

*Raze-or-Retrofit:
Institutional Influences on Redevelopment for Energy Efficiency*

Sean Shannon Engle

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*Ronald Kasprisin, Chair
Manish Chalana*

*Program Authorized to Offer Degree:
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University of Washington

Abstract

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Sean Shannon Engle

Chair of Supervisory Committee:

Professor Ronald Kasprisin

Department of Urban Design and Planning

Both my Planning (MUP) and Architecture (M.Arch) theses work around the rubric of the Architecture 2030 Challenge and the efforts of the Seattle 2030 District to meet it (2030DC - see <http://www.2030district.org/seattle/>). In taking up this challenge, the City of Seattle and the 2030DC have teamed up with major property owners, property managers, developers, architects and the Integrated Design Lab at UW to target and benchmark existing opportunities in Seattle's commercial building stock for potential deep retrofits and redesign. The goal of both theses is to provide the 2030DC with tools and intelligence that will assist in targeting its program and outreach efforts.

Both the MUP and M.Arch theses examine the behavior of commercial property owners and their propensity to either retrofit their buildings for energy efficiency or raze them in favor of redevelopment. To determine this, in the M.Arch thesis I developed a scoring system that utilizes various algorithms to process publicly available data combined with other data developed locally to derive a score that permits an apples-to-apples comparison of that propensity. The M.Arch thesis reviews these conditions at the building level; cites several case studies, and presents in-depth analysis of a selected commercial building in the Pike-Pine corridor, serving as an example of a typical Seattle property.

The MUP thesis scales the building owner propensity up to the neighborhood and district levels, and investigates the potential impact of development in Major Institutional Overlay (MIO) districts upon properties immediately adjacent to those districts. It applies the scoring system developed in the M.Arch thesis to demonstrate a correlation between proximity to an MIO district and the presence of predictive indicators of redevelopment. Thus, the scoring system can be used to indicate the likelihood of redevelopment in districts adjacent to an MIO district. The MUP thesis concludes with suggested policy changes to MIO districts to reduce the abrupt spatial transitions that are currently evident.

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LIST OF ACRONYMS

<u>Acronym</u>	<u>Element/Word</u>
2030C	2030 Challenge for Planners
2030D	Seattle 2030 District
2030DC	2030 District Committee
400EPS	400 East Pine Street
A2030	Architecture 2030
AIA	American Institute of Architects
AMZ	Amazon.com
ARRA	American Recovery and Reinvestment Act
BASIX	Building Sustainability Index
BBI	Better Buildings Initiative
BCA	Building Code of Australia
BMGF	The Bill and Melinda Gates Foundation
CAC	Citizens Advisory Committee
CCAP	Chicago Climate Action Plan
CCI	Clinton Climate Initiative
CDP	Chicago DeCarbonization Plan
CPDP	Climate Positive Development Program
DPD	Seattle Department of Planning and Development
EPA	U.S. Environmental Protection Agency
EPBD	Energy Performance of Building Directive
E-RIC	Energy-Regional Innovation Cluster
ES	Energy Star
EUI	Energy Use Intensity
FHCRC	Fred Hutchinson Cancer Research Center
FHD	First Hill District
GBCI	Green Building Certification Institute
GGAS	Greenhouse Gas Abatement Scheme
GGHC	Green Guide for Health Care
GHG	Green House Gasses
GSA	General Services Administration
HEB	High Efficiency Building
HMC	Harborview Medical Center
HVAC	Heating Ventilation Air Conditioning
ID	Institutional Development
KCDA	King County Department of Assessments
KGC	Kline Galland Center
LEED	Leadership in Energy and Environmental Design
LEED-CI	Leadership in Energy and Environmental Design - Commercial Interiors
LEED-CS	Leadership in Energy and Environment Design - Core & Shell
LEED-EB	Leadership in Energy and Environment Design - Existing Buildings

LIST OF ACRONYMS

<u>Acronym</u>	<u>Element/Word</u>
LEED-HC	Leadership in Energy and Environment Design - Health Care
LEED-ND	Leadership in Energy and Environmental Design - Neighborhood Development
LEED-SCH	Leadership in Energy and Environmental Design - Schools
LLR	Seattle Link Light Rail
Low-E	Low Emissivity (glass)
M.Arch	Master of Architecture (degree)
MIMP	Major Institution Master Plan
MIO	Major Institution Overlay
MIOD	Major Institutional Overlay District
MUP	Master of Urban Planning (degree)
MUP	Master Use Permit
NABERS	Australian Green Star Program
NGACS	New South Wales Green House Gas Abatement Certificates
NLLR-FH	North Link Light Rail First Hill (station)
NLRB	National Labor Relations Board
NREL	National Renewable Energy Laboratory
REIT	Real Estate Investment Trust
ROI	Return on Investment
RRC	Raze-Retrofit Continuum
SAC	Standing Citizens Advisory Committee
SAVE	Specific Actions for Vigorous Energy Efficiency
SBRI	Seattle Biomedical Research Institute
SCL	Seattle City Light
SF	Square Feet
SMC	Swedish Medical Center
UAE	United Arab Emirates
USCM	U.S. Conference of Mayors
USDOE	United States Department of Energy
USGBC	U.S. Green Building Council
USPAP	Uniform Standards of Appraisal Practice
VMMC	Virginia Mason Medical Center
VMT	Vehicle Miles Traveled
VOCs	Volatile Organic Compounds
WBBA	Washington Biotechnology and Biomedical Association
WW2	World War 2

SECTION .I - INTRODUCTION & BACKGROUND

Section Summary

In order to understand the logic of this thesis and why it is important, one must first understand the background in which this study was formed. The following section looks at the underlying reasons for the creation of the initiatives discussed, the historical background of the initiatives' formation, and what it is they now seek to accomplish. The goals of the initiatives discussed form the basis of the larger questions raised in this thesis.

THE BASIS OF CONCERN: CLIMATE CHANGE

Climate Change is the summary expression that refers to the body of science which has concluded that an increase in overall temperature of the Earth's atmosphere is correspondent to and resulting from the creation of greenhouse gasses (GHG) by human activity. Specifically, that the mass creation of GHGs (predominantly CO₂) resulting from various human activities is in and of itself the primary cause for the changes in the global climate and associated weather systems.

Members of the scientific community are consistent in their agreement that while there have been fluctuations in Earth's atmosphere CO₂ content, the period coinciding with that of the Industrial Revolution to present day has witnessed an unprecedented increase in the gas. Subsequently, many of the dramatic changes to the Earth's atmosphere have been attributed to the increase in GHGs.

BUILDINGS AS A MAJOR CO₂ SOURCE

Traditionally, the sources of greenhouse gases were divided among the various segments of economic activity, and their associated consumption of energy arising from fossil fuels. Data from 2004 clearly shows that transportation and industrial sources accounted for the majority of the energy consumed in the US, followed by commercial activities (Figure 1.1).

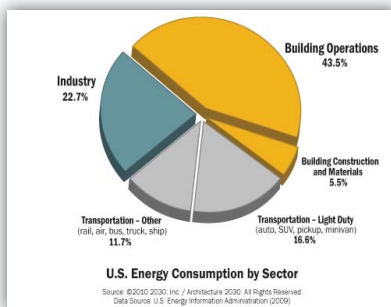


Figure 1.1 – US Energy Consumption by Sector Source: Architecture 2030

In 2009 however, this data was re-categorized, focusing on the point sources rather than the various economic segments, revealing for the first time that

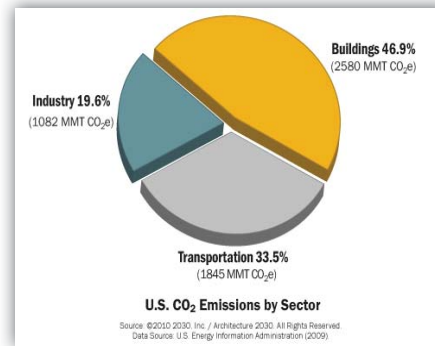


Figure 1.2 – US CO₂ Emissions by Sector Source: Architecture 2030

commercial buildings (regardless of their use) were responsible for the majority of greenhouse gases, followed by transportation and industrial activities, respectively (Figure 1.2). This change was significant because it permitted an approach in seeking the sources of Global Warming that focused on the specific contributor, rather than the type of activity it was engaged in.

The 2009 study also found that the buildings, including the creation and shipment of the materials which go into their construction, account for 46.9% of the CO₂ emissions within the United States – more than that of industry (22.7%) or transportation (27%).¹

Moreover, it revealed that more than three quarters (77%) of the electricity produced in the United States is dedicated to the operation of the buildings in which we live and work alone. That amount is far greater than that used by both industry (23%) and transportation (1%), and thus has become the focal point of

1 Architecture 2030. (2009). "Buildings Consume More Energy Than Any Other Sector." Retrieved July 4, 2011, from http://architecture2030.org/the_problem/problem_energy.

attention.

OTHER PATHS: RATING, MONITORING & REDUCING

This section looks at alternative paths of development than those which we've discussed. Specifically, it looks at a number of schemes currently (or recently) active within the United States, Europe and Australia to make buildings more efficient and reduce the level of GHG emissions.

Energy efficiency efforts in most countries have historically fallen into two major camps:

- Performance Based
- Design or Asset Based

Performance-based energy plans are more common outside the United States, in that they are derived from the actual environmental performance of the building in question, and not from its potential performance. In Europe, this typically meant that the utility supplying the energy would also provide the regulatory body with the energy use data, and then the law could be applied, dependent upon the goals of that country.

Design or asset-based energy plans are also common, both in the United States and elsewhere and are instead focused on the designed energy rating or the potential level of energy efficiency that building (or auto, consumer product, etc) might be capable of achieving.

Both approaches have shortcomings, both relating to the application of efficiency (described by the rating) the building receives. In the case of performance-based rating, the data lags behind the construction and sale of the building, and cannot be verified until a few years after the building has been occupied. Design or asset-based ratings have the reverse problem: while the rating is derived from a calculated potential to be efficient, and is useful in planning, marketing and selling the property, the building may or may not actually be capable of achieving those goals.

The Europeans, Australians, and Americans have all drawn up energy efficiency plans in recent history. While not an exhaustive survey, major movements in energy efficiency cited here serve to illustrate the means of implementation that were used to achieve those goals. And, while a great deal of similarity

exists among the countries and their plans for efficiency, as we'll see, much of the deployment and actual resulting performance from those policies are actually more closely tied to the legal and regulatory framework of the programs - including the disclosure of energy usage (as the Seattle 2030 District, coming up, leverages). For a complete discussion of the European, Australian and American to draft energy efficiency plans, please see "Appendix 4.0 - Energy Monitoring Programs" on page 80.

The Seattle 2030 District

The Seattle 2030 District (2030D) is a public-private partnership of property owners, property managers,

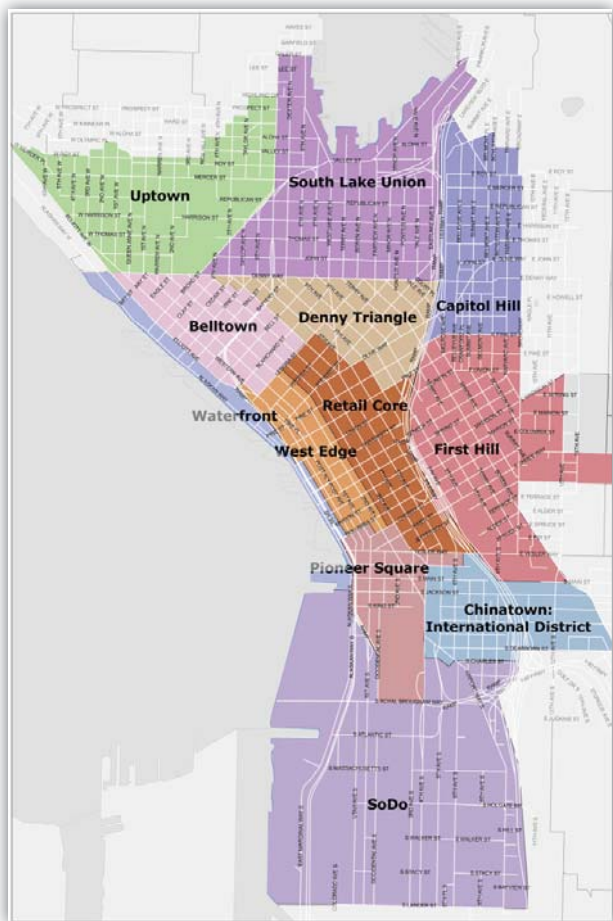


Figure 1.3 – Seattle 2030 Districts.
Source: Seattle 2030 District

city planners, utilities, designers and developers brought together for the purpose of improving the efficiency of the Seattle commercial building stock. Geographically, the 2030D is actually a conglomeration of 12 smaller sub-districts, each comprising a

discreet portion of the city of Seattle city core, and matching more or less the existing neighborhood or city-district boundaries (Figure 1.3).

In 2009 Seattle architect Brian Geller, inspired by the

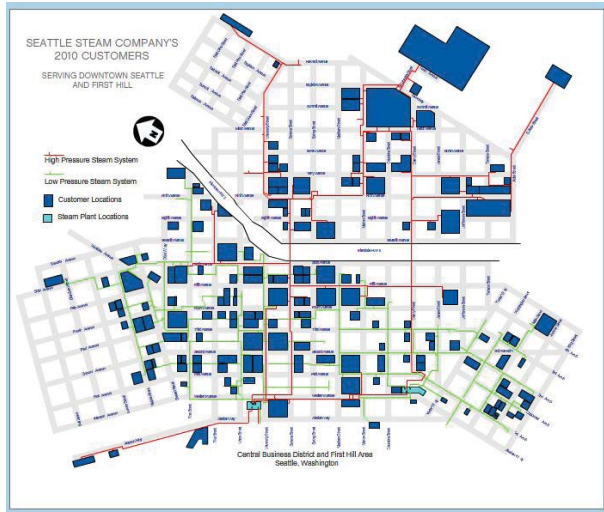


Figure 1.4 – Seattle Steam service map.
Source: Seattle Steam

efforts of the CCAP, the 2030C, and the CDP, noticed that the downtown core was compact enough that district-wide efficiencies might be gained. Using a modified version of the Seattle Steam Service Area Map Geller hosted a series of meetings with most progressive property owners and management companies in the city to gauge the degree of mutual interest in a public-private partnership to create the most efficient district of commercial buildings in the country, and to reduce Seattle’s carbon footprint to 2030C standards (Figure 1.4). Encouraged by the response of the stakeholders, Geller began to assemble what would eventually become the 2030D.

By December of 2010, the 2030D had gathered the support of major stakeholders in Seattle’s downtown, including major property holders and managers, the City of Seattle, the Mayor of Seattle, the Seattle City Council, major utilities and members of the energy efficiency community. By the end of that year, Letters of Commitment were signed and the group Mission Statement was formally released:

“The Seattle 2030 District Planning Committee (the Committee) is an interdisciplinary public-private collaborative working to create a ground breaking high-performance building district in downtown Seattle.

With the Architecture 2030 Challenge for Planners as the foundation for the Committee, we seek to develop realistic, measurable, and innovative strategies to assist district property owners, managers, and tenants in meeting aggressive goals that reduce environmental impacts of facility construction and operations. These collective efforts will establish the District as an example of a financially viable sustainability focused private sector driven effort that maximizes profitability and prosperity for all involved. Through collaboration among diverse stakeholders, leverage of existing and development of new incentives and financing mechanisms, and development and communication of shared resources, the 2030 District seeks to prove the business case for sustainability. Property owners will not be required to achieve the goals of the District by legislative mandates, or as individuals. Rather, this type of goal achievement requires sharing of resources and ongoing collaboration to make high-performance buildings the most profitable building type in Seattle.²

- The goals of the Seattle 2030 District fall within six areas:
- For existing buildings and infrastructure improvements:
- Energy Use: minimum 10% reduction below the National average by 2015 with incremental targets, reaching a 50% reduction by 2030.
- Water Use: A minimum 10% reduction below the National average by 2015, with incremental targets, reaching a 50% reduction by 2030.
- CO₂e of Auto and Freight: A minimum 10% reduction below the current District average by 2015 with incremental targets, reaching a 50% reduction by 2030.³
- For new buildings, major (or deep) renovations and new infrastructure:

2 Seattle 2030 District (2009). Seattle 2030 District Planning Committee - Information Sheet.

3 Northwest Energy Efficiency Council (2010) “Seattle “2030 District” Takes Shape.”

Section .I - Introduction & Background

- *Energy Use: An immediate 60% reduction below the current District average by 2015 with incremental targets, reaching a 50% reduction by 2030.*
- *Water Use: An immediate 50% reduction below the current National average.*
- *CO₂e of Auto and Freight: An immediate 50% reduction below the current District average”*

2030D functions as an informational clearing house for property owners, developers and city government in Seattle. Utilizing data on national energy use (by sector and building type), the 2030D is establishing foundational benchmark data by obtaining current statistics as a result of teaming with building owners, Seattle City Light (SCL) and the City of Seattle Department of Planning & Development (DPD). By establishing benchmarks and then following up on a monthly basis, building owners and other stakeholders can monitor the increased energy efficiencies gained.

“The Seattle 2030 District committee strategies include:

- *Inviting those who are already benchmarking their properties and/or already taking proactive steps to reduce energy use to join.*
- *Engage building owners and users in a collaborative district and develop elegant strategies and solutions to increase building performance.*
- *Map buildings for which current data exists.*
- *Develop common metrics for all buildings, considering EB Portfolio Manager and the Seattle Climate Partnership Carbon Footprint Calculator as good starting points.*
- *Create a mechanism to reward good performers and to help poor performance improve.*
- *Create a next step for property owners to follow after benchmarking their building in PortfolioManager for the City disclosure requirement.*
- *Create an “economic development umbrella” for participants.*

- *Investigate funding/financing possibilities to support goals and strategies”⁴*

(Seattle 2030 District)

In April 2011, the 2030D was funded by a \$454,000 grant from the Environmental Protection Agency (EPA) Climate Showcase Communities program, with another \$225,000 coming from in-kind member contributions effectively funding operations through the end of 2013. Following 2013, it is planned for 2030D to have developed sustainable funding strategies to support its operations going forward.⁵

During 2011, 2030D began the process of creating an organizational framework, and then developed strategies for training building managers to use the EB Portfolio Manager to track the buildings energy efficiency/performance. The City of Seattle will also begin meeting with approved Energy Service Contracting companies (ESCOs) to develop Energy Efficiency Contracting Packages which will comply with the 2030D reduction targets, and DPD will be developing methods of streamlining the permit process, among other things.⁶

How does 2030D differ from the Chicago plan?⁷ There are a number of differences between the establishment of 2030D and the CCAP:

- The 2030D is a public/private partnership: The 2030D is not a part of the Seattle City or Washington State governments. The approach taken by 2030D toward energy efficiency and the building owners is one of information sharing and encouragement, not a mandated, top-down approach (although the disclosure ordinance and state law gives it teeth).
- The 2030D achieves energy efficiency with cost

4 Seattle 2030 District (2009). Seattle 2030 District Planning Committee - Information Sheet.

5 Environmental Protection Agency. (2011). “Activating the Seattle 2030 District.” Retrieved July 01, 2011, from <http://www.epa.gov/statelocalclimate/local/showcase/seattle.html>

6 Seattle Department of Planning and Development. (2011). “Seattle 2030 District.” Retrieved May 1, 2011, from <http://buildingconnections.seattle.gov/2010/06/30/442/>.

7 See “Appendix 4.0 - Energy Monitoring Programs” on page 80 for a full description of the Chicago Climate Action Plan.

effective methods: Many of the 2030D methods of achieving energy savings comes from no- or low-cost measures such as retro-commissioning all the way up to deep building retrofits. The savings resulting from lower energy costs after the retrofit, translates back to the cost of the retrofit itself.

- The 2030D works within existing (and new) ordinances: The functional nature of the organization is that it operates within a space that the law/ordinance itself has dictated, and provides an interface to the private sector which would otherwise have to be filled by the public sector. The laws however, also give the organization legitimacy to operate within the public-private gap.
- The 2030D encourages the development of local commerce: Because the majority of retrofitting is paid for by the expected savings from lower utility bills, the 2030D actually increases the likelihood of creating new businesses as a result of their combined knowledge in the areas of design, retrofitting, technologies and construction. City analysis shows that more than 150 jobs have been created by the existence of this disclosure ordinance alone.

The 2030D will serve as a model of public-private cooperation: The 2030D serves as an opportunity to showcase those properties which have become more energy efficient. Utilizing tools such as the efficiency dashboard, 2030D has the capability of putting a positive spin on the experience, thus encouraging other owners to join in the effort. Without the 2030D, the effort would remain a ordinance-enforcement issue between DPD and property owners.

SUMMARY & APPLICATION TO INDIVIDUAL BUILDINGS

This section has outlined in very broad terms the overall goals of the 2030DC, as well as the foundational issues underpinning them. It has touched on the efforts of the Europeans and Australians at addressing these issues which impact the built environment in all nations, and pointed toward other American efforts to achieve the same results.

In seeking to increase the amount of highly efficient commercial buildings in Seattle, the 2030DC has undertaken an effort which will require the reader to possess an understanding of various aspects of building ownership and motivation and the construc-

tion methods and materials of the buildings themselves.

The issues surrounding the physical nature of highly efficient buildings, and the question of their (potentially) higher value have become a lightning rod of controversy in the last few years as efforts such as LEED and the sustainable building movement have gain momentum. Because of this, understanding the task that lays before the 2030DC requires the reader to have an understanding of the fine details involving building construction and its subsequent value.

The next section examines common considerations made in the construction of modern commercial buildings, and the elements therein. The section will look at the actions and motivations of the owners of these types of buildings, and the construction components and principles needed to actually fulfill the goal of becoming a highly efficient building.

SECTION .II - COMMON GREEN BUILDING CONSIDERATIONS

Section Summary

This section explores the components of the high efficiency building (HEB), both in the form of new construction, and in common retrofit scenarios. This section is not intended to be a complete survey of all the options of the design and construction of a HEB (nor a complete survey of all of the possible), but rather to provide the reader with a base understanding of the core components typically found in new buildings, as well as some of the techniques commonly used in retrofitting a building for energy efficiency.

THE HIGHLY EFFICIENT BUILDING: RETROFITS & NEW

HEB - New Construction

New construction is more of a straight-forward proposition when considering the creation of an HEB (extend discussion here - talk about AHSRAE standards increase and Seattle Energy Code improvements).

HEB - Retrofits

Retrofitting an existing structure for energy efficiency can be, depending upon the building to be retrofitted, either a fairly straight forward process, or one that is difficult and limited in its potential effectiveness. However, since even in the positive economic climates only a small percentage of existing commercial building stocks are replaced each year, the consideration for retrofitting existing stocks is critical.

There are four primary components in retrofitting existing building stocks, and five major barriers to doing so.¹ The major components are:

- Improved Building Insulation
- Higher Heating and Cooling Efficiencies
- Energy Efficient Lighting
- Reduced Plug Loads

These major components seem quite straight forward as presented above, however when considering improving these areas in a wide variety of existing building stocks, the barriers can become numerous:

- Financial Considerations
- Disconnect Between Costs and Benefits
- Lack of Knowledge and Experienced Workforce

¹ Tobias, L., and George Vavaroutsos et al (2009). Retrofitting Office Buildings to be Green and Energy-Efficient: Optimizing Building Performance, Tenant Satisfaction, and Financial Return. Washington D.C., Urban Land Institute. p.6

- Increase in Risk and Uncertainty
- Ignoring Small Opportunities for Conservation

The task of retrofitting the major components (above) into buildings controlled by owners with the types of barriers to doing so (above) is difficult enough. When multiplying this task against the myriad of building types and conditions, each of which have a profound impact upon the potential success of the project (and thus upon the willingness of the owner to do so), the entire process can become intractable. In seeking a way in which to locate a viable path to identifying candidates for retrofitting, one must first understand first the issues driving the motivations of the owner(s), and then also the general types of technology and principles utilized in developing an HEB - regardless if new or retrofit.

Motivations & Inhibitions in Green Construction

People purchase developed commercial property for a variety of reasons. The reasoning leading up to the time of purchase may dictate in many respects the reaction that the owner will have when faced with the decision to raze or retrofit a property holding for additional energy efficiency.

The following scenarios outline some of the possible motives that owners have in purchasing, holding and selling commercial property - those which directly impact the decision of whether or not to retrofit.

Long Term Investment

Long-term Investment in commercial real estate provides probably what is the best scenario for the possible retrofit. If a property has been purchased with the intent of holding it for the long term (defined as at least 15 to 30 years), then many of the retrofits being considered are more likely to be considered financially feasible.

For instance, the retrofitting or the upgrading of a building's heating system may have capital costs in excess of \$100,000 or more, stretching the potential

payback time from energy savings out to 15 years or more. If the building's owners are committed to holding the property for a longer period, then the likelihood of a more aggressive retrofitting schedule going forward is much greater.

Uncertain Economy

Owners who are holding property because of an uncertain future are also a typical scenario, and as of this writing, a very common phenomenon in our current economic climate. Owners (and purchasers) will hold back on committing themselves to selling (or buying) property when the overall economy is in turmoil due to the added difficulty in financing and the risk of assuming added liability going forward.

Currently, the US and UK are undergoing a contraction of this type, wherein both buyers and sellers are holding back on purchasing/selling property due at least in part to the unknown future, and the potential for losses of their investment.²

Simple Income

Often owners will obtain, purchase or otherwise come into ownership of properties which are held in their families, are willed or ceded to them, or via other methods of acquisition. In some cases, such properties come with existing tenants, and thus a dependable stream of revenue. In these cases, the revenue is the attraction of holding the property.

In such cases, depending upon the long term intentions of the owner, retrofitting for energy efficiency may or may not be of interest, as often it is the tenants themselves who pay the utility bills, and thus the owner has little incentive to invest his own money into a building for which he would have difficulty justifying a rental increase especially for an existing tenant, who is already providing an income stream.

