by the FAR. For example, given a 250,000 SF development, the national average for the LC/HC * FAR is [19% = -0.01 + 0.0000005 * 250,000 + 0.08 * 1].[44] To isolate the LC/BLDG SF, divide 19% by the assumed FAR of 1.0, then multiply by HC/BLDG SF, which, for the national average, are $114, resulting in a LC/BLDG SF of $22. This approach is followed for each of the markets present in the study. The following chart illustrates the dispersion of predicted land costs, by market.

[43] The survey results only yielded two downtown observations, an inadequate representation to consider reliable in forecasting total development costs.
[44] Rounding errors are present in this calculation.

FIGURE 27: REG I PREDICTED LAND COSTS, BY MARKET



For suburban projects, New York City exhibited the highest predicted LCs at $33/BLDG SF, given the assumptions listed above. El Paso, Texas had the lowest estimated LCs at $15/BLDG SF. The average land cost value was $21/BDLG SF.

Land Costs per BLDG SF for each of the CB data sets are calculated by dividing the given land prices per land SF by the assumed suburban FAR of 1.0.[45] The following table provides a comparison of summary statistics for each of the three land cost sources, as well as the reported survey data.

[45] In the case of the predicted CB data, the reported values were first divided by 43,560 to convert the data to a SF basis.

FIGURE 28: COMPARISON OF LAND COSTS

	MAX	MIN	MEAN	STDEV
SURVEY DATA	$300	$0	$26	$61
REGRESSION I	$33	$15	$21	$4
CB-TRANSACTION	$53	$3	$11	$9
CB-PREDICTED	$29	($1)	$10	$7
AVERAGE	***$31***	***$8***	***$14***	***$5***

The statistical values in the “AVERAGE” row are based on a market-level data set of mean land prices from the three data sources, rather than summarizing the numbers reported in the first three rows. These data do not incorporate the actual survey data.

The estimated values from the survey-based LC regression exhibit a lower volatility and a higher minimum cost than do the CB data sources. The maximum value of $33 fell near the CB-predicted amount of $29, but well below the $53 from the transaction data set. In considering the survey data, none of the maximum values come remotely close to the $300/BLDG SF paid for an actual project.

Differences in property mixes of the data sources most likely cause the high variability in summary statistics. For this reason, it is important to combine the information from all three sources to approach a more accurate representation of land costs for suburban office projects. For the purposes of calculating the suburban TDCs, values from the “AVERAGE” row will be employed.

Land estimates can also be calculated for downtown projects, then compared with a CB-transactional land data. Based on an FAR of 5.0 and assuming 250,000 BLDG SF, the regression model estimates range from $3 to $7, with a STDEV of $1, for LC per LAND SF. The CB transactions downtown data, on the other hand, range from $1 to $125, with a STDEV of $30. The following tables summarize these statistics. The first table provides summary statistics and the second table provides market-by-market comparisons.

FIGURE 29: REG LC v. CB-TRANS LC

	REG	CB-TRANS
MAX	$7	$125
MIN	$3	$1
MEAN	$4	$20
STDEV	$1	$30

	City	ST	LC (REG CBD)	LC (CB-Trans)	%DIFF
(1)	Albuquerque	NM	$4	$7	72%
(2)	Atlanta	GA	$4	$4	-7%
(3)	Austin	TX	$3	$26	684%
(4)	Baltimore	MD	$4	$3	-19%
(6)	Boston	MA	$5	$20	268%
(7)	Charlotte	NC	$3	$33	903%
(8)	Chicago	IL	$5	$60	1027%
(9)	Cincinnati	OH	$4	$1	-66%
(10)	Cleveland	OH	$4	$11	147%
(15)	Denver	CO	$4	$13	214%
(16)	Detroit	MI	$5	$5	14%
(19)	Fort Worth	TX	$3	$14	306%
(20)	Fresno	CA	$5	$4	-15%
(24)	Houston	TX	$4	$32	761%
(25)	Indianapolis	IN	$4	$8	89%
(26)	Jacksonville	FL	$3	$9	158%
(28)	Las Vegas	NV	$5	$5	18%
(29)	Los Angeles	CA	$5	$125	2464%
(32)	Miami	FL	$4	$26	610%
(34)	Nashville	TN	$4	$7	94%
(35)	New York	NY	$7	$75	1046%
(39)	Orlando	FL	$4	$15	320%
(42)	Phoenix	AZ	$4	$9	137%
(43)	Pittsburgh	PA	$4	$11	161%
(44)	Portland	OR	$5	$5	3%
(45)	Raleigh	NC	$3	$5	56%
(51)	San Diego	CA	$5	$5	-3%
(52)	San Francisco	CA	$6	$15	145%
(53)	San Jose	CA	$6	$5	-10%
(54)	Seattle	WA	$5	$5	6%
(57)	Tampa	FL	$4	$25	573%
(59)	Trenton	NJ	$5	$5	6%
(61)	Tucson	AZ	$4	$2	-44%
(62)	Washington	DC	$4	$119	2663%
(63)	Wilmington	DE	$5	$4	-16%

D

As is evident from the above tables, the regression does not seem to projects downtown LCs nearly as well as it does suburban land costs. For this reason, only suburban projects will be considered for building the Total Replacement Cost Index.

VI: TDC CALCULATION

This chapter walks the reader through each step of the total development cost calculation through the use of an example city, Albuquerque, New Mexico. LCs, SCs, and TIs will be calculated for each city by applying the regression results of each corresponding ratio (LC/HC * FAR, SC/HC, and TI/HC). HCs will be estimated by applying the RSMeans index values for each city to the estimated RSMeans national HC average. Once all of the cost components are calculated, summing them together will yield total development costs, by market. The calculated TDCs for each market will then be compared to RCA asset values to determine whether a particular market is facing a boom or bust in its real estate cycle.

