www.oregonmetro.gov

Appendix 2:

How public investments stimulate private development

August 2010

Metro | *People places. Open spaces.*

About Metro

Clean air and clean water do not stop at city limits or county lines. Neither does the need for jobs, a thriving economy and good transportation choices for people and businesses in our region. Voters have asked Metro to help with the challenges that cross those lines and affect the 25 cities and three counties in the Portland metropolitan area.

A regional approach simply makes sense when it comes to protecting open space, caring for parks, planning for the best use of land, managing garbage disposal and increasing recycling. Metro oversees world-class facilities such as the Oregon Zoo, which contributes to conservation and education, and the Oregon Convention Center, which benefits the region's economy

Metro representatives

Metro Council President – David Bragdon

Metro Councilors – Rod Park, District 1; Carlotta Collette, District 2; Carl Hosticka, District 3; Kathryn Harrington, District 4; Rex Burkholder, District 5; Robert Liberty, District 6.

Auditor – Suzanne Flynn

Metro
600 NE Grand Ave.
Portland, OR 97232
503-797-1800

www.oregon**metro.gov**

TABLE OF CONTENTS

JOHNSON REID
LAND USE ECONOMICS

ASSESSMENT OF RESIDENTIAL EFFICIENCY MEASURES

JULY 21, 2010 | METRO

TABLE OF CONTENTS

I. INTRODUCTION

As part of Metro's ongoing efforts to assess the carrying capacity of the Region's residential land inventory, Johnson Reid developed a modeling framework to supplement and expand upon Metro's existing models.

The model developed is a "production" model, in that it approaches the question of the anticipated nature of future development from the perspective of a developer. Key inputs are incorporated into a determination of what development form returns the greatest value to the underlying property. The model is based on a series of simplified decision pro formas, which represent a range of prospective development forms, using different construction techniques and having distinct density and cost characteristics. The output of the model can be represented as an assumed predominant development form given a set of assumptions within a specified geographic area.

This document will summarize the key components of the model and general output results. The report also addressed price premiums associated with a range of neighborhood characteristics. This information is derived based on a review of existing literature as well as original hedonic modeling. It should be noted that the model incorporates a number of significant variables that are highly dynamic, which will likely shift substantively over the planning horizon.

II. METHODOLOGY

GENERAL OVERVIEW

Our approach to this assignment was to develop a "production" model, which mimics a developer's decision tree and solves for the highest and best use residential development form. We use a pro forma based predictive model to generate predominant residential development profiles for a series of delineated subareas. This model evaluates highest and best use development forms under a range of assumptions, based on the implied residual property value[1] under each use. This allows us to calculate the likely predominant development form within a series of geographic subareas.

This section outlines the characteristics of the production model developed, and the relationship between changes in assumptions and key variables and predicted development form. Extensive work was done to quantify to the extent possible price premiums associated with a range of factors, primarily literature review as well as original hedonic modeling. A key output of this work is identification of the marginal impact of a range of potential public actions on the anticipated form and magnitude of development activity.

The model can be broken up into three primary categories that are determinative of final development form: achievable pricing, cost to develop, and threshold returns. The following is a schematic of the general range of assumptions in the model, as well as a discussion of the key components.

[1] Residual Property Value reflects the maximum supportable acquisition value of the property under an assumed development program.

SCHEMATIC OF MODEL

A key objective of this model is to develop a theoretical construct within which to evaluate the impact of a range of public investments and actions on the anticipated form of development. The analysis will assess the level to which investments such as public transit and streetscape can change achievable residential pricing, which the model can convert into a marginal anticipated impact on development form using a development model approach (production model). Public investments and actions can have a significant impact on pricing, the cost to develop as well as threshold returns.

ACHIEVABLE PRICING

Achievable pricing in the market is the variable that has the most significant impact on development form. The model approaches pricing at a geographic district level, and then allows for additional

adjustments to pricing based on specific locations within the district. Current achievable pricing can be determined with a considerable level of reliability, but pricing would be expected to shift over time. Metro's MetroScope[2] modeling can provide input to supportable assumptions with respect to anticipated shifts in housing prices over time.

Current achievable pricing can be established for both rental and ownership housing at the regional and district level using readily available sources of current market information. For rental units, these would include periodic surveys completed by groups such as the Metro Multi-Family Housing Association, Norris Beggs & Simpson and Norris & Stevens. While these surveys are valuable, care should be taken to differentiate between new product and general market patterns, as the model is predicated on new development trends.

Current achievable pricing patterns for ownership housing can be derived from sources such as the Realtor's Multiple Listing Service (RMLS) and New Home Trends. As with the rental product, the model is driven by assumptions with respect to achievable pricing for new product as opposed to the general market average.

The variables in the model are based on an assumed achievable price per square foot for rental as well as ownership product. Adjustments by district are based on observed patterns in the secondary survey materials.

COST TO DEVELOP

Cost to develop is another key determinant on final development forms. For this analysis, we chose five alternative development forms:

Development Form	Description	Example Photo
High Rise	Steel and concrete construction. Assumed density was a 12.0 FAR. Local examples are found in the South Waterfront and recent Pearl District projects.	

[2] MetroScope is an interactive transportation and land use forecasting tool developed by Metro.

Mid-Rise	Also steel and concrete construction, but limited in height to 4-7 stories. These are seen locally in early urban projects, or areas in which a high-rise solution is considered too large in scale.	
Type V Construction over Podium	Wood frame and/or steel stud construction over a single story concrete podium. This is a common construction type on infill sites in the close-in eastside neighborhoods.	
Type V Construction with Surface	Typically wood frame construction with surface parking, carports or stand-alone garages. Construction is usually two to three stories high, with a density approaching 30 units per acre. This is the predominant form in most suburban contexts in the metro area.	
Duplex/Townhomes	Also typically wood frame, these units often have parking under the unit. Projects can be fee simple or with condominium ownership of the ground.	

As a general rule, the higher density development forms have a higher cost per square foot to construct. This is offset by a greater achievable density (units/acre), which has value when the achievable price is higher than the cost of construction excluding land. When achievable pricing is below construction costs, there is no marginal value associated with the increase in density and development forms with delivery values greater than achievable pricing are deemed to be not viable.

Construction cost assumptions are derived in the model based on R.S. Means median values for the development forms evaluated. The R.S. Means numbers are based on real project experience, but are necessarily backward looking as they are based on recent experience. This can provide for some short-term bias in the estimates, but the bias will shift over time and be less significant over a longer term planning horizon.

We recognize that the basic development forms used in our analysis do not represent the full spectrum of potential outcomes, but at a district level we feel that they can adequately address what a "predominant development form" assumption should be.

THRESHOLD RETURN

Achievable pricing and the cost to develop are reconciled with an assumed threshold rate of return necessary to induce development. While developers don't always make money, their going in assumption always reflects an expectation of return to offset the risk inherent in development. Acceptable rates of return can vary considerably over time, and reflect factors such as the perceived risk associated with a particular form of real estate relative to other available returns. Not all developers calculate returns in a consistent manner, as their individual deal structures and anticipated dispositions vary.

For this analysis, we selected a measure of threshold return that is easily tracked and simple to calculate. For income properties, the threshold return is expressed as a risk spread between current market capitalization rates[3] and the project's initial return on cost at stabilization. Within the analysis, we are assuming a 2% risk spread. This allows for some dynamism by area as well as over time. Capitalization rates move substantially over time, and tend to track with outside variables such as treasury rates and financing costs. In addition, capitalization rates can vary considerably by the nature and type of product, with lower capitalization rates seen in areas perceived to represent lower levels of risk.

For the ownership residential product, the assumed threshold rate of return was set at a 20% return on sales, which reflects that the gross profit after sales commission is 20% greater than the cost of construction.

As a general rule, the threshold return is a function of returns available for other investments, and their relative perceived level of risk. Real estate is a highly cyclical industry with extended delivery times and considerable construction and market risk, and as such typically demands higher return

[3] A capitalization rate (cap rate) is a commonly used way to value an income property (investment property). Net operating income before taxes is divided by the cap rate to establish a market value.

levels. Threshold returns dropped during the last construction cycle as higher rates of leverage (allowable debt levels, which lower equity requirements) and increased non-recourse loan availability reduced perceived risk levels to developers. This is no longer the case in terms of the availability of non-recourse loans, but market rates of return have remained quite low.

HIGHEST AND BEST USE

The underlying assumption was that development patterns would largely occur in the form determined to represent the highest and best use, defined as the development form that generated the greatest residual property value. In other words, marginal development activity would largely be consistent in form with what the model indicates would support the greatest value for the underlying property.

The highest and best use determination is based on the allowable use that has the highest indicated residual property value between the five alternative development forms and two tenure options (owner and renter). An entitlement screen is necessary, as use types identified as having the greatest residual values may not be allowable under existing zoning. This can represent either a density restriction (allowable densities are below what is market supportable), or a mandated density (minimum densities are above what is market supportable).

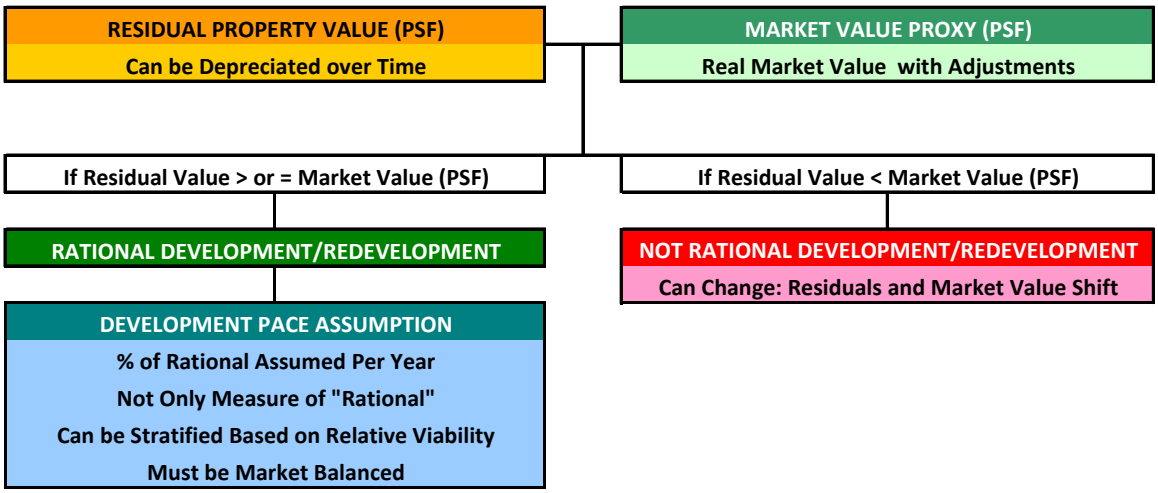
Another key screen that should be monitored is what is referred to as a "market screen". While the analysis is likely to identify a use as the highest and best use in an area, the market may not support full build-out in that use type. As an example, if rental residential development in Type V construction over a podium is identified as the highest and best use, it is unlikely that all new housing developments will be rental apartments, as the rental market serves approximately 35% of households in the Portland metropolitan area. If the market was completely built-out in this manner, it would likely get substantially over-built and achievable pricing would drop.

Ability to pay is another factor to consider with the highest and best use determinations. While achievable pricing at the margin may be adequate to support relatively costly cost housing forms such as high-rise condominiums, there is a limit to how many households would be able to afford this option. MetroScope has output related to the implied housing cost burden, which needs to be considered in these calculations.

REDEVELOPMENT

The determination of residual property values also provides key input into predicting redevelopment activity. As a general rule, redevelopment is considered plausible when the residual land value under the highest and best use development scenario is equal to or greater than the estimated current value of the property, including improvements.

REDEVELOPMENT MODEL SCHEMATIC



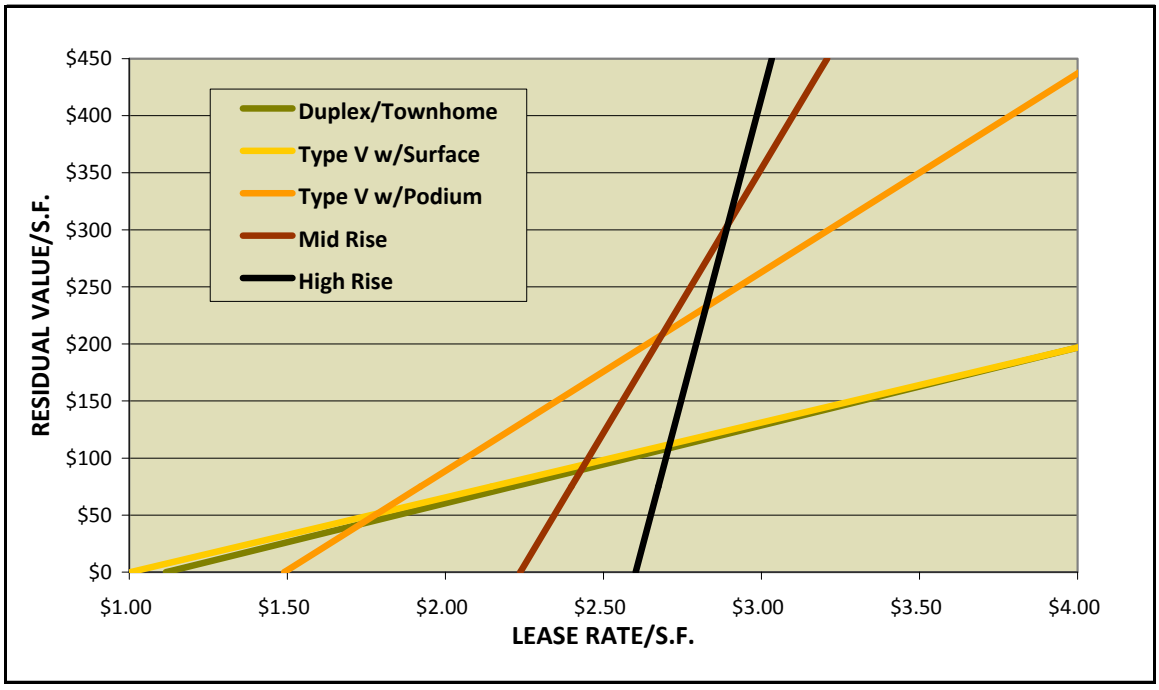
If the residual value is greater to or equal to the market value of the property, it is assumed to represent a rational development or redevelopment opportunity. While development and/or redevelopment is considered viable in these instances, it does not necessarily mean that it will be developed with the study time frame. There are a number of additional factors that impact redevelopment, and we assume that only a portion of opportunities identified as viable will be realized within the study horizon.