Changes in Regulations

Often owners will hold property and not improve it and not sell in the hopes of existing regulations (most often zoning, height or use restrictions, etc) changing. Most often this scenario is played out in an expanding economy, wherein an owner believes that his property will increase in value as a result of regulations that loosen restrictions of use on his property. This was seen in Seattle in 2005 when the owner of the old

Broadway QFC site refused to develop his vacant property until the City revised the height limit, thus making his project more profitable.³

Short Term Increase Value of Property

Owners who are interested in purchasing commercial property solely for a short term gain in the property's value are commonly found in very active real estate markets or in other locations where property is expensive and/or scarce.

In these kinds of purchases, the owner of the building is usually not interested in holding the property long enough for a return on a light or medium retrofit. If the retrofit is more substantial, such as that found in deep retrofits, and the added capital costs are considered a necessary component to reselling the property at a higher cost, then a retrofit is likely to occur.

Decreasing Value & Obsolescence

In some cases, properties are held and leased out for as long as possible without major upgrades or retrofits, and the majority of changes to the building come from tenant improvements. At some point however, the building degrades to such a degree that it is no longer leasable, and it begins to sit vacant.

At this point, the owner may decide to sit and wait for a redevelopment plan to be developed and simply pay the taxes on the property in the meantime. This scenario can occur concurrently with the waiting for regulations scenario above, or (more often), the wait is simply a product of the owner putting a new project together that makes sound financial sense.

ARE HIGH EFFICIENCY BUILDINGS WORTH MORE?

Much of the debate surrounding green building, energy efficiency retrofitting and high efficiency buildings is the notion that structures which comply with the general principles discussed earlier are often valued more highly than the standard, non-green comparison. Is this true?

In this section, we will explore some of the current thinking on green building and address the question of high efficiency buildings being worth more.

2 Unknown (2011) "Uncertainty over jobs and economy puts property market on hold." urbanpad.co.uk.

3 For an full description, please see "Appendix 2.0 - Anatomy of Need: The Revitalization of Broadway" on page 76

Evaluative Financial Models - Property Value vs. Improvements

The question asks whether there is a linkage between the principles of sustainable development and the market value of any given building. Traditionally, market value of any property is determined by the outcome of a series of exhaustive studies aimed at ascertaining the relative demand value for any piece of property.⁴

To achieve this, three types of evaluative assessments are run against the property in question, and in doing so, a large amount of data collection must be done; including market studies, land analysis, site analysis, improvement analysis and the determination of best/highest use for the property and project located there.

Cost Approach

The cost approach to determining the relative value of a property is simply the concept that all market participants relate value to cost. Often used where there is little real estate activity and few transactions to compare the property to, this cost approach utilizes concepts such as functional depreciation, condition and other technical measures to arrive at a value.

Because most of the sustainable features discussed within the context of this report have longer time horizons, it would be difficult to use this approach to evaluate energy efficient properties.

At a minimum, one would need to consider issues such as what materials were used, and how they might eventually impact the value of the project; and if the use of sustainable projects alter or extend the rate of depreciation and eventual building obsolescence.

Sales Approach

A much more common and well used method to determining value is the sales approach. In the sales approach, the property in question is compared to other, similar properties which were recently sold or are for sale during the same period. Unfortunately, the number of green, high efficiency buildings is still relatively small, making such comparisons difficult to undertake. Moreover, the standards assigned within

4 Chappell, T. (2009). High Performance Green Building: What's It Worth? Investigating the Market Value of High Performance Green Buildings, Cascadia Foundation; Vancouver Valuation Accord; Cushman & Wakefield., pp.14-18

the components of green building have yet to be fully established, and thus, in the aggregate are very difficult to evaluate - just within themselves.

For example, since LEED certification is achieved somewhat differently project to project, two similar buildings can achieve the same certification through two different routes of obtaining points and can use differing product which may or may not have the same basis as "sustainable"; the certification itself is not a basis of financial comparison.

Issues, at a minimum, to be considered with this approach include the different features that a sustainable, highly efficient building would offer; whether a tenant would be willing to pay more for them; if the sustainable features will impact the marketing effort; and finally, what the physical differences are between the sustainable building and those in the market being compared to it.

Income Capitalization Approach

When a project is valued by determining the current value of benefits which will occur in the future as the property is utilized, then the income capitalization approach is used. This "...approach incorporates concepts such as life cycle cost analysis and other methodologies to appropriately compare components and assess performance over either the life or holding period of an investment ...(which is) ...necessary to provide a true and accurate indication of value."⁵ Since this model of valuation utilizes future performance of the project, it offers the most accurate and dependable approach for valuing a highly efficient building.

Issues to be considered with the income capitalization approach include the leases; to whom the benefits will accrue; how quickly the building leases out; tenant retention; downtime between leases; maintenance costs; and the associated overall risk (taking all the other issues into account).

There is not a requirement for one of these approaches to be used in lieu of another. The Uniformed Standards Appraisal Practice (USPAP) only requires what is considered "most appropriate" for any particular valuation.

In the end, the issue of whether or not highly energy efficient buildings are worth more is a question which ultimately will be left to the market place. Early indica-

5 *ibid*, pg. 33

tions however seem to show that indeed, the very sustainable qualities that the buildings possess (those which can be monetized) provide a glimpse into the added value that such structures have over their more conventional counterparts.⁶

COMMON COMPONENTS & PRINCIPLES OF THE HEB

Some of the most common components and principles found in HEBs, and many of the issues relating to each of them are discussed in Appendix 5. This list is not exhaustive, and like the discussion of building efficiency itself, the components that might be found within any HEB are likely to reflect the particular circumstances of that project or site. For additional information, please see “Appendix 5.0 - Green Building Considerations” on page 90.

6 Ceres Corporation (2009). Energy Efficiency and Real Estate: Opportunities for Investors, Merck Family Fund. p.7

SECTION .IIb - INSTITUTIONAL DEVELOPMENT & INFLUENCE ON ADJACENT PROPERTIES

Section Summary

This section explores the concept of institutional development as it relates to the construction or retrofitting of the HEB. This section is intended to show the causal links between the development and maintenance of such buildings, and the attraction and retention of city institutions which contribute heavily to the local economy.

ECONOMIC AND INSTITUTIONAL DEVELOPMENT

Economic Development

Seattle, like other cities in the United States, regularly works to attract new businesses and the revenue and jobs that follow them. Cities and states have always sought to attract income-producing companies and retain those it considered important players in the local economy and culture, so the concept is not a new one.

In the most recent decade, the biotech industry has seen an explosion of growth and a corresponding increase in state and municipal efforts to begin or enhance a "biotech cluster". In Seattle, the redevelopment of the South Lake Union District (SLU) was viewed as a prime opportunity to attract new businesses of this type.

Because of the growth of biotech popularity among economic development professionals, it is being utilized here to demonstrate how a single industry can impact a city economy, and thus the transformation of its new and existing building stocks.

Seattle's Biotech Industry

In 2002, the Washington Biotechnology and Biomedical Association (WBBA) defined the rapidly growing biotech industry in Washington State with its report *Biotechnology and Medical Device Industry in Washington State: An Economic Analysis*. That report cited more than 190 biotech firms - at that time - and more than \$1.5b in research and development funding which was already present in Washington State. It was estimated that the multiplier ratio from one biotech employee was 2.23 - meaning that for every biotech employee, another 2.23 would be created to support them.

The report found that the state had more than exceeded critical mass needed to acknowledge the industry as its own and urged the state, county and city governments to consider creating a public-private partnership in order to further the industry. Among the recommendations were:

- Promote the state as a place for biotechnology and medical device research and manufacturing.
- Develop a formal liaison between the industry and the state's legislative and executive branches.
- Solicit a three-way partnership between the state, industry and university in creating institutes for science and innovation.
- Improve the structure for commercializing innovation, including skilled staff in licensing and physical facility to serve new ventures formed from the initiative.
- Address the issue of high cost of doing business in Washington as an obstacle to growth.
- Revisit the state's existing program of research and development credit and tax deferrals for the biotechnology and medical device industry.
- Encourage the development of an early-stage venture capital fund for Washington-based biotechnology and medical device companies.

(Huckell/Weinman Associates 2002)

This report was largely the formal establishment of policy for the industry and the state. As early as 1981, when Zymogenetics was founded on the



Figure 2.5 – Dendreon headquarters, downtown Seattle. Source: Cushman-Wakefield (<http://winnrichey.lisinglab.com/prop1906/>)

shores of Lake Union, and biotechnology had slowly been gaining a foothold; by 1994 companies such as Dendreon of California (makers of the prostate cancer treatment Provenge) would also be relocating to Seattle (Figure 2.5 on page 10 and Figure 2.6) .

By 2005, Washington Governor Christine Gregoire established the Life Sciences Discovery Fund from the tobacco settlement fund. The state-based fund committed \$350 million to life science research over a ten year period. During 2008, the life science industry generated \$6.4 billion in revenues for the State of Washington, with more than 22,000 jobs. In Seattle alone, there are more than 7,600 people employed in 55 biotech/life sciences companies, and the effort to grow this field further continues.

Economic Impact of Health Care Delivery

The population phenomenon known as the Baby Boom helped to ignite what many view one of the few areas of current economic growth in the United States: healthcare delivery. Occurring as a result of the population spike from 1945 to 1964, the United States currently expects the retirement of 69.4 million Americans by 2030, up from 35.5 million in 2000. As a result, expenditures, costs and associated investments in the healthcare delivery industry have increased dramatically.

Healthcare delivery is a catch-all for the "...diagnosis, treatment, and prevention of disease, illness, injury, and other physical and mental impairments in humans. Health care is delivered by practitioners in medicine, chiropractic, dentistry, nursing, pharmacy, allied health, and other care providers. It refers to the work done in providing primary care, secondary care and tertiary care, as well as in public health."¹ Healthcare delivery often also refers to elder care, including rehabilitation and nursing facilities.

While a great deal of controversy surrounds the implications of the rapid growth of the healthcare delivery industry (specifically who is funding it, and if it is another "bubble" economy about to burst), there can be little doubt that nearly every city and state in the country has made economic development efforts to attract elements of this industry, and retain those they already have. In Seattle, we are no different.

INSTITUTIONAL DEVELOPMENT: THE MIO DISTRICT

Seattle maintains a Major Institution Overlay (MIO) designation for those organizations it considers to be critical for the economic, cultural and/or social life of the city. Overlay designations are little more than special zoning allowances, assigned to a particular

¹ Wikipedia. (2011). "Healthcare Delivery". Retrieved March 03, 2011, from http://en.wikipedia.org/wiki/Healthcare_delivery.



Figure 2.6 – ZymoGenetics building (former Seattle City Light #1 power plant) as seen from Lake Union. Source: <http://www.cochraninc.com>

institution to allow it to operate or develop in ways than would otherwise not be allowed by the underlying zoning.

Such overlay zoning (often referred to as an overlay district) is specific in its application, requiring the recipient organization to adopt a Major Institution Master Plan which: 1) identifies geographic boundaries within which the revised rules will apply, and 2) identifies the specific rules which will apply to development within this boundary. The overlay attempts to balance the needs of the institution with the needs of the surrounding neighborhood, retaining the quality of both in the process.²

The City of Seattle, through the Department of Planning and Development, has established thirteen overlay districts for major medical and educational institutional organizations in the area, including three to be discussed in this report: Swedish Medical Center, Virginia Mason Medical Center and Harborview Medical Center.

The MIO districts were established by Seattle Land Use Code Section 23.69.032, which requires the applicant organization to develop a long range Major Institution Master Plan (MIMP) which stipulates the zoning rules which apply to the organization, identifies a long-range plan for the development of the institution's property and a transportation management plan that is intended to reduce single occupant vehicle use.

The MIMP is revised from time to time, dependent upon the actions or requirements of the institution. Revisions the MIMP typically occur when:

- The institution is planning an expansion of its boundaries or a change its development standards established under the plan so as to be less restrictive;
- The existing plan does not permit, or the planned changes exceed the rules of the existing plan;
- The proposed changes include the demolition of more than four residential structures, two residential buildings, or the designation of a building from residential to non-residential.

- The existing development has utilized the total amount of area allowed, thus requiring an increase in the amount within the MIMP.

The on-going monitoring of the MIMP and the actions of the institution operating within it are conducted by representatives of the institution itself, members of the City and members of the community. When changes to the plan are proposed, a City appoints members to the monitoring group, known as a Citizens Advisory Committee (CAC); when the plan has been adopted, the group becomes the Standing Citizens Advisory Committee (SAC).

The CAC participates in the development of the MIMP from the very start, working to mitigate any negative impacts of the suggested changes. The City supports the CAC, and meets with them to resolve differences. When the final CAC recommendation is made on the request for revision to MIMP, it is presented to both the City of Seattle Hearing Examiner and the Seattle City Council for consideration.

The SAC is reformed after the adoption of the MIMP revision - typically a two year process. The SAC meets annually or more, and reviews/comments on the annual report of the institution regarding its development; on its transportation plan; reviews requests for amendments and recommends further action or revision if necessary and provides comments on any plan that might require a Master Use Permit (MUP), a supplemental environmental review or a plan that is subject to any conditional use.

The MIO designation is important because of the degree of influence it creates with the recipient organization. The resulting agreement between the holder of the MIO and the City create an environment that is predictable and can be monitored and controlled to the benefit of the institution holding it, as well as the members of the neighborhood and the City itself. As we'll see in later sections, however, properties directly adjacent to the MIO are often impacted by it - without the oversight of the CAC or SAC.

THE LINK TO ENERGY EFFICIENT BUILDING STOCKS

Impact on New Building Stocks

The linkage between economic and institutional development and the creation of more efficient building stocks is easy to see. The Gates Foundation campus is a significant example of this at the scale of a single building, wherein the very campus is designed, from

² Department of Planning and Development. (2011). "Major Institutions Planning Process." Retrieved April 23, 2011, from <http://www.seattle.gov/neighborhoods/mi/miac/>.

the start, to work with natural sources of light and water in order to reduce the use of fossil fuels. SLU demonstrates this same principle on a neighborhood or district level. There, Vulcan Corporation has worked with designers and developers to create a wider district which will require fewer energy inputs (also through daylighting, geo-sourced heat pumps and rainwater harvesting, among others) than would otherwise be the case.

Under Seattle's 2009 Energy Code (one of the strictest in the United States), new construction must meet a higher degree of energy efficiency than existing construction. The revised code joins more closely with the ASHRAE 90.1-2007, ASHRAE 189.1-2009, and Energy Star standards; more closely dictating the requirements of the building envelope and fenestration. Some of the new requirements include:

- Roofs: revise so that the U-factor criteria are comparable for all classes of roofs;
- Walls above grade: revise so that the U-factor criteria are comparable for all classes of walls but with mass walls slightly higher, revise insulation for metal building walls per ASHRAE/USGBC/IESNA Standard 189.1-2009, revise insulation for other walls per addendum bb to ASHRAE/IESNA Standard 90.1, provide alternate compliance options for otherwise continuous insulation with limited isolated metal penetrations;
- Walls below grade: revise to be no less stringent than the 2006 SEC;
- Floors over unconditioned space: revise insulation for wood-framed floors per addendum bb to ASHRAE/IESNA Standard 90.1;
- Slab-on-grade floors: revise insulation for unheated slab floors per addendum bb to ASHRAE/IESNA Standard 90.1;
- Opaque doors: require insulated doors per new default values in Table 10-6C;
- Vertical fenestration: set maximum baseline prescriptive fenestration area at 30% of the wall area per addendum bb to ASHRAE/IESNA Standard 90.1; revise U-factor for nonmetal framing per ASHRAE/USGBC/IESNA Standard 189.1-2009 and to match 2010 Energy Star criteria, revise U-factor for metal framing by comparable amount, add alternate U-factor

criteria for revolving doors and vestibules, and retain existing 2006 SEC SHGC criteria; and require additional improvements for prescriptive fenestration area in excess of the 30% of the wall area allowed by addendum bb to ASHRAE/IESNA Standard 90.1; require 5-7% further improvement in fenestration U-factor and SHGC criteria and establish minimum VT criteria for 30-40% fenestration area; allow higher U-factor for a limited area of operable vertical fenestration with metal framing;

- Skylights: revise U-factor for skylights without curb per ASHRAE/USGBC/IESNA Standard 189.1-2009, revise U-factor for skylights with curb to match 2010 Energy Star criteria, revise SHGC for all per ASHRAE/USGBC/IESNA Standard 189.1-2009; require 5-10% further improvement in fenestration U-factor and SHGC criteria for 30-40% fenestration area.

(Seattle DPD 2010)

Under Seattle's City Green Building program (also part of the DPD), new construction is encouraged to meet host of requirements, all of which are designed to save energy and add value to the city's building stock as a whole. The program achieves these goals with resources such as:

Design Tools and Strategies - Offering design tools from the US General Services Administration (GSA), and promoting best practice comparisons.

Recognized Green Building Programs - Benchmarking tools and the programs which utilize them are offered, including:

- Energy Star
- The 2030 Challenge
- The Living Building Challenge
- Seattle's Green Factor
- Eco-Charettes
- LEED Standards for Commercial Construction
- Green Guide for Healthcare
- Guide for Green Tenant Improvements

The changes to the Seattle Energy Code ensure the improvement of new building stocks going forward,

yet they have little impact on the existing structures which are still in use, and/or have not had a major upgrade in a considerable amount of time.

Impact on Seattle's Building Stock


The question of the degree of impact upon those building stocks within close proximity of major development, whether near the Gates Foundation, those in South Lake Union (SLU) or other areas, is obvious; it is total. When growth in a particular area occurs very rapidly, there is greater likelihood of existing structures immediately adjacent to that growth will themselves be razed and redeveloped (rather than retrofitted) due to the sudden increase in property values and potential business activity.

the case of SLU, the neighborhood contains many remnants of its working past as a center for light industrial use. There are a number of buildings from the 1920s and 1930s, with good examples of post-and-beam construction and details such as terra cotta, fine brick patterns and older multi-pane industrial windows.

Depending upon the kind of redevelopment that is being undertaken (SLU is primarily mixed-use with offices, although more than 35% has been developed as life sciences/research space), and the adaptability of the existing building stock, adaptive reuse may or may not be possible with some percentage of the structures.

In

**Icogenex Biotech Incubator
Space Available for Lease**



454 North 34th Street
Seattle, WA

For more information, please contact:


icogenex™

[Icogenex Corporation](http://icogenex.com)
Gale Hoekstra
Director of Operations
Phone: (206) 545-2676
E-mail: info@icogenex.com

Full service laboratory and office incubator space is available for sublease. Ideal for small biotech companies or startups, individual lab benches and secure office space may be rented with short- or long-term lease options. Laboratory lease terms include the use of basic molecular and cell biology laboratory equipment, as well as glass wash and janitorial services.

Features:

- Standard laboratory bench space, including power and shelving.
- Tissue culture hoods and incubator space.
- Chemical fume hoods.
- Access to large equipment including centrifuges, microscopes, -80 degrees, -20 degrees, & 4 degrees C storage space.
- Access to small equipment including DNA gel boxes and power supplies, vortexers, microfuges.
- Access to copy machine, FAX, conference room, lunchroom.
- Desk or office rental includes internet access via a partial T1 line.



Located within a ten minute drive of the University of Washington, Institute for Systems Biology, Seattle Biomedical Research Institute, PATH (Program for Appropriate Technology in Health), ZymoGenetics, and the Fred Hutchinson Cancer Research center. The facility is located one block from the Burke-Gilman trail in the heart of the vibrant Fremont neighborhood.

Figure 2.7 – Ad for leasable space adapted for use by Icogenex Corporation. Source: Icogenex Corporation

In SLU, some existing spaces have been converted into smaller incubator research spaces, extending the lives of the buildings. An example can be found at 454 North 34th Street in the Fremont neighborhood of Seattle. While not in the SLU district per se, this building is located close by, and is quite similar (to those found in SLU) in both vintage (1980) and construction (masonry).

Built originally as a 12,600 sq ft warehouse, the building was retrofitted by IcoGenex Corporation to be energy efficient, and then repurposed to operate as a laboratory/office incubator space that is "...ideal for a small biotech company or startup; individual lab benches and secure office space to be leased on a short or long term basis." (Figure 2.7 on page 14)

Impact on Existing Neighborhoods - SLU

The impact upon a neighborhood or district from retrofitting or redevelopment is dependent largely upon the scale and scope of the development which has occurred. As we've seen in SLU, where much of the property was owned by a single individual, when redevelopment occurs on a massive scale, the neighborhoods and/or districts may or may not radically change - it's all dependent upon the planning and involvement from stakeholders.

In the 2002 report, Potential Economic and Fiscal Impacts of South Lake Union Development, Paul Sommers, PhD of the University of Washington, wrote that the 1998 Neighborhood Plan for South Lake Union appeared to be on target. That conclusion was based on a 2002 study conducted by Heartland Associates for the City of Seattle wherein the growth in South Lake Union was estimated to be a net increase of 7.2 million square feet of commercial space from a 2000 to 2020 baseline. By the time the 2002 report was completed, more than 3 million square feet of new commercial space had been announced or was under construction.

By 2004, the neighboring Cascade neighborhood had consolidated the Cascade Playground/P-Patch and the Cascade Park was in place in an effort to mitigate any negative impacts from development to its west (in the core of SLU). To the north, the South Lake Union Park was in its planning stages. In the 2004 Comprehensive Plan, SLU was designated an urban center - recognizing significant growth planned for that neighborhood. The 2004 Comprehensive Plan targets SLU to gain 16,000 new jobs and 8,000 new households between 2004 and 2024.

In a March 2011 update report, Mike Mann (policy staffer to former Mayor Greg Nickels) showed that development in SLU exceeded the initial 2004-2010 projections dating from 2002; exceeded job creation projections by 3,200 permanent positions; and tax revenue projections to the city by about \$5 million. The report concluded:

"Between 2004 and 2010, the real estate development activities in Seattle's South Lake Union neighborhood have exceeded the projections incorporated in Paul Sommers' The Potential Economic and Fiscal Impacts of South Lake Union Development report. Since 2004, the assessed value of newly constructed building exceeds \$1.1 billion. In this time frame, the neighborhood has attracted over 13,000 permanent jobs, achieving over 72% of the City's 2024 Comprehensive Plan goal for the South Lake Union Urban Center. This magnitude of construction and economic activity has resulted in an average of \$5 million per year in additional tax revenues to the City of Seattle."

(Mann 2011)

This development impacts the neighborhoods and district not only in income, development, and employment, but also in energy efficiency. Most of the new developments in SLU are either efficient or highly efficient in nature. A few examples:

- Alley 24 - Project by Vulcan and PEMCO - Day-lighting, solar and external blinds control the balance of daylight in the office building over the course of the day. The building utilizes geo-thermal heat pumps primarily, and cooling (when needed) will be provided by under floor air conditioning ducts.³
- Seattle Biomedical Research Institute (SBRI) - Designed by Vulcan as energy and water efficient, this was the first research facility to attain the LEED Silver Certification for the Core and Shell program. The building uses 23% less potable water than industry standards or 186,000 gallons saved annually; the HVAC system for the building has extensive heat and cool air recovery, reducing energy usage by more 30% annually; the interior components

3 Unknown (2004) "Vulcan and PEMCO Start Construction on "Alley 24"" South Lake Union News.



Figure 2.8 – 1200 Madison Street tower under construction (November 2011).
Source: Sean Engle

utilize low volatile organic compounds (VOCs) to improve air quality; large windows and shading devices increase interior daylight and reduce the energy demand.⁴

As SLU continues to grow and change, the older district components (such as the Cascade Neighborhood) will reintegrate themselves - albeit on a new basis with the district centered around Vulcan's development and (now) the Gates Foundation nearby. While there can be no doubt that the redevelopment has changed the SLU neighborhood, only time will tell if those changes are positive in nature over the long run.

Impact on Existing Neighborhoods - First Hill

Like SLU, First Hill is also changing in the face of de-

⁴ SRBI Media Relations (2005) "South Lake Union Research Building Wins National Honor for Green Features." Seattle BioMed.

velopment project - resulting from both institutional and private sector growth. As the three hospitals SMC, VMMC and HMC all grow and expand the face of the district will continue to change - albeit in a controlled, deliberate manner.

The peripheral growth that is occurring in the Madison corridor between Broadway and Boren Street is another matter altogether. The City of Seattle has already recognized this area as one of significant growth, and thus designated it an Urban Village Center, clearing the way for additional growth.

In 1995, the growth of businesses along the Madison corridor slowed, prompting the City to redesignate the zoning on the north side of Madison Street between Broadway and Boren as a Neighborhood Commercial 160'; dramatically increasing the values of the parcels (mostly small, one story commercial strips) that existed there.

Now, as the economy continues to stabilize since the 2008 crisis, development in this part of First Hill has resumed, and a tower crane has been erected at the former one story Bank of America site for a new 17 story mixed-use apartment tower; the first on First Hill in more than 35 years (Figure 2.8).⁵

Additional discussion of this portion of First Hill will be taken up in Section 4b. There, the impacts on the urban design of First Hill and the Madison Street Corridor neighborhood adjoining Swedish Medical Center will be more closely examined.

5 Jones, J. (2011). "Holland Partners starts First Hill project." Puget Sound Business Journal Retrieved April 27, 2011, from <http://www.bizjournals.com/seattle/blog/2011/04/holland-partners-starts-1200-madison.html>.

SECTION .IIIa - MODEL & METHODOLOGY OF RESEARCH

Section Summary

This section outlines the basis for research conducted in the core of this report, and explains why the research will be conducted in that manner. It discusses the multi-level approach to research which will be utilized, and explains how the results will be determined, why they are important and in what manner the conclusions will be made.