Before the cost components are calculated, assumptions regarding the size of development, its density, and type must be made. Assumptions are based on what typically occurs in the market and leverage the reliability of the model built in this thesis. All cost amounts will be quoted in term of BLDG SF. The additional project assumptions are—

- SUBURBAN, CORPORATE OFFICE, SPECULATIVE
- FAR = 1.0
- BLDG SF = 250,000
- HC = $113.82 (RSMeans national average matching scenario assumptions)
- UNION LABOR = % likelihood based on BLS statistics[46]
- LC = average of Regression I results and CB data sets.

A. LAND COSTS

The previous chapter demonstrated how land costs are calculated by taking the average of the Regression I results and the CB data sets. In this section, the resulting values, by market will be shown in the following table. These values represent the first cost

[46] See footnote 38.

component of TDCs. Following this methodology, for example, the estimated LCs for Albuquerque, New Mexico are $10/BLDG SF.

B. HARD COSTS

Calculating HCs involves multiplying the RSMeans Index ratio to the RSMeans estimated national average HC number ($113.82), given the assumptions. For example, estimating the $102 HC/SF amount for Albuquerque, New Mexico would entail multiplying $113.82 (HC national average) by Albuquerque’s 2006 Index ratio (90%). Note that the 90% index ratio is Albuquerque’s index value of 144.9 divided by the national average of 156.2. Index ratios for each market mirror this calculus.

Albuquerque’s combined LC and HC amount is [$112 = $10 (LC) + $102 (HC)].

C. SOFT COSTS

Soft Costs are calculated by multiplying the SC/HC ratio estimated by Regression II by the market-specific HC amount. To determine the SC/HC ratio, scenario assumptions are applied to the coefficients estimated by Regression II. In the case of Albuquerque, New Mexico, HCs are $102, the likelihood of a union project is 12%, and the RSMeans Index ratio is 90%. Inputting these variables, along with the scenario assumptions, into the model predicts Albuquerque’s SC/HC ratio to be 43%. This means that SCs in Albuquerque are predicted to be $44, or 43% of the $102 HCs. The following table summarizes this calculation.

FIGURE 30: CALCULATION OF SC/HC RATIO

	Coefficients		INPUTS		Total
Intercept	-13.8%			=	-13.8%
BLDG SF	0.00008%	x	250,000	=	20.6%
HC/SF IN YEAR 2006	0.07506%	x	$102	=	7.7%
DUM - D (1)/S (0)	-16.9%	x	0	=	0.0%
DUM - CORP (0)/NON (1)	-8.1%	x	0	=	0.0%
DUM - BTS (1)/NON (0)	-9.0%	x	0	=	0.0%
DUM - UNION (1)/NON (0)	6.4%	x	12%	=	0.8%
2006 HC % OF NATIONAL INDEX (156.2)	31.0%	x	90%	=	27.8%
			SUM		43.0%

Adding the $44 SCs [=43% * $102] to the $112 LC and HC amount yields $156/BLDG SF.

D. TENANT IMPROVEMENTS

Tenant Improvements represent the final cost component required for the calculation of Total Development Costs. The first step to estimate TIs is applying the Regression III results to the given assumptions and market-specific inputs. Continuing the Albuquerque, New Mexico, example, the following table summarizes this calculation.

FIGURE 31: CALCULATION OF THE TI/HC RATIO

	Coefficients		INPUTS		Total
Intercept	27.5%			=	27.5%
BLDG SF	0.00004%	x	250,000	=	9.2%
DUM - D (1)/S (0)	-10.7%	x	0	=	0.0%
DUM - CORP (0)/NON (1)	29.2%	x	0	=	0.0%
DUM - UNION (1)/NON (0)	-16.1%	x	12%	=	-1.9%
2006 HC % OF NATIONAL INDEX (156.2)	10.7%	x	90%	=	9.6%
			SUM		44.4%

The resulting 44% TI/HC ratio implies [$45 = 44% x $102] in TI expenditures for every $102 in hard costs. Adding the $45 TI expenditures to the $156 sum of previous costs yields a predicted TDC of $201/BLDG SF for Albuquerque, New Mexico.

E. TOTAL DEVELOPMENT COSTS

Now that each of the costs have been calculated to determine the TDC for Albuquerque, New Mexico, estimating the TDC for the remaining markets follows the same methodology. Total Development Costs, in terms of building square feet, are calculated by [*TDC* = *LC* + *HC* + *SC* + *TI*]. The following table provides LCs, HCs, SCs, TIs, and TDCs for each of the markets represented in the study.

(SEE FOLLOWING PAGE.)