III. GENERAL OUTPUT

The residential development model generates a general relationship between the five basic development forms, under both a rental and ownership assumption. Within the model, achievable pricing is the independent variable while costs to development and threshold returns are givens and outside of the developer's control. Based on the assumptions used, we can generate a simple graphic that demonstrates the basic relationship between the development forms.

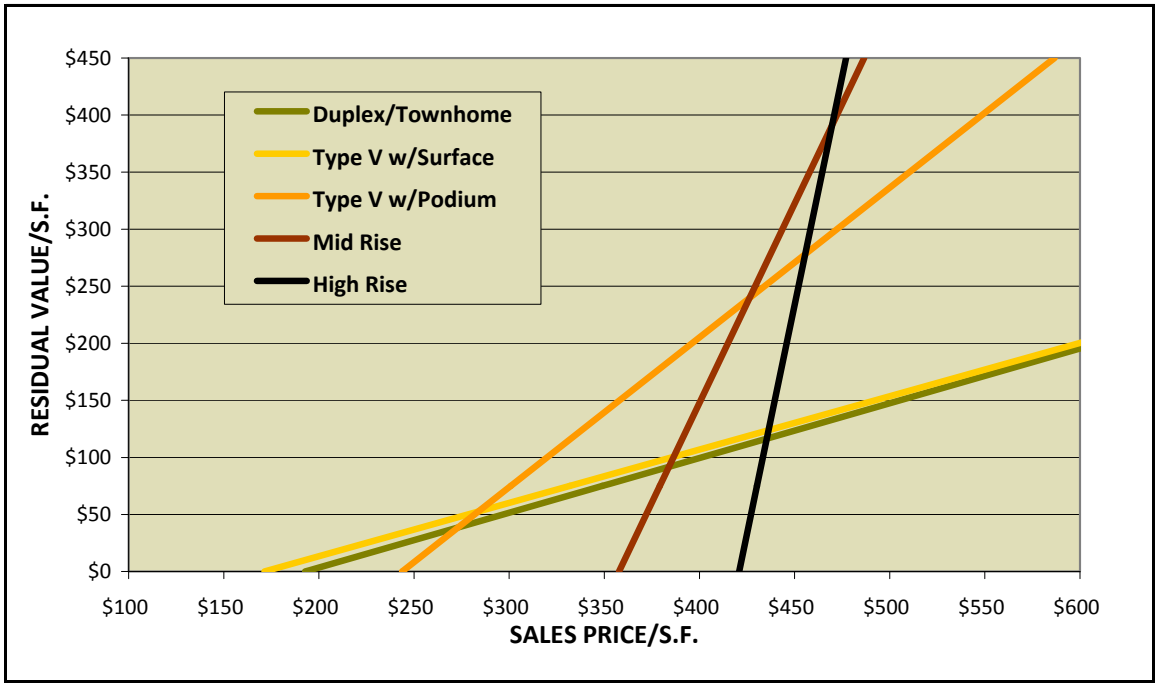
As shown in the following graphic, the pro formas for the development prototypes support different residual property values under different achievable lease rates for rental residential product. Under each assumed lease rate, the development form that supports the highest residual property value is considered the highest and best use, assuming the form is entitled. As shown in the graphic, a market with achievable pricing at $1.50 per square foot would see Type V construction with surface parking as representing the highest and best use. As achievable rents approach $1.60 per square foot, Type V construction with podium parking transitions into the highest and best use. When achievable pricing assumptions move above $2.40, we see Mid-Rise and High-Rise products becoming the indicated highest and best use.

RENTAL RESIDENTIAL DEVELOPMENT



The model indicates a similar pattern for ownership residential product. In this case the transition between Type V surface parked development and Type V podium development is at an achievable sales price of around $270 per square foot.

OWNERSHIP RESIDENTIAL DEVELOPMENT



In both cases, the marginal benefit of the higher costs per square foot for construction are offset by greater achievable densities when achievable pricing is high enough.

The generalized relationships shown cannot account for all potential permutations associated with the cost of delivering products. There are significant economies of scale associated with many development forms, which are difficult to efficiently design and construct on small sites, or sites with topographical on configuration limitations. Conversely, there are market driven limits to the amount of product that is feasible to develop in a market, which argues against large-scale developments in markets that are insufficiently deep to support them.

IV. DISTRICTS

Viable development forms vary substantially throughout the Portland metropolitan area. This is primarily due to differences in achievable pricing and can be reflected in the model. As noted previously, we can set achievable pricing at a district level based on secondary market data sources. While the generalized relationships between development forms remain constant, we find that geographic districts within the region vary substantially in achievable pricing, and subsequently likely predominant residential development forms.

A matrix of current achievable pricing assumptions for new construction was generated for eleven distinct geographic districts. These numbers were derived from a combination of data sources, including New Home Trends, Realtor's Multiple Listing Service, and the Metro Multifamily Housing Association. The following table summarizes the baseline assumptions by district used in our model:

ASSUMED PRICING BY DISTRICT

District		Rental $/SF	Price/ SF
1	Portland CBD	$2.16	$371
2	Close-In Eastside	$1.72	$275
3	Close-In Westside	$1.79	$250
4	East Multnomah County	$1.38	$250
5	East Clackamas	$1.43	$250
6	Milwaukie/Gladstone	$1.39	$250
7	Oregon City	$1.41	$250
8	Lake Oswego/West Linn	$1.63	$363
9	Beaverton	$1.43	$250
10	SW Suburbs	$1.39	$250
11	NW Suburbs	$1.46	$250

The assumed pricing matrix reflects per square foot baseline pricing by district for new product. Rental rates are expressed by monthly rate, while the price per square foot reflects ownership pricing. These prices are not necessarily reflective of actual achievable rents in the current markets, but theoretical achievable rents if the area was fully amenitized. The model also allows for further refinement in achievable pricing based on level of amenity adjustment. The baseline rents are set to reflect a 100% location[4], with locations considered less desirable discounted from those baseline levels.

The market is currently unusually fluid, and pricing estimates are seen as less reliable than normal under these conditions. The pricing matrix is set up as a dynamic input into the model, allowing for regular updating as appropriate.

V. AMENITY RELATED PREMIUMS

A variety of public investment types, ranging from parks to transit to other public facilities, has a demonstrated record of affecting the economic value of the built environment nearby. This section provides a broad review of notable research into the economic premiums created by public investment types, nationwide and in the Portland metro area. This section also discusses original hedonic modeling intended to identify economic premiums from a variety of public investment types that have not yet generally been explored in the Portland metro area.

LITERATURE REVIEW

For almost 30 years, significant economic and statistical research has been published that attempts to quantitatively explain the many different variables that can affect the value of a home. The original study that framed the issue in modern statistical methodology was Sherwin Rosen's 1974 study "Hedonic Prices and Implicit Markets: Product Differentiation in Perfect Competition" published in the *Journal of Political Economy*.

[4] A 100% location refers to the most desirable/marketable location within a market.

That study introduced a rigorous statistical process – hedonic modeling – that enables estimates of how individual factors, isolated among many different ones, affect home prices. For instance, the methodology lets research answer the questions:

- *Does a nearby city park distinctly affect the value of a home no matter what the many physical features of a home may be?*
- *Does the park positively affect value?*
- *By how much does the park distinctly contribute to the appeal and price of the home?*

Over the past fifteen years, as statistical modeling software has become far more sophisticated and economical while data sets have become more detailed and easier to access, a highly diverse and robust body of literature has grown that analyzes many different factors affecting home values. These include "amenities" such as parks, proximity to employment centers, and school districts. Research also explores the negative, housing price impacts of "disamenities," or such things as landfills and noise from freeways.

For purposes of this specific analytical effort, we focus on published research literature that has sought to identify the impact of specific public facility and amenity investments and their impact upon home values.[5] The literature review is divided into four general categories of study, in order of how long the topic has been researched – and therefore the more "robust" and rigorous the body of literature is. These are:

- Impact of parks and open space upon home values;
- Impact of non-automobile transportation investment upon home values;
- Impact of commercial services or "urban amenities" upon home values; and
- Impact of street design and pedestrian connectivity amenities upon home values.

A conclusion section summarizing findings follows thereafter. A discussion of caveats to the published literature is also included, primarily among them the issue of single-family residential property value bias. The overwhelming majority of studies in the literature, and among those summarized below, attempt to estimate the value of different public investments on residential values as measured by single-family residences. Detached homes are the prevalent residence type nationwide and thus represent a multitude of data observations with easily measurable economic values and other independent determinants.

As the use of this analysis will be treatment of public investments that may enhance the economic viability of higher-density residential choices, largely attached residential development, the literature is useful in establishing economic value parameters but not necessarily indicative of choices made by households who prefer attached residential product. Accordingly, we caveat the single-family residential bias of these results, as well as later discuss a "self-selection" bias among households who prefer attached residential development and have unique preferences for amenities as well.

---

[5] The yet-unpublished study, *Hedonic Price Effects of Pedestrian and Transit-Designed Development* (Keith Bartholomew & Reid Ewing, Department of City & Metropolitan Planning, University of Utah, 2009) and "The Economic Benefits of Open Space, Recreation Facilities and Walkable Community Design" (published in Active Living Research, March, 2010, Robert Wood Johnson Foundation, http://activelivingresearch.org) were identified as the most recent surveys of academic and non-profit/advocacy literature. Jointly, both works serve as the foundation of this literature review.

The value of park space as an amenity generally to communities and specifically residential development is one of the oldest issues of study in both planning and real estate economics, extending to 1926 analysis of the financial return of New York's Central Park.[6] Open space, and specifically urban park space, are long established as important public investments for maintaining robust, healthy communities – assuming they are well-maintained and safely managed. Review of more modern research literature indicates the following about the distinct impact of different park and open space amenities upon nearby home values:

- Capitalization of the benefits of public park space into residential development is typically concentrated between 500 and 3,000 feet from park space, with declining benefit as distance increases.[7]
- For larger, regional parks, measurable positive home value impact goes out to 1,500 feet distance; however 75% of the benefit is within 500 to 600 feet of the park.[8]
- Park space design maximizes value capitalization with the "Edge Principal," i.e. longer narrow parks with greater edge are of higher value than parks with wider or round parks.[9]
- Parks with emphasis on natural areas (woods, ponds, etc.) exhibit higher value capitalization than improved, flat open spaces for social or athletic functions.[10]
- Although numerous empirical studies have been conducted nationwide with a diverse array of results, in general larger, passive-use and well-maintained parks add anywhere from 10% to 20% additional value to residential development within 3-4 blocks, all else equal.[11]
- The most thorough review of park amenity impact literature generally concludes the size of the park and proximity to it are the best indicators of positive economic value created by the park.[12] Generally, higher park size and greater proximity to the park – open space or improved space – contribute to economic value of a residence. Economic distinction between improved park space and open/natural park space was more mixed.

Nearly all of the above studies focused on a diversity of urban residential form, i.e. attached residential development as well as detached, and capitalized property values associated with parks.

---

6 Metropolitan Conference of City and State Park Authorities (1926). Parks as investments. New York City. Cited in L.H. Weir (1928), Parks*, A Manual of municipal and county parks*. New York: A.S. Barnes.

7 Crompton, J.L. (2001). The Impact of Parks on Property Values: A Review of the Empirical Evidence. *Journal of Leisure Research*, Vol. 33, No. 1, pp. 1-31.

8 Crompton, J.L. (2004). *The proximate principle: The impact of parks, open space and water features on residential property values and the property tax base.* Ashburn, VA: National Recreation and Park Association.

9 Little, C. E. (1990). *Greenways for America*. Baltimore: John Hopkins University Press.

10 Kaplan, R. & Kaplan, S. (1990). *The experience of nature*. New York: Cambridge University Press.

11 Crompton, J.L. (2001). The Impact of Parks on Property Values: A Review of the Empirical Evidence. *Journal of Leisure Research*, Vol. 33, No. 1, pp. 1-31.

12 McConnell, V. and Walls, M. (2005). *The value of open space: Evidence from studies of nonmarket benefits*. Cambridge, MA: Lincoln Institute of Land Policy.

A study of parks and capitalized values within the City of Portland in 2000,[13] which largely focuses on detached, single-family housing actually found less marginal impact of parks on prices and, therefore, premiums paid by households to live near parks. Findings of the study indicated:

- Overall, park space proximity displayed a 1.43% price premium to nearby, largely single-family homes;
- Golf course open space by far exhibited the greatest price premium estimated at 5.97%;
- General public park space benefited proximate homes by 1.28% on average.