STUDY MODEL USED IN ANALYSIS

The model used in this analysis will be largely descriptive, but will also use some database information from the King County Department of Assessments (KCDA) in order to assist in drawing conclusions. The model is comparative in nature, and will examine the role of institutional development on the decision making process of commercial property owners to either retrofit their buildings, or raze them in favor of redevelopment.

Given the highly individual nature of building purchases, retrofits, sales and redevelopment, it is impossible to make absolute determinations on what any specific outcome might be. However, with the information that is available, it is possible to provide an overview of the general influence of factors which will affect the decision making, and thus the potential dispensation of properties.

THE QUESTION

Is there a cohesive or more homogeneous group of property owners - arising from issues involving institutional development (ID) or economic development (ED) - which the 2030 District Committee (2030DC) can focus on when approaching the next major group of building types (after high-rises) in Seattle? How might these parcels and their owners be identified?

- What possible strategies could the 2030DC and the City of Seattle consider when addressing this next largest cohort of commercial property owners?

To answer these questions, this thesis will establish that:

- There exists a relationship between the propensity of a property owner to either fully develop, or fully not redevelop when within a particular proximity to institutional development.
- There exists within existing data sets enough information to uncover some indications of which

properties may constitute a cohort sufficiently cohesive for the 2030DC to consider pursuing it.

- Institutional and economic development can play a role in identifying a potential cohort for the 2030DC to address regarding energy efficiency.

THE RESEARCH METHODOLOGY

Pre-Analysis: District Scale & The RRC

Because this paper builds upon the analysis conducted in my earlier thesis, the choice of city district, the study area and the individual buildings therein will be the same as that selected from the earlier work in order to maintain continuity between the two reports. I have opted to contain my study to these specific buildings, study area and district at the relative levels of discussion, however once the analysis exceeds the district level, the entire 2030D area of interest will be utilized.

The selection of the chosen district were based on a number of factors. Such factors include locating a district which contains: a lack of numerically overwhelming use types; a lack of commercial building types; an absence of any new large scale redevelopment; and one with a potential for a basis of study in the planning thesis.

The primary analysis tool to be used in this report is the Raze-Retrofit Continuum (RRC), developed in the first thesis. The RRC, which will be described in detail later in this section, is a system of building evaluation that utilizes existing data sets in order to return a score that places the building at as position upon a linear continuum. That continuum ranges from negative values to neutral values to positive values, and indicates the degree of likelihood of the owner retrofitting for energy efficiency or razing their property in favor of redevelopment.

Preliminary Analysis: Sensitivity to Institutional Behavior

In order to respond to the questions above, this report will utilize the RRC in conjunction with background detail, to closely examine the study buildings within the study area. Like the peripheral development discussed in SLU in the preceding section, this first analysis will uncover trends in property ownership which will demonstrate the impacts of economic/institutional development upon the decision making with respect to investing additional funds in a property to make it more energy efficient or razing it in favor of redevelopment.

The information which will be utilized for this analysis is primarily descriptive in nature, consisting of tables of data describing various aspects of the buildings located within the outlined study area on the First Hill District of Seattle. This data is contained in a number of tables, and have been joined by combining common fields. The data included in these tables includes: the parcel identification number; the buildings tax assessment account number; the amounts of the most recent property taxes assessed and paid; the name of the tax payer; the address of the tax payer; the amounts of previous payments and value assessments within the last ten years; the current assessed land value; and the current assessed building value.

The analysis will be undertaken by utilizing software including GIS-10 and Microsoft Access to manipulate the data and seek out trends which respond to the questions posed. Specifically, the preliminary analysis will:

- Establish that an apparent relationship exists between the relative location of a property and that of a major institution generally;
- Show that the development plans or apparent development intentions of the institutions and/or city may play a role in the ultimate disposition of those properties (within the context of the study area);
- The goal sought in conducting the preliminary research is to provide a basis of justification for looking property impacts at a broader (district or city) scale, and an understanding of what issues might arise in the immediate urban design of affected areas.

Secondary Analysis: Aggregated Scoring

The RRC will provide a composite of data types which numerically describe the buildings physical characteristics; give some information about its owner; provide an understanding of the behavior the 2011 valuation; and an understanding of the value of both the land and the improvements, over two (averaged) five year periods. While not creating a complete picture of the property, and incapable of doing so in any event, the RRC does result in a starting place with which one may consider the final score with respect to retrofitting the building (or not).

In order to understand the broader question of whether or not an institution has an impact on this score - whether or to what degree it influences it - the scoring mechanism must be moved into the aggregate with other scores of a common type, and then examined with controls which will uncover any commonality.

In order to measure any influence, the number of stories/levels field in the RRC will be utilized to isolate the 3-6 story building type from the influence that buildings of other heights might have. The data will then be pooled in aggregated in bands of distance from the three major institutions on First Hill: Swedish Medical Center, Virginia Mason Medical Center and Harborview Medical Center. Because of the compact nature of Seattle, the bands will be narrow in the beginning and wider at the end in order to control for the reduced influence and the impact of terrain features (hills, freeways, etc).

To complete this task, the distance bands will be set at:

- Band A: 0.0 mile to 1/8 mile from the major institutions.
- Band B: 1/8 mile to 1/4 mile from the major institutions.
- Band C: 1/4 mile to 1/2 mile from the major institutions.

Once the data is aggregated into bands, it will be calculated in the following manner:

- Average RRC score - by band.
- Average deviation of the RRC Score - by band.
- Median RRC score - by band.

Conglomeration of the scoring system in this manner reflects the assumption that the closer in a property is to the institutions, the more influenced they are by them. The building scores should be influenced in such a manner as to demonstrate the increased propensity of redevelopment due to more rapidly increasing values (which were the fields most heavily weighted in the scoring mechanism evaluation). Because of this change in valuation, the propensity for redevelopment should be highest close to the institutions, while

Specifically, as one moves away from the institutions, there should be a reduction in the influence that they impart upon the scoring of the mechanism. Further, that as one migrates away from the institutions; the variation in scores should moderate and lessen; that the volatility of the associated scores should decrease as a result.

Primary Analysis: Comparison of Districts

The last level of analysis will involve taking the RRC evaluations, as assigned to the distance bands of the First Hill district, and applying to another district within the 2030D area of interest. In this second application, similar types of results should be found; that is, that the scoring should be found to be similar in nature to that to the results found on First Hill; with some allowances provided for differences between the districts themselves.

In the first thesis, the only other district considered for selection was the Uptown District, also known as Lower Queen Anne; chosen because of the distribution of building types there and the lack of large redevelopments having recently occurred, etc. However, due to the requirement of measuring relative to a major institution in order to measure the impacts, the scope of review will be increased to include the South Lake Union district, immediately to the east of the Uptown district.

In increasing the scope to both the Uptown and South Lake Union, the two primary anchor institutions will be the Fred Hutchinson Cancer Research Center, located in northeast South Lake Union, and the Bill and Melinda Gates Foundation, located in eastern Uptown. Since South Lake Union has recently been redeveloped, I am also including the headquarters of Amazon.com to round out the selection, calculated in conjunction with the non-profits in order to account for the new core of development in that location, in order for the data not to be skewed overall.

SECTION .IIIb - MODEL & METHODOLOGY OF RESEARCH

Section Summary

This section outlines the basis for research conducted in the core of this report, and explains why the research will be conducted in that manner. It discusses the multi-level approach to research which will be utilized, and explains how the results will be determined, why they are important and in what manner the conclusions will be made.

THE RAZE-RETROFIT CONTINUUM

Three Spheres of Influence

Before describing the Raze-Retrofit Continuum (RRC), one must understand the nature of individual decision making, how it impacts the retention or sale of property, and how those decisions are derived. One way of considering the relationship of forces which influence the eventual decision to raze or retrofit a building is found in the diagram entitled the "Three Spheres of Influence" (Figure 3.1) . This diagram lays out the three major components resulting in the eventual decision to raze or retrofit: the owner themselves; the building/parcel itself and the city/locale in which that structure is located.

In this diagram, each sphere contains significant influence - and three work in concert with one

another - exerting different influences at different times. Typically two of the spheres tend to dominate the decision to raze or retrofit - that of the owner and that of the building itself. Increasingly however, the influence of the city or community in which the building resides is playing a more significant role. In the end, the goal of the diagram is to have a balanced approach to the decision - resulting in the portion of the diagram where the three spheres intersect.

Examples of this diagram in action could include:

- Building owner who seeks income only from his building and is interested only in the minimal upkeep costs to keep that income coming in. Here, the bottom sphere plays only a very small role in the decision making.
- An owner whose building is capable of

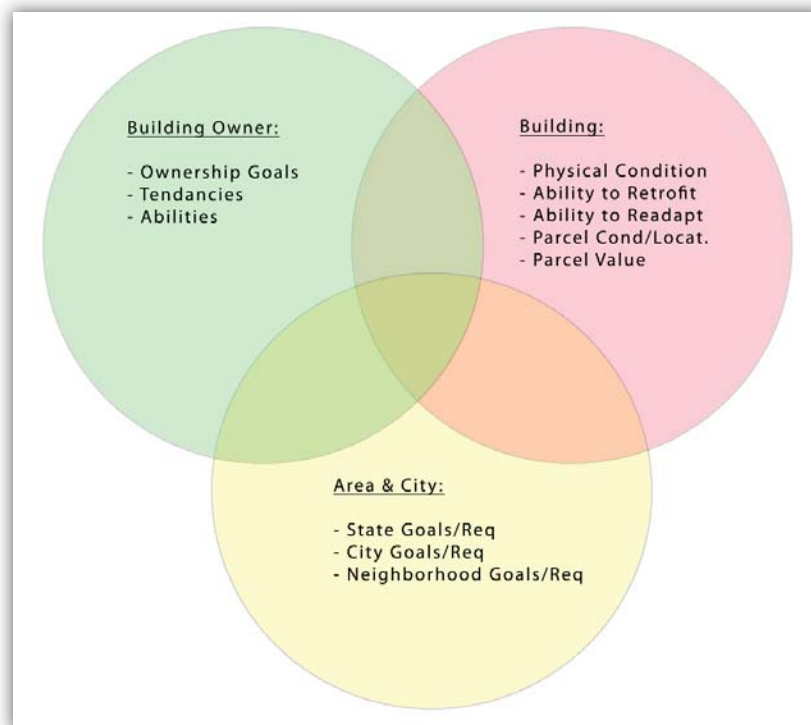


Figure 3.1 – Three Spheres of Influence Source: Author

becoming a recycling center for industrial plastics and rubber - except that the building is located in South Lake Union. Here the upper two spheres exert a strong influence, but are overruled by the bottom sphere which will prohibit that type of activity from taking place in that particular district.

- The Bullitt Foundation - seeking to build a high profile, environmental show piece, works with the city to acquire a parcel which will show the building off, and meets the owner's intentions of investment in efforts of the public good. In this case, all three spheres are working together to derive an outcome - and thus comes into the middle section of the diagram.

In the end, the Three Spheres of Influence diagram only begins to explain the decision to raze or retrofit - it is one way of looking at individual decision making. When those decisions are collectively placed next to one another - a hierarchy is formed wherein the decision to raze or retrofit appears along a linear scale - the scale which is The Raze-Retrofit Continuum.

THE RAZE-RETROFIT CONTINUUM - DEFINED

The RRC is a linear scale which connects the common decision making processes of many commercial property holders, and ranges (on the high end) from a high probability of a complete retrofitting the building in question to (on the low end) a high probability of razing the building and completely redeveloping the site. It holds that the owner's decision to choose either an energy efficiency retrofit (to whatever degree) for their building or, to completely raze that building in favor of redevelopment, are decisions which are made in response to a myriad of different building conditions, values, locations, uses and other factors (some outlined in the Three Spheres). Indeed, that in the decision to raze-or-retrofit, there are endless differing conditions; so much so that each building in reality becomes a case study unto itself, and thus making any broad, sweeping conclusion regarding a particular district or city impractical and ineffective.

General conditions can be described however, which commonly surround this decision making process, and give some form as to its general nature, thus removing some of the uncertainty as to the outcome of the decision maker. In the conditional descriptions of razing/retrofitting are found common conditions

which might also exist elsewhere enough to assist the reader in determining where any particular building might be located on the continuum, and thus how particular policies or investments might be made.

Scoring the Raze-Retrofit Continuum: The Data Points

The RRC is a scoring system built upon various points of publicly available data, combined with scores and weights established by a careful review of the data and consideration of typical market behaviors. Since the behaviors of the market are most often under-pinned and driven by human behaviors, for this analysis, both conditions are considered in synch, and thus specific, narrow events located well away from the average data set are assumed to be outliers, and have been dismissed from consideration.

The data used to provide initial placement along the Raze-Retrofit Continuum has to be broad enough to be common to all types of commercial buildings in Seattle, while at the same time possess enough individuality to enable useful analysis. Ideally, such information would include information such as existing energy efficiency measures, owner status, the type of business the tenant is engaged in and other measures which might illuminate. Due to existing American property law, however this type of data is considered to be private in nature.

What is available is a combination of the data used earlier in this report to describe the broader make up of Seattle's existing commercial building stock, combined with current and historical property tax assessment data from the KCDA.

The RRC is based on the following data points. The data was either made available by the DPD and KCDA, or was developed separately by the author:

- 2011 Value Ratio
- Improvements and Land Value Volatility
- Construction Class
- Decade of Construction
- Effective Year
- Owner Locale
- Use Sensitivity
- Proximity to a Major Institution

Section .IIIb - Model & Methodology of Research

Table 3.1 – Evaluation Criteria and Scoring. Source: Author

RRC Evaluation Criteria and Scoring		
Value Name	Description	Values Created
2011 Value Ratio	This measurement point is a common one used in the assessment of property for redevelopment. While building owners amortize the value of their building over time, once it reaches a point of no value, or significantly less value than the lot it is residing on, the property theoretically becomes more likely for development.	(-1) = building is worth less than land. (0) = building and land are of equal value (1) Building is worth more than land
Improvements and Land Value Volatility	This is a seven state stage value set - which looks at the behavior of the Land/Imps value change over the preceding ten years - in two five year average values. Specifically, this value set looks for volatile changes in the change of the value of the property and/or improvements - especially those which have changed by (on average) more than 100% within five years. Values exceeding 100% in five years indicates full redevelopment, those having dropped 100% or more in five years indicates imminent redevelopment. These are actually FOUR fields - two sets of two - for improvements and land, both for the periods 00-05 and 06-11.	Value/Score 4 where >=1.0 2 where >=0.5 And <1.0 1 where >0 And <0.5 0 where they are equal -1 where they are <0 And >-.5 -2 where they are <=-0.5 And >-1.0 -3 where they are <=-1.0
Construction Class	This valuation point considers at the materials the building is constructed of, and assigns a value based on general assumptions of those materials and their value to energy efficiency. Generally speaking, the more robust the material, the greater the mass, the more likely it is to work in favor of energy efficiency.	Description/Score Unknown 0 Structural steel 1.0 Reinforced concrete 2.0 Masonry 1.5 Wood frame -1.0 Prefab steel 1
Decade of Construction	This value considers the decade in which the building was constructed, and then assigns a value based on general assumption of that period with respect to how buildings were constructed relative to their intensity of use of energy. Generally speaking, the period of the 1950s to 1970s receive lower values while those prior to World War II are higher (due to the buildings generally carrying more building mass and possessing higher ceilings/taller windows).	Decade/Score 2000 1.00 ; 1990 0.75 1980 -2.00 ; 1970 -3.00 1960 -4.00 ; 1950 -3.00 1940 -2.00 ; 1930 2.00 1920 2.00 ; 1910 2.00 1900 2.00 ;
Effective Year	This value considers the last registered major upgrade was made to the building. Typically this record is updated when building permits are applied for making major changes to the building envelope, physical plant, etc - and this value makes the assumption that the more recent a effective year value the more current the HVAC system may be, or building envelope, etc. For example, if the building is from the 60s-80s, and the effective date is also from that period, then it could be an indicator that the system is out of date, etc. The score works by subtracting the effective year from the present year - giving an indication of how long it's been since the last major upgrade at that building.	EffYr Range/Score 00-06 years = 1.0 07-10 years = 0.5 11-15 years = -0.5 16-25 years = -1.5 26-50 years = -2.5 51+ years = -5.5
Owner Locale	This value considers the locality of the building owner - as a measure of the owners intent. To determine the locale of the owner, the registered tax payer zip code is utilized. If a local owner, it is seen as more likely to retrofit, whereas if the owner is out of state, then it's more like to raze the building. Three levels of sensitivity are given, local (Seattle), State and Out of State.	Owner Local = 1 Owner in WA = 0 Owner Not = -1
Use Sensitivity	This is a five stage value; used to determine the degree of uniqueness the mission of the building has - whether or not other buildings nearby could offer the same service/housing - making the first building less valuable, and more likely to raze. Originating from the Predominate Use field, each use is assigned the values shown at right based on the likelihood that particular use will behave in a certain way when the building ages and becomes less efficient. See the complete list for more detail.	Very Likely Retrofit = 2 More Likely Retrofit = 1 Neutral = 0 More Likely Redevelopment = -1 Very Likely Redevelopment = -2
Institution Nearby	This is a four stage value - which indicates if that property is within a specified distance from a major institution. It is used to indicate the sensitivity of a building/its value/its propensity to retrofit or redevelop arising from that location. Ranges are: 0 to 1/8 mile; 1/8 to 1/4 mile; 1/4 to 1/2 Mile and Greater than 1/2 mile.	Distance from Inst./Score 0 to 1/8 Mile: -2.00 1/8 Mile to 1/4 Mile: -1.00 1/4 Mile to 1/2 Mile: -0.50 More than 1/2 Mile: 0.00
Building Quality	This is a eight stage value - that looks at the stated quality of the building and assigns a score based on that value. Essentially, a rating of "average" is neutral, whereas "Low to average" receives a negative value and "Good" and above receives a positive value.	Quality Rating/Score No Value 0.0 Average to good 1.0 Low cost -2.0 Good 2.0 Low to average -1.0 Good to Excellent 2.5 Average 0.0 Excellent 3.0
Heating System	This is a simple evaluation which considers the type of heating mechanism the building in question possesses. Since this data is not always accurate, and owners sometimes update or change their systems without notice, this particular metric has a lower value rating generally. The values for the various systems reflect a higher value for more energy efficient heating systems, and lower ones for less so.	Type of Heating System/Score Electric -2.00 ; Electric wall -2.00 Forced air unit -2.00 ; Hot water 2.00 Hot water-radiant 2.00 ; Space heaters -2.00 Steam 2.00 ; Steam without boiler 1.00 Ventilation 0.00 ; Wall furnace -1.00 Package unit -1.00 ; Warmed and cooled air 0.00 Hot and chilled water 1.00 ; Heat pump 0.00 Floor furnace -1.00 ; Thru-wall heat pump -1.00 Complete HVAC 0.00 ; Evaporative cooling 1.00 Refrigerated cooling -1.00 ; No heat 0.00 Unknown 0.00;

- Building Quality
- Heating System

The evaluation data and related scoring logic are set forth in more detail in Table 3.1 on page 23.

After selecting the specific points of data, a hierarchy was then established for the eventual scoring weights. Weighted scoring was utilized in order to adjust the sensitivity of the individual data set - to give particular data sets a greater impact on the final score. The hierarchy was established using a standard priority grid. Upon initial scoring, sample building scores were utilized to further tune the weights, to make them more reflective of reality. Tables shown on the following pages provide information on the root scoring points (Table 3.1 on page 23), the priority grid used to establish a hierarchy (Table 3.2 on page 25) and the final weighting assigned to the resulting raw scoring (Table 3.3 on page 26)

Four Conditions on the RRC - Described

For the purposes of this study, and for simplicity, there will be four conditions along the raze-retrofit continuum cited: minor retrofit, intermediate retrofit, deep retrofit and the condition where the entire building would likely be razed and redeveloped - regardless of its state. Generally speaking, these conditions represent a wide variety of conditions, but often consist of the following:

Minor Retrofit:

The mildest condition, the minor retrofit often is undertaken when smaller elements or adjustments to existing elements are all that is required to make the needed increases in energy efficiency.

Such elements include changing lighting fixtures, water fixtures, adjusting physical plant settings and adding additional insulation to existing bays (where easily completed), among other things. Minor retrofits are most often undertaken in structures which are in service and cannot have on-going construction occurring within them.

Intermediate Retrofit:

The middle condition, the intermediate retrofit is undertaken when a building or part of a building is going to be temporarily unoccupied and not in active service. Most often, these types of retrofits involve the replacement of more major elements of a building,

making extended, on-going occupation of those spaces (by lease holders) impractical.

The elements included in this level of retrofitting includes the replacement of physical plant elements; replacement of doors and/or windows; replacement of roofs; adding or replacement of cavity insulation, necessitating the opening of walls, ceilings and floors.

Deep Retrofit:

The most extreme of the retrofit choices, the deep retrofit is undertaken when a building or part of a building can be taken out of active service for a longer period of time, so that major elements of a building can be changed - but that the function of the building - or its existing primary mission will remain the same.

These types of elements can include the demolition and replacement of exterior walls and wall systems; the demolition and replacement of entire roof assemblies; the exposure of building foundations (from both sides); and the complete replacement of a buildings physical plant. A deep retrofit can also include these elements combined with an expansion or extension of an existing space, when the new and old spaces are intended to work together under the new regimen.

Raze - Complete Redevelopment:

The alternative to retrofitting all together - when the entire building is torn down and redeveloped rather than try to amend its existing condition. Usually, in these cases such buildings have become obsolete, or the conditions around the building have changed to such a great degree as to make the existing use of the building impractical or financially unsound.

In other situations, the building condition may be quite functional or serviceable, however the owner of the property has elected to raze the building nonetheless. In these circumstances, the most common scenario is one wherein the value of the parcel the building sits upon has become excessively valuable, and forgoing redevelopment would actually represent a potential loss for the owner's investment.

Under these types of circumstances, the building owner will seek to redevelop the site into a new building of greater value, or sell the property to another who will undertake the project themselves. In either case, the owner is seeking to collect the maximum return on his investment.

Table 3.2 – Raze or Retrofit Priority Grid. Source: Author

		Raze or Retrofit Priority Grid										
		01.) 2011 Value Ratio	02.) Particular Construction Class	03.) Decade of Construction	04.) Effective Year Listed	05.) Owner Local or Distant	06.) Use Sensitivity	07.) Institution Nearby	08.) Building Occupied	09.) Building Quality	10.) Value Volatility	11.) Heating System
01.)	2011 Value Ratio	1										
02.)	Part. Const. Class	1	3									
03.)	Decade of Const.	4	4	4								
04.)	Effective Yr.	1	2	3	4							
05.)	Owner Local	1	2	3	4	6						
06.)	Use Sensitivity	7	7	7	4	7	6					
07.)	Institution Nearby	8	8	8	8	8	8	8				
08.)	Building Occupied	9	2	9	9	9	9	8	8			
09.)	Building Quality	10	10	10	4	10	10	10	10	10		
10.)	Value Volatility	1	2	4	5	5	7	9	10	10	10	
11.)	HeatingSystem											

In DB	9/28/2011	winner	choice	# times selected
*	Building Occupied*	#1	08 =	10
*	Value Volatility	#1	10 =	10
*	Eff. Year	#2	04 =	8
*	Building Quality	#3	09 =	6
*	2011 Value Ratio	#4	01 =	5
*	Inst. Nearby	#4	07 =	5
*	Const. Class	#5	02 =	4
*	Decade Const.	#6	03 =	3
*	Owner Local	#7	05 =	2
*	Use Sensitivity	#7	06 =	2
*	Heating System	#8	11 =	0

* Under evaluation - may be dropped due to lack of available data.

This grid functions as a simple priority grid in order to establish a heirarchy of values used in the assessment of the various criteria. Each criteria is considered against one another, and those deemed having the highest value will be awarded a higher weighting in order to provide clearer seperation in the final continuum.

Table 3.3 – RRC Criteria Scoring Ranges, Weights and Range. Source: Author

Criteria Scoring Ranges, Weights and Total Score Range						
Criteria	Score Range	Max Low Score	Max High Score	Weight	Max Wt Low Score	Max Wt High Score
Scoring_2011ValueRatio	-1 to 1	-1	1	1.75	-1.75	1.75
Scoring_ConstClass	-1 to 1	-1	1	1.5	-1.5	1.5
Scoring_DecadeConst	-3 to 3	-3	3	1.25	-3.75	3.75
Scoring_EffYr	-5 to 1	-5	1	2.25	-11.25	2.25
Scoring_OwnerLocal	-1 to 1	-1	1	2	-2	2
Scoring_UseSensitivity	-2 to 2	-2	2	1	-2	2
Scoring_InstNearby	-2 to 1	-2	1	2.8	-5.6	2.8
Scoring_BldgOccupied*	-1 to 1	0	0	3.5	0	0
Scoring_BuildingQuality	-2 to 3	-2	3	2.1	-4.2	6.3
Scoring_ImpsValueVolatility_00-05	-3 to 4	-3	4	1.75	-5.25	7
Scoring_ImpsValueVolatility_06-11	-3 to 4	-3	4	2.5	-7.5	10
Scoring_LandValueVolatility_00-05	-3 to 4	-3	4	1.75	-5.25	7
Scoring_LandValueVolatility_06-11	-3 to 4	-3	4	2.5	-7.5	10
Scoring_HeatingSystem	-2 to 2	-2	2	1.25	-2.5	2.5
Total Max Points		-31	31		-60.05	58.85
		RANGE OF SIMPLE SCORING		RANGE OF WEIGHTED SCORING		

* This criteria in development; may be dropped due to unavailability of data.