FIGURE 32: SUBURBAN TDC, BY MARKET *(IN BLDG SF)*

	City	ST	LC	HC	SC	TI	TDC
	NATIONAL AVERAGE		**$16**	**$114**	**$54**	**$51**	**$235**
(1)	Albuquerque	NM	$10	$102	$44	$45	$201
(2)	Atlanta	GA	$15	$102	$43	$46	$207
(3)	Austin	TX	$10	$91	$36	$40	$177
(4)	Baltimore	MD	$12	$106	$47	$46	$211
(5)	Birmingham	AL	$15	$99	$42	$43	$199
(6)	Boston	MA	$19	$131	$70	$61	$282
(7)	Charlotte	NC	$8	$91	$35	$41	$175
(8)	Chicago	IL	$16	$130	$69	$59	$274
(9)	Cincinnati	OH	$10	$106	$47	$46	$209
(10)	Cleveland	OH	$13	$114	$55	$51	$232
(11)	Columbus	GA	$10	$92	$36	$41	$179
(12)	Columbus	OH	$9	$107	$48	$47	$212
(13)	Dallas	TX	$8	$96	$39	$43	$185
(14)	Dayton	OH	$10	$107	$48	$47	$212
(15)	Denver	CO	$12	$109	$49	$49	$219
(16)	Detroit	MI	$12	$121	$61	$54	$247
(17)	El Paso	TX	$12	$88	$33	$38	$171
(18)	Fort Lauderdale	FL	$15	$99	$41	$44	$200
(19)	Fort Worth	TX	$10	$93	$37	$41	$181
(20)	Fresno	CA	$19	$124	$63	$56	$262
(21)	Greensboro	NC	$11	$90	$35	$40	$176
(22)	Hartford	CT	$12	$124	$63	$56	$254
(23)	Honolulu	HI	$31	$140	$80	$63	$314
(24)	Houston	TX	$9	$101	$43	$45	$198
(25)	Indianapolis	IN	$11	$105	$47	$47	$210
(26)	Jacksonville	FL	$10	$92	$36	$41	$179
(27)	Kansas City	MO	$11	$118	$57	$54	$240
(28)	Las Vegas	NV	$26	$117	$56	$52	$251
(29)	Los Angeles	CA	$29	$122	$61	$55	$267
(30)	Louisville	KY	$13	$104	$46	$46	$209
(31)	Memphis	TN	$10	$99	$42	$45	$196
(32)	Miami	FL	$16	$100	$42	$45	$202
(33)	Minneapolis	MN	$12	$127	$66	$58	$263
(34)	Nashville	TN	$10	$99	$41	$44	$194
(35)	New York	NY	$31	$149	$90	$68	$339
(36)	Newark	NJ	$15	$126	$66	$57	$264
(37)	Norfolk	VA	$12	$98	$41	$44	$195
(38)	Oklahoma City	OK	$10	$94	$38	$42	$184
(39)	Orlando	FL	$12	$98	$40	$44	$194
(40)	Oxnard	CA	$19	$122	$62	$55	$258
(41)	Philadelphia	PA	$13	$130	$68	$60	$271
(42)	Phoenix	AZ	$15	$100	$42	$45	$203
(43)	Pittsburgh	PA	$11	$113	$54	$51	$228
(44)	Portland	OR	$16	$118	$58	$53	$245
(45)	Raleigh	NC	$9	$91	$35	$40	$175
(46)	Richmond	VA	$12	$98	$41	$44	$195
(47)	Riverside	CA	$13	$121	$61	$54	$249
(48)	Sacramento	CA	$16	$125	$65	$57	$263
(49)	Salt Lake City	UT	$13	$100	$42	$45	$201
(50)	San Antonio	TX	$10	$95	$38	$42	$185
(51)	San Diego	CA	$20	$120	$59	$54	$252
(52)	San Francisco	CA	$28	$139	$79	$65	$311
(53)	San Jose	CA	$21	$133	$72	$61	$288
(54)	Seattle	WA	$16	$119	$59	$53	$246
(55)	St. Louis	MO	$14	$116	$56	$53	$238
(56)	Stamford	CT	$21	$127	$66	$58	$271
(57)	Tampa	FL	$10	$100	$42	$45	$196
(58)	Toledo	OH	$12	$113	$53	$50	$227
(59)	Trenton	NJ	$14	$124	$64	$55	$257
(60)	Tulsa	OK	$11	$92	$36	$40	$178
(61)	Tucson	AZ	$12	$98	$41	$44	$195
(62)	Washington	DC	$17	$111	$52	$50	$231
(63)	Wilmington	DE	$13	$115	$55	$52	$236

The above table provides estimated TDCs for each of the 63 markets being studied. New York City, New York, exhibited the highest predicted TDCs at $339, while El Paso, Texas, yielded the lowest TDCs at $171 (both in terms of BLDG SF). The study average was $225, while the predicted national average was slightly higher at $235.[47] For the 25th percentile, the estimated TDC was $195; the 75th percentile TDC was $253. The following table summarizes the predicted TDC values versus those present in the survey data.

FIGURE 33: PREDICTED v. SURVEY TDCs

	PREDICTED	SURVEY	%DIFF
MAX	$339	$431	-21%
MIN	$171	$93	83%
MEAN	$225	$220	2%

For the means, the model predicts TDCs within 2% of the survey data; however, the model does not fair as well in the extreme cases, differing from the maximum value by -21% and from the minimum value by 83%. Due to the limited data set and the heterogeneity of the represented projects, the model does much better describing the average TDC than it does individual projects.

The predicted TDCs, however, represent an average index value, however, against which developers can compare individual project TDCs. For example, in Albuquerque, if developers are proposing to construct an office building matching the assumptions in the model (suburban, corporate, speculative, 12% union), then contrasting their costs with the model's predicted $201 TDCs will enable them to determine whether their costs are above or below the index value. Utilizing such a benchmark can assist all real estate professionals in more effectively judging whether and why a project's costs are above the local market average.

[47] The predicted national average was based on national averages produced by RSMeans for HCs and the Bureau of Labor Statistics' average union construction project percentage.

F. PREDICTING REAL ESTATE BOOMS AND BUSTS

The benchmark created in the last section can also be applied to predict whether a particular real estate market cycle is about to boom or bust. As defined in Chapter I, a "booming" market is one in which asset values are significantly higher than total replacement costs; a "busting" market cycle suffers from asset values depressed below total replacement costs. This section walks the reader through the process of comparing the TDC benchmark against asset value transactions to determine at what stage in the cycle a particular real estate market stands.

Since the TDC benchmark was calculated in the previous section, the next step is to create a market-specific net asset value ("NAV") data set. Using the RCA data, I calculated average suburban NAVs for the two most recent periods (1995-1999 and 2000-2006). If a particular city did not have values for both periods, I dropped it. I also eliminated markets where NAVs for the two periods exhibited excessive variation. This filtering process reduced the number of cities available for the analysis to 24.