Later work by Netusil with Lutzenheiser[14] studying Portland, Oregon data estimated that the optimal size of a park should be that of a golf course. Finally, a study of the impact of street trees upon home values throughout the Portland metropolitan area indicated that the number of trees fronting a property and within 100 feet of the property can, all else equal, increase the price of a home by $8,000 (2008 dollars).[15]

RESIDENTIAL VALUE IMPACTS OF NON-AUTOMOBILE TRANSPORTATION IMPROVEMENTS

With significant capital investment in local-serving rail nationwide over the last twenty years, and increasing bicycle and pedestrian right-of-way more recently, a body of literature has grown that statistically estimates the impact of various non-automobile transportation access and proximity.[16]

Rail Transit Impacts

The great concentration of statistical research has focused on rail transit, and particularly light-rail or streetcar transit proximity to a home, and to a lesser extent commercial property. Heavier commuter rail impacts upon property values have also been studied. The following is a summary of key findings from the standout, more-often cited published studies, most accessibly surveyed by a 2001 paper by consulting firm Parsons Brinckerhoff.[17]

Nationwide Residential Impacts

- Homes have sold for between $197 to $272 more for every 100-foot greater proximity to a light rail station in San Jose and San Diego, California, respectively, while similar analysis found no effect in Sacramento.[18]

---

13 Bolitzer, B. & Netusil, N.R. (2000). The impact of open spaces on property values in Portland, Oregon. *Journal of Environmental Management*, Vol. 59, pp. 185-193.

14 Lutzenhiser, M., and Netusil, N.R. (2001). The effect of open spaces on a home's sale price. *Contemporary Economic Policy* 19 (3): 291-298.

15 White, R. (2009). Spreading the green and sharing the wealth. *Metroscape* 27-30.

16 The reader is also invited to review two studies that provide alternative methodology to hedonic modeling to estimate the value of rail/streetcar transit in the Portland metro area: "Portland Light Rail Transit Land Development Experience & Application," E.D. Hovee & Company, LLC Memorandum to David Unsworth & Jillian Detweiler, TriMet, July 28, 2008; and *Portland Streetcar Development Oriented Transit*, Office of Transportation and Portland Streetcar, Inc., April 2008.

17 Parsons Brinckerhoff. (2001). The effects of rail transit on property values: A summary of studies (Project 21439S). Cleveland, OH: NEORail.

18 Landis, J. R. Cervero, S. Guhathakurta, David Loutzenheiser, and M. Zhang. (1995). *Rail Transit Investments, Real Estate Values, and Land Use Change: A Comparative Analysis of Five California Rail Transit Systems.*

- Average home prices decline by between $1,600 and $2,300 for every 100 feet distance from the commuter rail station to the home in San Francisco and New York, respectively.[19]
- Apartment rents decrease by an average of 2.5% for each 530-foot distance from Washington D.C. Metro stations.[20]
- Single-family homes enjoy nearly 7.0% higher values located in Los Angeles communities with commuter rail.[21]
- Conversely, similar studies found contradictory evidence in San Francisco, namely no significant impact of a rail station on home price but did find that within 1,000 feet of CalTrain right-of-way, house prices are generally $51,000 lower, all else equal,[22] while a Boston study found residential prices 20% lower within 400 feet of heavy commuter or freight rail.[23]

Nationwide Commercial Impacts

- Commercial space in Santa Clara County, California within ¼ mile of a light rail station demonstrated up to $0.05 greater rent per square foot, all else equal, while office space sales within the ¼ mile of a light rail station recorded $4.87 higher price per square foot, all else equal.[24]
- Commercial space per square foot in Washington, D.C. decreases by $2.30 for every 1,000-foot distance from a commuter rail station.[25]
- Alternatively, a study found no impact of commercial property impacts from rail station access in San Diego.[26]

Portland Metro Area Residential Impacts

- Within 100 feet of a light rail station, Portland homes have sold for $663 more than other homes all else equal.[27] Alternatively, other analyses have found that for every 100 foot distance from light rail, homes sell for $75 less.[28]

---

19 Lewis-Workman, S. & Brod, D. (1997) *Measuring the Neighborhood Benefits of Rail Transit Accessibility*. Transportation Research Record 1576, pp.147-153.

20 Benjamin, J. and G. Stacy Sirmans. (1996). "Mass Transportation, Apartment Rent and Property Values." *The Journal of Real Estate Research*, Vol. 12, No. 1.

21 Fejarang, R. (1994). *Impact on Property Values: A Study of the Los Angeles metro Rail*. Preprint, Transportation Research Board, 73rd Annual Meeting, Washington, D.C., January 9-13.

22 Landis, J. R. Cervero, S. Guhathakurta, David Loutzenheiser, and M. Zhang. (1995). *Rail Transit Investments, Real Estate Values, and Land Use Change: A Comparative Analysis of Five California Rail Transit Systems.* Monograph 48, Institute of Urban and Regi*/onal Studies, University of California at Berkeley.

23 Armstrong, R. (1994) Impacts of Commuter Rail Service as Relected in Single-Family Residential Property Values. Preprint, Transportation Research Board, 73rd Annual Meeting.

24 Weinberger, R. (2000). *Commercial Property Values and Proximity to Light Rail: Calculating Benefits with a Hedonic Price Model*. Presented at Transportation Research Board 79th Annual Meeting, Washington, D.C. January 9-13.

25 Federal Transit Administration. (2000). *Transit Benefits 2000 Working Papers: A Public Choice Policy Analysis.* Washington, D.C.: Federal Transit Administration, Office of Policy Development.

26 Landis, J. R. Cervero, S. Guhathakurta, David Loutzenheiser, and M. Zhang. (1995). *Rail Transit Investments, Real Estate Values, and Land Use Change: A Comparative Analysis of Five California Rail Transit Systems.*

- Within 200 feet of a light rail station, Portland homes have sold for $2,300 more than others, all things equal.[29]
- Beginning at a distance of 100 meters, every meter distance beyond was estimated to reduce Portland area home prices by $32.20 on average.[30]

The most recent, comprehensive national survey of hedonic home price analysis of transit proximity conducted by Cervero[31] indicates in general, within a ¼ mile to ½ mile radius, home price escalation is typically anywhere from 6.4% to 45% reflecting significant geographic variation and sensitivity to study specifications.

Finally, in what is perhaps the most pertinent and recent study on the issue, Michael Duncan of the University of North Carolina at Charlotte studied the differences in how detached, single-family residences and condominium units distinctly capitalize the benefits of rail proximity.[32] His laboratory was the San Diego metropolitan statistical area and its transit oriented development areas. Findings include:

- Condominium units within 1/4 mile of a rail station had, all things equal, $22,452 greater property value than like condominium units beyond a quarter-mile but within a mile of the rail station.
- The condominium unit proximity premium translates into a value boost of 16.6%, all things equal.
- Single-family residential units within ¼ mile of a rail station had, on average, $11,800 greater value than like homes beyond a quarter-mile, but within one mile of the station.
- The single-family premium, comparable to other findings in the literature review, translates into a 5.7% property value boost for proximity to a rail station, all else equal.

Commercial Development Impacts

A less robust body of literature now exists that is beginning to empirically support the contention that commercial uses proximate to residential areas boosts the value of homes, all things equal. In other words, research is indicating potential home value premiums for being within a "15-minute neighborhood" or a "16-hour district" in current planning terms.

---

27 Al-Mosaind, M. K. Dueker, and J. Strathman. (1993). *Light Rail Transit Stations and Property Values: A Hedonic Price Approach.* Portland, OR: Center for Urban Studies. Preprint, Transportation Research Board, 72nd Annual Meeting.

28 Lewis-Workman, S. & Brod, D. (1997) *Measuring the Neighborhood Benefits of Rail Transit Accessibility*. Transportation Research Record 1576, pp.147-153.

29 Dueker, K. and M. Bianco. (1999). *Light Rail Transit Impacts in Portland: The First Ten Years.* Presented at Transportation Research Board, 78th Annual Meeting.

30 Chen, H., A. Rufulo, and K. Dueker. (1998). *Measuring the Impact of Light Rail Systems on Single Family Home Prices: A Hedonic Approach with GIS Applications.* Prepared for the Transportation Research Board, 77th Annual Meeting.

31 Cervero, R., S. Murphy, C. Ferrell, N. Goguts, Y. Tsai, G.B. Arrington, et al. 2004. Transit-oriented development in the United States: Experiences, challenges, and prospects (TCRP 102). Washington, DC: Transportation Research Board.

32 Duncan, M. (2008). Comparing Rail Transit Capitalization Benefits for Single-Family and Condominium Units in San Diego, California. *Transportation Research Record: Journal of the Transportation Research Board*, No. 2067, Transportation Research Board of the National Academies, Washington, D.C., pp 120-130.

Unlike the large volume of research on impacts of transit proximity, research on commercial development impacts is far less uniform in its findings of positive benefits. Some studies find value in being near a commercial district in general, while others find that being too close to the traffic, noise, and lights from various commercial property types translate into lower residential values in the immediate vicinity. For instance:

- Early research has found that being immediately adjacent to commercial offerings has a negative impact to property values, while homes that are not immediately next door to commercial development decrease in value by roughly $1,500 for every 33 feet away from retail.[33]
- A 2008 analysis in King County, Washington found interesting, but mixed results regarding transit-oriented development mix and residential values.[34] The study identified increased value for lower-cost housing to be near retail job opportunities, while proximity to retail reduced value for higher-end homes, all things equal.
- A 1999 study of the Kentlands New Urbanist, planned community development in Maryland indicated generally positive residential value impacts of mixed uses, including parks and open space as well as commercial uses, proximate to residential areas.[35]

The research team of Yan Song of the University of North Carolina and Garrit-Jan Knaap of the University of Maryland has published a series of studies on the impacts of various New Urbanism design, mixes of use, and infrastructure feature impacts upon housing values, most notably in 2003.[36] Studying Washington County, Oregon, they have found the following relationships via hedonic modeling, though with results sensitive to specification:

- In general, residential development proximate to commercial development enjoys greater values.
- However, homes have higher value, all things equal, when within a more homogenous, single-family residential area compared to homes within a mix of uses.
- The closer single-family homes are to multi-family homes, values tend to decrease.

Measuring the impact of proximate commercial development on residential home values is in practice the most difficult relationship to model statistically. Among other things:

- Commercial development size, forms, and services can vary widely;
- Unlike dedicated park or open space, commercial services can easily change within a five-year timeframe or shorter depending upon the health of the center;
- Traffic noise, visibility, and access in relationship to residential areas can be highly variable;
- Individual retail or service establishments can have very different appeal (café vs. tavern) at different times of day, to different demographics; *and*

---

33 Li, M. and J.H. Brown. (1980). Micro-Neighborhood Externalities and Hedonic Housing Prices. *Land Economics* 56 (2): 125-141.

34 Mathur, S. 2008. Impact of Transportation and Other Jurisdictional-Level Infrastructure and Services on Housing Prices. *Journal of Urban Planning and Development* 134 (1): 32-41.

35 Tu, C. and M. Eppli. (1999), Valuing New Urbanism: The Case of Kentlands. *Real Estate Economics* Vol. 27.

36 Song, Y. and G. Knapp. (2003), New Urbanism and Housing Values: A Disaggregate Assessment. *Journal of Urban Economics* 54: 218-238.

- The value of being near a district in general as compared to specific types of commercial/non-residential development can be difficult to statistically distinguish.

To counter these problems in estimating commercial amenity values, the 2007 Urban Living Infrastructure study for Metro's Transit Oriented Development Program comprised a hedonic model of residential values as a function of specific commercial offerings within a 1.5 block distance. Home sales proximate to six key, mixed-use districts in the Portland metro were analyzed. Important findings specific to this metro area included:

- Specialty grocers, which sell gourmet goods and organic produce as well as have a café and flower store in-house, had very significant positive impacts to residential values nearby.
- Cinemas, typically single-screen and vintage in established commercial districts, also had substantial positive property value impact, likely signaling such an amenity as an anchor for entertainment and dining after business hours, i.e. the "16-hour district."
- Book shops, garden stores, and a few other unique commercial offerings were also found to have positive property value impact for homes nearby.
- Many other amenities were studied and had positive impact estimates, but were not "statistically significant" or statistical confidence in the estimates was not as strong.
- Alternatively, some commercial offerings were estimated to act as property value "disamenities," most notably pub/taverns primarily for alcoholic beverage consumption, day spas likely due to resident/non-resident parking conflict, and record stores.

RESIDENTIAL VALUE IMPACTS OF STREET DESIGN & NON-AUTO CONNECTIVITY

As economic research into the impacts of transit and open space upon residential values has become more robust, the second area of increasing new research has to do with New Urbanist street design, pedestrian connectivity, and even bicycle connectivity. Published research into each has only recently emerged and as such, a review indicates the body of work is from conclusive. A summary of key studies is found for each topic below.

Connected Street Patterns

New Urbanist residential development in different parts of the country has increasingly utilized "connected" street patterns, i.e. neighborhood grid-type systems rather than cul-de-sacs, etc. Research has followed seeking to identify which street system type is preferred by buyers and if that value is capitalized into home prices. Published research to date is mixed in findings:

- Song and Knaap in their 2003 study of Washington County, Oregon homes found homes have higher value, all else equal, in developments with grid-like connectivity in addition to value being nearby commercial development.[37]
- A 2007 study of Seattle-area residential development found that more traditional grid-like street patterns increase home values where neighborhoods are more homogenously residential, while grid-like street patterns have negative effects on property values when higher traffic volume uses such as commercial are nearby.[38]

---

37 *Ibid.*

38 Matthews, J. and G. Turnbull. (2007) Neighborhood Street Layout and Property Value: The Interaction of Accessibility and Land Use Mix. *Journal of Real Estate Finance and Economics* 35: 111-141.