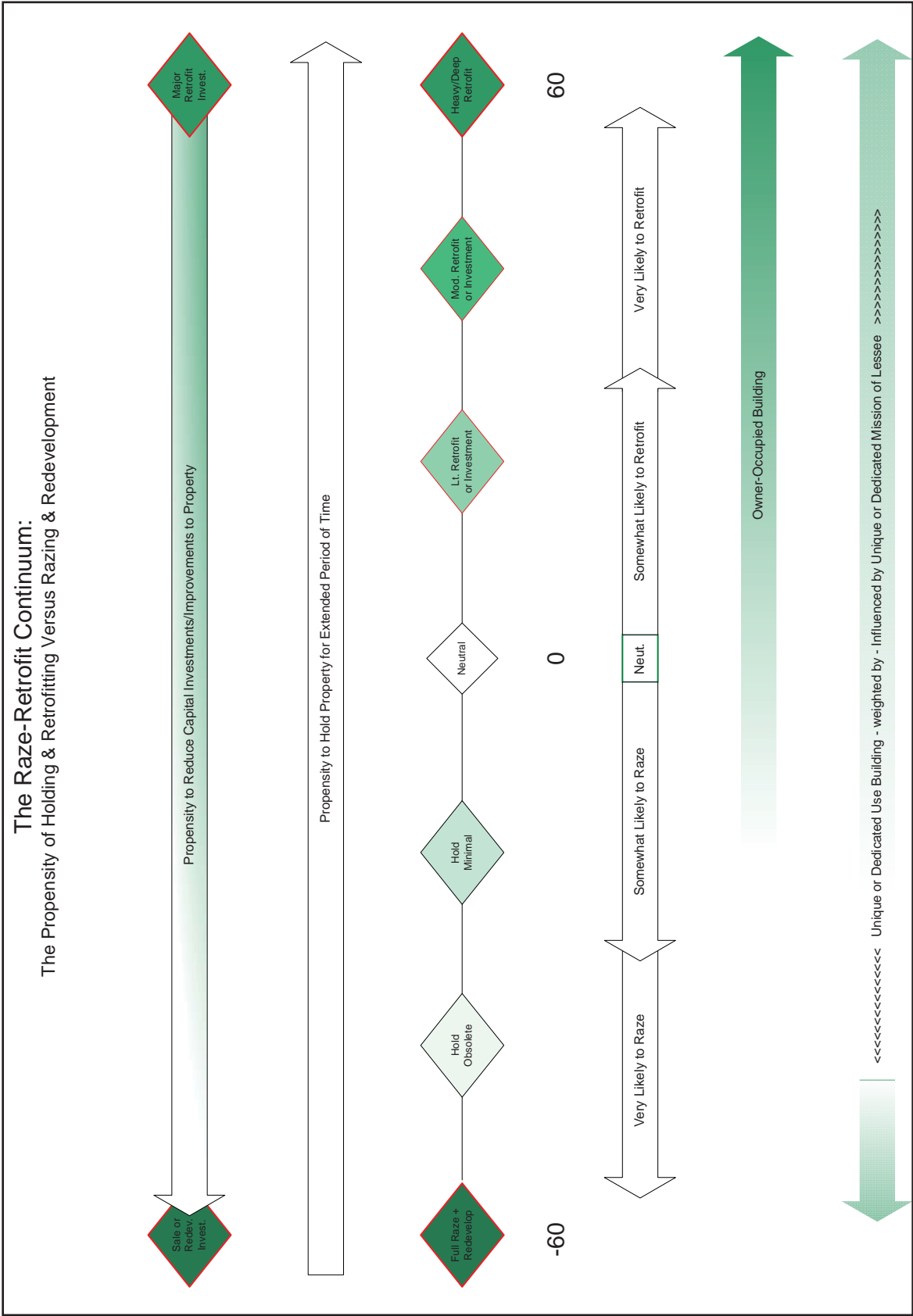


Figure 3.2 – Raze or Retrofit Continuum. Source: Author

Four Cases on the Continuum - Displayed

Figure 3.2 on page 27 contains a graphic display of the RRC and shows the relative location of each of the conditions described above. Generally speaking, this chart demonstrates that as properties move along the RRC to the right - toward deep retrofitting and a higher financial investment, the likelihood of long-term ownership increases. Correspondingly, the inverse is also true: as one moves left along the RRC, the likelihood of long-term ownership decreases as one descends past building obsolescence and eventual redevelopment (Figure 3.2 on page 27)

When combined, these factors provide the underpinning for the scored evaluation of the properties, and allow the evaluation to be broken into five sub-conditions of (from left-to-right):

- Very Likely to Raze
- Somewhat Likely to Raze
- Neutral
- Somewhat Likely to Retrofit
- Very Likely to Retrofit

In addition, factors such as the owner-occupation of the building tends to increase the likelihood of retrofitting, while the uniqueness of the buildings mission can also move it to the right - or, in the event of obsolescence or excessive high property value, can snap it to the left.

Surrounding Area Influences

As previously outlined, the primary study area for this project is within the First Hill District of Seattle, and contained within the streets of Broadway to the east, Madison Avenue to the south, Minor Avenue to the west and Union Avenue to the north. The four study buildings that will be discussed are on the relative corners of the study area, and represent the most common building typologies in Seattle - with the sole exception of the fourth building, which was chosen as being representative of buildings in the path of rapid growth.

First Hill is home to three major hospitals, and because of this, much of the associated commercial activity is medical related. There are also a significant number of multi-family buildings on First Hill. Both of these facts combined result in an area with concentrated

economic activity, and one which provides fertile grounds for additional retail activity, entertainment and other types of businesses (Figure 3.3 on page 29)

In addition to the existing bases of activity on First Hill, is the development of two additional large economic activity corridors: the formalization of the Pike-Pine overlay district, and the First Hill Streetcar, currently under construction. In both cases, the planned changes to these corridors will have significant impacts upon the level of development on First Hill, and thus upon the individual buildings located there - relative to their location, use, size, and condition.

The Pike-Pine overlay district, is a linear area of economic and residential activity extending between Pike Street and Pine Street (on an east-west axis); running from the Interstate 5 throughway eastward the termination at Madison Avenue (at the intersection of 15th Avenue). The area essentially rises up the common slope east of downtown between Capitol Hill and First Hill, and known as "the saddle" (as it sits astride the Capitol Hill and First Hill ridge, and slopes down in the middle where the Pike-Pine corridor intersects it.) It is an area that has been developed over a long period of time, and is now being recognized by the City of Seattle as a definable neighborhood in its own right because of its level of economic, cohesiveness and function as a gateway to Capitol Hill and First Hill.

The First Hill Streetcar is a street-level transit system planned to run from Occidental Park in Pioneer Square, east through the International District, then north along Broadway, making stops along First Hill, and then continuing over the long spine of Capitol Hill, past the new Sound Transit Link Light Rail station, finally terminating at Denny Way (north end of Cal Anderson Park). The street car is designed to provide needed linkages between the Pioneer Square, International District, First Hill and Capitol Hill neighborhood, as well work as a feeder for the new Sound Transit station located on Broadway. Its design closely mimics the original Broadway street car line, built in the same location over one hundred years ago.

Both the Pike-Pine corridor and the First Hill Streetcar are significant because of the impacts they will have upon First Hill. A recent economic activity study conducted by the Seattle Department of Transportation (SDOT) in conjunction with the Capitol Hill Streetcar planning phases showed that relative to existing economic activity on First Hill, the addition of

SECTION .IV - ANALYSIS

Section Summary

This section undertakes the first level of analysis which will examine the propensity of building owners to either retrofit for energy efficiency, or to for redevelopment, and how this decision is influenced by having a major institution in close proximity.

PRELIMINARY ANALYSIS - INDIVIDUAL BUILDING LEVEL

In an effort to reveal the linkages between institutional development and the propensity for owners to raze or retrofit their buildings, it is necessary to initially start at the level of the individual building, wherein the motivations and influence of building owners largely controls the decision to raze or retrofit.

To do so, we will begin by examining portions of the analysis in my M.Arch thesis, in which the study buildings received wide-ranging RRC scores for a variety of reasons. From those scores, we can see that most of the buildings which are within the immediate

zone of the major institution - Swedish Hospital in this case, tend to have low scores within the probable retrofit range of the RRC.

Table 4.1 – Study Buildings Final RRC Scoring Table

Final Building Scoring from M.Arch Thesis	
Study Building	Final RRC Score
1224 MADISON ST	7.08
1001 BROADWAY	8.03
1110 HARVARD AVE	6.61
1310 MINOR AVE	-10.62

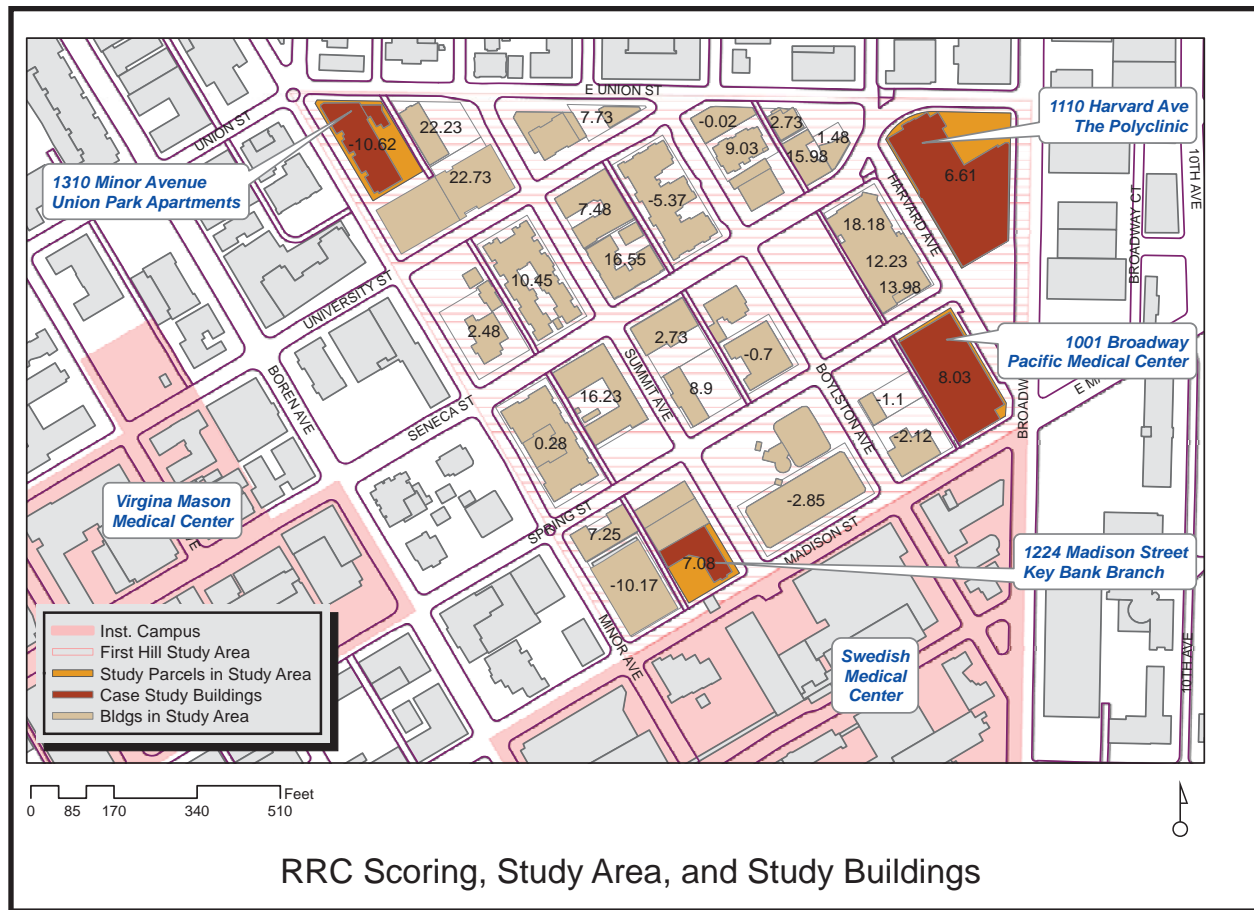


Figure 4.1 – Study Area Map With RRC Scoring. Source: Author

The Study Buildings: Summary

The reasons underlying these particular scores for these buildings are outlined in detail in the M.Arch thesis, and are summarized in Table 4.1, and can also be seen in the associated map in Figure 4.1 on page 31. The reasons for these relative scores vary, and in each circumstance, the building type, building use, age, condition and other factors of the building vary. What follows is a general summary of the study buildings. For more detailed information on these buildings, please see my M.Arch thesis entitled *Raze-or-Retrofit: Evaluation of Seattle's Commercial Building Stock for Energy Efficiency*.



Figure 4.2 – Area Map and Image of 1225 Madison Street. Source: Author

1224 Madison Street - Keybank Building;

RRC Score = 7.08:

Scoring low in the "Somewhat likely to retrofit" category, this small, masonry retail bank building is well constructed and maintained, and has very good potential for retrofitting for energy efficiency - especially daylighting (Figure 4.2 on page 32 and Figure 4.3).

The scoring reflects, however that such potential will likely not be met, as the building is located in the middle of the Madison Street corridor, across the street from Swedish Medical Center; its property value

far exceeding that of the building itself (Figure 4.4). The property is also located next to 1200 Madison, which was, until January of 2011, also small retail banking branch. In January that building was demolished and a thirteen story mixed use apartment tower is currently under construction in that location.

The building is owned by the banking conglomerate KeyCorp of Cleveland OH, and is a mission-driven retail property whose development potential is no longer realized. The likely scenario for this property is to eventually be sold off and/or redeveloped to the area height limit of 160'.

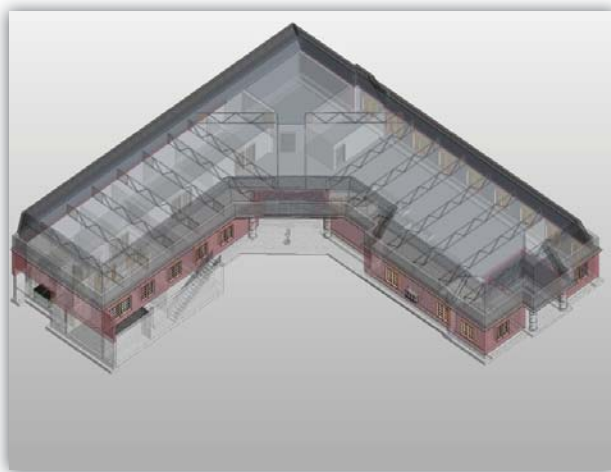


Figure 4.3 – Revit Model of 1224 Madison by Author



Figure 4.4 – Aerial Image of Study Area (yellow) and SMC (green). Source: Author and Google Earth

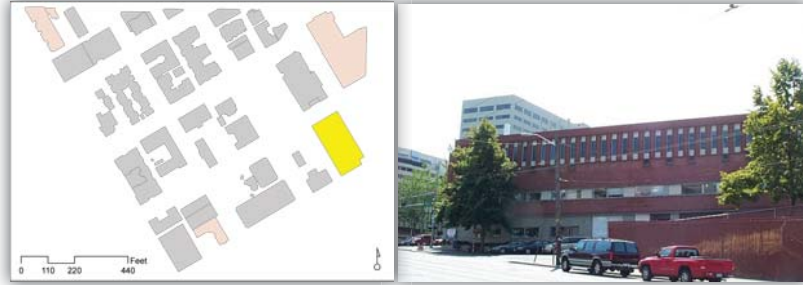


Figure 4.5 – Area Map and Image of 1001 Broadway. Source: Author

1001 Broadway - Pacific Medical Center;

RRC Score = 8.03:

Scoring low in the "Somewhat likely to retrofit" category, this small to medium sized medical office building, constructed in the 1930s and added onto in the 1960s; has substantial masonry construction and an ideal location at the cross streets of Madison and Broadway, across the street from a major planned stop on the First Hill Streetcar line (Figure 4.5).

While this building has some good aspects for day-lighting (good glazing ratios, high massing in the exterior walls, well lit perimeter spaces), the building scored lower because is not unique, serves a purpose which is not unique for First Hill, and so will likely not command higher rents in the future (Figure 4.6).

Further, 1001 Broadway, like 1224 Madison Street, resides in the Madison Street corridor, which has a height limit of 160', making the value potential for this property unfulfilled. This is an important distinction because the owners of the building (who are in the business of elder care) appear to have purchased the building solely as an investment, expecting the area commercial values to increase with the construction of Seattle's Link Light Rail line.

The likely scenario for this building is to be held until the premium paid for it is paid off, then the property will be redeveloped. While minor energy retrofits are possible in the near future, heavy retrofits of the building for substantial increases in efficiency are unlikely.



Figure 4.6 – Revit Model of 1001 Broadway by Author.

Section .IV - Analysis



Figure 4.7 – Area Map and Image of 1301 Minor Avenue by Author

1310 Minor Avenue - Union Park Apartments;

RRC Score = -10.62:

The sole study building to receive a negative score, placing it in the "Somewhat likely to raze" category, this multifamily, mixed-use apartment building is in good condition, and is located well - only three blocks from the Madison Street corridor (Figure 4.7).

Like 1001 Broadway however, it serves no unique purpose, and cannot command higher rents due to many near-by competing apartment buildings. In addition, the building was lightly constructed in 1989/1990 of wood framing with a stucco exterior, resulting in an overall low wall mass (Figure 4.8).

Because of this, the building would require a heavy retrofit in order to significantly increase its energy efficiency, which is unlikely due to the buildings existing role and the property ownership.

Like the other buildings, the critical key to 1310 Minor is that it is owned by the same group that owns the remainder of the block where it is located; including the massive Kline Galland Center and The Summit at First Hill - recently built high-rises engaged in elder care - and the holder of the MIO zoning designation. The likely scenario for this building is to continue to offer lower rents to independently living elders, and eventually up-zone the remainder of the block; razing the building as part of an expansion of their larger operations to the south.

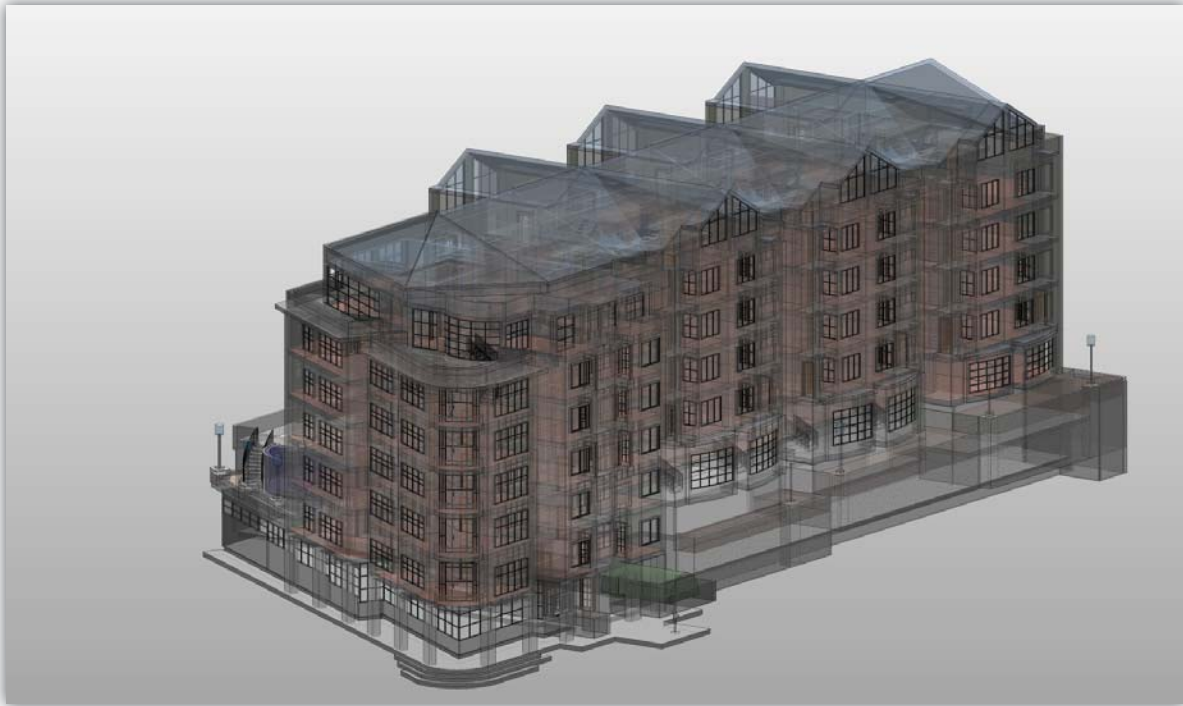


Figure 4.8 – Revit Model of 1301 Minor Avenue by Author.

Section .IV - Analysis



Figure 4.9 – Area Map and Image of 1110 Harvard Avenue. Source: Author

1110 Harvard Avenue - The Polyclinic;

RRC Score = 6.61

Coming in at a low score and “somewhat likely” to retrofit, this large, post-tensioned concrete out-patient surgical center is wholly owned by the operators of the Polyclinic, and serves a more unique function (Figure 4.9). The building - an addition to an existing building - has very deep, and narrowly spaced floor plates (14' floor-to-floor), making daylighting the existing structure problematic (Figure 4.10).

The large, solid construction of the building, combined with the mission-driven use and locale (of the study

buildings) second furthest away from the influence of the hospitals on First Hill however, other factors of construction and the highly adaptable type of buildings currently sought by hospital and clinic operators place this building out of contention for heavy retrofitting.

Because of these factors, and due to the continued growth of the Polyclinic as a successful non-profit organization, it is unlikely that this building could be, or will be heavily retrofitted in the future. The more

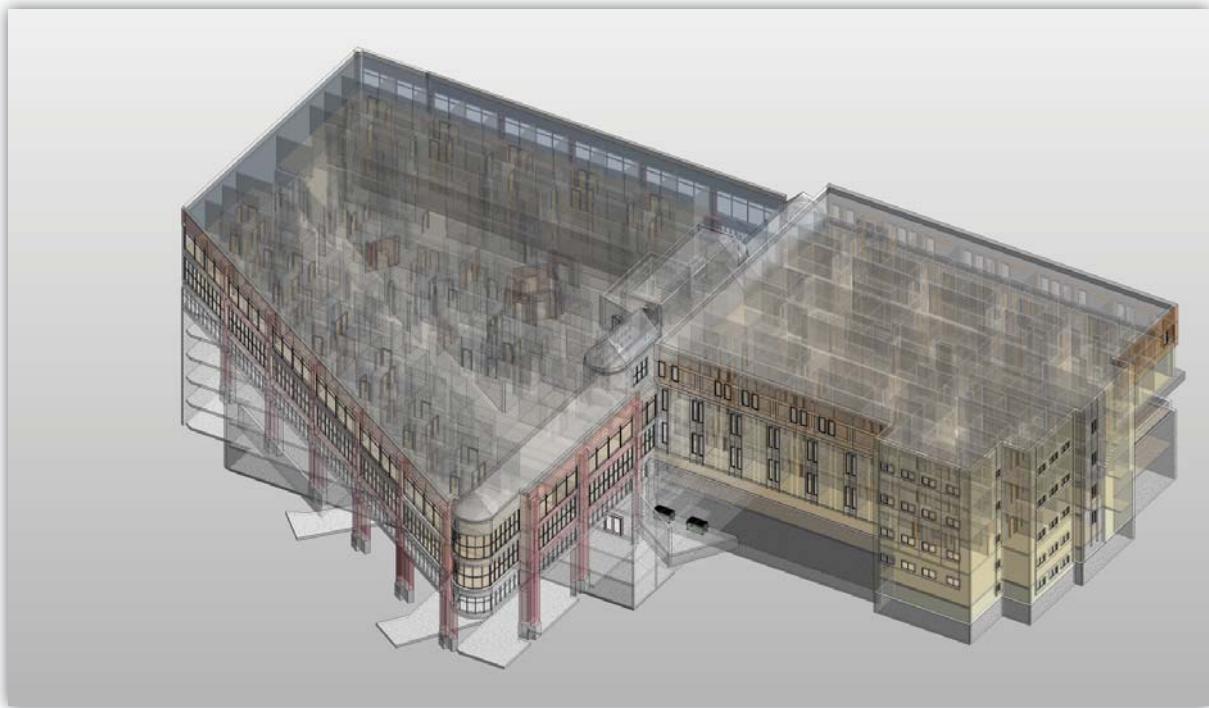


Figure 4.10 – Revit Model of 1110 Harvard Avenue by Author.

likely scenario is that the building will stay in use until it is fully obsolete, then it will be razed and redeveloped.

The Influence of Swedish Medical Center

For the sake of this discussion, the primary influencing institution considered will be Swedish Medical Center (SMC). While Virginia Mason Medical Center (VMMC) is certainly an influencing factor, as is Harborview Medical Center (HMC), SMC is the closest located to the study area, and will be used to demonstrate institutional development influence generally. Discussion with multiple healthcare facilities will take place in the second level of analysis, at the district level.

Seattle's healthcare industry translates into more \$6.37b of local economic output; 74,600 jobs and more than \$11m in tax revenues to the City. Annual wages and salaries for medical workers in Seattle average \$40,470, slightly above the City's average workers.¹

With 619 beds, more than 35,547 annual discharges, almost 150,000 patient days, and a campus covering more than ten city blocks, the SMC on First Hill alone is by the far the largest medical facility in Seattle. SMC has a total employee role of more than 7000 employees and 2300 doctors, and has become the largest hospital in Seattle via acquisition of other providers such as Seattle General Hospital (1980), Ballard Community Hospital (1992) and Providence Seattle Medical Center (2000).²

DISCUSSION

SMC Broad Impacts

The presence of institutions like SMC is critical for the economic development of both the district of First Hill, and for the City of Seattle as a whole. Attraction of new firms to provide jobs and economic growth can be extremely difficult without the available of high quality medical services.³

1 Huckell/Weinman Associates, I. (2004). Economic Contribution of the Healthcare Industry to the City of Seattle. Seattle, WA.

2 Swedish Medical Center. (2011). "Overview." Retrieved September 03, 2011, from <http://www.swedish.org/About/Overview>.

3 Doeksen, G. (1998). "A Healthy Health Sector is Crucial for Community Economic Development." *The Journal of Rural Health* 14(1): 66-72.