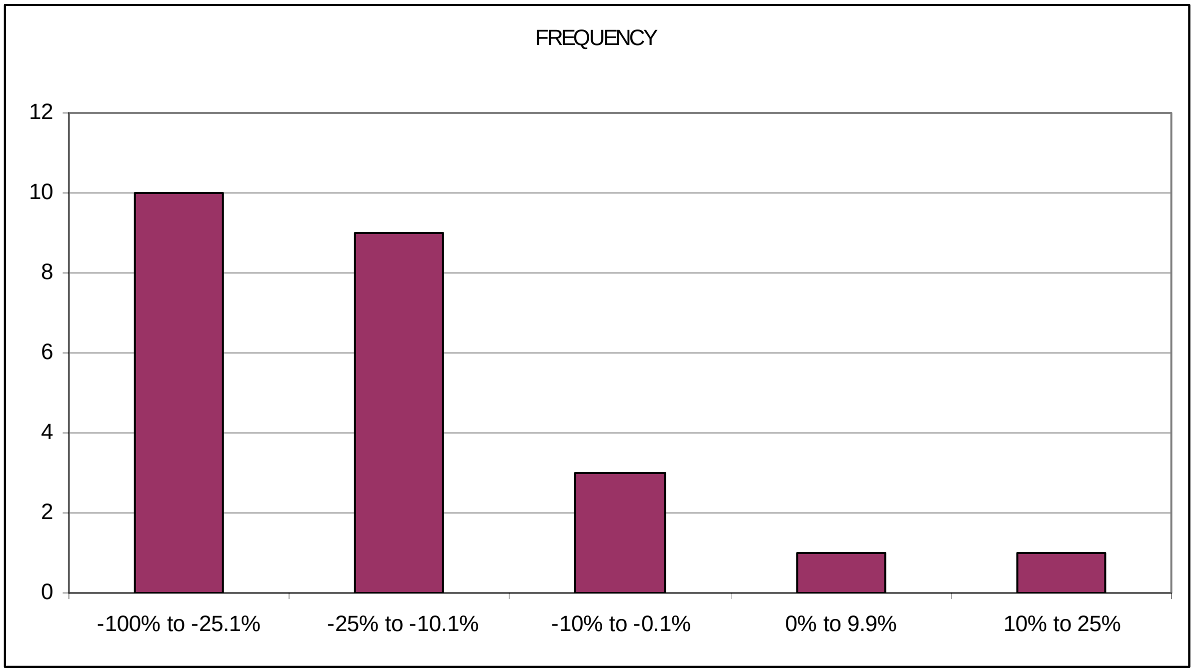
Combining the TDC benchmark data with the RCA data for each of the 24 markets enables the prediction of a boom or bust market. Calculating the percentage difference between the TDC and the NAV implies whether a market is predicted to be in decline or growth. The following illustrates this calculation for the 24 relevant RCA markets.

FIGURE 34: PREDICTED BOOMS AND BUSTS (*IN BLDG SF*)

City	ST	TDC	NAV	%DIFF	PREDICTED CYCLE STAGE
NATIONAL AVERAGE		**$235**	**$191**	**-19%**	**BUST**
(1) Atlanta	GA	$207	$156	-25%	BUST
(2) Austin	TX	$177	$164	-7%	BUST
(3) Charlotte	NC	$175	$166	-5%	BUST
(4) Chicago	IL	$274	$179	-35%	BUST
(5) Cincinnati	OH	$209	$124	-41%	BUST
(6) Dallas	TX	$185	$161	-13%	BUST
(7) Denver	CO	$219	$146	-33%	BUST
(8) Detroit	MI	$247	$167	-32%	BUST
(9) Fort Lauderdale	FL	$200	$178	-11%	BUST
(10) Fort Worth	TX	$181	$111	-39%	BUST
(11) Houston	TX	$198	$141	-29%	BUST
(12) Indianapolis	IN	$210	$169	-20%	BUST
(13) Jacksonville	FL	$179	$138	-23%	BUST
(14) Las Vegas	NV	$251	$222	-12%	BUST
(15) Los Angeles	CA	$267	$273	2%	***BOOM***
(16) Minneapolis	MN	$263	$123	-53%	BUST
(17) Phoenix	AZ	$203	$201	-1%	BUST
(18) Portland	OR	$245	$206	-16%	BUST
(19) Richmond	VA	$195	$146	-25%	BUST
(20) Salt Lake City	UT	$201	$137	-32%	BUST
(21) San Francisco	CA	$311	$278	-10%	BUST
(22) Tampa	FL	$196	$146	-25%	BUST
(23) Toledo	OH	$227	$133	-42%	BUST
(24) Washington	DC	$231	$254	10%	***BOOM***

According to this analysis, Los Angeles and Washington DC are the only two markets expected to boom. All other markets are predicted to be in bust stage of the real estate market cycle. Three additional markets, Austin, Charlotte, and Phoenix are only slightly negative, which may or may not indicate a bust cycle, given the standard error in the study. Los Angeles also fall into the may-or-may not category by being only slightly positive. Of the 22 markets predicted to experience a bust, 9 have values between -10.1% and -25% and 10 have values between -25.1% and -53%. Minneapolis represents the city most likely to experience a bust, with an NAV 53% below the predicted TDC. The following chart summarizes the frequency distribution of the percentage differences between TDCs and NAVs.

FIGURE 35: FREQUENCY DISTRIBUTION OF TDC v NAC DIFFERENCES



G. *MODEL PREDICTIONS v CBRE OFFICE REPORT*

Considering the bleak outlook the model predicts for the 24 represented markets, I investigated how these results compare with current market situations. To do this, I utilized CBRE's "United States National Office Vacancy Index" report for the second quarter of 2006.[48] According to this report, the market with the second largest increase in suburban vacancy rates over the last quarter was Minneapolis, which tops the model's list for the market most likely to experience a bust. Overall, 11 (48%) of the 23 cities[49] represented in the CBRE report relevant to the Total Replacement Cost Index match the model's predictions. Matching cities include Austin, Charlotte, Dallas, Detroit, Fort Worth, Houston, Jacksonville, Las Vegas, Minneapolis, Phoenix, and Salt Lake City.

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[48] http://www.cbre.com/Global/Research/Market+Reports/US+Vacancy+Reports/default.htm.
[49] Richmond, VA, is not listed in the CBRE report.

Vacancy rates represent one example of how to verify whether the model is properly predicting the direction of a real estate market. Other metrics, such as net absorption and asking lease rates might also be used. A more accurate method of testing the accuracy of the index would be to use forecasted market measures instead of relying solely on historical data. I did not attempt to forecast real estate metrics for each of the markets represented to provide a more accurate comparison of the benchmark’s predictions and what is forecasted to happen in each market.