- Alternatively, two studies – one in 1990[39] and the other in 2002[40] – generally found that neo-traditional features such as grid-patterned streets and alleyways had lower capitalized values in home prices than cul-de-sacs and more typical suburban driveway/garage form.

Traffic Calming vs. Traffic Disamenity

Regardless of street layout, traffic calming devices have been studied for their impact upon residential values with mixed results in two older studies identified, potentially dependent upon the specific type of traffic calming device.

- Most recently, it was found that speed tables – street-wide speed bumps with a flat plateau in the middle - in residential areas to slow traffic had little discernible impact upon home values when neighborhoods without calming devices were compared.[41]
- In a much older study[42], diagonal diverters were the topic of study in a comparison of highly similar neighborhoods with and without the improvements. Diagonal diverters are barriers running diagonally across an existing four-way intersection that prevents through-traffic for automobiles, but maintains through-traffic for bicycles and pedestrians. The study found that home values appreciated faster in neighborhoods with the device than without.

Interestingly, the study of noise created by auto-friendly street design has far more robust research published and gives more confidence about the need for pedestrian-friendly design in different instances. The most prominent studies on the topic find that negative value impacts of street noise range from 0.2% value reduction per decibel of noise[43] to 0.6% value reduction[44], while a third indicates the negative value impact only occurs above 65 decibels of noise.[45]

On a related topic, research has occurred on a still-limited scale regarding the replacement of traffic-intensive freeways and associated noise with boulevards or other less-intensive automobile uses. The most notable paper on the topic,[46] prepared for the University of California Transportation Center in December of 2007, provided hedonic modeling of home prices as effected by the

39 Asabere, P. (1990) The Value of a Neighborhood Street with Reference to Cul-De-Sac. *Journal of Real Estate Finance and Economics* 3 (2): 185-193.

40 Guttery, R.S. (2002). The Effects of Subdivision Design on Housing Values: The Case of Alleyways. *Journal of Planning Education and Research* 23 (3): 265-273.

41 Edwards, V. and W. Bretherton. (1998) The Economic Impact of Speed Humps on Housing Values. Paper presented at the 1998 Institute of Transportation Engineers Annual Meeting, Toronto, Ontario. Washington, DC: ITE.

42 Bagby, D. (1980). The Effects of Traffic Flow on Residential Property Values. *Journal of the American Planning Association* 46: 88-94.

43 Bateman, I., B. Day, I. Lake, and A. Lovett. (2001). *The Effect of Road Traffic on Residential Values: A Literature Review and Hedonic Pricing Study.* Norwich, UK: Economic & Social Research Council.

44 Wilhelmsson, M. (2000). The Impact of Traffic Noise on the Values of Single-Family Houses. *Journal of Environmental Planning and Management* 43 (6): 799-815.

45 Thebe, M. (2004). Planes, Trains, and Automobiles: The Impact of Traffic noise on House Prices. *Journal of Real Estate Finance and Economics* 28 (2/3): 209-234.

46 Cervero, R., Kang, J. and K. Shively. (2007). "From Elevated Freeways to Surface Boulevards: Neighborhood, Traffic, and Housing Price Impacts in San Francisco." Working Paper, University of California Transportation Center.

replacement of the Embarcadero Freeway Corridor and the Central Freeway Corridor in San Francisco with more pedestrian-friendly, less auto-intensive boulevards. Highlights include:

- Before and after freeway replacement, proximity to automobile noise translated into disamenities, or home value discounts for homes proximate to the two corridors.
- A modest amenity benefit was estimated within ¾ miles from the new Embarcadero Boulevard after 2000, controlling for proximity to the waterfront.
- Values of homes proximate to the new Octavia Boulevard, the replacement of the Central Freeway Corridor, jumped by $116,000 in 2005, all else equal.
- The study also reviewed traffic patterns and usage to find that replacement of the freeways with Boulevards did not cause measurable negative impact to property values or neighborhoods with dispersion of traffic in the wake of freeway replacement.

"Walkability"

The term "walkability" has become common in both planning and real estate realms due in part to the increasingly New Urbanist orientation of residential development nationwide. "Walkability," however, is an inexact term generally reflecting relative proximity of a residential or commercial property to other commercial or employment destinations. To be "walkable," a property is usually within a mile of a destination and pedestrian connectivity is typically convenient.

Most recently, the private software company Front Seat launched its Walk Score methodology[47] and website to increasing notoriety and popularity in real estate and formal planning circles. A "Walk Score" is assigned by the service based on ¼-mile distance increments from a residence or business to other key commercial destinations. The ratings system is largely distance-driven, rather than infrastructure-driven; safe pedestrian access is not necessarily guaranteed in a "high" Walk Score (within ¼ mile distance).[48] In other words, the ratings system does indicate proximity, but does not indicate safe pedestrian or bicycle infrastructure or connectivity. This is particularly true for a Walk Score from one commercial address to another.

It is also not to be confused as a measure of how much walking or bicycling takes place. A home may have a high Walk Score, but the proximity of the home to a commercial area can just as likely indicate a very short, convenient drive via automobile to the commercial area in question. Even so, Walk Score has become a short-hand algorithm for proximity of a residential use or commercial use to a wide menu of commercial uses as a proxy for lesser need for an automobile.

Walk Score has specifically been utilized as a measure of "walkability" in recent studies of commercial property impacts upon residential and other commercial properties. The work of researchers Gary Pivo of the University of Arizona and Jeffrey Fisher of the University of Indiana best represents rigorous academic study of walkable proximity, or "Walk Score," between property types.

- Their 2009 study[49] of Walk Score premiums on a variety of residential, commercial and industrial properties nationwide found, on average, a 5% to 8% value gain for every 10 point gain in a property's Walk Score. The study also found, however, that higher Walk Score

47 http://www.walkscore.com/about.shtml

48 http://www.walkscore.com/methodology.shtml

49 Pivo, G. and J. Fisher. (2009). "Effects of Walkability on Property Values and Investment Returns." Working Paper. Responsible Property Investing Center, Boston College and University of Arizona, and Binecki Center for Real Estate Studies, Indiana University.

translates into mixed effects on commercial property returns and capitalization rates depending upon use, with the most negative effect upon retail property return measures.

- Their follow-up 2010 study[50] further explored the mixed results of walkability and income properties specifically with a more detailed methodology. They found that for every ten-point increase in Walk Score, property value increased by 1% to 9% on average and more generally correlated with lower capitalization rates and higher income.

Bicycle Connectivity

With bicycle mobility planning gaining momentum in different parts of the country, bicycle connectivity has become increasingly studied in academic literature. Interestingly, study methodologies are a bit more diverse and yield mixed conclusions about the value of bicycle access investment upon property values.

Opinion survey studies have historically been more numerous in gauging the effect of bike paths, on and off-road, and bike trail greenbelts upon residential home values *purely from the perception of property owners*. An unpublished review of survey studies in Colorado, Seattle, Omaha, Vancouver, Monmouth County, New Jersey, Santa Rosa, California, three National Park Service trails indicates that property owners nearby bike trails of various forms generally view the investment as an amenity, and specifically either boost nearby property values slightly or not at all.[51]

Hedonic modeling of bike value impacts on property value, alternatively, provides far more mixed results. Unlike existing property owner surveys, hedonic modeling offers the advantage of being able to control numerous variables that affect the value of a property, as well as simultaneously study a far larger sample of properties than just immediate property owners. Hedonic modeling is a more recent focus of research.

- The Delaware Transportation survey study[52] included a more simple hedonic model of bike access value impact for properties with only a handful of variables and found significant, positive impacts of being near bike paths.
- Alternatively, researcher Kevin Krizek of the University of Minnesota has published a series of papers on the various benefits of bike access upon property values and finds results depend highly upon the path type and urban or suburban setting. His most oft-cited study[53] of various districts and path types in the Twin Cities metro area finds that in a more urban environment, for every 400 feet closer to a roadside bike path, home values decline by nearly $2,300. For every 400 feet closer to an off-road path, value increases by $510. In a suburban setting, every 400 feet closer to a roadside path decreases home value by $1,059, while every 400 feet closer to an off-road path decreases home value by $240.

50 Pivo, G. and J. Fisher. (2010). "The Walkability Premium in Commercial Real Estate Investments." Working Paper, Responsible Property Investing Center, University of Arizona, and Binecki Center for Real Estate Studies, Indiana University.

51 Racca, D. and A. Dhanju. (2006). "Property Value/Desirability Effects of Bike Paths Adjacent to Residential Areas." Project Report, Delaware Center for Transportation and the State of Delaware Department of Transportation.

52 *Ibid.*

53 Krizek, K. (2006). Two Approaches to Valuing Some of Bicycle Facilities' Presumed Benefits. *Journal of the American Planning Association* 72 (3): 309-320.

The Krizek study controls for automobile/bicycle traffic volume issues and conflict potential, but subsequent hedonic research has focused on appropriate bicycle path buffers and their effect on bicycle commuting patterns. No studies were identified that takes the next step of drawing a relationship between on-street bicycle path buffers and property values.

CONCLUSIONS & CAVEATS

After a review of the most notable literature on the topic of various public investments and property values, we come to the following conclusions about what guidance research can give to Metro regarding development potential, in order of confidence and robustness of the literature.

- **Parks & Open Space:** The oldest and most-studied topic of parks and impacts upon property values overwhelmingly indicates positive correlation between type of park space (unimproved/open higher than improved), size of space (larger having higher impact) and access to park space from residential areas.
- **Transit:** Transit, rail in particular, has highly robust academic research over a period of time lending empirical confidence to the idea that proximity to rail is a positive amenity for property owners. Studies are not quite as voluminous, and are limited to metro areas large enough and dense enough where commuter rail investment has been possible. Results are also varied by nature of rail (heavy vs. light) and geographic location.
- **Commercial Amenity:** An increasing body of work is finding positive, though admittedly mixed, benefits for proximity of various property types to commercial development. While some studies indicate noise and traffic nuisance as a concern, others find being nearby a commercial district but "not too close" has positive impacts. The Metro Urban Living Infrastructure study went as far as to identify specific business types that have unique, significant impacts upon property values as potential indicators of urban development catalysts.
- **Traffic Nuisance/Calming:** Although research into the efforts to calm the nuisance, or perception of nuisance, of traffic nearby residential areas have not been robust, a more persuasive body of research has estimated the negative impact to property values of residences nearby noisy/auto-intensive roads and related noise.
- **Walkability/Connectivity:** Although not precisely defined, the impact of being reasonably proximate to commercial and employment areas via distance only or connectivity of street design indicates positive, but again mixed, impacts to property values. Research is limited and conclusions are difficult to draw. Furthermore, some design elements such as alleys have been identified as having negative value impacts.
- **Bicycle Connectivity:** Statistical analysis of the value of bike trail/path improvements on property values is limited at this time. The most rigorous analysis has found that bike paths are generally negative for residential property values in suburban environments and mixed in benefit in an urban environment. Alternatively, numerous property owner surveys generally reflect a positive perception of being near trails by those property owners.

Review of all of the above indicates significant, rigorous analysis of the topic at hand. But it is also worth noting the caveats and limitations of the hedonic modeling body of work.

- **Detached Residential Bias:** As indicated at the beginning of this section, the overwhelming topic of study is the impact of amenities to single-family homes or land zoned for single-family residential development. Demographic and product "tastes" can be significantly

different enough for attached residential form that sensitivities to public investments may be somewhat different.

- **Geography:** The vast majority of studies scrutinize property values in specific cities or districts of cities all over the United States, including studies in this literature review. Studies cited above, however, are identified as significant ones in the body of work and frequently take a regional approach for comparison purposes. However, household behavior in hotter climates may or may not be indicative of household behavior in the milder Pacific Northwest climate where year-round bicycling, for instance, is less subject to weather extremes.
- **Time & Amenity Saturation:** As time moves on, a new and unique park may generate significantly positive improvement values nearby. But with depreciation and construction of other parks in greater saturation, the uniqueness of the park or any other public investment declines and impact value likely declines as well.
- **Nominal Dollar Values:** With time changing, the results of many studies identified were expressed in terms of current dollars. Unfortunately 1999 dollars for example provides little indication of value impacts in 2010.
- **Self-Selection:** Topics of study – parks, bike paths, walkability – are all amenities but it can also be said that "beauty is in the eye of the beholder." While development patterns in the Portland metro area indicate increased interest in urban, attached residential forms, the public amenities analyzed in these studies likely apply to that specific share of the regional population: those seeking to be nearby specific public investments.
- **Urban & Suburban Differences:** Some studies in the literature review attempted to identify different value impacts of public investments and indeed found differences between urban and suburban residential areas.

Upon conclusion of the following section, which discusses a new set of measurements of public investment upon property values in the Portland metro area, a reconciliation of literature review findings and new analysis results is provided to indicate potential urban amenity values for policy consideration.

HEDONIC MODELING

Overview

JOHNSON REID conducted several iterations of an econometric, hedonic model of metro area improvement values as potentially determined by various public investment types and other typical indicators of development value. Hedonic, or personal preference/pleasure, modeling seeks to explain observed behavior when there are likely numerous and widely varied factors and preferences involved in that behavior. Hedonic modeling is particularly powerful in dealing with the issue of property value analysis because it enables:

- The ability to measure many determinants of the value of a property; *and*
- The ability to understand the *marginal* or isolated value of an individual property feature, such as off-street parking, presence of street trees, or pedestrian access.