Further, public medical facilities such as SMC are in fact part of the capital stock which makes up the public infrastructure. As public infrastructure, it adds capital stock to the city generally, and is an unpaid factor in the production process and consumption of goods of households. Simply put - if facilities such as SMC were not present, neither would be attendant firms and organizations, the incomes of the employees who work there, or the value, both in terms of economic income (tax revenues and hospital income) and social good (services/benefits provided) for the community as a whole.⁴

At a local scale, the value of SMC is also demonstrated by the presence of non-SMC healthcare providers (medical offices), medical equipment suppliers, and associated services, as well as the myriad of support services needed for any area of economic activity (food retail, parking, multifamily residential, hotels, etc.).

All of these elements tie together in the decision making of any property owner - whether it is a group of investors, a professional group re-locating their practice, or a developer choosing to build mixed-use apartments on a site formally occupied by a small retail building. In each case, it is the mix of existing and potential economic activity, combined with the mix of available properties, all resulting in potential economic return which drives the decision making of the investor/property owner.

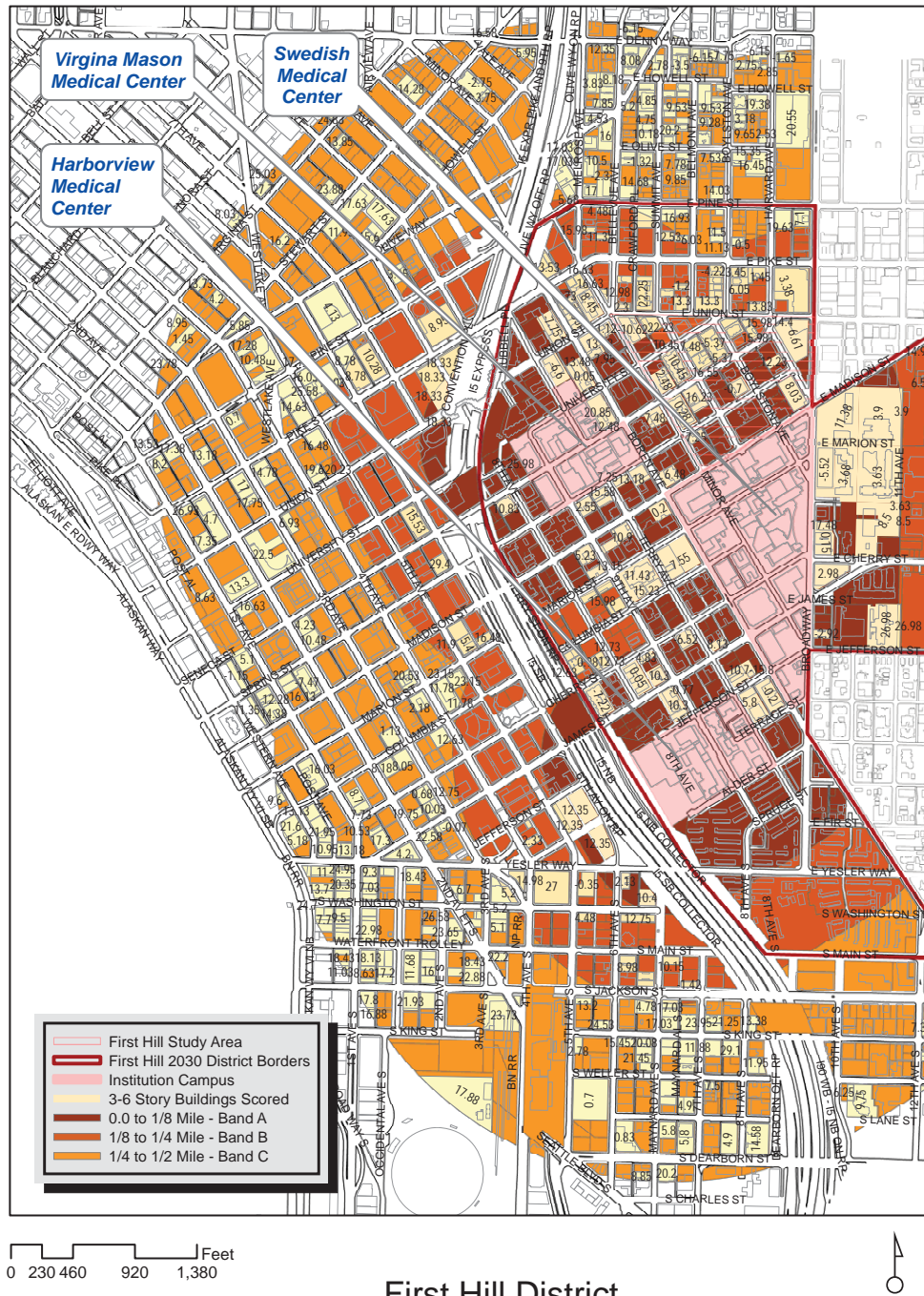
Specific Influences - Development Stagnation

The development plans for all of the major institutions are a matter of public record. Under Seattle city ordinance, institutions are required to keep and maintain a long range plan on the specific use of their properties and any expansion they may be considering.⁵ Because of this, properties adjoining the First Hill SMC campus are provided the luxury of long term investment planning, and like the City of Seattle planning itself, local property owners take advantage of it.

While such long term planning can be beneficial to

4 Duffy-Deno, K. (1989). Public Infrastructure and Regional Economic Development - A Working Paper. Cleveland, OH, Federal Reserve Bank.

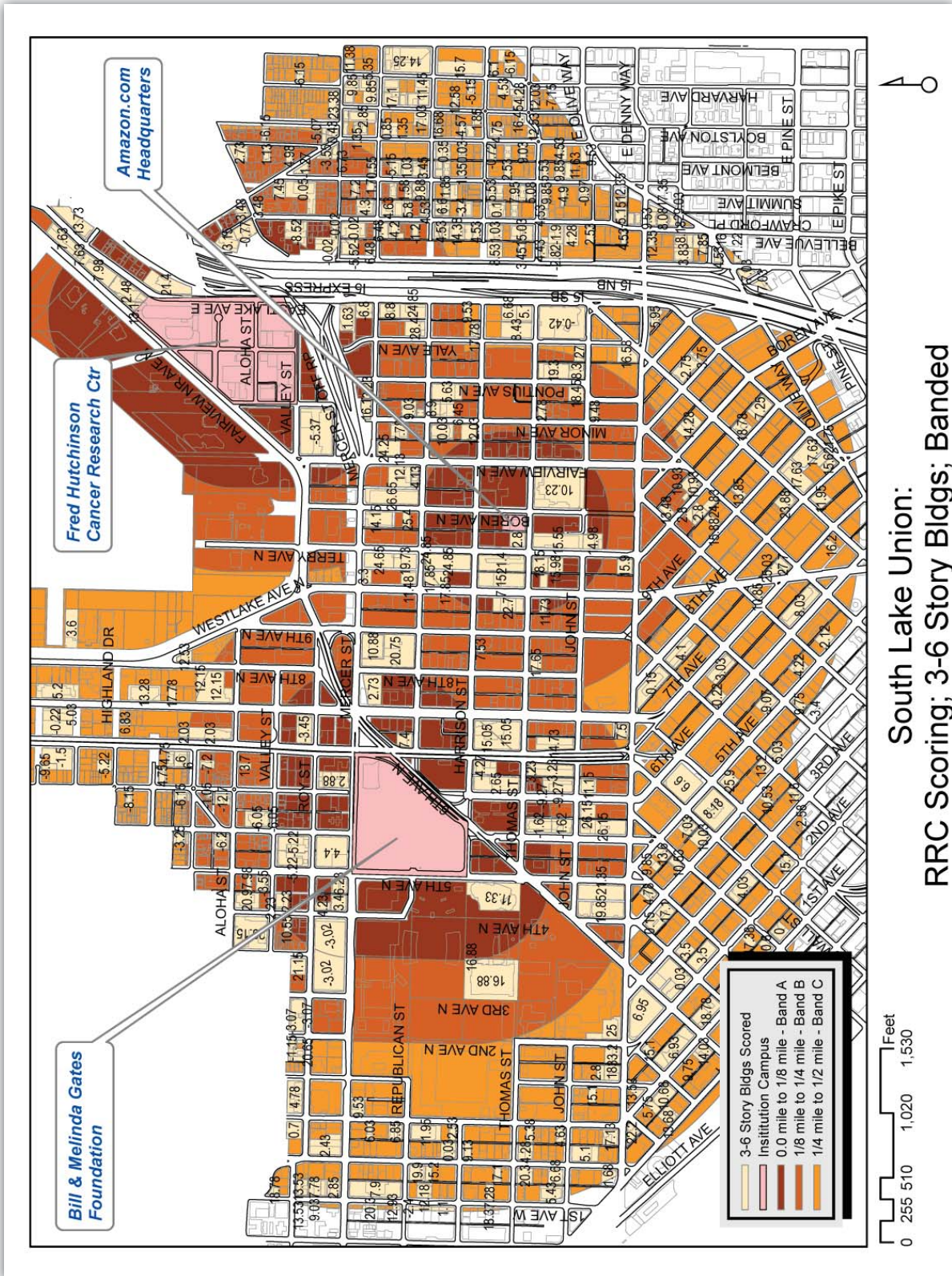
5 Department of Planning and Development. (2011). "Major Institutions Planning Process." Retrieved April 23, 2011, from <http://www.seattle.gov/neighborhoods/mi/miac/>.



First Hill District
RRC Scoring: 3-6 Story Bldgs, Banded

Figure 4.11 – GIS Map of First Hill Showing RRC Scoring for 3-6 Buildings - 3 Bands. Source: Author.

Section .IV - Analysis



the development of the areas adjoining any MIO property, the very same benefit can also become a liability (for the community) in that stagnation of properties can occur. Commercial property owners cause or encourage property stagnation whenever they are anticipating a significant increase in the value of a property such that simply holding that property becomes the sole objective.

In these cases, the income from the properties continues to flow to the owners; however the owners do not actively improve the properties or redevelop them in anticipation of higher return on investment (ROI). Such practices can result in a less energy efficient property which may or may not be occupied, and may eventually develop substandard conditions due to building obsolescence.⁶ Incidents of such decisions may be seen in several properties along the southern edge of the study area, further west along Madison Street, and on nearly all the perimeter streets in general. What causes such decisions to be made?

In 1996, voters approved the Sound Move transit plan which included a North Link Light Rail service connecting Downtown Seattle, First Hill, Capitol Hill, the University District and Northgate. By 2000, Sound Transit was purchasing properties for the construction of North Link Light Rail Station (NLLR-FH), anticipated to be located along Madison Street, in the area currently making up the southern border of the study area.

In two separate purchases made in 2000, the City of Seattle purchased 1400 Madison Street for \$2.2m, and 1200 Madison for \$1.6m in preparation of construction of a NLLR-FH station (Figure 4.13 on page 40).⁷ By 2005, the plans for a station at this location had been rejected by the city, due to the 210ft depth requirement of the station, and the lack of suitable soils for tunneling. As a substitute, the First Hill Street Car was planned to be routed down Broadway, linking Pioneer Square to Capitol Hill via the International District and First Hill (Figure 4.14 on page 41).⁸

The decision to consider placing a NLLR-FH station along Madison Street caused the properties there, some already being held by investment groups, and others which subsequently sold or re-sold, to suddenly increase in value. Following the rejection of the NLLR plans in 2005, one of the City-owned properties, 1200 Madison, was then sold to a local developer, Holland Partners, in preparation of a seventeen story mixed-use apartment building to be constructed on the site. Within the same timeframe (following the rejection of the NLLR-FH station), 1001 Broadway sold twice, increasing its value nearly three-fold to \$21m, even though the property had never been purchased by the city.⁹

As a result, both 1001 Broadway and 1224 Madison Street are today more highly valued than just a few years ago; making the eventual redevelopment of the properties more likely, and the potential for retrofitting the existing structures less so. The decision by the City of Seattle to consider the NLLR-FH station in the first place was based on the presence of SMC and VMMC, and the thousands of employees, commuter-trips and multifamily residences located there. Without SMC and VMMC, it is unlikely that the NLLR-FH station would have been considered at all, the associated properties would have been purchased; the valuation of nearby properties impacted; and that 1224 Madison Street and/or 1001 Broadway would have been retrofitted for energy efficiency.

SUMMARY

The preceding analysis on the study buildings within the study area, when combined with such factors as known contributions of income, employment and community involvement, and speculation resulting from a known event (the NLLR-FH station) clearly demonstrates the potential relationship between large institutions such as Swedish Medical Center and adjacent properties. It shows the impact that public works projects have on land valuations, and in turn, the impact of those land valuations on owners' decision to raze or retrofit their property, even when

6 An excellent example of this phenomenon comes not too far from SMC, on a Broadway property located on Capitol Hill. Please see "Appendix 2.0 - Anatomy of Need: The Revitalization of Broadway" on page 76

7 King County Department of Assessments. (2011). "KCDA eReal Property - 1400 Madison Street." Retrieved October 1, 2011, from <http://www5.kingcounty.gov/parcelviewer/viewer/kingcounty/viewer.asp>.

8 Mithun Architecture (2007). First Hill Street Card Design

Commission Presentation. Seattle, WA, Mithun Architecture.

9 King County Department of Assessments. (2011). "KCDA eReal Property - 1200 Madison Street." Retrieved October 1, 2011, from <http://www5.kingcounty.gov/parcelviewer/viewer/kingcounty/viewer.asp>.

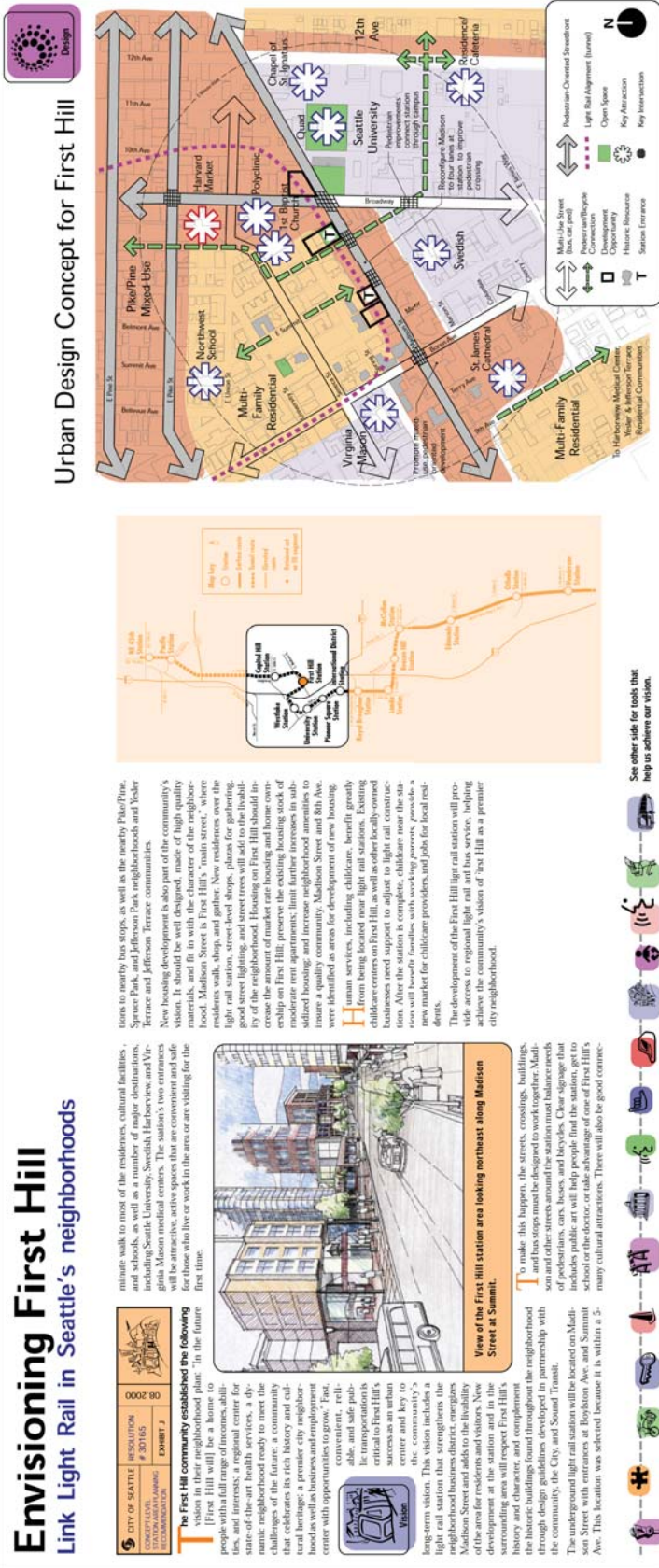


Figure 4.13 – 2000 Phamphlet Discussing Potential First Hill Station. Source: Sound Transit

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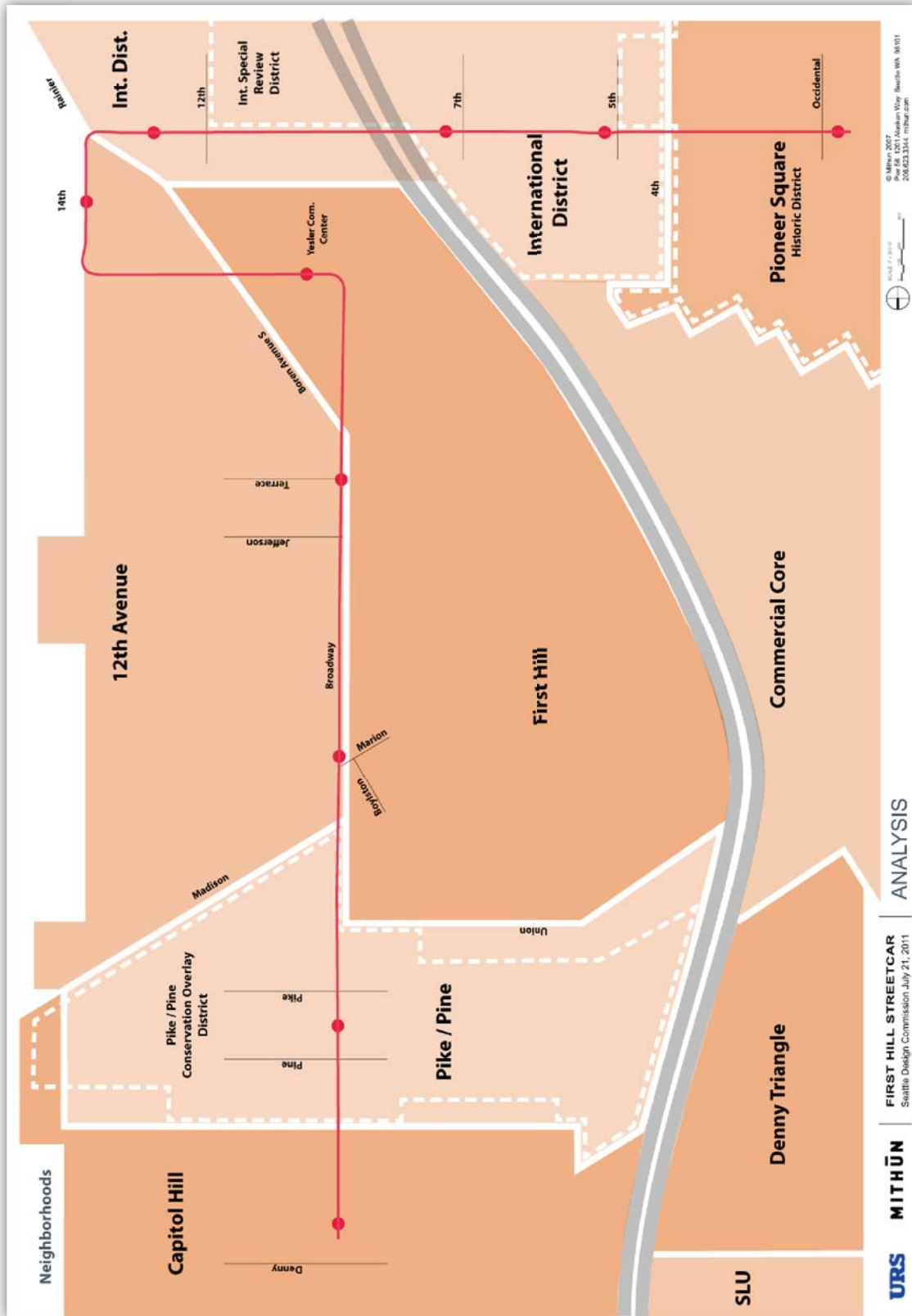


Figure 4.14 – Map Showing First Hill Street Car route and stations. Source: Mithun Architecture

those projects are not seen through to fruition.

- Median Mechanism score - by band.

SECONDARY ANALYSIS - STUDY AREA/DISTRICT LEVEL

As we move from buildings in the study area to the larger district, the RRC database can be used to determine the buildings placement along the Raze-Retrofit Continuum and whether the presence of major institutions will influence that placement.

The RRC and Aggregate Scoring Results

As outlined in Section 3, in order to determine the degree of sensitivity of influence the institutions exert

DISCUSSION

* See Figure 4-2 - First Hill District RRC Scoring.

Average RRC Scores - Banded

As noted in the table above, the average RRC scores were shown to increase as one moved from the boundaries of the institutions themselves, out past markers of 1/8th mile, 1/4 mile and finally 1/2 mile. Among the 3-6 story commercial buildings reviewed, the results reveal that the consistent increases in the average RRC scores show a marked decrease in the influence of the three major institutions cited (SMC,

Table 4.2 – First Hill Banded Scores Table - 3 Bands. Source: Author

3-6 STORY BUILDING RRC SCORES - BANDED			
Band	Average	Avg. Dev.	Median
A: 0.0 to 1/8 mile	5.32	7.08	6.48
B: 1/8 to 1/4 mile	8.42	6.28	8.50
C: 1/4 to 1/2 mile	10.84	3.78	11.38

on any given building, first the 3-6 story buildings were selected from the database, and their RRC scores were aggregated in three bands with the following distances:

- Band A: 0.0 mile to 1/8 Mile from the major institutions.
- Band B: 1/8 mile to 1/4 mile from the major institutions.
- Band C: 1/4 mile to 1/2 mile from the major institutions.

Once the data was aggregated into bands, it was calculated in the following manner:

- Average Mechanism Score - by band.
- Average Mean Deviation of the Mechanism Score - by band.

VMMC, and HMC) .¹⁰ See Table 4.2 and the associated map in Figure 4.11 on page 37 .

As the RRC average score increases, so does the likelihood that the building in question will be retrofitted rather than razed and redeveloped. That is, it shows a marked decrease in the propensity of the type of marked value changes that typically accompany redevelopment.

Average Deviation of RRC Scores - Banded

As noted in the table above, the average deviation of the RRC scores was shown to decrease as one moved from the boundaries of the institutions themselves, out past markers of 1/8th mile, 1/4 mile and finally 1/2 mile. Among the 3-6 story commercial buildings reviewed, the results reveal that the consistent decreases in the average deviation, in the RRC scores indicating a marked decrease in the influence of the three major institutions cited (SMC, VMMC, and HMC).

The higher volatility of individual RRC scores is indica-

¹⁰ The median was used in addition to the average score to control for outlying scores or score volatility which might have otherwise skewed the results

tive of a greater difference in the final RRC score, matched building-to-building within the same band. Those differences in scores, among buildings of a higher degree of similarity, itself reflect the changes most commonly expressed in the continuum - in the valuation of the building/property.

Median RRC Scores - Banded

Finally, as noted in the table above, and similar to the average RRC scores, the median RRC scores were shown to increase as one moved from the boundaries of the institutions themselves, out past markers of 1/8th mile, 1/4 mile and finally 1/2 mile. Among the 3-6 story commercial buildings reviewed, the results reveal that the consistent increases in the median RRC scores, like the average RRC scores, reflect a marked decrease in the influence of the three major institutions cited (SMC, VMMC, and HMC).

SUMMARY

The RRC scores, aggregated together provide a clear

PRIMARY ANALYSIS - APPLICATION TO OTHER DISTRICTS

This final analysis again utilized the RRC scoring system, in a similar manner to the secondary analysis, but moved the focus from FHD to another district: SLU. In doing so, it provided opportunity to examine further the influence of major institutions; but unlike FHD, the institutions considered by the scoring system were a mixture of traditional institutional, non-profit and for-profit institutions: Fred Hutchinson Cancer Research Center (FHCR), The Bill and Melinda Gates Foundation (BMGF), and internet retailing giant Amazon.com (AMZ). For this analysis, the term "institution" does not solely refer to an organization with an MIO designation, but expands the definition to include a "...established organization or corporation (as a bank

Table 4.3 – South Lake Union Banded RRC Scoring. 2 Bands. Source: Author

3-6 STORY SLU BUILDINGS RRC SCORES - BANDED			
Band	Average	Avg Dev	Median
A: 0.0 to 1/8 mile	8.55	7.48	7.69
B: 1/8 to 1/4 mile	13.37	6.80	12.03

picture of the influence of the major institutions on First Hill. While there are certainly influences on the same buildings from other directions, this method of analysis shows a clear relationship of the same type of 3-6 story buildings, within defined bands.

or university) especially of a public character..." which might have similar impacts to adjacent development (and thus the decision to raze or retrofit) as did SMC, VMMC, or HMC.¹¹

The institution type and district were changed in order to check the accuracy of the RRC and to validate its power in evaluating impact beyond a single type of institution. Thus, in this analysis, unlike the previous analysis the organizations and the developed urban fabric they are situated in are very different from one another:

- A well-established, major research institution, with long-established neighborhoods and infrastructure arranged about it (FHCR).

¹¹ Merriam-Webster Dictionary. (2011). "institution." Retrieved March 14, 2011, from <http://www.merriam-webster.com/dictionary/institution>.