VII: CONCLUSION

The Total Replacement Cost Index provides real estate professionals an additional market measure a real estate market's direction. The benchmark predicted only 2 of the 24 real estate markets to have "boom" period on the horizon—Los Angeles and Washington DC. Comparing these results with the CBRE reported vacancy changes from 1Q 2006 to 2Q 2006 yielded a 52% probability of matching the model's predictions with historical suburban vacancy movements.

Results for suburban office projects fell within actual data ranges and provided insights into how project characteristics impact the LC/HC * FAR, SC/HC and TI/HC ratios. The study also verified that the RSMeans data do provide reliable estimates for construction hard costs and reliably enabled the RSMeans Index values for each market to be used in the calculus of each ratio.

One of the interesting findings in this study involved union labor's impact on the each of these ratios. Union labor increases the SC/HC ratio, while decreasing the TI/HC ratio. In competing against non-union projects, developers tend to reduce in TI allowances to compensate for the added expenses. A portion of these expenses, according to the model, is absorbed into soft costs.

Another residual insight gained through writing the thesis was the lower-than-expected 12% LC/HC * FAR ratio value, where LCs are in terms of LAND SF and HCs are in terms of BLDG SF. This estimate is lower than expected, but does vary greatly depending on a particular project's FAR.

Increasing the size of the survey data base will enhance the model's ability to predict real estate booms and busts in both CBD and suburban areas. Given the characteristics of the survey data, the index seems to provide only for suburban office projects. With additional data for downtown office projects, the index could be updated to better account for such developments. The limited number of observations in the multifamily housing survey data prohibited this analysis. Again, gathering additional data for multifamily developments will enable a relevant study. The most critical factor for enhancing and expanding the reliability of this Total Replacement Cost Index includes is the survey data base size.

The Total Replacement Cost Index can be used by all real estate professionals to enhance their project analyses. Developers can utilize the index to prepare budgets and decide in which markets they can most profitably develop. Real estate lenders can utilize the index to assist them in analyzing a developer's lending documents and the appropriateness of his or her program. Consultants, brokers, investors, and appraisers can benefit from the index in similar ways as do the developers and lenders. The Replacement Cost Index will ultimately become a standard tool in any real estate professional's analysis kit.

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APPENDIX A

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June 23, 2006

The MIT Center for Real Estate's Commercial Real Estate Data Laboratory (CREDL) is embarking on a pilot for a new research initiative that we believe could be of great benefit to the real estate development, investment, and appraisal industries. We hope you will be part of this pioneering effort by taking a few minutes to complete a survey for one of our current MSRED student theses.

Real Estate investors and appraisers are continually searching for more effective methods to measure the replacement cost of their existing real estate assets. Creating a reliable replacement cost benchmark for real estate development is even more imperative in the current market. Replacement costs consist of land acquisition, soft, and hard costs. The existing literature, both academic and professional, falls short in describing each one of these. The purpose of this MIT study is to use survey methods to properly estimate all components of replacement cost for two property types, office and multifamily housing. If the initial survey is successful, the MIT Center for Real Estate will conduct it periodically.

It is important to be clear that the individual survey results – at both the property and firm level - will be held in strict confidence at the MIT Center and not released to any party. Only summary statistics will be released and published.

As a leading real estate developer, we invite you to participate in this study by completing the attached survey (Excel filename "Replacement_Cost_Survey.xls"). The survey asks for land acquisition, soft, and hard costs for up to five of your most recent office or multifamily housing development projects in each metropolitan statistical area ("MSA") in which you have developed. If you have recently been active in both office and multifamily developments, please provide data for up to five projects of each property type. We expect that the survey will take 5 minutes per MSA. If you have any questions regarding the survey, **your contact will be Mr. David Hansen (dhansen@mit.edu,801-725-4366)**. Also, please email David your completed survey.

The survey form does not include entry elements for the exact address or location of your projects (except for MSA). You need only identify the year built, approximate land and building square feet (or units), stories, and then the cost components.

We appreciate your willingness to participate in this groundbreaking research. In order to complete the project in a timely manner, we would ask you to send us your responses no later close of business on **JULY 7, 2006**. Upon completion of the project, we will gratefully share with you all the summary statistical results from the study.

Again, the MIT/CRE thanks you for your contribution.

Sincerely,

David Geltner
Director, Center for Real Estate

William C. Wheaton
Dept. of Economics & Center for Real Estate

SURVEY INSTRUCTIONS

As a representative of the MIT Center for Real Estate's Commercial Real Estate Data Laboratory (CREDL), I would like to thank you for participating in this survey. Results from this survey will enable real estate investors and appraisers to more effectively measure the replacement cost of real estate assets.

The tab "CODE BOOK" provides a list of the variables included in the survey, along with examples and definitions f

The tabs "SURVEY-MULTI-FAMILY" and "SURVEY-OFFICE" each provide survey tables.

are a total of five (5) possible projects per MSA for each property type. Please provide data for as many projects and MSAs as is possible. If the MSA is not listed, feel free to manually fill in the data in the MSA observations left blank and located at the bottom of the MSA list. As noted in the cover letter, once you have gathered the information, entering data for each project should take no longer than 5 minutes.

As a reminder, please respond to the survey by July 7, 2006.