In mathematical notation, the relationship of interest is between the observed behavior (market value of a residential, mixed-use, or commercial property) and the potential factors that contribute to the value of those properties:

(1) Price = f (Locational, Physical, Environmental, Economic, Other)

or, Price is a function of Locational, Physical, Environmental, Economic and Other factors. Here, "Other" factors include those likely difficult to observe, specifically the unique preferences of property owners, investors, and other factors that can be difficult to objectively observe.

In statistical notation for hedonic modeling of property values, Equation (1) is expressed as follows:

(2) $P = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots + \beta_n x_n + \varepsilon$

where:

P = Price

α = A fixed (constant) dollar figure independent of the value property owners place on factors described in Equation (1)

β = The dollar value that a property owner places on a specific property feature

x = An individual feature of a property that has a unique dollar value

n = The total number of property features that factor into its estimated value

ε = Unpredictable determinates of property value, or "random error"

Equation (2) can be understood as follows:

> *The value of a property can be expressed in terms of a the basic value for the ownership of a property in general (α), n different and unique features of a property (x), the dollar value that an owner places on each feature (β), and unpredictable factors (ε).*

JOHNSON REID then created a hedonic model of property values throughout the Portland metro area utilizing an original data set compiled by Metro for this study. Over 1,600[54] properties were sampled throughout the metro area, specifically in the following designated areas:

- Three Regional Centers: Clackamas, Gresham, and Hillsboro;
- Two Town Centers: Happy Valley and Tanasbourne;
- Pearl District; and
- Corridors: Fifteen designated corridors in all three of the metro area counties. A detailed list of all centers and corridors in the study can be found in the Appendix.

For every property observation and its market value,[55] Metro compiled a wide menu of qualitative and quantitative data on a host of issues ranging from zoning, property age and quality, primary use,

[54] Due to incomplete data fields and irregularities in some observations, Johnson Reid and Metro agreed that a number of observations should be excluded, leading to a final observation count of 1,346 properties throughout the metro area.

presence of street trees, property access, traffic volume and speeds, and a number of other physical and economic factors. In all, a total of 30 property quality variables were utilized to explain the values of properties in the sample. A detailed list of all variables, ranging from pedestrian environment to property construction type to location is found in the Appendix.

For the vast majority of information, JOHNSON REID constructed qualitative "dummy" or indicator variables, which simply assign a value of 1 or 0 depending upon whether or not the property does or does not have a certain quality. For instance, the indicator variable for commercial zoning was assigned a value of "1" if the property is zoned for commercial and a "0" if not.

Centers & Corridor Value Premium Results

On the following page is a comprehensive hedonic model "run" for the Centers/Corridors/non-Pearl District data set typical of various model specifications possible. We would generally observe the following:

- The model run utilizes the majority of the geographic, locational, and public investment variables as constructed and observed by Metro staff.
- The dependent variable is the natural logarithm of Real Market Value (RMV) per square foot.
- Independent variables are the natural logarithms of data observation values for each variable, as well as many indicator or "dummy" variables assessing qualitative information.
- The model attempts to correct for heteroskedasticity, or the risk that observations in different districts will have different variation.

Corridor & Center Locational Findings

A total of 22 locational dummy variables were utilized in the model. Accordingly, Coefficient ("Coef." or "premium" estimates should be read as the value of being within a specific corridor or center relative to being in the Pearl District, the Happy Valley Town Center, and the Clackamas Regional Center. Significant, high-value commercial development roughly equated statistically and the three districts "dropped out" as coefficients during statistical analysis.

Coefficient estimates are generally what one would expect, with the vast majority of the other centers and corridors showing a discount relative to the Pearl District, all things equal. Coefficient estimates themselves are individually somewhat problematic alone, however, and should be viewed as relative magnitude or relative discount compared to other districts.

Detailed results including locational variables are found in the Appendix of this report.

Corridor & Center Property Quality Findings

[55] Assessed real market value per square foot was utilized as the dependent variable for measure rather than transaction sales value. To wit, sales transactions records and prices were of far lesser consistency upon review than assessed real market value as indicated in tax records. Neither measure is perfect, but assessed real market value is at least consistent in its merits and problems.

Like locational variables, property quality variables also generally make intuitive sense as to what would indicate higher or lower value for a commercial or attached residential development. As with locational variables, however, the magnitude of individual coefficients or "premiums" is misleading and should be read as relative to a baseline variable.

- Construction age: A property built before 1994 is corroborated by the model as having a negative premium value to a new development or even development between 1994 and 2000.
- Zoning: Zoning coefficient estimates generally make intuitive sense relative to one another. Specifically, relative to mixed use residential zoning (MUR), more commercial-related zoning had relative price premiums. Public facility zoned-property surprisingly had the highest relative value. Commercial zoning was the only coefficient to demonstrate statistical significance.
- Number of floors: Somewhat surprisingly, more floors in a building indicate a discount. This likely reflects the lower value of a building with the more floors of rental apartment development – the most common type of such structure – the structure has. The coefficient is not statistically significant.
- Construction types: Value coefficients for different construction material types generally also make intuitive sense. Relative to wood frame, typically low-rise construction, predominantly concrete low-rise construction has a slight discount. Unsurprisingly, steel and glass construction indicates a significant relative premium to wood frame at over 13%, all things equal.
- Depreciated Value: In contradictory manner, the model estimates that properties indicated to be recently in poor quality indicate a 1% premium over new construction, all things equal, though the coefficient fails to be statistically significant.
- Street Parking Only: Unsurprisingly, buildings primarily served by on-street parking had a negative premium of 2%. This estimate is, of course, endogenous as land value indicates the economic efficiency gained by structured parking versus surface parking provision.

Corridor & Center Property Neighborhood & Public Investment Findings

Public amenity investments generally contribute positive property value compared to those properties that do not benefit from such proximity.

- Neighborhood Score: A higher neighborhood score results in a significant price premium according to model results. Again, it is important to emphasize self-selection for this variable as urban, walkable neighborhoods are preferred by only a percentage of the population.
- Traffic Speed and Volume: Higher-speed roads are found to cause a nearly 15% price discount, all things equal. Traffic volume, alternatively, shows a modest premium of 3% by the model, likely reflecting the appeal of higher volume traffic by commercial enterprises. Neither coefficient is statistically significant.
- Bike Racks & Street Furniture: Bike racks have a statistically significant price premium relative to properties without bike racks nearby, estimated at roughly 22%, all things equal, and statistically significant. Street furniture is associated with an estimated discount of 19%, though statistically insignificant.

- Street Design: Property values are estimated to enjoy a modest value premium of 7% when proximate to roads of greater than two lanes. This result likely underscores the value of access and visibility for vehicular traffic to commercial development. Left turn access, alternatively, is associated with a 6% discount based on model results. Both coefficients are statistically insignificant. Two-way traffic, on the other hand, is estimated to modestly improve values by up to 3%, the coefficient is not statistically significant in this specification. Street trees negatively contribute to property value to the tune of -17% discount, all else equal, though the coefficient is not statistically significant. Findings given the above indicate the conflict between pedestrian "friendliness" for districts, but at the same time clear visibility and access for commercial properties also in the districts.
- Street Frontage and Connectivity: Model results indicate that significant sidewalk exposure and street frontage with maximum pedestrian access both negatively affect property values. Though larger, the negative price effect all else equal is statistically significant for street frontage impacts. We would cite this as further evidence of the impact of the importance of preserved visibility and vehicular access in balance with pedestrian visibility and access for business viability.
- Cul-de-Sac Layout: Consistent with research literature, properties that are situated in suburban-style cul-de-sac street layout are estimated to experience a negative price effect, though not in a statistically significant manner.

Corridor & Center Findings Conclusions

We generally find the results of modeling to indicate the following:

- Commercial building property value effects are important in centers and corridors. Greater visibility and ease of vehicular access are important for property values in balance with pedestrian access and landscaped environment based on sample observations.
- Relative discounts vs. premiums generally corroborate intuitive understanding, though the importance of commercial visibility and access – even for ground floor retail in mixed use projects – should not be understated.
- Magnitudes of coefficient estimates should be interpreted in relation to one another and "all else equal" rather than read as exact premium or discount estimates. Unfortunately, all else equal rarely exists.
- Bike racks clearly indicate additional value per foot for properties in center and corridor areas.
- The model itself has an adjust-R^2 of roughly 80%, indicating that the majority of variation in property values is being explained by the model as specified.
- There is likely collinearity among different variables as is usually the case, however a standard test was run utilizing Stata and only two variables indicated significant risk of collearity: incompatible zoning and industrial zoning. Industrial zoning was subsequently dropped from the model(s).

In general, our results corroborate hedonic model results expressed in the literature review for other metro areas as well as previous studies of the Portland metro area. As is the case in all econometric studies, the model is sensitive to specification and variation in results is usually a consequence. Results expressed above, therefore, should be viewed as a one-time snapshot of public amenity investments and their impact upon property values, rather than a definitive indication of public investment tools.

PUBLIC AMENITY PREMIUMS: EVIDENCE & CONCLUSIONS

A careful reading of the literature, as well as the hedonic modeling exercise summarized above, indicates a number of different economic, physical, and public features that alone or "all else equal" positively contribute to property values. Although tempting, it would defy common sense to assume that all of the different public environment variables and private development qualities would cumulatively offer high property value premiums. A literal reading of the above analyses would indicate that a transit station, a specialty grocery store, and a golf course-sized park all within a quarter mile of a property would generate a combined value premium of well over 100%, all else equal, for example.

In reality, amenities do not "stack" cumulatively; they reflect self-selection by households that prefer such amenities; and are highly location-specific given household location preferences. In other words, amenity improvements combine differently for different parts of a metro area, different households, and in different permutations. For example:

- Proximity to rail, for example, has very different value potential for a central city resident whose rail commute is seven minutes versus a suburban resident whose commute via the nearby station is 45 minutes.
- Alternatively, the nearby development of a new park in an unsaturated suburban community would have different value for a suburban household than a new park for an urban household already proximate to a number of city parks.

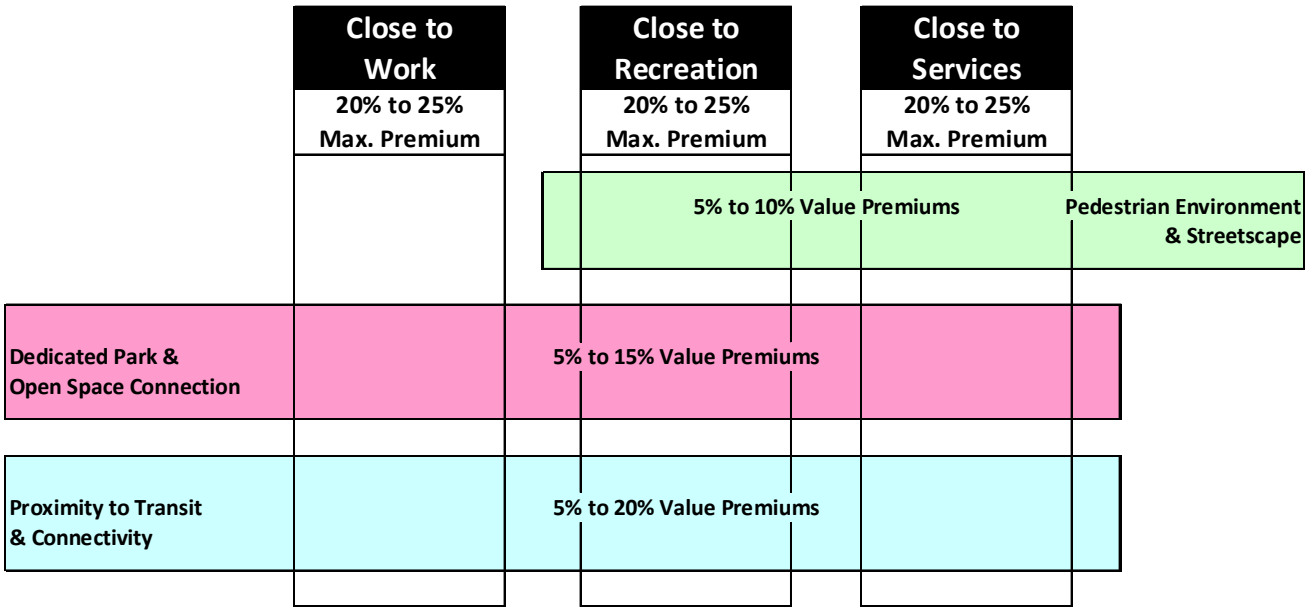
Rather, an appropriate approach to considering different amenties and their values is to consider location and spending behavior among households who strongly prefer or marginally prefer to live in attached housing. For such households, location preferences are very high – proximity to employment, recreation, and services is generally of higher value than for households that prefer single-family residential development.

In essence, the value of the various locational features and amenities in a geographic area capitalized into property values is a reflection of the ability of the household to substitute transportation expense for housing expense. In other words, a premium for being near a transit station is really a shift of the household's spending on nearby transit rather and away from frequently more-expensive automobile expenses. The same is true for proximity to shopping and services, as well as recreation opportunities. The greater ability to walk or bicycle, rather than incur automobile travel time and expense, enables greater substitution from traditional travel expense to housing expense. The shift, of course, is preferable for only a share of population based on life stage, employment, age, and other factors.

Given this behavior among households who prefer attached housing, the following schematic was created to illustrate the relationship between the three primary drivers of convenience - Work, Recreation, and Services – the various amenities identified in the literature review and the model results, and JOHNSON REID's experience working with various jurisdictions and private development interests on the issue of property values and location throughout the metro area.