- A two year old, totally redeveloped urban center with a very large internet entity establishing a new campus (AMZ).¹²
- A brand new (less than one year old) headquarters for a global non-profit organization (BMGF), located between SLU and the Uptown District.¹³

The RRC and Aggregate Scoring Results

As outlined in Section 3, in order to determine the degree of influence the surrounding institutions exert on any given building, first the 3-6 story buildings were selected from the database, and their RRC scores were aggregated into distance bands. Unlike the secondary analysis however, in this case the bands only cover the two distances shown below.¹⁴

- Band A: 0.0 mile to 1/8 Mile from the major institutions.
- Band B: 1/8 mile to 1/4 mile from the major institutions.

Once the data was aggregated into bands, the following calculations were performed:

- Average Mechanism Score - by band.
- Average Mean Deviation of the Mechanism Score - by band.
- Median Mechanism score - by band.

DISCUSSION

* See Table 4.3 above and the associated map at Figure 4.12 on page 38 regarding South Lake Union RRC Scoring.

In this analysis, the results appeared to be very similar to those of the secondary analysis, seeming to confirm the presence of similar developmental pressures associated with proximity to a major institution:

Average RRC Scores - Banded

Similar to the secondary analysis, the average RRC scores were shown to increase as one moved from the boundaries of the institutions themselves, out past markers of 1/8th mile and 1/4 mile. Among the 3-6 story commercial buildings reviewed, the results reveal that the consistent increases in the average RRC scores show a marked decrease in the influence of the three major institutions cited; FHCRC, BMGF, and AMZ (Table 4.3 on page 43).

12 For this analysis, the existing AMZ headquarters building only is being targeted as the boundaries of the "institutional campus". In reality, AMZ will be taking over several buildings eventually, and will have a much larger footprint in SLU than currently exists.

13 The author acknowledges that the BMGF is not located in SLU, however in further references, the distinction between SLU and Uptown are not considered relevant.

14 The distance banding in this analysis was reduced to two levels because of two large influencing conditions located adjacent to the study district: Lake Union (to the north) and the Denny Triangle District (to the south). For additional information, please see "Section .IIIa - Model & Methodology of Research" on page 18.

As the RRC average score increases, so does the likelihood that the building in question will be retrofitted rather than razed and redeveloped. That is, it shows a marked decrease in the propensity of the type of marked value changes that typically accompany redevelopment.

Average Deviation of RRC Scores - Banded

In this analysis, the average deviation of the RRC scores was shown to decrease as one moved from the boundaries of the institutions themselves, out past markers of 1/8th mile and 1/4 mile. Among the 3-6 story commercial buildings reviewed, the results reveal that the consistent decreases in the average deviation, in the RRC scores indicating a marked decrease in the influence of the three major institutions cited.

The decline in this value is consistent with the departure away from the more developed core - whether it is around the FHCRC campus, the new SLU core or near the Experience Music Project where the new BMGF campus is located. The areas in-between these three campuses have qualities similar to those on the same distance periphery of the MIO campuses on FHD - thus validating the scoring.

Median RRC Scores - Banded

Here too, the median RRC scores were shown to increase as one moved from the boundaries of the institutions themselves, out past markers of 1/8th mile and 1/4 mile. Among the 3-6 story commercial buildings reviewed, the results reveal that the consistent increases in the median RRC scores, like the average RRC scores, reflect a marked decrease in the influence of the three major institutions cited.

SUMMARY

The applications of the RRC scoring system to non-traditional institutional campuses reveal that major entities exert influences on development (and thus the question of raze or retrofit) similar to traditional institutions. In the case of SLU, the presence of both non-profit and for-profit organizations appears to have minimal differences in scoring results from those in the FHD; aside from the relative differences of the properties scored.

SECTION .V - THE MADISON STREET CORRIDOR

Section Summary

This section examines the impacts and influences of institutional development upon the built environment immediately adjacent to it. It looks at the role of the institution with respect to the corresponding development outside of its boundaries, and suggests what the urban design implications are as a result.

PRELIMINARY DISCUSSION

The analyses undertaken in the previous section demonstrated the existence of impacts coming as a result of institutional development at various levels:

- At the individual level; wherein the individual owner of an individual property is directly influenced by the economic impacts of both the institution adjacent to it, as well as to any responses from the government in response to it.
- At the neighborhood or district level; wherein the distance from the corresponding institution has a measurable impact or influence upon the decision making of property owners.
- At the city level; wherein other types of institutions (not just major hospitals as those tested upon First Hill) can influence the decision making of property owners in a similar manner.

At each level, institutional influences in the purchase and disposition of commercial properties may be found which are related to the decision to either raze or retrofit the property for energy efficiency. Correspondingly, like the measurement of the raze-retrofit continuum, the influence of the institutions holding the Major Institutional Overlay (MIO) designations show a distinctive impact upon the properties adjacent to them.

To address these impacts, the area controlled by Swedish Medical Center (SMC) was examined, as were the non-MIO areas immediately adjacent to it. The similarities and differences between these areas will be discussed here, and will focus specifically upon the area known as the Madison Street Corridor; that area of Madison Street between Broadway to the east and Boren Avenue in the west, bounding the SMC MIO District (MOID) northern border.

Current Conditions

Swedish Medical Center

As a major medical institution, SMC operates within the bounds of the MIO designation to which they have been assigned. As discussed previously, all MIO designations maintain a master plan for the development of their physical grounds, and changes to the development plan are shared with the community and other interested/potentially impacted parties.

Adjacent Non-MIOD Development

Properties adjoining or adjacent to the MOID are of mixed variety, but typically are related in some manner to the activities on First Hill: the delivery of medical services. Development surrounding the MIOD is a mix of existing medical offices, some retail, and a variety of residential units, including condominiums and apartment towers.

Surrounding Influences - Public Sector

Regional Growth Center/Urban Village Designation

In 1998, the Department of Neighborhoods at the DPD issued the First Hill Neighborhood Plan. The plan outlined the existing population, employment centers and building stocks on First Hill, and made a critical assessment of the educational, cultural and occupational opportunities located there. The plan called for (among other things) the creation of a recognized economic corridor along Madison Street, starting west of Broadway, all the way to the Central Business District downtown.

In 1994, Seattle's *Toward a Sustainable Seattle* comprehensive plan was developed to accommodate 72,000 new residents, 50,000 to 60,000 new households, and an estimated additional 130,000 to 140,000 jobs. The plan used an "Urban Village" approach to retaining neighborhood cohesiveness and livability. It created five Regional Growth Centers and a larger number of neighborhood centers clustered around a mix of housing, retail, and cultural, occupational and educa-

tional opportunities; centered upon public transportation systems to provide mobility.

Since First Hill is a major employment center, and a rapidly growing residential area, it was designated as both an Urban Village and a Regional Growth Center.

Accordingly, the zoning along Madison Street west of Broadway was up-zoned to NC3-160, as an encouragement to property owners and developers, and to provide some continuity with the heights of developed properties within the SMC and VMMC MIODs.

Sound Transit First Hill Station & the First Hill Streetcar

Because it was designated as a Regional Growth Center, the First Hill neighborhood was expected to absorb a large portion of the expected population growth, and was also targeted as a prime location for a station in the planned North Link Light Rail System. At that time properties along Madison Street on First Hill were purchased by the City of Seattle in anticipation of the creation of the station.

Discussed in earlier sections, the North Link Light Rail station was dropped due to engineering difficulties with the types of soil on First Hill combined with the great depth and resulting very high cost of such a deep station. As an alternative, the First Hill Streetcar was proposed to run from Pioneer Square to Capitol Hill via First Hill. Planning for the First Hill Streetcar has since continued, and is expected to be completed in 2013.

Private Sector Activity on First Hill/Capitol Hill

Like many other American cities, Seattle has experienced an increase in their healthcare sector, and as a result the associated hospitals, medical centers and research facilities have grown in size and scope. Since First Hill is a district dominated by medical facilities, this growth has had an associated impact on the growth of businesses and residences directly and indirectly related to the field, creating demand for improved transportation networks.

With the planned improvements in the First Hill Streetcar and Link Light Rail discussed in the previous section, additional residential developments are expected, creating more demand in support services and entertainment; itself creating more reciprocal incentive for additional residents to call First Hill home.

All of these impacts have an influence upon the value of properties adjacent to the MIODs of First Hill. The previous section examined this influence, and showed that the likelihood of properties being redeveloped is positively related to its distance to the MIOD (Figure 5.5 on page 51).

SMC DEVELOPMENT POLICY AND THE MSC

Background

The Madison Street Corridor has become one of the primary pedestrian routes across First Hill. Running northeast to southwest, Madison Street connects First Hill to downtown and serves as a local retail center for workers and residents alike.

Since the designation of First Hill as a Regional Growth Center, and the up-zoning of the upper portion of the Madison Street Corridor to NC3-160, many of the properties adjacent to the MIODs have been purchased by investment groups or individuals in anticipation of the public transportation improvements discussed earlier in this section. The decision by the City of Seattle not to place the Link Light Rail Station on First Hill, and the property's subsequent sale, has returned the upper portion of corridor to a slower path of development, dominated by mixed use and office projects related to the SMC and VMMC campuses.

The 2005 SMC Development Projections

In their 2005 Major Institutional Master Plan, SMC defined their MIOD as an area of approximately 14.92 acres, bounded by James-Boren-Madison-Broadway, excluding the public right-of-ways, and is broken into three major components: a core hospital zone (consisting of the main hospital campus from Broadway west to Minor Avenue, and north to Marion Street); a medical office zone (from Marion Street northward to Madison Street); and a support/parking zone (located between Minor Avenue and Boren Avenue) .

The 2005 MIMP from SMC indicated that the growth of their mission and their relationship with the surrounding community was of paramount importance. SMC cited the need for renewal of existing structures, and changes to the existing development standards (within the bounds of their MIOD) in order to fulfill their mission to the community.

One approach that SMC utilized to facilitate such growth was to (under the terms of the MIMP) was to work within the city's goal of increased development

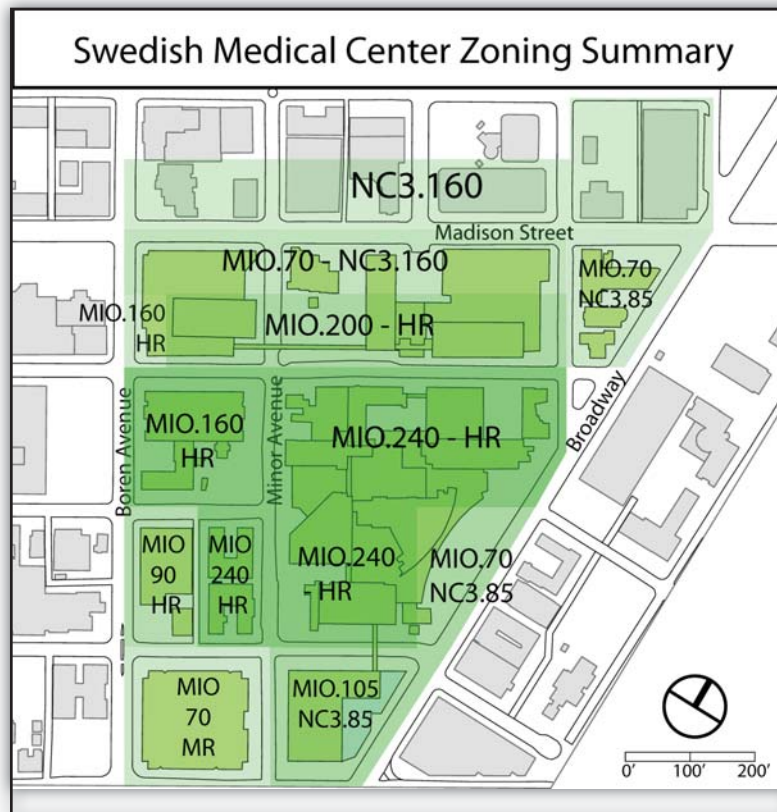


Figure 5.1 – SMC Current Zoning Pattern. Source: Sean Engle

density level within the MIOD to meet their needs. The MIMP specifically specifies the target density, and utilizes both the height limit of allowed development and the floor to area ratio (FAR). The existing maximum FAR for the MIMP is 5.5. When applying the chargeable building area (3,500,000 sq ft, not including mechanical, below grade, parking and circulation spaces) to the existing land area (649,876 sq ft, not including public rights-of-way), the resulting FAR of SMC is approximately 5.386. Consequently, in order to obtain additional needed space for program development without expanding past the existing boundaries, adjustments in the existing buildings building height limits became necessary.

In the 2005 MIMP, four district heights existed on the SMC campus: MIO-70, MIO-90, MIO-200 and MIO-240. The developed heights within the campus were constructed in such a manner that the tallest buildings are in the center, and then decrease in height as they approached the MIOD boundary, with the intent of matching the maximum height allowed in adjacent development. When combined with the existing FAR, additional development needed to be creative in order to move forward.

To match the limits on development with the expansion of their medical programs, SMC had to utilize existing space within the MIOD rather than extend its boundaries, while at the same time ensure that the expansions they could participate in were those which would improve the competitiveness of the SMC as a whole. In 2005 SMC managed to do just this - in that one of their major goals was the expansion of their existing orthopedics program, and the development of a world-class orthopedics institute on their main campus.

To complete the program, SMCs 2005 MIMP proposed to reduce the height limits on the block bounded by Marion-Minor-Columbia-Boren from MIO-90 and MIO-240 to MIO-160, matching the adjacent non-MIOD zoning at NC3-160. At the same time, SMC also proposed a height limit increase from MIO-70 to MIO-105 on the block bounded by James-Cherry-Minor-Broadway, where, at that time, the SMC Broadway Annex stood. The Broadway Annex had been constructed in the 1950s, so the replacement of the facility was overdue, and seemed to mesh well with the program needs for the expansion of the SMC orthopedics program. By 2007, the new SMC Or-

601 Broadway: An Example of Institutional Development Influencing Adjacent Properties

A good example may be found of the type of impact that institutional development may have upon adjacent properties can be found at the south end of MIOID, at the new Swedish Medical Center Orthopedic Institute (SMC-OI).

Since the project was mentioned in the 2005 SMC Master Plan, all the way to when the SMC-OI opened its door in 2008, the properties immediately adjoining it to the south have experienced a substantial increase in their assessed value.

In fact, during 2008 alone, many grew substantially despite the downturn in the economy:

Address	Const. Yr.	% Growth 2008 Only
505 Minor Ave	1958	32.25%
516 Boren Ave	1988	35.42%
600 Broadway	1990	9.51%*

* 600 Broadway is owned by SMC, and many existing orthopedics offices moved to the new facility.



Figure 5.2 – Aerial of SMC's Orthopedic Institute, June 2008. Source: Swedish Medical Center

So, within the circumstance involving the SMC-OI, there is good evidence to support the contention that institutional development influences adjacent properties with respect to their value, and thus, their disposition. It is likely that similar increases have occurred or will occur with other adjacent properties with an MIOID is redeveloped or expanded.

thopedic Institute was under construction at the old Broadway Annex site, and by 2008 was accepting its first patients.

Reassigning existing development potential within the MIOID allowed SMC to construct and operate their Orthopedic Institute (Figure 5.2). In this way, the densification of the MIOID is achieved over time as SMCs requirements change and evolve. But what influence does the development within the MIOID have upon the adjacent properties neighboring SMC? Please see the box above entitled “601 Broadway: An Example of Institutional Development Influencing Adjacent Properties” to learn more about how they were impacted.

Future SMC Development

Potential or Planned Development

In its 2005 MIO Master Plan, SMC noted a number of potential projects for future development. Among the list was the Broadway Annex already discussed (see box) and a number of planned and projected replace-

ment for various aging buildings on the SMC campus.

A review of SMC properties shows that the core of the hospital complex is located in the middle/north portion of the campus and is made up of hospital buildings constructed in the 1920s and 1930s. In addition, there are several other aging buildings to the on the western edge of the campus, built immediately after World War Two which need to be replaced (Figure 5.3 on page 50).

While such development is often driven simply by the condition of the existing infrastructure, other forces which contribute to the entire replacement of buildings in this manner include competition from other area hospitals, and the legal requirements for seismic controls within buildings assumed critical to the community (hospitals being near the top of the list).

In this circumstance, SMC faces competition from local Seattle hospitals (such as those located only two blocks away) and those located further out in the

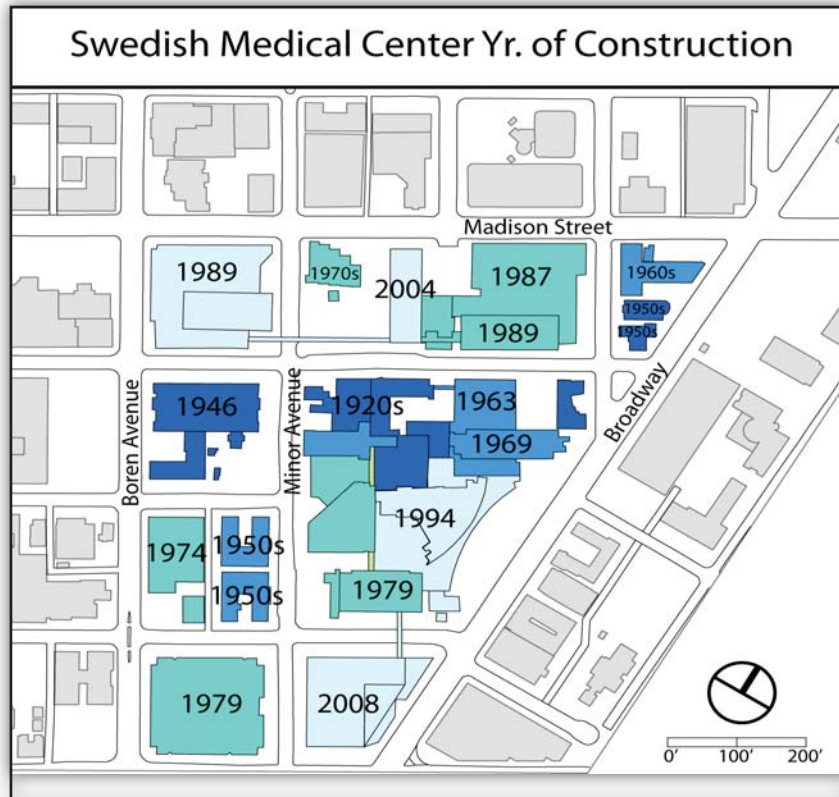


Figure 5.3 – Summary of SMC Building Construction Dates.

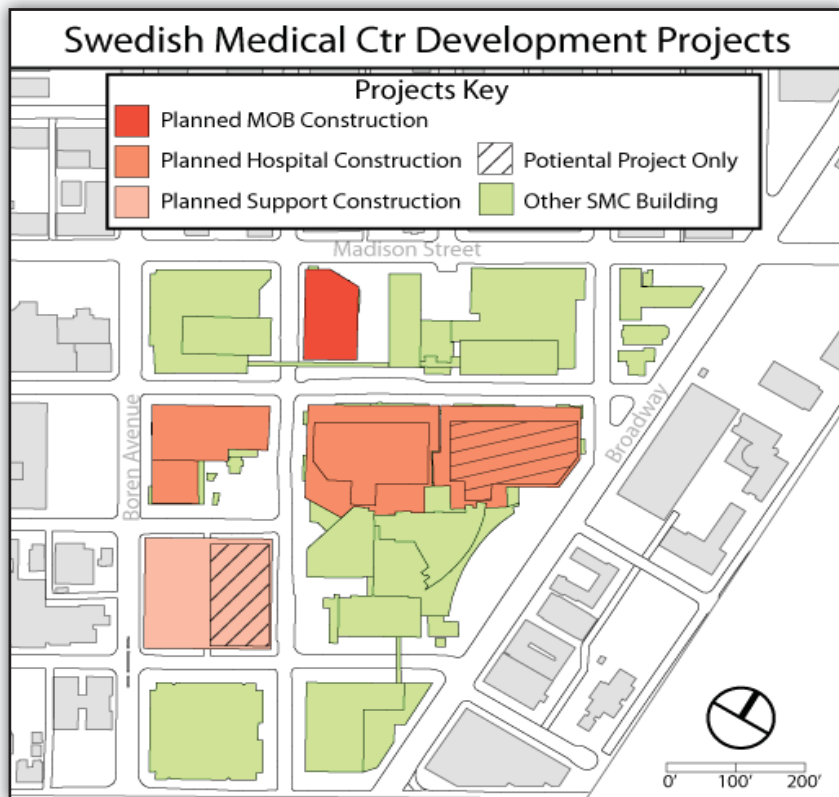


Figure 5.4 – Summary of Planned SMC Development Projects (2005)



Figure 5.5 – MMIP Inspired Development in Adjacent Properties. Source: Author

suburbs. In contrast, SMC itself recently opened a new hospital in Issaquah to increase its competitiveness in the suburbs of the East Side of Puget Sound. The necessity of maintaining the SMC flagship campus is no different, and explains some of the planned development.

The 2005 master plan cited this cluster of buildings in the central/north portion of the campus to be among those most likely to be replaced within the next cycle of development. The core replacement buildings operate within the MIO-240 zoning envelope mentioned earlier, with that to the west in the MIO-160, and the office tower on Madison in the split-block zoning area of MIO-160 and MIO-70. All projects are likely to take full advantage of the height limit when they are constructed (Figure 5.4 on page 50).

Potential Impact of SMC Planned Development

Generally speaking, the projects that have already been executed by SMC along Madison Street have created an edge condition, that while not completely blocking sunlight, does reduce a significant portion of it from reaching the street. Because of this, changes to the existing zoning within the MOID should ideally improve the northern edge - to ensure that more light reaches the street (Figure 5.6).

The projects that SMC were considering in their 2005 Master Plan would replace the existing north wings of the campus, add a medical office tower on Madison Street, a maintenance facility and another tower along Minor Avenue between Marion and Cherry Streets, and a third tower at the triangular lot bounded by Madison, Broadway and Bolyston Avenue.

The bulk of the primary additions - those in the north and east wings, could add substantially to the main campus, and could create additional barriers to sunlight reaching Madison Street. While the height limit is 240 feet in that portion of the MIOD, the solid nature of those additions would stop at least winter sun from reaching Madison (Figure 5.7).

Another opportunity exists for SMC to shift the anticipated bulk of their needed facilities to the western portion of their campus, thereby providing the north edge a more porous edge for sunlight and air, and by creating shadows which will be cast upon the very organization which created them in the first place (Figure 5.8 on page 52).

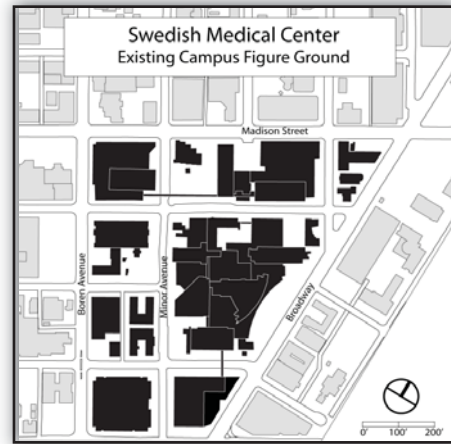


Figure 5.6 – Figure ground of SMC campus; existing condition. Source: Author

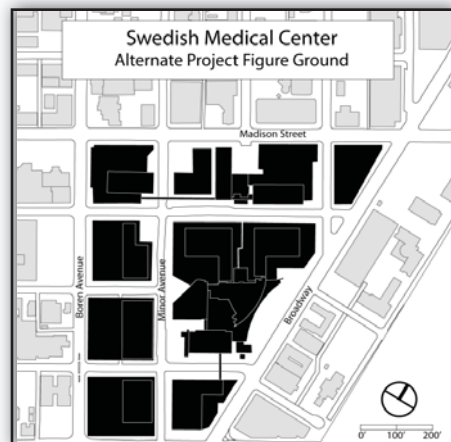


Figure 5.7 – Figure ground of SMC campus; expected projects. Source: Author

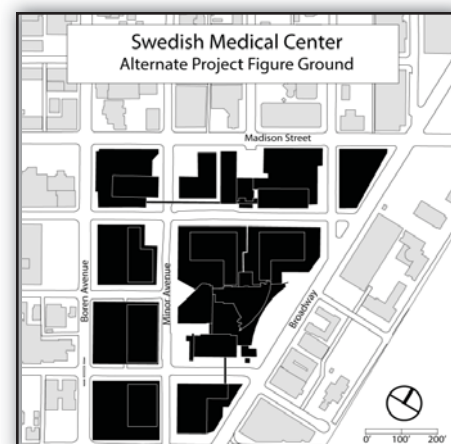


Figure 5.8 – Figure ground of SMC campus; suggested alternative. Source: Author

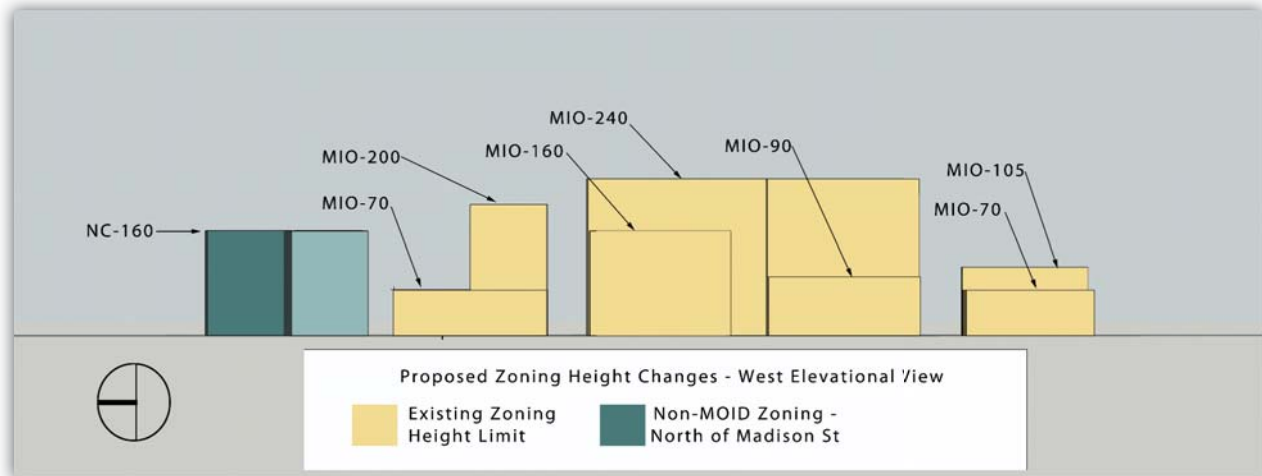


Figure 5.9 – Western elevational view of existing MOID zoning height limits.