Again, we at CREDL greatly appreciate your willingness to participate in this groundbreaking study. If you have any questions, please do not hesitate to contact ***David Hansen (801-725-4366, dhansen@mit.edu)***

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Code Book

	Variable	Value	Example	Definition
(1)	MSA		Albuquerque	MSA in which the project occurred. If the project spans into two MSAs, please select the MSA in which the majority of the project is.
(2)	Year Completed	YYYY	2006	Year in which the project completed
(3)	Downtown/Suburb	D or S	D	Location within the MSA. "Downtown" is defined as a particular MSA's central business district, or a city's concentration of retail or commercial real estate. The "Suburb" value represents any location not in a central business district.
(4a)	Condo/Apt	C or A	C	Designation of type of multifamily housing development project. This value refers to the ultimate purpose of the project, not what the existing structure(s) are.
(4b)	Corporate/Medical	C or M	M	Corporate refers to a traditional office space; medical office refers to buildings used by medical or dental professionals.
(5)	Build-to-suit?	Y or N	Y	[Office projects only] Yes ("Y") confirms that the development was a build-to-suit project, and No ("N") refers to all other designations.
(6)	Union?	Y or N	Y	Designates whether the project utilized union or non-union workers.
(7)	Subgrade, Garage, or Lot Parking	S, G, or L	S	Subgrade parking refers to underground parking; Garage parking refers to a parking terrace; Lot parking refers to at-grade, open-air parking.
(8)	Land Square Footage	#,####	50,000	Total gross square footage of parcel. Remember that there are 43,560 square feet per acre.
(9)	Building Square Footage	#,####	25,000	Total gross square footage of the structure. Again, remember that there are 43,560 square feet per acre.
(10)	Stories	##	15	Number of stories in the structure.
(11)	Land Acquisition Cost (excluding existing structures)	$#,###,###	$1,000,000	Total cost to purchase the land parcel, excluding the value of any existing structures.
(12)	Value of Existing Structures	$#,###,###	$1,000,000	Market value of existing structures (e.g, buildings, parking terraces, etc.).
(13)	Existing Structure(s) Renovated /Demolished	R or D	R	Designation as to whether the building was demolished or renovated.
(14)	Remediation/Mitigation Cost	$#,###,###	$1,000,000	Cost of remediation and mitigation efforts for the project.
(15)	Soft Cost	$#,###,###	$1,000,000	Sum total of Loan Fees, Construction Interest, Legal Fees, Soil Testing, Environmental Studies, Land Planner Fees, Architectural Fees, Engineering Fees, Marketing Costs (including Advertisements), Leasing or Sales Commissions, and other fees or costs not attributed to hard or land costs
(16)	Hard Cost (excluding TIs)	$#,###,###	$1,000,000	Sum total of Site Preparation Costs (e.g., excavation, utilities installation), Shell Costs, Permits, Contractor Fees, Construction Management and Overhead Costs, Materials, Labor, Equipment Rental, Developer Fees, and other costs directly attributed to the actual construction of the structure. THIS AMOUNT DOES NOT INCLUDE TENANT IMPROVEMENT EXPENDITURES.
(17)	TIs	$#,###,###	$1,000,000	Tenant Improvement costs. Typically part of hard costs, these costs refer to improvements necessary to make the space ready for tenant occupancy.
(18)	Total Development Cost	$#,###,###	$3,000,000	Sum of Land Acquisition, Soft, and Hard Costs.

Massachusetts Institute of Technology

MIT CENTER FOR REAL ESTATE

Survey of Total Office Replacement Cost

Land, Soft, and Hard Cost Associated with Real Estate Development

		Office - Project #1																
MSA	**STATE**	**Year Completed**	**Downtown /Suburb**	**Corporate /Medical**	**Build-to-Suit?**	**Union?**	**Subgrade, Garage, or Lot Parking**	**Land Square Footage**	**Building Square Footage**	**Stories**	**Land Acquisition Cost** (excluding existing structures)	**Value of Existing Structures**	**Existing Structure(s) Renovated /Demolished**	**Remediation/ Mitigation Cost**	**Soft Cost**	**Hard Cost** (excluding TIs)	**TIs**	**Total Development Cost**
(1) Albuquerque	NM																	$0
(2) Atlanta-Sandy Springs-Marietta	GA																	$0
(3) Austin-Round Rock	TX																	$0
(4) Baltimore-Towson	MD																	$0
(5) Birmingham-Hoover	AL																	$0
(6) Boston-Cambridge-Quincy	MA																	$0
(7) Buffalo-Niagara Falls	NY																	$0
(8) Charlotte-Gastonia-Concord	NC																	$0
(9) Chicago-Naperville-Joliet	IL																	$0
(10) Cincinnati-Middletown	OH																	$0
(11) Cleveland-Elyria-Mentor	OH																	$0
(12) Columbus	OH																	$0
(13) Dallas-Fort Worth-Arlington	TX																	$0
(14) Denver-Aurora	CO																	$0
(15) Detroit-Warren-Livonia	MI																	$0
(16) Hartford-West Hartford-East Hartford	CT																	$0
(17) Honolulu	HI																	$0
(18) Houston-Sugar Land-Baytown	TX																	$0
(19) Indianapolis-Carmel	IN																	$0
(20) Jacksonville	FL																	$0
(21) Kansas City	MO																	$0
(22) Las Vegas-Paradise	NV																	$0
(23) Los Angeles-Long Beach-Santa Ana	CA																	$0
(24) Louisville-Jefferson County	KY																	$0
(25) Memphis	TN																	$0
(26) Miami-Fort Lauderdale-Miami Beach	FL																	$0
(27) Milwaukee-Waukesha-West Allis	WI																	$0
(28) Minneapolis-St. Paul-Bloomington	MN																	$0
(29) Nashville-Davidson—Murfreesboro	TN																	$0
(30) New York-Northern New Jersey-Long Island	NY																	$0
(31) Oklahoma City	OK																	$0
(32) Omaha-Council Bluffs	NE																	$0
(33) Orlando-Kissimmee	FL																	$0
(34) Philadelphia-Camden-Wilmington	PA																	$0
(35) Phoenix-Mesa-Scottsdale	AZ																	$0
(36) Pittsburgh	PA																	$0
(37) Portland-Vancouver-Beaverton	OR																	$0
(38) Providence-Fall River-Warwick	RI																	$0
(39) Raleigh-Cary	NC																	$0
(40) Richmond	VA																	$0
(41) Riverside-San Bernardino-Ontario	CA																	$0
(42) Rochester	NY																	$0
(43) Sacramento--Arden-Arcade--Roseville	CA																	$0
(44) Salt Lake City	UT																	$0
(45) San Antonio	TX																	$0
(46) San Diego-Carlsbad-San Marcos	CA																	$0
(47) San Francisco-Oakland-Fremont	CA																	$0
(48) San Jose-Sunnyvale-Santa Clara	CA																	$0
(49) Seattle-Tacoma-Bellevue	WA																	$0
(50) St. Louis 1	MO																	$0
(51) Tampa-St. Petersburg-Clearwater	FL																	$0
(52) Virginia Beach-Norfolk-Newport News	VA																	$0
(53) Washington-Arlington-Alexandria	DC																	$0
A																		$0
B																		$0
C																		$0
D																		$0
E																		$0