As the schematic illustrates, each of the three primary locational needs of households that prefer attached housing – rental or ownership – generally achieve no more than a 20% to 25% price premium by category. In other words, a condominium within convenient walking distance or convenient transit ride to a major employment center generally does not fetch more than a total

premium of 25% compared to similar properties with no such convenience. The same can be said for being near parks, open space or other recreation, and great convenience to shopping and services.



Within each of the three location needs, however, different amenity investments contribute differently to property values.

- Proximity to transit in the literature indicates anywhere from 5% for single-family residences to 20% for various condominium-type development according to analysis.
- Transit & Connectivity do, however, contribute to the convenience premium for all three locational needs if the property is not immediately close to employment, recreation, or services.
- Dedicated Park & Open Space similarly contributes to property values in their convenience to all three locational needs, generally offering a 5 to 15% locational premium at most for proximity to such offerings based on previous findings. Such investment not only improves residential recreation and quality of life, but park space frequently amenitizes employment areas and commercial areas.
- Finally, Pedestrian Environment & Streetscape affords the lowest marginal premiums based on literature review and findings. We find that such improvements are symptomatic of more urban, dense locales rather than causal factors. However, some improvements can and do enhance pedestrian accessibility that did not previously occur according to the literature review. Combined premiums, based on findings review, would not likely combine distinctly for more than 5% to 10% value enhancement.

Given the above, we conclude the following:

- Fundamentally, proximity or convenience to Work, Recreation, and Services are the most significant drivers of property value from the transportation spending substitution effect. In other words, without significant proximity or convenience to one or a combination of the

three, substantial public investment in parks, transit that does not make one of the three convenient, or streetscape will have little measurable impact in inducing higher-density development.

- Individual, major amenity investments or a combination of various smaller amenity investments aimed at enhancing convenience to employment, recreation, or services, will not likely combine for more than a distinct 20% to 25% price premium, with premiums likely greater in areas with less connectivity or amenity saturation.
- For areas such as the Pearl District, which are highly amenitized in all of the above categories, a cumulative price premium from those amenities likely doesn't exceed 60% to 75% all else equal. All other districts and corridors should likely expect lower combined premiums from relative investment levels.
- We would not anticipate much greater than a 20% to 25% maximum premium for a single or combined public investment in most suburban corridor locations based on relative district pricing differences and predominant automobile-dependent development pattern.

IMPACTS OF MARKET INTERVENTIONS

The model can provide a structure within which to evaluate the marginal impact of a series of potential market interventions. These can be roughly divided into exogenous variables and variables that can be affected by local actions and regional policy. Variables such as the cost of materials and baseline lending terms are typically outside of local control. There are a number of areas in which local jurisdictions and policy makers have an ability to substantively impact the development process, which can be modeled using the framework developed.

Policy sensitive market shifts can be categorized by their impact on the three primary components of a highest and best use determination.

ACHIEVABLE PRICING

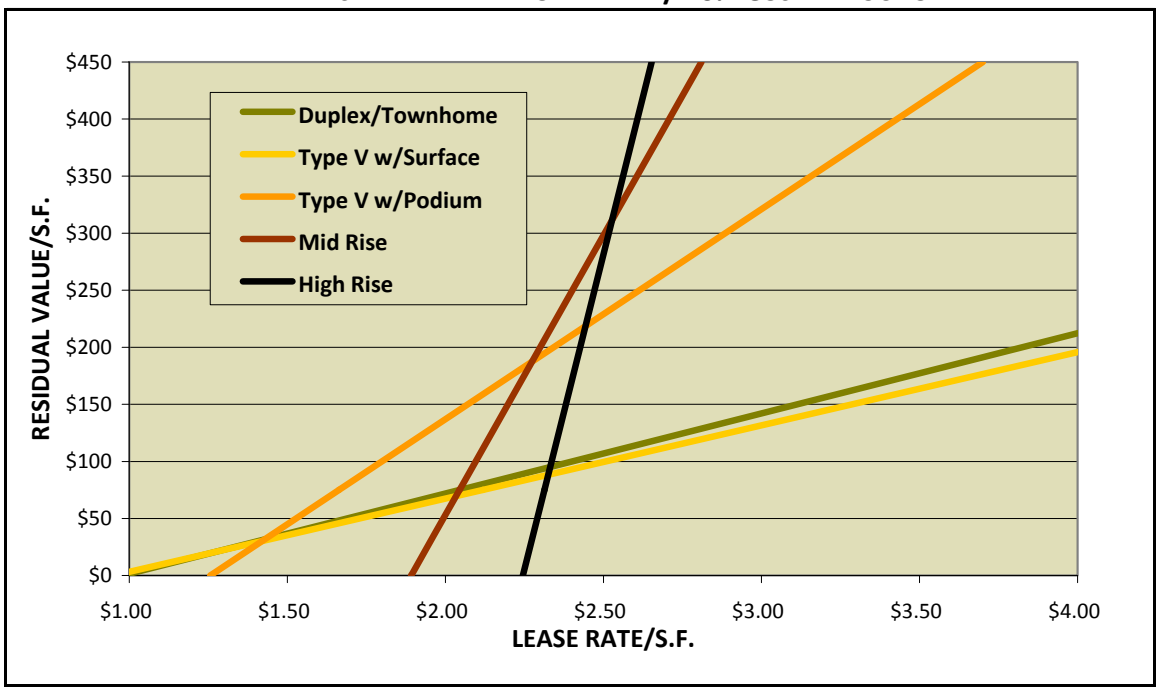
Achievable pricing in an area is a function of a complex set of variables, many of which can be impacted by intentional interventions. A key determinant of achievable pricing is the perceived level of amenity associated with any location. This can be related to items such as convenience (proximity to employment and services), community amenities (school districts), and physical amenities (views, golf courses). Public investments in areas such as transit and public realm improvements can significantly impact achievable pricing, as can support for highly valued tenants such as specialty grocers.

The net impact of a shift in achievable pricing on development form is dependent upon the districts current pricing. As shown previously, there is a direct relationship between achievable pricing and predicted development densities. This relationship is reflected in a step function, in which the development form with the greatest return shifts when pricing passes a threshold level. For a district in which current pricing is close to an inflection point that will support higher density development forms, a marginal shift upward in achievable pricing may result in a higher density of predicted development.

COST TO DEVELOP

Common market interventions are related to directly impacting the cost to develop. These include measures such as SDC waivers, land write-downs, parking management districts, tax credits and advantageous lending terms. As shown in the following two graphics, if a 10% cost reduction was assumed in the model, the transition point between uses would shift to lower price points.

RENTAL RESIDENTIAL DEVELOPMENT W/ 10% COST REDUCTION



In this case, the 10% reduction in cost shifts the inflection point between Type V surface and podium parked product from approximately $1.60 to approximately $1.45 per square foot. Public policy that serves to reduce the cost to develop can be expected to shift marginal density levels higher when the cost shift changes the highest and best use determination. If achievable market pricing in the preceding example was $1.50 per square foot, the 10% cost reduction would be expected to shift marginal construction from Type V surface parked at 30 units per acre to Type V with podium parking at 87 units per acre. If done in a market with achievable market rents at $1.00 per square foot, there would be no expected impact on the form of development in this case.

THRESHOLD RETURN

Within the model, the "threshold return" is intended as a proxy for the expected profit necessary to induce development. Real estate development entails considerable risk, and predicted returns need to be commensurate with that risk if new development is to be assumed. As with any investment, higher perceived risks require higher expected rates of return. The following are key areas of risk in real estate development:

- ***Entitlement*** – *Securing entitlements for development is often an uncertain and time consuming portion of the development process. Even when the proposed development represents an outright allowed use under the code, a project may be subject to issues such as design review requirements and neighborhood outreach which may impact entitled uses and/or add time to the process.*

- ***Financing*** – *Financial commitments can be fluid during the development process, with lenders and/or equity partners backing out of deals or renegotiating terms mid-*

development. These players can also limit flexibility. In addition, financing commitments are subject to appraisal, which always carries risk.

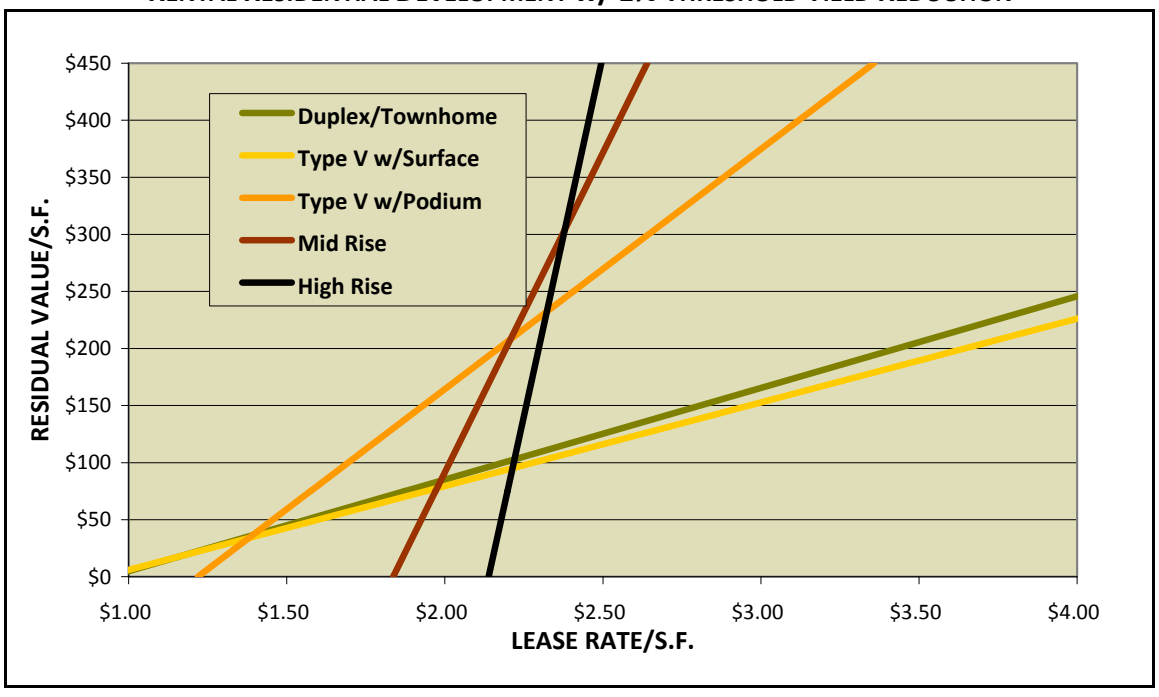
- ***Construction*** *– There are many risk factors associated with construction. The cost of materials can fluctuate significantly, timing delays can impact contractor availability windows, unforeseen problems may emerge during site-work, etc.*

- ***Market*** *– Actual achievable rent levels and/or sales prices may be significantly different than assumed at the time development was initiated. In addition, capitalization rates often shift significantly, which has a pronounced impact on income properties.*

Developments that are unprecedented locally are typically considered to carry an unusual amount of risk, if not by the developer then certainly by the lender. The amount of debt financing available will be largely subject to the results of a bank-commissioned appraisal, which will have difficulty establishing a value for an atypical development form.

We can run a permutation of the basic relationship between uses and run the model assuming a reduction in the threshold yield from 8.0% to 7.0% for rental residential product. As shown in the following graph, the reduction in threshold yield shifts the inflection point between Type V surface and podium parked product from approximately $1.60 to approximately $1.40 per square foot. While the 1% differential in the rate of return seems negligible, the change from 8% to 7% reflects a 12.5% reduction in actual return.

RENTAL RESIDENTIAL DEVELOPMENT W/ 1% THRESHOLD YIELD REDUCTION

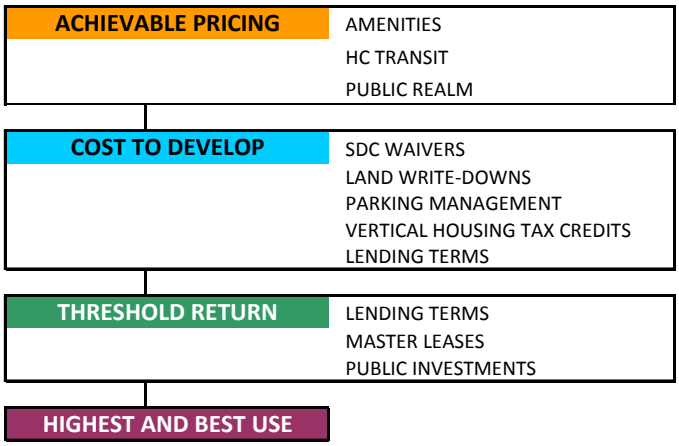


The primary underlying dynamics of a threshold return are largely outside of local control, and are related to variables such as available interest rates. There are two key areas of return that are significant in assessing yield, the cost of first position debt (secured by the property and often a

personal guarantee) and equity (cash, or subordinated debt, which serves as equity). First position debt often has attractive interest rates, as it is considered more secure. The equity portion of financing typically has a considerably higher cost, as it has a higher level of risk.

POLICY EFFORTS

There are areas in which public policy can impact perceived risk, many of which have been used over the years. The following categories some policy-sensitive variables and/or market interventions, and their impact on components of the highest and best use determination:



Each of these areas of market intervention can change the highest and best use determination, and subsequently the prevailing form of development assuming it is consistent with local entitlements. The marginal impact of any particular policy measure can be addressed using the methodological construct outlined in the model, and will vary substantially by geographic area within the Portland metropolitan area.

The anticipated effectiveness of policy efforts within specific districts can be predicted with the modeling framework developed as part of this assignment. The model can address marginal shifts in the form and magnitude of development and redevelopment activity, as well as providing a more rigorous and reliable methodology to assess the likelihood of redevelopment at the parcel and district level.