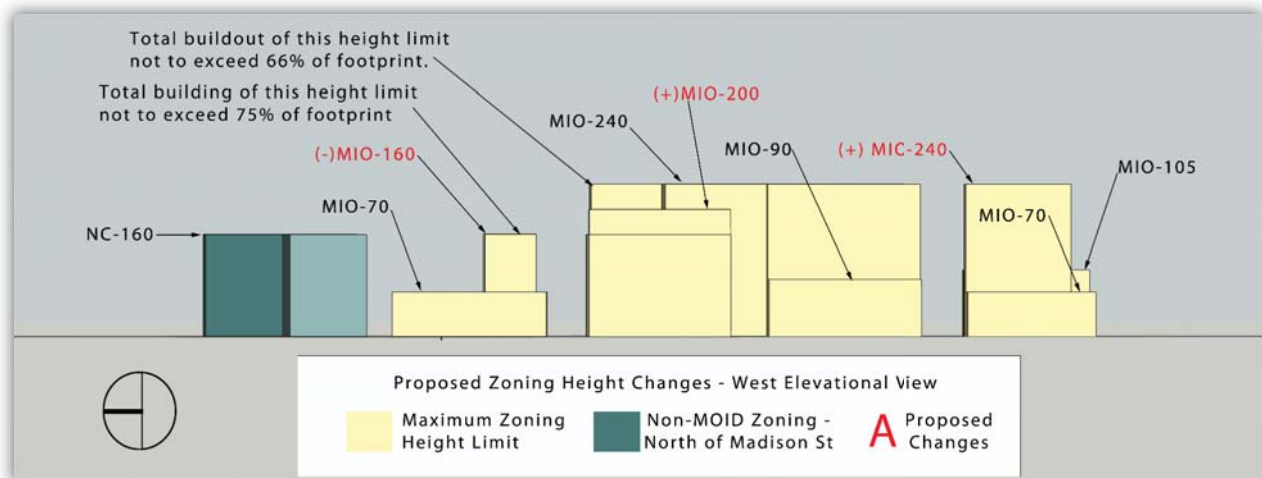


Figure 5.10 – Western elevational view of proposed MOID zoning height limit changes.

Recommendations

Create a Buffer Zone Along SMC’s Northern Edge

To change the existing interface between the MOID and adjacent properties, a buffer zone should be created for the northernmost edge, with a reduction in the overall height limit in the southern half of the block bordering Madison Street to 160 feet rather than 200 feet.

In order to accomplish this, the other edges of the campus should be permitted to increase somewhat in height. The MIO Master Plan should be amended to require a strategy to create such a buffer zone, and phase it over a period of years as buildings are replaced, or new development is undertaken.

A northern buffer zone would ensure that the Madison Street Corridor retains enough air and light to make it more inviting, and that the newly developed buildings there have sufficient solar access to make them more efficient.

The heights of these zoning envelopes would slope down as the northern edge of the MOID was approached as they do now, however the reduction would be the greater on the Madison Street edge, and much less so on the western and southern edges.

Increase Northern Border Transparency

In addition, the reduction in the height limits along the northern edge would create a more porous condition; not only with increased solar access to the Madison Street Corridor, but also with an increase in

Section .V - The Madison Street Corridor

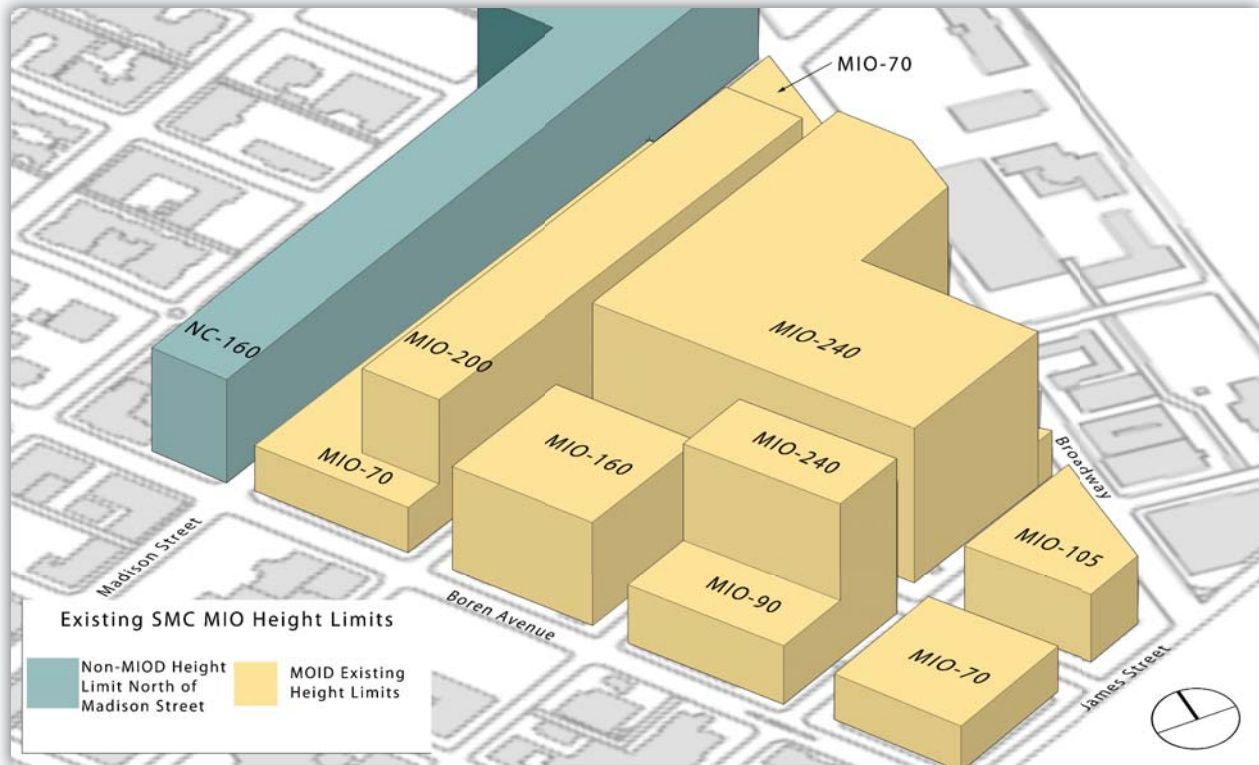


Figure 5.11 – Axonometric view of SMC campus looking NE; Shows existing height limits.

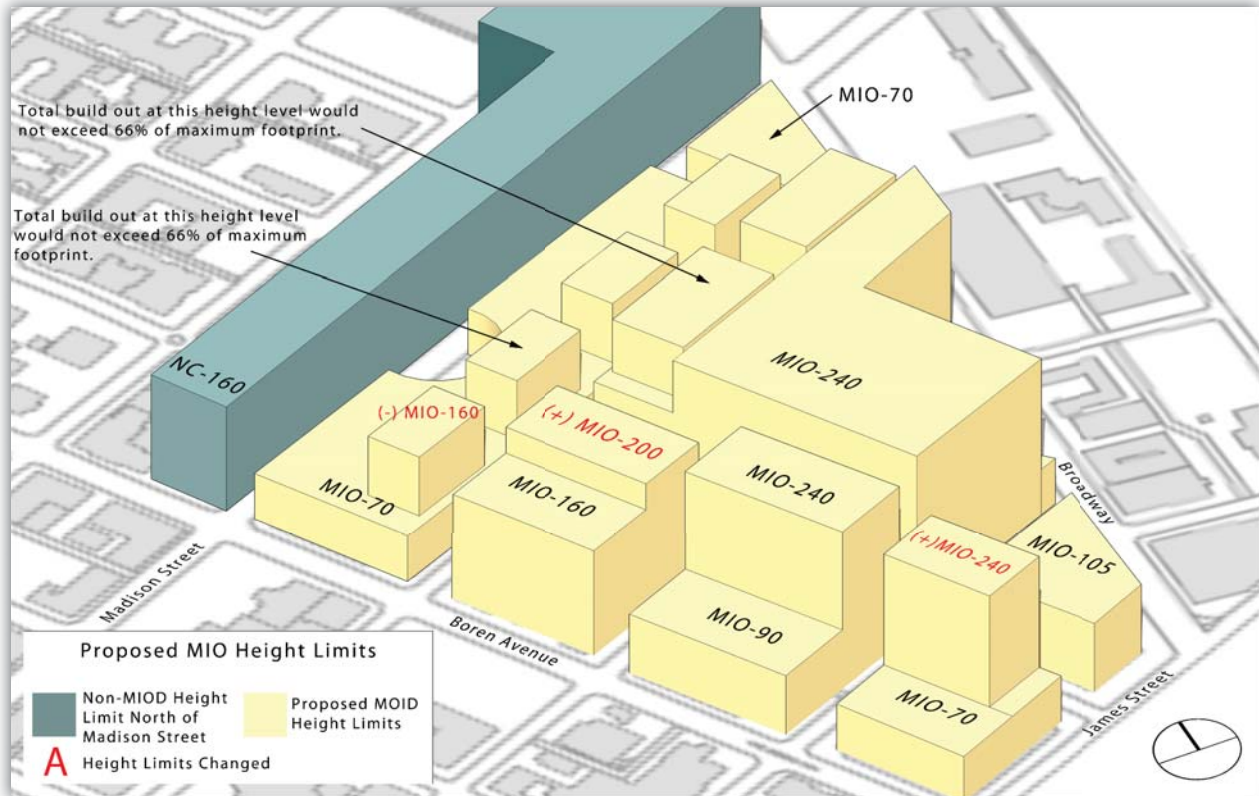


Figure 5.12 – Axonometric view of SMC campus looking NE; Shows proposed height limits.

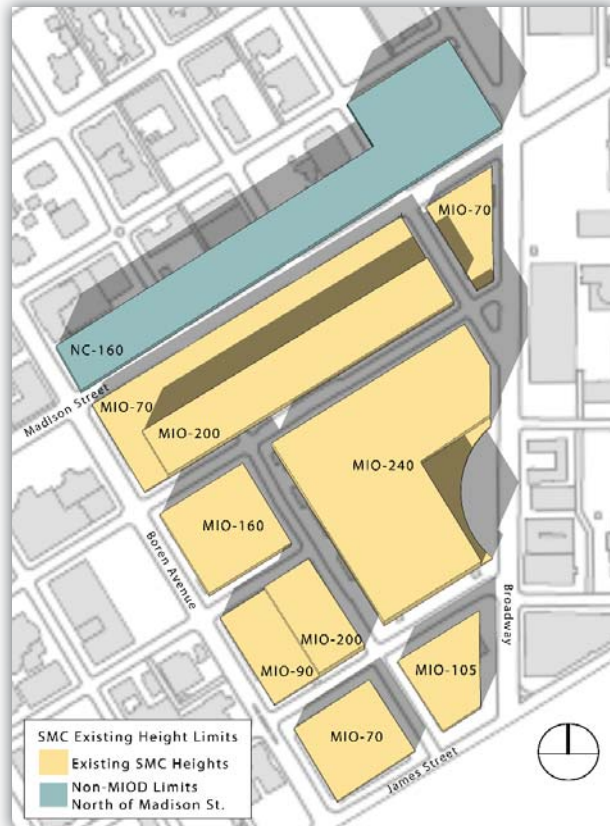


Figure 5.13 – Plan view of SMC Existing Height Limits.

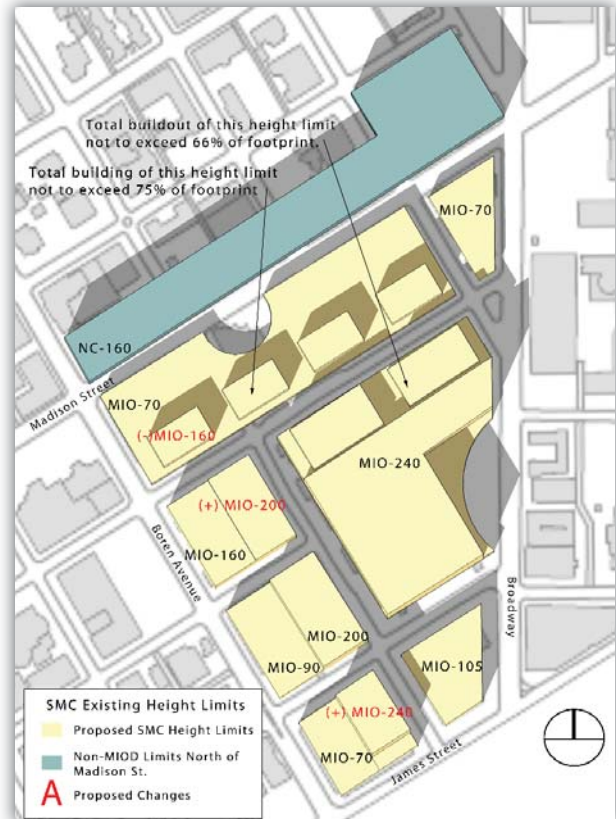


Figure 5.14 – Plan view of SMC Proposed Height Limits.

layered views from the north to the south - back to the main wing of SMC itself.

To accomplish this, the two high ridges running west to east, those between Madison Street all the way south to the east and northeast wing of the hospital would not fully develop the footprint of the building. Reducing the total percentage of tower to be permitted for development to approximately 75% of the workable base, both at the north and east wings, and 66% at the southern half of the Madison Street block. In the diagrams above, this is represented by the creation of smaller maximum zoning blocks on the green zoning diagrams (Figure 5.10 on page 53, Figure 5.12 on page 54 and Figure 5.14 on page 55).

Construct New Tall Towers on the West Edge of SMC

Reducing the height limits on the Madison/Marion block and reducing the total build out permitted on the new east and northeast wings will decrease the total amount of useable floor area developed for SMC.

A relatively non-invasive solution to this problem is to direct the new construction of the newest towers (those currently in planning to replace the east and

northeast wings) to the west rather than to their existing footprints. The towers could be set back half a block on Boren Avenue, just as they are on Madison Street now, however unlike Madison Street, the shadows they cast will only fall upon SMC property, and should have little or no solar impact upon adjacent properties.

Specifically, those parcels adjoining Boren Avenue could have their height limits increased to MIO-200 (on the eastern half of the block at Boren between Marion Street and Columbia Street. In addition, the two blocks immediately to the south could also be razed and redeveloped for towers with 90 foot halfblocks on the west, and 200 or 240 heights on the eastern half. (See Figure 5.9 on page 53 to Figure 5.14 on page 55 for further clarification).

Utilizing the western edge of the SMC campus will actually benefit hospital operations by allowing continued use the east and northeast wings without disruption during construction. This is because the west side of the SMC campus is lightly developed, and has (until this point) been utilized for support services such as parking, maintenance and support programs for

the hospital.

Create Pockets for Pedestrians Along Madison

In addition to the feathering of the building peaks within the MOID, and the northern edge becoming more transparent, SMC could adopt what we are calling the 'Pass Thru' Pedestrian Approach in addressing pedestrian access in the Madison Street Corridor. (see Figure 5.15 on page 57).

The Pass Thru approach holds that at given points along the northern boundary of the MOID, the building line should draw back within the parcel area, and the bulk of the building should step down to the street, becoming more transparent as it approaches the ground.

At the second story and below the facade of the structure (here marked as the "front porch" would be mostly transparent, and open to pedestrians, with small retail activities, pedestrian cover from the elements and opportunities to linger and eat, or rest, etc.

Between the "front porch" and the sidewalk would be another zone called the "front yard" which would be more transparent still - and possibly a mix of covered and outdoor spaces, also capable of allowing pedestrians to stop and linger; perhaps eating their lunch during summer afternoons, etc. The front yard could also have a glade of planted trees, or other amenity which provides comfort to the pedestrians.

The "Pass Thru" comes from the notion that while pedestrians have a normal path of travel (shown by green arrows) along Madison, that at intervals the building edge would pull back, allowing the pedestrians to see objective buildings across the corner (in this case demonstrated by the red arrow on Figure 5.15 on page 57), offering them the chance to enter a small retail or restful zone, away from the noise and traffic of Madison Street.

The Pass Thru approach can be used in conjunction with changes to the Madison Street edges themselves; improving them by adding 3 ft or 4 ft barrier walls at the curb - which would run between the crosswalks, and thus prevent street crossings at mid-block, providing pedestrian protection from automobiles, and providing some mitigation of street/tire noise to the pulled back portions of the building edge (the "front yard").

Conclusion on SMC and the MSC

This section has shown that:

- Major institutions like SMC create development plans which directly impact the adjacent properties in positive and negative manner.
- That the response to that development from the adjacent properties can create unpleasant interfaces with the MIO (such as the Madison Street Corridor), but that those abrupt changes can be mitigated to some degree.
- That even in very limited spaces, room can be created for pedestrians and street level activities. That by pulling back the bulk of the northern edge buildings opportunities can be created wherein pedestrians can rest, and (with tower development restricted to 75% of the footprint), more sunlight will be able to reach the street.

Since SMC has a clear, open process for development planning the influence upon the adjacent properties is considerable, and this is unlikely to change in the near future. However, if interface zones could be established on those edges most impacted (here the northern edge), then some of the negative influences arising from this type of development may be mitigated.

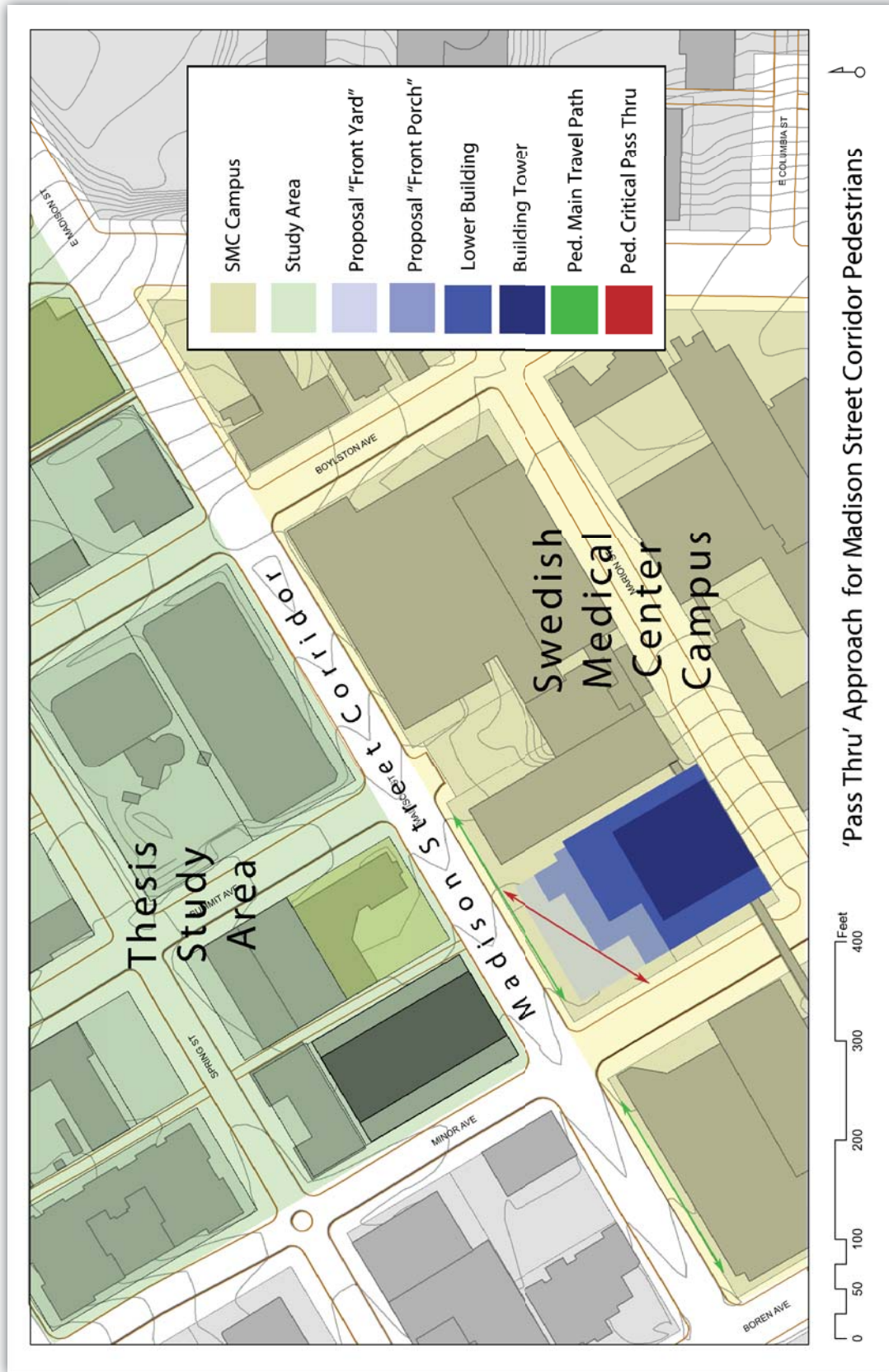


Figure 5.15 – Map of 'Pass Thru' Approach for Street Level Pedestrian Travel

SECTION .VI - CONCLUSION & DISCUSSION OF FINDINGS

Section Summary

This section recaps the findings of the study, provides the resulting conclusions and makes recommendations for the 2030DC based on those findings and conclusions.

FINDINGS & CONCLUSIONS

Statement of Findings from Analysis

Influence of Individual Decision Making Regarding ROI

This study has shown that the individual property owner is the key component in understanding how and why properties are bought, sold or retrofitted for energy efficiency. The elements within any given ownership profile provides the basis to understand what decision owners might make with regard to development, and thus how they might react to any given policy implementation or institutional change.

Because of current policies of property ownership in the United States, the choices for development of a comprehensive program in commercial stock retrofitting are increasingly difficult once the initial group of high-rise buildings and the (relatively) smaller number of owners, managers and associated companies have been dealt with. For this next largest group in Seattle beyond the high-rises, low-rise buildings with three to six stories, additional examination of similarities of ownership may help guide the approach to dealing with this next significant cohort.

Institutional Development and Public Sector Policy

This study has demonstrated that influence of institutional development on the part of entities such as SMC, VMMC, and HMC through its decreasing radiating level of influence away from those source institutions. The decreasing amounts influence also reduced the propensity for properties to redevelop, and more likely to retrofit for energy efficiency.

Since the healthcare sector plays such a large role within the economic life of Seattle, the decisions and movements of these three medical institutions have profound impacts upon the decision making of the individual buildings owners in the adjacent areas, and the banded scores of the RRC should be used as a tool to assist in navigating the next phase of outreach on the part of the 2030DC.

Likewise, the decisions taken on the part of the City of Seattle of where to lay new transit tunnels and stations, where to designate the Urban Village Center, or where to place a new streetcar line - or even the stops on that streetcar line are profound; going a long, long way toward impacting the decision of the institutions and the individuals who work with and around them.

This study has shown that peripheral influence generated by development of major institutions does exist - and that their impact is real and significant.

Significance of South Lake Union Comparison

The comparison of the commercial building stock in South Lake Union validated the RRC scoring system as consistent from one district to another. As anchoring institutions, major organizations provide the most significant pull of businesses both associated with, and those supporting the organizations in question. This study showed the linkage from the individual to the district to the larger city.

The nature of the existing building stock in South Lake Union is that many of the very new structures neighbor other, much older existing structures, and yet the scoring of the RRC is still comparable to that of First Hill, demonstrating the validity of the tool as an indicator of the next most viable cohort to approach regarding the 2030D.

RECOMMENDATIONS

For the 2030DC: Looking Beyond the High Rises

Consider the implications of reaching out to a much broader group of building owners and managers than is currently being undertaken with the larger and taller buildings. By concentrating the bands of owners into groups - grouped by motivation or potential motivation, a clearer picture of their possible decision to raze or retrofit may emerge.

While determining the motivation of any given property owner is difficult, assembling a profiling method such as that incorporated by the RRC demon-

strates can be a valuable guide when considering how to best target limited resources.

For the Seattle DPD: Track the Degree of Opportunity

Consider collecting data on the degree to which the owners of any given property have utilized all of the given opportunities to increase their return investment. This type of data is easily obtained by making comparisons between existing circumstances and the existing allowances by city ordinance.

For example, if the zoned height limit of any given area is 160', and the structure on a given parcel in that area is only 50' in height, the reciprocal should be a calculated field of data which can be aligned with other fields to show the degree of opportunity the owners of that property have not exploited. The knowledge that building "X" has 110' of development height potential, when utilized in conjunction with other data can provide a clearer understanding - especially when aggregated with other records (such as financial/tax records of the KCDA) - of what the eventual dispensation of the properties could be.

Trend Tracking

Other types of information may be more difficult to obtain, however it would be helpful to more precisely develop decision making paths taken by existing building owners going forward.

To do this, the 2030DC could develop trending a database, wherein observations on property like those discussed above are noted. When combined with a second database showing the actual disposition of the property the 2030DC would have a repository of actual behavior of owners , enabling reasonable forecasts of owner behavior in the future (under a range of scenarios).

THE RAZE-RETROFIT CONTINUUM : A LAST WORD

American property law, combined with privacy laws and fear of public record keeping has created a constrained climate that makes planning difficult in the best of circumstances. In order to successfully mitigate some of the negative effects of private ownership, and balance it with successful management/planning of a modern American City and the desire to reduce consumption of fossil fuels, a new method of describing the intent (potential or actual) of a property owner would go a long way toward

achieving this balance.