Survey of Total Multi-family Housing Replacement Cost

Land, Soft, and Hard Cost Associated with Real Estate Development

		Multi-family Housing - Project #1															
MSA	**STATE**	**Year Completed**	**Downtown /Suburb**	**Condo /Apt**	**Union?**	**Subgrade, Garage, or Lot Parking**	**Land Square Footage**	**Building Square Footage**	**Stories**	**Land Acquisition Cost** (excluding existing structures)	**Value of Existing Structures**	**Existing Structure(s) Renovated /Demolished**	**Remediation/ Mitigation Cost**	**Soft Cost**	**Hard Cost** (excluding TIs)	**TIs**	**Total Development Cost**
(1) Albuquerque	NM																$0
(2) Atlanta-Sandy Springs-Marietta	GA																$0
(3) Austin-Round Rock	TX																$0
(4) Baltimore-Towson	MD																$0
(5) Birmingham-Hoover	AL																$0
(6) Boston-Cambridge-Quincy	MA																$0
(7) Buffalo-Niagara Falls	NY																$0
(8) Charlotte-Gastonia-Concord	NC																$0
(9) Chicago-Naperville-Joliet	IL																$0
(10) Cincinnati-Middletown	OH																$0
(11) Cleveland-Elyria-Mentor	OH																$0
(12) Columbus	OH																$0
(13) Dallas-Fort Worth-Arlington	TX																$0
(14) Denver-Aurora	CO																$0
(15) Detroit-Warren-Livonia	MI																$0
(16) Hartford-West Hartford-East Hartford	CT																$0
(17) Honolulu	HI																$0
(18) Houston-Sugar Land-Baytown	TX																$0
(19) Indianapolis-Carmel	IN																$0
(20) Jacksonville	FL																$0
(21) Kansas City	MO																$0
(22) Las Vegas-Paradise	NV																$0
(23) Los Angeles-Long Beach-Santa Ana	CA																$0
(24) Louisville-Jefferson County	KY																$0
(25) Memphis	TN																$0
(26) Miami-Fort Lauderdale-Miami Beach	FL																$0
(27) Milwaukee-Waukesha-West Allis	WI																$0
(28) Minneapolis-St. Paul-Bloomington	MN																$0
(29) Nashville-Davidson—Murfreesboro	TN																$0
(30) New York-Northern New Jersey-Long Island	NY																$0
(31) Oklahoma City	OK																$0
(32) Omaha-Council Bluffs	NE																$0
(33) Orlando-Kissimmee	FL																$0
(34) Philadelphia-Camden-Wilmington	PA																$0
(35) Phoenix-Mesa-Scottsdale	AZ																$0
(36) Pittsburgh	PA																$0
(37) Portland-Vancouver-Beaverton	OR																$0
(38) Providence-Fall River-Warwick	RI																$0
(39) Raleigh-Cary	NC																$0
(40) Richmond	VA																$0
(41) Riverside-San Bernardino-Ontario	CA																$0
(42) Rochester	NY																$0
(43) Sacramento--Arden-Arcade--Roseville	CA																$0
(44) Salt Lake City	UT																$0
(45) San Antonio	TX																$0
(46) San Diego-Carlsbad-San Marcos	CA																$0
(47) San Francisco-Oakland-Fremont	CA																$0
(48) San Jose-Sunnyvale-Santa Clara	CA																$0
(49) Seattle-Tacoma-Bellevue	WA																$0
(50) St. Louis 1	MO																$0
(51) Tampa-St. Petersburg-Clearwater	FL																$0
(52) Virginia Beach-Norfolk-Newport News	VA																$0
(53) Washington-Arlington-Alexandria	DC																$0
A																	$0
B																	$0
C																	$0
D																	$0
E																	$0