INCIDENCE

A key consideration in evaluating public interventions in the development market is the concept of "incidence". Incidence is a common concept in economic disciplines such as tax theory, and relates to who actually pays or benefits from a particular policy. In the case of market interventions, it is important for jurisdictions or agencies to understand the impact of their actions. Over time, the market will capitalize a subsidy into factors such as land value.

Many areas with a substantial record of market intervention have altered local market conditions as a result of the likelihood of intervention in future projects. An area that cuts development cost by waiving SDCs or offsite requirements may find that land values are subsequently higher to reflect the

availability of lower construction costs in that area. This can offset the marginal advantage offered by the public intervention, and reduce its usefulness over time.

If the policy objective for market intervention is to alter the form of development, these impacts need to be understood and monitored.

CONCLUSION

Our analysis indicates that public intervention in the residential housing market can have a measurable impact on the form of development, as well as the likelihood of redevelopment. Public investments in measures such as transit, public open spaces and services have a demonstrated ability to increase achievable pricing. As outlined in the production model developed, in many cases these shifts in pricing can alter the highest and best use equation within a market and change the predominant development form.

While many of the investments in infrastructure and services are supportable based solely on their amenity value to residents, these investments can also be utilized to encourage a change in development form. The effectiveness of these investments in shifting forms will depend upon the current market conditions in the area, and the extent to which a marginal shift would be predicted to shift achievable pricing to a level that supported a higher intensity development form. Markets with current achievable pricing only moderately below that necessary to support a more urban development form are likely to see a better return on public investment than a market with current pricing well below the threshold necessary to support a different form.

The analysis and model is geared towards a broad regional assessment. The methodological approach developed in this analysis can also be utilized for more detailed assessments of planning areas or districts. In addition, it allows for sensitivity testing of the marginal impact of more specific public investments on anticipated development forms. Market parameters will vary widely throughout the region, in terms of pricing as well as market responsive product types.

The model utilizes a number of variables that would be expected to vary substantively over time. As a result, these variables should be tracked and updated on a regular basis. While Metro is using this analysis to inform a longer term planning effort, the model is also able to provide meaningful data and output for short-term and more targeted policy decisions.

DEFINITION OF TERMS

- Site Size: This refers to the site size in square feet, and is intended to represent usable. In most urban contexts, the usable will be close to the total square footage, but the actual usable may be substantially lower if impacted by inefficient configuration, wetlands or other site characteristics that reduce the site's developable area. In general, as sites get smaller configuration issues become more significant, as there are less options to mitigate impacts.

- Floor Area Ratio (FAR): This is a common planning term, reflecting the ratio of built space to usable site area.

- Efficiency: Building efficiency refers to the percentage of a building that is leaseable or saleable. Corridors and common areas are not typically counted in this calculation, and building forms with extensive public areas and enclosed corridors will have lower efficiency ratios. The efficiency ratio is inherently lower in condominium buildings as opposed to rental apartments, as unit sizes are measured in different ways.

- Parking Ratio: This is an important variable, and one that is impacted by market demands, financing requirements as well as zoning requirements. This is policy sensitive to the extent that policy is fundamentally impacting parking. While publicly-mandated parking requirements can be removed, market and/or financing factors may still require significant ratios.

- Operating Expenses: These apply to rental apartments, and represent items such as property management fees, property taxes, utilities and maintenance.

- Cost/Construct: The cost to construct reflects the costs to improve the property, largely related to the new structures but may also include substantial demolition or off-site cost requirements. In this model, the costs are limited to construction of the building(s), interior finishes, contractor profit and architectural fees. This is derived from RS Means, which summarizes building experience reports by construction type and area.

- Soft Costs: Additional soft costs are an integral part of the overall cost of construction. These include engineering, traffic studies, system development charges, impact fees, financing costs and developer fees.

- Parking Costs: This is broken down as an average all in cost per space delivered.

- Capitalization Rate: The Capitalization Rate or Cap Rate is a ratio used to estimate the value of income producing properties. Put simply, the cap rate is the net operating income divided

by the sales price or value of a property expressed as a percentage. Investors, lenders and appraisers use the cap rate to estimate the purchase price for different types of income-producing properties. A market cap rate is determined by evaluating the financial data of similar properties which have recently sold in a specific market.

- Risk Spread: This represents the percentage differential between an acceptable rate of return on cost and the prevailing market capitalization rate.

- Efficiency: Building efficiency refers to the percentage of a building that is leaseable or saleable.

CONSTRUCTION TYPES

Type I

Typically these are concrete frame buildings made of noncombustible materials. All of the building elements (structural frame, bearing walls, floors and roofs) are fire resistance rated.

Type II

These buildings are constructed of noncombustible materials. Typically these are masonry bearing walls structures with steel studs for walls and steel bar joists for floor and roof structures. IIA has fire rated building elements (structural frame, bearing walls, floors and roofs). IIB is the most common construction type for commercial buildings because the building elements are not required to be fire resistance rated but still must be non-combustible.

Type V

Type V construction is typically wood frame construction. V-A requires fire rated assemblies for all building elements (structural frame, bearing walls, floors and roofs); this is often seen in older construction that predates sprinklers but still not commonly used. V-B is very common because it does not require any fire rating.

DETAILED ECONOMETRIC RESULTS

ECONOMETRIC ANALYSIS RESULTS OF PUBLIC INVESTMENT TOOLS IN CENTERS & CORRIDORS

lrmv	Coefficient	t score	P>|t|	95% Confidence Interval	
n_score	0.74	1.11	0.27	-0.56	2.04
_94_const	0.04	0.54	0.59	-0.11	0.18
pre_94_const	-0.16	-2.15	**0.03**	-0.30	-0.01
mfr_zon	0.01	0.10	0.92	-0.14	0.16
com_zon	0.35	3.36	**0.00**	0.14	0.55
mue_zon	0.03	0.31	0.76	-0.14	0.20
sfr_zon	0.39	1.38	0.17	-0.16	0.95
pf_zon	0.41	1.49	0.14	-0.13	0.96
incomp_zon	0.12	0.47	0.64	-0.37	0.60
lspeed	-0.15	-1.00	0.32	-0.43	0.14
lvolume	0.03	0.33	0.74	-0.16	0.23
lhalf_sfr	0.02	0.18	0.86	-0.18	0.21
lhalf_mfr	0.00	-0.04	0.97	-0.14	0.13
lstruc	0.85	36.42	**0.00**	0.81	0.90
prim_sfr	-0.06	-0.64	0.52	-0.24	0.12
prim_mu_res	0.42	4.28	**0.00**	0.23	0.61
prim_rental	-0.18	-2.02	**0.04**	-0.36	-0.01
prim_retail	0.15	1.30	0.20	-0.08	0.38
prim_off	0.04	0.30	0.77	-0.22	0.29
prim_ind	-0.30	-2.33	**0.02**	-0.55	-0.05
lfloors	-0.07	-0.97	0.33	-0.20	0.07
conc_brick~t	-0.07	-0.94	0.35	-0.21	0.07
steel_glas~t	0.13	1.59	0.11	-0.03	0.28
renov	0.04	0.30	0.76	-0.20	0.28
deprec	0.01	0.07	0.95	-0.20	0.22
bike_racks	0.22	2.12	**0.03**	0.02	0.43
st_furn	-0.19	-1.58	0.11	-0.43	0.05
street_only	-0.02	-0.30	0.77	-0.14	0.10
_lanes	0.07	0.90	0.37	-0.08	0.21
two_way	0.03	0.65	0.52	-0.05	0.10
left_turn	-0.06	-1.22	0.22	-0.17	0.04
street_front	-0.20	-2.18	**0.03**	-0.38	-0.02
sidewalk75	-0.12	-0.33	0.74	-0.82	0.58
trees50	-0.17	-0.46	0.64	-0.88	0.54
trad_grid	0.43	1.95	**0.05**	0.00	0.85
cul_de_sac	-0.16	-0.25	0.80	-1.39	1.08
constant	6.54	5.11	**0.00**	4.03	9.05

The following is a brief description of each of the variables utilized in the model:

Dependent Variable: Real market value of the observed property. As the model is log – log in specification, the dependent variable is really the natural log of real market value.

- lrmv (log value): natural log of the real market value of the property observation;

Locational Variables: The following variables are solely utilized to "account for" or capture the unique economic variation between different centers and corridors in the study.

- pearl_district (dummy): 1 if observation is located in the Pearl District;
- clack_center (dummy): 1 if observation is located in Clackamas Regional Center;
- gresh_center (dummy): 1 if observation is location in Gresham Regional Center;
- happyv_center (dummy): 1 for location in Happy Valley Town Center;
- hills_center (dummy): 1 for location in Hillsboro Regional Center;
- tanasb_center (dummy): 1 for location in Tanasbourne Town Center;
- centrale_center (dummy): 1 for location in Central Eastside;
- 122_148_burn_corr (dummy): 1 for location along the 122nd to 148th portion of East Burnside;
- alberta_corr (dummy): 1 for location along the Grand to 32nd portion of Alberta;
- allen_beav_corr (dummy): 1 for location along the Allen corridor in Beaverton;
- cornel_corr (dummy): 1 for location along the Route 8 corridor in Cornelius;
- divis_20_39_corr (dummy): 1 for location between 20th and 39th along the SE Division corridor;
- glis_48_72_corr (dummy): 1 for location between 48th and 72nd along the NE Glisan corridor;
- kruse_corr (dummy): 1 for location along the Kruse Way corridor in Lake Oswego;
- lwr82nd_corr (dummy): 1 for location along the Lower SE 82nd corridor;
- lwrlomb_corr (dummy): 1 for location along the Lower N Lombard corridor;
- mclough_corr (dummy): 1 for location along the SE McLoughlin corridor;
- outse_div_corr (dummy): 1 for location along the Outer SE Division corridor;
- outerse_stark_corr (dummy): 1 for location along the Outer SE Stark corridor;
- pachi_tig_corr (dummy): 1 for location along the Pacific Highway corridor in Tigard;
- sellw_13_corr (dummy): 1 for location along the 13th Ave corridor in Sellwood;
- tvhi_corr (dummy): 1 for location along the Tualatin Valley Highway corridor in Beaverton/Aloha/Hillsboro;

Qualitative Variables: The following variables are meant to model the physical quality of the sample observations, as well as the various types of neighborhood qualities and public investments that may affect enhanced property values based on the literature review.

- n_score (value): Metro's Neighborhood Score for the property;
- _94_const (dummy): 1 if improvement constructed between 1994 and 2000;

- pre_94_const (dummy): 1 if improvement constructed before 1994;
- vac_const (dummy): 1 if property is vacant;
- mfr_zon (dummy): 1 if property zoning is MFR multifamily residential;
- com_zon (dummy): 1 if property zoning is COM or primarily commercial;
- mue_zon (dummy): 1 if property zoning is MUE mixed-use employment;
- pf_zon (dummy): 1 if property zoning is PUB or public facility;
- incomp_zon (dummy): 1 if property use is incompatible with zoning;
- lspeed (log value): natural log of modeled speed for nearest street segment;
- lvolume (log value): natural log of modeled automobile volume for the nearest street segment;
- lhalf_sfr (log value): natural log of number of single-family residential dwellings within a half-mile;
- lhalf_mfr (log value): natural log of number of multifamily residential dwellings within a half-mile;
- lfloors (log value): natural log of the number of stories in the building structure;
- conc_brick_struct (dummy): 1 if the primary construction material for the building is concrete or brick typical of low-rise construction;
- steel_glass_struct (dummy): 1 if the primary construction material for the building is a combination of steel, concrete and/or glass typical of mid-rise and high-rise construction;
- renov (dummy): 1 if the property was observed to be recently renovated or remodeled based on Metro staff observation of tax record data;
- deprec (dummy): 1 if the property was observed to have deferred maintenance or dated quality based on Metro staff observation of tax record data;
- bike_racks (dummy): 1 if bike racks are immediately present near the property;
- st_furn (dummy): 1 if street furniture is immediately present near the property;
- street_only (dummy): 1 if the building is parked only on-street;
- struct_park (dummy): 1 if the building is primarily parked by internal structured parking;
- trad_design (dummy): 1 if Metro staff observed traditional design in the property;
- _lanes (dummy): 1 if the primary road near the property has more than two lanes;
- two_way (dummy): 1 if the primary roadway near the property has two-way traffic;
- left_turn (dummy): 1 if the primary roadway near the property enables left turns;
- street_front (dummy): 1 if the building directly fronts the sidewalk/roadway or has minimal but pedestrian-friendly/landscaped setback from the sidewalk;
- sidewalk75 (dummy): 1 if Metro staff observed sidewalks in more than 75% of the property's surrounding area;

- trees50 (dummy): 1 if Metro staff observed street trees planted on more than 50% of the area surrounding the property; *and*
- cul_de_sac (dummy): 1 if the property access is via a suburban/cul-de-sac street layout as opposed to a grid pattern.