APPENDIX B

Top U.S. Real Estate Developers
Office and Multifamily

					Building Type		Region			
Company	City	State	Zip	Web Site	Multifamily	Office	E	MW	S	W
(1) ADVANCE REALTY GROUP	Bedminster	NJ	07921	www.advancerealtygroup.com	0%	84%	100%	0%	0%	0%
(2) ARCHSTONE-SMITH TRUST	Englewood	CO	80012	www.archstonesmith.com	100%	0%	48%	5%	8%	40%
(3) AVALONBAY COMMUNITIES INC.	Alexandria	VA	22314	www.avalonbay.com	100%	0%	90%	0%	0%	10%
(4) BH CAPITAL PARTNERS L.L.C.	Coral Gables	FL	33134	www.bhcapitalpartners.com	100%	0%	0%	0%	100%	0%
(5) BPG PROPERTIES LTD.	Philadelphia	PA	19102	www.bpgltd.com	13%	80%	67%	33%	0%	0%
(6) BROOKFIELD PROPERTIES CORP.	New York	NY	10281	www.brookfieldproperties.com	0%	100%	0%	0%	0%	0%
(7) CAMDEN PROPERTY TRUST	Houston	TX	77046	www.camdenliving.com	100%	0%	0%	0%	100%	0%
(8) CARRAMERICA REALTY CORP.	Washington	DC	20006	www.carramerica.com	0%	80%	83%	0%	17%	0%
(9) CARTER	Atlanta	GA	30363	www.carterusa.com	0%	25%	6%	0%	93%	1%
(10) CORPORATE OFFICE PROPERTIES TRUST	Columbia	MD	21045	www.copt.com	0%	100%	100%	0%	0%	0%
(11) DUKE REALTY CORP.	Indianapolis	IN	46240	www.dukerealty.com	0%	36%	10%	57%	33%	0%
(12) EDWARD ROSE BUILDING ENTERPRISE	Farmington Hills	MI	48333	www.edwardrose.com	100%	0%	5%	95%	0%	0%
(13) GABLES RESIDENTIAL	Atlanta	GA	30339	www.gables.com	0%	100%	7%	0%	93%	0%
(14) GOLUB & CO.	Chicago	IL	60611	www.golubandcompany.com	52%	48%	0%	30%	0%	14%
(15) GREC CONVERSIONS	Miami	FL	33172		100%	0%	0%	0%	100%	0%
(16) HIGGINS DEVELOPMENT PARTNERS L.L.C.	Chicago	IL	60611	www.higginsdevelopment.com	0%	39%	35%	21%	12%	16%
(17) HINES	Houston	TX	77056	www.hines.com	35%	57%	16%	29%	18%	22%
(18) HOLDER PROPERTIES INC.	Atlanta	GA	30339	www.holderproperties.com	0%	100%	50%	0%	50%	0%
(19) J.H. SNYDER CO.	Los Angeles	CA	90036	www.jhsnyder.net	55%	5%	0%	0%	0%	100%
(20) JPI COS.	Irving	TX	75039	www.jpi.com	100%	0%	60%	0%	25%	15%
(21) KOLL DEVELOPMENT CO.	Dallas	TX	75225	www.kolldevelopment.com	0%	75%	20%	20%	40%	20%
(22) LEGACY PARTNERS	Foster City	CA	94404	www.legacypartners.com	100%	0%	0%	0%	0%	100%
(23) LIBERTY PROPERTY TRUST	Malvern	PA	19355	www.libertyproperty.com	0%	38%	80%	10%	7%	2%
(24) LINCOLN PROPERTY CO.	Dallas	TX	75201	www.lincolnproperty.com	35%	15%	20%	15%	30%	20%
(25) LOWE ENTERPRISES INC.	Los Angeles	CA	90049	www.loweenterprises.com	10%	20%	6%	0%	0%	94%
(26) MONUMENT REALTY L.L.C.	Washington	DC	20036	www.monumentrealty.com	81%	19%	100%	0%	0%	0%
(27) MULLINS COMPANY	Braintree	MA	02184	www.mullinsinc.com	100%	0%	100%	0%	0%	0%
(28) NEW BOSTON FUND INC.	Boston	MA	02109	www.newbostonfund.com	73%	11%	75%	0%	24%	0%
(29) NORTHWESTERN MUTUAL LIFE INSURANCE CO.	Milwaukee	WI	53202	www.northwesternmutualinvestments.com	84%	11%	20%	12%	28%	40%
(30) ORIX REAL ESTATE CAPITAL	Chicago	IL	60606	www.orix.com	25%	0%	5%	17%	39%	39%
(31) PATRINELY GROUP L.L.C.	Houston	TX	77056	www.patrinelygroup.com	0%	100%	35%	0%	65%	0%
(32) PMZ COMMERCIAL/CORE	Modesto	CA	95350	www.pmz.com	0%	25%	0%	0%	0%	100%
(33) PRINCIPAL REAL ESTATE INVESTORS	Des Moines	IA	50392	www.principalglobal.com	19%	0%	16%	16%	0%	68%
(34) PROMETHEUS REAL ESTATE GROUP INC.	Redwood City	CA	94065	www.prometheusreg.com	100%	0%	0%	0%	0%	100%
(35) RECKSON ASSOCIATES REALTY CORP.	Melville	NY	11747	www.reckson.com	0%	90%	100%	0%	0%	0%
(36) REMI COS.	Hoboken	NJ	07030	www.remicompanies.com	100%	0%	100%	0%	0%	0%
(37) S.L. NUSBAUM REALTY CO.	Norfolk	VA	23510	www.sinusbaum.com	30%	0%	100%	0%	0%	0%
(38) SARES-REGIS GROUP	Irvine	CA	92612	www.sares-regis.com	50%	0%	0%	0%	0%	100%
(39) SIMPSON HOUSING SOLUTIONS L.L.C.	Long Beach	CA	90802	www.simpsonsolutions.com	74%	0%	0%	0%	6%	94%
(40) SPAULDING & SLYE (PART OF JONES, LANG, LASALLE)	Boston	MA	02109	www.spauldingandslye.com			100%	0%	0%	0%
(41) TARRAGON CORP.	New York	NY	10019	www.tarragoncorp.com	100%	0%	22%	0%	78%	0%
(42) THE ALTER GROUP	Skokie	IL	60077	www.altergroup.com	0%	44%	15%	25%	30%	30%
(43) THE BOYER COMPANY	Salt Lake City	UT	84101	www.boyercompany.com			0%	15%	0%	85%
(44) THE FIFIELD CORP.	Chicago	IL	60441	www.fifieldco.com	100%	0%	0%	46%	13%	41%
(45) THE GALE CO.	Florham Park	NJ	07932	www.thegalecompany.com	0%	100%	100%	0%	0%	0%
(46) THE OPUS GROUP	Minnetonka	MN	55343	www.opuscorp.com	34%	19%	16%	38%	11%	35%
(47) TISHMAN SPEYER	New York	NY	10111	www.tishmanspeyer.com	28%	60%	0%	0%	0%	0%
(48) TRAMMELL CROW CO.	Dallas	TX	75201	www.trammellcrow.com	4%	20%	0%	0%	0%	0%
(49) TRAMMELL CROW RESIDENTIAL	Atlanta	GA	30339	www.tcresidential.com	100%	0%	12%	0%	53%	35%
(50) TRANSWESTERN COMMERCIAL SERVICES	Houston	TX	77027	www.transwestern.net	0%	46%	11%	15%	62%	12%
(51) USAA REAL ESTATE CO.	San Antonio	TX	78230	www.usaarealco.com	1%	27%	10%	25%	15%	50%
(52) WOODBURY CORPORATION	Salt Lake City	UT	84109	www.woodburycorp.com			0%	0%	0%	100%

Sources:

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