Linear regression

Number of obs	1346
F(52, 1289)	.
Prob > F	.
R-squared	0.8961
Root MSE	.3384

lrmv	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
pearl_dist	(dropped)					
clack_center	(dropped)					
gresh_center	-.6995432	.8227902	-0.85	0.395	-2.313698	.9146116
happyv_cen~r	(dropped)					
hills_center	.2522438	.8589919	0.29	0.769	-1.432932	1.937419
tanasb_cen~r	-.2563281	.9570467	-0.27	0.789	-2.133868	1.621212
centrale_c~r	-.8268383	.4231055	-1.95	0.051	-1.656889	.0032126
_148_burn_~r	-.1513192	.8980519	-0.17	0.866	-1.913123	1.610485
alberta_corr	-.1143948	.5876596	-0.19	0.846	-1.267269	1.038479
allen_beav~r	-.1329063	.932286	-0.14	0.887	-1.961871	1.696058
cornel_corr	-.1527516	.9347463	-0.16	0.870	-1.986543	1.681039
divis_20_3~r	-.3079474	.5114039	-0.60	0.547	-1.311223	.695328
glis_48_72~r	-.1830298	.5439078	-0.34	0.737	-1.250071	.8840118
kruse_corr	-.4486796	1.276574	-0.35	0.725	-2.95307	2.055711
lwr82nd_corr	-.1567235	.9120319	-0.17	0.864	-1.945953	1.632506
lwrlomb_corr	-.3558589	.7209774	-0.49	0.622	-1.770277	1.058559
mclough_corr	-.3351376	.9142534	-0.37	0.714	-2.128726	1.45845
outse_div_~r	-.2755084	.9142546	-0.30	0.763	-2.069099	1.518082
outerse_st~r	-.1122046	.8939294	-0.13	0.900	-1.865921	1.641512
pachi_tig_~r	-1.151555	.856904	-1.34	0.179	-2.832635	.5295241
sellw_13_c~r	-.1563114	.4686772	-0.33	0.739	-1.075765	.7631423
tvhi_corr	-.3600532	.9068029	-0.40	0.691	-2.139025	1.418918
n_score	.7400585	.6649689	1.11	0.266	-.5644816	2.044599
_94_const	.0398098	.0738636	0.54	0.590	-.1050962	.1847158
pre_94_const	-.1590961	.0738685	-2.15	0.031	-.3040118	-.0141805
mfr_zon	.0078116	.0776509	0.10	0.920	-.1445243	.1601476
com_zon	.3472377	.1033889	3.36	0.001	.1444087	.5500667
mue_zon	.0271265	.0871875	0.31	0.756	-.1439185	.1981715
sfr_zon	.3904692	.2829286	1.38	0.168	-.1645818	.9455203
pf_zon	.4131831	.2764975	1.49	0.135	-.1292514	.9556176
incomp_zon	.1163109	.2482876	0.47	0.640	-.3707812	.603403
lspeed	-.1456958	.1455589	-1.00	0.317	-.4312542	.1398625
lvolume	.0331934	.1009487	0.33	0.742	-.1648484	.2312352
lhalf_sfr	.017562	.0997807	0.18	0.860	-.1781884	.2133124
lhalf_mfr	-.002554	.0695471	-0.04	0.971	-.1389919	.133884
lstruc	.851139	.0233696	36.42	0.000	.8052925	.8969856
prim_sfr	-.0605511	.0939444	-0.64	0.519	-.2448517	.1237496
prim_mu_res	.4158853	.0972526	4.28	0.000	.2250946	.6066761
prim_rental	-.1822744	.0903571	-2.02	0.044	-.3595376	-.0050112
prim_retail	.1517426	.1171499	1.30	0.195	-.0780829	.381568
prim_off	.0387783	.1296974	0.30	0.765	-.2156629	.2932195
prim_ind	-.2991658	.1284399	-2.33	0.020	-.55114	-.0471916
lfloors	-.0668457	.0690471	-0.97	0.333	-.2023026	.0686112
conc_brick~t	-.0671165	.0714775	-0.94	0.348	-.2073416	.0731085
steel_glas~t	.1264546	.0797509	1.59	0.113	-.0300012	.2829103
renov	.0375662	.1236163	0.30	0.761	-.204945	.2800774
deprec	.007092	.1066225	0.07	0.947	-.2020805	.2162646
bike_racks	.2243743	.1056774	2.12	0.034	.0170557	.4316929
st_furn	-.1940468	.1225235	-1.58	0.113	-.4344142	.0463205
street_only	-.0185358	.0620328	-0.30	0.765	-.1402321	.1031604
trad_design	.4750167	.6163625	0.77	0.441	-.734167	1.6842
_lanes	.0654083	.0723136	0.90	0.366	-.0764569	.2072734
two_way	.0251285	.0389367	0.65	0.519	-.0512578	.1015148
left_turn	-.0638571	.0525182	-1.22	0.224	-.1668877	.0391735
street_front	-.2005185	.0917735	-2.18	0.029	-.3805604	-.0204767
sidewalk75	-.1188397	.3569071	-0.33	0.739	-.8190223	.581343
trees50	-.1677431	.36265	-0.46	0.644	-.8791921	.543706
trad_grid	.4251297	.218054	1.95	0.051	-.00265	.8529094
cul_de_sac	-.1574	.6302416	-0.25	0.803	-1.393812	1.079012
_cons	6.538009	1.279686	5.11	0.000	4.027513	9.048506

Metro White Paper:

Using hedonic analysis to estimate achievable market rents/prices and a real estate pro forma to estimate additional redevelopment capacity

BACKGROUND

This analysis examines how much additional residential capacity can arise from redevelopment of selected centers and corridors in the Metro region. The 2009 UGR (and MetroScope analysis) estimates that half of today's high density multi-family zoned capacity in the region will go under-utilized during the next 20 years. The analysis indicates that developer costs and market acceptance will be too high a hurdle for the market to efficiently clear. This suggests that if the achievable rents/prices for high-density development forms could be increased, then more of the high-density zoned capacity could be within reach of the market. Our study estimates the value of investing in public amenities; its impact on raising achievable prices/rents for condos and apartments; and on the subsequent market responses that higher prices/rents may produce for residential redevelopment densities. Higher achievable rents allow for a shift in the "highest and best use" equation to favor higher density anticipated redevelopment formats with higher associated residual property values.

The high-density multi-family development form offers the region significant development capacity, but a significant proportion is not accessible to the market either today or in the future. Residential supply in the Metro UGB is based on local zoning in place today. In some areas, zoning is well ahead of market acceptance. Zoning densities are too high and the cost to develop at the minimum density is too expensive for the achievable prices/rents that can be fetched from the market today (or in the future.) Because the market is unable to access this high-density zoning capacity, the UGR has discounted its effective carrying capacity in its 20 year analysis. Ideally, development occurs when markets are allowed to clear such that market preferences, development costs, entitlement rights, and development subsidies (if any) come together at equilibrium market prices. The market clearing price and quantity is set by market participants, that is, buyers (or renters) and sellers (i.e., developers). The analysis reveals that the same conditions prevail for redevelopment which is also hampered by a market that is unable to clear without higher achievable prices/rents and quantities (i.e., densities).

We perform an hedonic analysis to first quantify the value homeowners and renters would pay for the public amenities. Secondly, a pro forma real estate model is employed to determine how additional public investments/subsidies shift price points to allow redevelopment to higher density multifamily projects than otherwise would be produced by the market. This production model approach will yield a range for how much more capacity might be generated when public investments are concentrated in centers and corridors to help stimulate higher density redevelopment opportunities.

This analysis considers how much additional capacity can be gained when the value of public amenities are quantified into a pro forma real estate framework. This framework includes ten

proto-type development forms and estimates the development form which is the most profitable to build. An amenity versus no amenity approach combines the hedonic analysis with the pro forma to estimate whether public investment(s) are indeed enough to shift market clearing to a higher-density development format.

METHODOLOGY

Metro staff contracted with the consulting firm Johnson-Reid to assist in the estimation of the hedonic model. Johnson-Reid has prepared a formal write up of their results.[1] Metro staff has also prepared a brief report describing our independent hedonic analysis. These reports describe the results of the hedonic measurement analysis and form the basis for the real estate price premium employed in the pro forma.

The price premium is employed in the pro forma real estate model to calculate a residual real estate value. The premium adds to the baseline achievable prices/rents. The residual real estate value is an estimate of the maximum acquisition price that can be incorporated into a development while still yielding an acceptable return for the developer. We use the residual real estate value on ten different development forms with the price premium adding to baseline achievable prices/rents. This is the pricing filter employed to screen out potential sites in selected corridors and centers which have the potential to redevelop.

The price premium represents an estimate based on observed sales information, assessor data, and discernible site characteristics gathered specifically from primary data collection sources and compiled into the hedonic modeling data set. The price premium represents the value homeowners and renters are willing to pay for neighborhood characteristics and public amenity investments that have been capitalized into the sales price or value of the real property. Hedonic measurement techniques are used to estimate the price premium from the public amenity items in our study.

The redevelopment screen using the pro forma valuation with the price premium is applied to five selected corridors or centers, including:

- Foster
- Interstate/Prescott
- Gresham center
- Milwaukie center
- Lake Oswego center

We assume ten typical development forms for the pro forma with commensurate achievable prices/ rents, cost of construction, capitalization rates and operating costs. These ten forms are divided into

[1] Please refer to the Johnson-Reid report *Residential Carrying Capacity Analysis* for more detailed information on methodology and assumptions.

two ownership categories: own (condominiums) and rent (apartments/townhomes). There are five building types:

- High rise (FAR =12)
- Mid-rise (FAR = 5.5)
- Type 5 construction over podium
- Type 5 construction with surface parking
- Townhomes/Duplexes

A generalized district-level pro-forma is developed for each of the ten development forms. Highest and best use calculations with and without price premiums applied. Highest and best uses were calculated for each of the five project areas (i.e., centers and corridor locations). The redevelopment screen was used to filter out potential redevelopment sites/acres.

A difference analysis was performed on the potential redevelopment acres that compared what could be the highest and best uses with and without price premiums. The net difference in increased capacity from redevelopment owed to a price premium on public investments was based on redeveloping sites only if the price premium ramped up development to a higher/denser development form as compared to a highest and best use when price premiums were excluded and redevelopment would have occurred at a lesser density development form.

ASSUMPTIONS AND FINDINGS

The hedonic analysis suggests that we can expect a range of public amenities such as improving neighborhood design, streetscape design, adding street car or light rail facilities could impart a **price premium between 5 to 60%** for a center or corridor area. A **price premium of 20% for non-central city locations is more realistic** as it's very unlikely that a suburban center or corridor will have the full set of public amenity investments that has been incorporated into our hedonic equations.[2]

[2] Please review the Johnson-Reid 2010 report *Residential Carrying Capacity Analysis* for more detail on how these price premiums were developed.

Consequently, we assume a 20% premium in our real estate pro-forma analysis for the five study areas. Combining the price premium with district area achievable prices/rents yields these highest and best use estimates for the five locations. These prices are necessarily averages for each district and do not represent any particular site or project. They are generalized representations of highest and best use estimates.

• Foster	$70 per square foot	Type 5 podium rental
• Interstate/Prescott	$70	Type 5 podium rental
• Gresham center	$36	Type 5 surface ownership
• Milwaukie center	$25	Type 5 surface ownership
• Lake Oswego center	$144	Type 5 podium ownership

Also, we have generalized assumptions for the five building types assumed in our pro forma.

Building Type	**FAR**	**Avg. Unit Size**	**Units/Acre**
High Rise	12	850	518
Mid-Rise structured parking	5.5	850	227
Type 5 Podium parking	2	850	87
Type 5 Surface parking	0.6	850	30
Duplex/Townhome	0.6	1200	22

A comparison of highest and best use for each study area indicates only Foster, Interstate/Prescott and Lake Oswego Center having the pro forma market pricing to shift redevelopment forms from a lower density product type (without price premium) to a higher density product (with price premium). The change in density as a result of moving to a higher and better use is 57 dwelling units an acre, or the jump from Type 5 with surface parking to podium parking. The additional density of building at 2.0 FAR and podium parking permit development at 87 dwelling units per acre versus 30 units in our generalized pro forma for the study areas.

Assuming a redevelopment screen of $70 for Foster, Interstate/Prescott and $144 for Lake Oswego Center, we get 28.5 and 63.0 acres of land that could be redeveloped. Additional density which accords 57 more dwelling units per acre and the nearly 92 more redevelopment acres yields an **estimated top-end of about 5,200 more dwelling units** that could be added to the residential supply/capacity calculations.

If the redevelopment screen was tightened to $50 a square foot for the three study areas that saw their theoretical densities rise as a result of the pricing premium, it would result in about 15 acres of possible redevelopment in Foster, Interstate/Prescott or Lake Oswego. **This amounts to about 1,000 more dwelling units as a low end estimate.**

CONCLUSION

The value that households ascribe to investments in public amenities can be measured using statistical analysis called hedonic modeling. This analysis statistically isolates what people are willing to pay to live close to public amenities. People are willing to pay more to have access to public goods, but it is difficult to quantify and measure a public goods underlying value without hedonic statistics. Metro staff, with help from Johnson-Reid, has estimated a price premium of about 5% to 60% that can be attributed to public investments in transportation infrastructure, community and neighborhood design and development of public assets adjacent to corridors and centers in the region. The more likely price premium seems to be about 20% for suburban locations.

This price premium is employed in a generalized district-level pro forma real estate analysis and is used as a screening device that can filter out existing development to pick out potential redevelopment. Ten different development forms are modeled in the pro forma. The pro forma is then capable of estimating which development form can be built given market rents/prices against development and operating costs. A development form emerges as the highest and best use. The residual value from the highest and best development form becomes the filter value for selecting redevelopment sites in our five study areas.

The results from our analysis of the five study areas illustrates redevelopment possibilities and what could be expected as additional realizable capacity that can be traced to higher achievable rents/prices. The price premium is owed to the proximity and access to nearby public investments. People are willing to pay more to be close to these amenities. The higher achievable price/rents permit developers to build apartments and condos at a higher density than otherwise. As a result, we come up with a maximum capacity adjustment of 5,200 dwelling units and a low-end estimate of 1,000 units depending upon our assertion of the price premiums on rents and housing prices in each subarea.