This report has suggested a method that yields a better gauge of what a property owner has in mind when choosing between razing their building for redevelopment or retrofitting it for energy efficiency.

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APPENDIX 1.0 : MANS AFFAIR WITH FOSSIL FUELS

A LONG HISTORY

If one examines the 250,000 year history of man and his use of fossil fuels, only recently in our history has intensive use/abuse of this resource been undertaken. Prior to the Industrial Revolution, fuels which were utilized by man were essentially basic in nature, and close at hand.

The sun was our first energy source - providing the heat and light that man needed to survive. The next and probably more important fuel/process used was fire - the carbonization of existing fuels that could be found to provide heat and light. The major incentive for man's use of consumptive fuels via burning was the resulting energy (in the form of heat and light) - which could be released - on demand.

As time progressed, the uses of consumptive fuels were more or less in sync with passive forms of energy - those coming from the sun, wind and water. Since crops grew only from the sun for instance, man's agricultural pursuits often combined the more passive forms of energy with those which consumed stored energy. Tasks that could be completed via passive means were often preferred in order to conserve the stocks of consumptive fuels - which were more difficult to obtain, or were more expensive to utilize.

Varying region to region, the most common consumptive fuel was wood. In various parts of the world, shallow coal deposits were discovered and utilized by the local people, largely as a substitute for wood, either because of lack of resources or because of the characteristics of burning coal (burns cleaner and longer than wood coal). During this period oil, natural gas and geothermal resources were also locally discovered at utilized on a limited basis due to issues in storage, transport and/or extraction.

In all cases, uses of consumptive fuels was predominantly a static activity - in that to burn a consumptive fuel one had to maintain a supply of it and a place to burn it - so transportation early on was limited to the more sustainable animal and wind power. Even the increased use of coal in the eighteenth and nineteenth centuries, during the First Industrial Revolution, resulted in transportation systems which were limited due to their weight and speed. The development of the steam engine during this period is a

good example, in that while it was clearly a departure from earlier forms of labor, it was still limited by its weight and output in what transportation solutions it could provide. It was not until the Second Industrial Revolution, and the development of the steel making process, and resulting steel, chemical, petroleum, electrical and (later) the automotive industries that consumptive fossil fuels began to take off on a massive scale. By the early twentieth century, liquid fossil fuels - in particular petroleum products - had established a firm foothold in human society - and their impacts were only just beginning to be felt - particularly in the United States.

The rise of petroleum products is tied largely to its ability to deliver a great deal of energy in proportion to the cost of obtaining and transporting it. Gasoline, for instance, delivers more actual work by weight than other types of energy sources. Combined with the petroleum products being easily developed, stored and transported made it a popular choice. As we'll see, it is the very nature of petroleum (or crude oil) itself - that its construction is derived from complex hydrocarbons - permitting it to be manipulated into many other forms (making other products); making it the fuel - and material - of choice.

As the twentieth century started, coal began to be pushed aside in favor of petroleum products, and the economy began to expand at an increased rate (Figure 7.16 on page 74). As the use of petroleum products increased, and the economy along with it, more fuel was demanded. The Great Depression in the 1930s blunted this advance somewhat, so until the Second World War began in 1941, coal was still the nation's predominant energy source, providing primarily heating and fuel for the train network.

As the United States entered the Second World War, the demand for petroleum products began to soar to meet the demand of the new mechanized weapons systems. Once the war ended, the oil industry was fully rooted in the American economy, and turned its attention to the civilian markets of automobiles and the built environment. Combined with the expansion in the post-war economy, the late 1940s and 1950s witnessed a dramatic increase in the nation's consumption of petroleum products. The federal highway

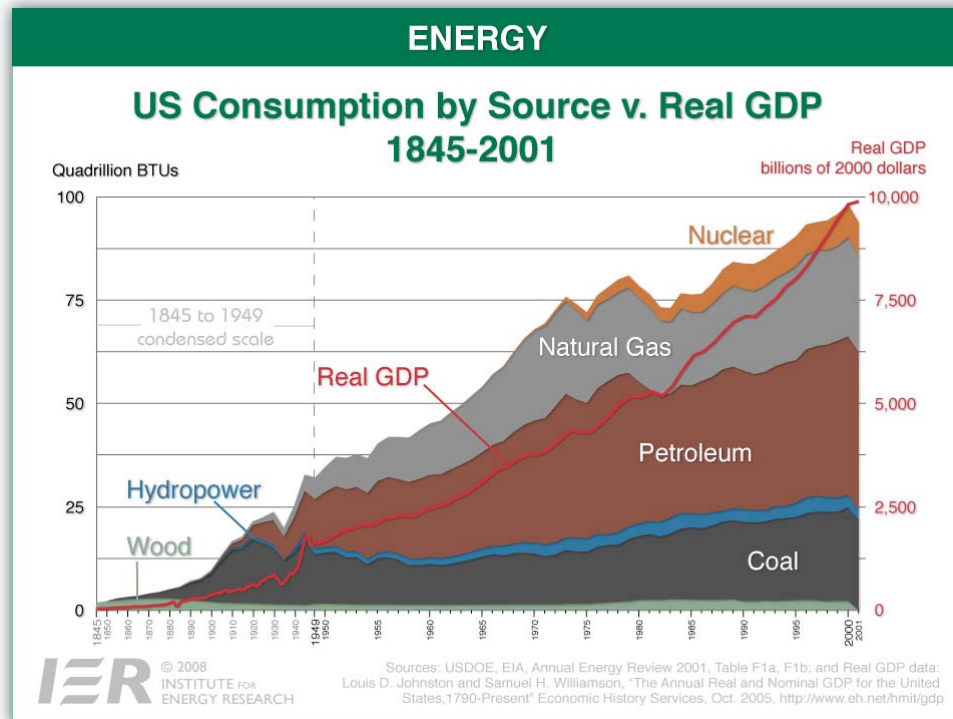


Figure 7.16 – US Energy Consumption by Source. Source: Institute of Energy Research

program of 1956 was one of most visible parts of this increase, as the roadways it constructed opened up the suburban areas around the major US cities, and made long distance commuting possible. Because of this, as the suburbs expanded, petroleum became the defacto energy source for the country's transportation network and the primary heating source for new residential and commercial buildings in the rapidly expanding suburbs. At that time, the United States was still the world's primary source for crude oil and the home of the burgeoning petrochemical industry which followed. By 1973, this would no longer be the case and the United States was superseded as the world supplier of oil by countries in the Middle East.

From October 1973 to March 1974, the United States faced an oil supply embargo by the Organization of Arab Petroleum Exporting Countries (OAPEC). Coming primarily as a response for our supporting the State of Israel during the Yom Kippur War and partially from on-going trade tensions relating to the departure of the United States from the Bretton Woods Accord, the Organization of Petroleum Exporting Countries (OPEC) dramatically raised the price of its oil from \$3 to \$12 a barrel. This action created fuel shortages, fuel rationing and high inflation (itself lasting until

the early 1980s) within the United States and other importing nations, and was the predominate cause of the US stock market crash of 1973-1974.

Following the 1973 oil embargo, the United States and other countries undertook various conservation measures to reduce the consumption of oil-based fuels. Strategies such as lowering the national speed limit, canceling of motor sports events, and Federal assistance in weatherizing and making homes and commercial buildings more efficient were common place in the United States. In Europe, more dramatic efforts were undertaken, including the banning of air travel on Sundays, rationing of gasoline and heating oil, imprisonment of those who exceeded their heating allowance and requests for home owners to only heat one room at a time.

The 1973 energy crisis also led to a greater awareness of alternative fuels and renewable energy technologies such as solar and wind power. There was also an increasing dependence on coal fired and nuclear power plants, and an increased awareness of mass transit.

By 1981, OPEC had failed to retain sole control over oil production, partially because of member-states failure

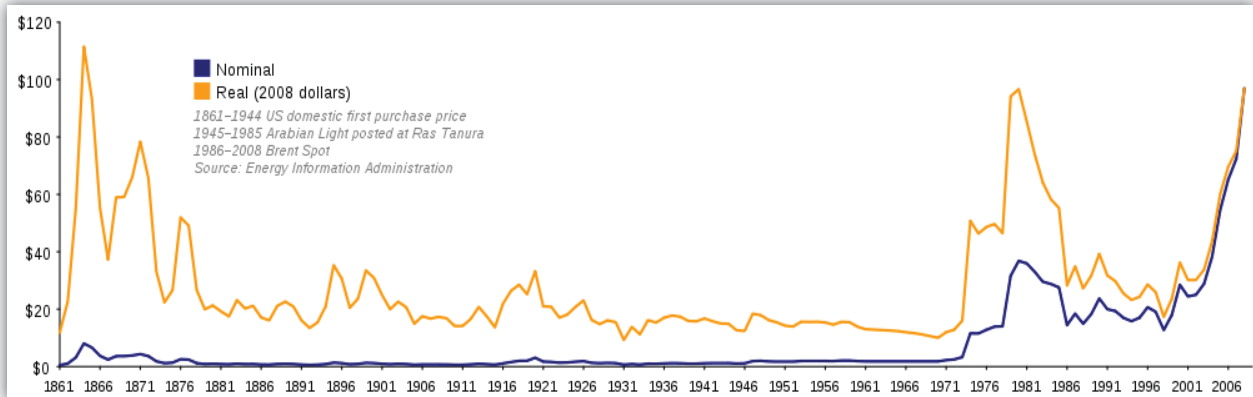


Figure 7.17 – Oil Prices 1861-2007 - In Nominal and 2008 Dollars Source: http://upload.wikimedia.org/wikipedia/commons/8/87/Oil_Prices_1861_2007.svg.

to comply with production limits, but also because of the reduction in demand from the consuming nation had greatly reduced their incomes. Also, during this period new oil deposits were discovered on the North Slope of Alaska and North Sea which, when combined with increased output of other producing nations, began the mid-1980s oil glut, with prices briefly falling back to pre-1973 levels (Figure 7.17).

Finally, with the exception of the 1991 price spike, the price of a barrel of oil stayed fairly stable, typically under \$25 a barrel, from the mid-1980s to the early 2000s. In the early 2000s, when it once again began to climb - reaching \$60 a barrel in 2005, and peaking at \$147.30 a barrel in July 2008.

MANS AFFAIR WITH FOSSIL FUELS = GLOBAL WARMING

The theory and science of Global Warming asserts specifically that the GHGs have been accumulating in the atmosphere, resulting both from the rate of accelerated burning of fossil fuels combined with an increased inability for the Earth's natural processes (such as transpiration of carbon dioxide and oxygen by the remaining forests of the planet) to keep up with the demand placed upon them. As a result, the earth captures more of the sun's energy and reflects less of it back into space – resulting in an overall increase in the average temperature of the atmosphere. That increase in turn sets up a chain reaction of reducing the amount of ice at the Earth's poles, thus retaining even more of the sun's heat, and in turn, more frozen GHGs, once sequestered in permafrost, ocean bottoms and elsewhere are released into the atmosphere.

The changes resulting from the minute increase in atmospheric temperature include the resulting less predictable and more violent weather systems;

increased desertification of some regions and flooding in others; increased sea levels resulting from the melting of the polar ice caps; the melting and dissolution of the planet's major ice sheets and glaciers; the resulting increase in crop failures and associated famines, among others. As of this writing, these relationships are in their early stages of being researched and understood, however the scientific community are in agreement that a link between Global Warming and the use/exploitation/dispensation of fossil fuels exists.

Thus, the consequences of Global Warming, and the changes it brings to the planet are considerable, and present a perilous and unsustainable condition to mankind at a level never seen before. Careful administration of our systems of industry, architecture, food supplies, city making, etc will ensure that those elements tied directly to fossil fuels - nearly everything within our societies - will minimize additional damage to the Earth and the natural systems that support us. Thus, addressing the consumption of, and dependence upon fossil fuels by man is an issue which will touch all aspects of our existence going forward.

APPENDIX 2.0 - ANATOMY OF NEED: THE REVITALIZATION OF BROADWAY

by Sean Shannon Engle

Summary

This article is one that I wrote for a planning studio in 2005 covering the on-going discussion on what to do to revitalize the Broadway corridor on Capitol Hill. The article is being placed within this paper because of its applicability in examining the decision making of property owners to redevelop or not, and what role the government plays in encouraging those actions.

Background

The Broadway Retail core - that which extends from Pike Street, north along Broadway SE to E Roy Street - has, for nearly five years, been experiencing a downturn in both sales and an erosion of its customer base. Currently, there are several large store fronts vacant on Broadway, and remaining merchants have been openly worried about declining sales and the future of their businesses. In addition, there also exists a mix of increased panhandling, homelessness and illegal drug use which has both local residents and businesses increasingly agitated.

Both Capitol Hill in general and Broadway in particular, have a history of being in flux. As recently as the 1970s, the culture of Broadway became dominated by younger, more urbane clientele, fueled in part from the presence of south Broadway's anchor, the Seattle Central Community College (SCCC). The eighties and nineties witnessed an increase and legitimization of the 'Culture of Broadway', with city tourist guides and newspaper articles touting the area as the 'hippest' and 'most happening' area in all of Seattle.

The 2000 downturn in both the national and local economies brought this period of Broadway to an end, however. The youth-oriented culture of Capitol Hill gave way to a seedier culture, creating a self-fulfilling scenario of a low demand retail mix, resulting in fewer shoppers, which prompted more businesses leaving, sending the district into further decline.

In October, 2004 Seattle Mayor Greg Nickels proposed legislation aimed at motivating private sector redevelopment of the Broadway business district. The history and source of the motivation, or need, of the legislation is the subject of this paper. Here I attempt to provide the reader with a sense of understanding in how the need for these policies came to be, and in doing so, assist the reader in determining if the suggested policies are an appropriate treatment for what ails Broadway.

The Initial Period: 1977-2001

As late as the 1965, the Broadway business district was impacted by the youthful culture of the existing high school and technical schools that were located at the foot of Broadway. In the mid 1970s, the SCCC was rebuilt to the large brick building we know today. With a substantial enrollment and no parking garages, one of the primary issues found in the 1977 Broadway Business District Study was the lack of parking, and its negative impact on merchants. At the time, the suggested approach to resolving this issue was the construction of two SCCC parking garages, and some other measures designed to create a definitive boundary or edge between the SCCC and the business district to the north.

These changes were implemented, and the SCCC-related parking issues somewhat abated. These issues did not impact the cultural character of the residents of the Broadway area, however. The area immediately around the Broadway district has a large youthful population component. Related somewhat to the presence of the SCCC at the south end of Broadway, and Cornish College at the north end, this youthful element is largely what has driven the translation of business on Broadway for the past three decades.

During the last seventies series of public investment mentioned above, Broadway was largely 'spruced up' with efforts such as a tile motif running along the store fronts, a series of decorative bronze 'dance steps' mounted into the side walks and new street-scapes and furniture. Significant improvements, such as the burying of telephone and power lines was also undertaken at this time.

Between the mid/late 1980s and mid/late 1990s the influence of an increasing gay population was most keenly felt on Broadway. Indeed, as an additional cultural group, the gay population on Broadway actually exerted a 'moderating' influence, and permitted the area to thrive as a 'counter-culture' district, and yet still manage to promote commerce

among many of the shops, who were catering to an increasingly narrow segment of the market. This combined with the roaring economy of the mid/late 1990s, created a 'funky-but-safe' atmosphere on Broadway that became its high water mark.

By the very late 1990s the culture on Broadway began to shift again. The aging population, with its increasing affluence, began leaving the district for other parts of Capitol Hill or the city and beyond, largely leaving a youthful, pierced-and-tattooed-counter-culture behind it. At this time, Sound Transit began looking at Broadway as a area for a light rail station, creating a cooling effect upon development/redevelopment (due to the uncertainty) and increasingly existing projects were shelved.

At the same time, sky-rocketing commercial leasing rates were forcing many of the mom and pop niche stores to leave Broadway, taking the 'friendly-yet-independent' flavor of the area with it. Inexpensive retail outlets and fast food restaurants moved in, attracting a still-younger crowd, one not associated with the SCCC, including many teen runways and homeless youth. The public street life began to exert more of a negative influence (an increase in public drunkenness and drug use, aggressive panhandling, overflowing dumpsters, and a low perception of police presence), adding more fuel to the exodus of businesses from Broadway.

The Transition: 2002-2003

In early 2002, the Businesses on Broadway organization (BOB), managed by Monica Mo in coordination with the Business Improvement Area (BIA) established by the Seattle Office of Economic Development (OED) was closed due to financial irregularities.

BOB had been a force on Broadway for more than a decade, working with local business owners and residents as a liaison between them and the City of Seattle. Funding for BOB came from the BIA funds levied from local businesses owners, and in 2001, with the national economy in decline, the City of Seattle faced a shortfall in its revenue. When BOB began posting debt of more than \$90,000, and began having trouble paying its creditors, the end came swiftly. BOB was disbanded, and the funds from the BIA were re-routed by the OED to Shirley Bishop, Inc - a financial management consultancy, who engaged the rate-paying business owners directly.

The recession of the early 2000s turned City Hall's

attention away from Capitol Hill and the Broadway district. With BOB removed, the representation of the needs of the residents and remaining businesses on Broadway was less substantial than those of other districts. Accordingly, when the few dollars that were available were dispensed, Broadway on Capitol Hill was overlooked in favor of locations such as Northgate, University Village and Fremont.

At the same time, more businesses continued to leave Broadway, and those that remained faced an ever increasing number of vagrants and drug addicts. Customers, afraid of confronting such issues began to stay away from the few remaining businesses that could support their needs (for basic goods, like clothing, shoes, etc), and instead chose to shop downtown or other locations. Because of the loss of customers, those businesses, in turn, left Broadway, further worsening the problem.

Commercial leasing rates on Broadway had not fallen, reflecting this loss, and were/are still among the highest in Seattle. Local residents began to complain of being unable to find the products they seek on Capitol Hill. The BIA membership made efforts to improve the business climate during this period, by utilizing funds available from the city to clean up the area and make it more attractive to shoppers, etc - all to no avail.

By early 2003, the call for City Hall to do something was becoming hard to ignore. The public on Capitol Hill, and the Broadway area specifically, began complaining openly that they were being ignored and overlooked. The membership of the Broadway BIA was unhappy as well - and demanded equal attention with the other districts of the city. Later that year, the city took notice of the issue, and acted.

That year, the city had the Gardner-Johnson consulting firm do an economic analysis of the vitality of Broadway and make recommendations. The study cited the issues of height and parking restrictions, split block zoning as the primary stumbling blocks to development. They recommended, among other things, a package of incentives (including the reduction of the mentioned restrictions mentioned above) in an attempt to jump-start development/redevelopment along Broadway. The report also mentioned a saturation of retail space on Broadway, indicating that retail redevelopment might run into roadblocks where there no additional revenue source (that whatever was developed would have to draw revenue from multiple

sources to be successful).

These include the removal of split-block zoning established in the 1970s, the increase of height restrictions along Broadway from 40 feet to 65 feet, and a reduction in the parking requirement in new development from 1.1 cars to .80 cars per unit. The report stated that only with the increase in height could the development of the area become economically viable for the private sector.

A New Vision: 2004 to Present

On November 23, 2004, Seattle Mayor Greg Nickels put forth a package of legislation aimed at jump-starting Broadway. Based largely on the Gardner-Johnson report, this package aims to generally roll back the restrictions that developers (not to be confused with the business operators or residents) have been citing as the reason for their avoiding the district, including those on building height and parking restrictions.

Since that time, a number of public hearings have been held, and while there has been some reservation at the reduction of the height/parking restrictions, the public, largely out of desperation, seems willing to go along with the changes. It would seem that most of the residents and business owners are more concerned about the lack of economic vitality and presence of crime than they are concerned about what outcome the regulation changes might bring.

This is in contrast to the Broadway of 1999 when discussion of development spurred strong opposition.

On May 3rd, 2005 another public hearing was held for the revitalization plan, and while some questions were raised, the overall environment was a positive one. As mentioned above, while there was some concern over the height issue, most at the meeting seemed more concerned about having changes made as soon as possible.

At that meeting, Seattle developer Bob Burkheimer stood to address Seattle City Councilman Peter Steinbrueck. Referring to his idle QFC property on Broadway, and its blank (and now tagged) wall, he exclaimed "...like that blank wall? Well, you get to keep it!" Developers like Burkheimer let it be known that they had no intention of considering properties like the old QFC site (Figure 8.18) for redevelopment until the city passed the zoning changes contained in Mayor Greg Nickel's revitalization package. Eventually, Burkheimer would get his way (Figure 8.19 on page 79).

On May 9th, the City Councilman Steinbrueck proposed some amendments to the legislation which should address the few residents concerns cited on May 3rd. These included, among other things, an amendment to require 20% affordable housing (for those below the 60% of median income cut off) in developments of 65 feet for a period of 50 years, upper



Figure 8.18 – Bob Burkheimer's old QFC supermarket on Broadway, May, 2005. Source: Author



Figure 8.19 – The Old QFC Site on Broadway - 2009, now the Joule Apartments complex. Source: Essex Property Trust, LLC

level setbacks to ensure access for light and air, and a codified linkage between the new development construction and the pending design guidelines for Broadway.

Toward the Future

From the perspective of this report, the problems that face the revitalization of Broadway are significant. In the absence of a new population base, the success of the existing Broadway retail district is largely dependent upon the local residents choosing to spend their money locally, foregoing other districts of the city. In order for that to occur, new businesses would need to relocate to the area to provide the goods and services that are either currently not available or are too far away, etc.

The proposed legislation is aimed at increasing the value of the existing parcels for those who hold them, and in doing so, encourage private sector investment and redevelopment. Sites such as the old Safeway site and old QFC site stand to benefit, as they are the only sites large enough to support significant development, and are properly positioned to benefit not only from direct access to Broadway, but also a closer association with the more affluent north end of the district.

If more moderately-priced, mixed-use residential units were to be developed on Broadway as has been suggested, it seems plausible that the new popula-

tion of residents would require additional products and services that the current population is either not seeking or (more likely) is unable to locate. In this, new demand would be created that could drive additional investment on the part of the private sector.

A resulting negative from this scenario, of course, is the potential displacement of (segments of) the existing population. Once residential development and resulting demand development occur (especially in conjunction with the Capitol Hill Light Rail Link station), the property values and rental rates would most likely climb significantly. While some percentage of the displaced population would be accommodated under the terms of development noted above (the 20% set aside in new development mentioned above), the vast majority would be permanently displaced, or would have to contend with higher rents or leases.

The opportunity for redevelopment can be found on Broadway, however what form the district takes following the next phase of change remains to be seen. If the legislation currently marked for approval spurs new development along Broadway, then the area could see a resurgence of growth.

- Sources used in "Anatomy of Need" were combined in this documents primary "Bibliography" on page 60.

APPENDIX 4.0 - ENERGY MONITORING PROGRAMS

Section Summary

In order to understand the logic of this thesis and why it is important as it is, one must understand the full scope of the other efforts made by developed nations to reduce GHGs. This section outlines those efforts in Europe, Australia and earlier efforts in the United States up to the disclosure laws enacted in Washington State and the City of Seattle, which the Seattle 2030 District now utilizes in its programming.

OTHER PATHS: RATING, MONITORING & REDUCING

This section looks at alternative paths of development than those which we've discussed. Specifically, it looks at a number of schemes currently (or recently) active within the United States, Europe and Australia to make buildings more efficient and reduce the level of GHG emissions.

Energy efficiency efforts in most countries have historically fallen into two major camps:

- Performance Based
- Design or Asset Based

Performance-based energy plans are more common outside the United States, in that they are derived from the actual environmental performance of the building in question, and not from its potential performance. In Europe, this typically meant that the utility supplying the energy would also provide the regulatory body with the energy use data, and then the law could be applied, dependent upon the goals of that country.

Design or asset-based energy plans are also common, both in the United States and elsewhere and are instead focused on the designed energy rating or the potential level of energy efficiency that building (or auto, consumer product, etc) might be capable of achieving.

Both approaches have shortcomings, both relating to the application of efficiency (described by the rating) the building receives. In the case of performance-based rating, the data lags behind the construction and sale of the building, and cannot be verified until a few years after the building has been occupied. Design or asset-based ratings have the reverse problem: while the rating is derived from a calculated potential to be efficient, and is useful in planning, marketing and selling the property, the building may or may not actually be capable of achieving those goals.

What follows is a survey of European, Australian and American energy efficiency plans developed in recent history. While not an exhaustive survey, major movements in energy efficiency are provided which serve to illustrate the means of implementation that were used to achieve those goals. And, while a great deal of similarity exists among the countries and their plans for efficiency, as we'll see, much of the deployment and actual resulting performance from those policies are actually more closely tied to the legal and regulatory framework of the programs.

European and Australian Efficiency Efforts: Rating, Labeling & Disclosing

Early efforts in Europe were primarily based on supply and not efficiency. In 1973, following the entry of Denmark into the European Economic Community, the focus began to change as Denmark, whose own energy policy was based on controlling demand (by increasing fuel prices, increasing automobile prices, etc), began advocating similar methods for general European energy policy.¹

In 1987, the first calls for a European directive on efficiency in buildings came forward, and by 1989, resulted in Specific Actions for Vigorous Energy Efficiency (SAVE). SAVE was significant in that it was a departure in European thinking about efficiency, and resulted in six primary principles which would guide further work in this area:

- Energy certification of buildings.
- Separate billing for heating, hot water, and air conditioning, based on actual consumption.
- Third-party financing for energy savings in the public sector
- The need for thermal insulation of buildings.
- Inspection of boilers.

¹ David, H. (2007) "The 50 Years History Behind the EPBD: From the European Coal and Steel Community to the EPBD." EPBD Buildings Platform.

Appendix 4.0 - Energy Monitoring Programs

- Energy audits in big industrial installations.

Based on the commitment made by the EU at the United Nations Framework Convention on Climate Change in Kyoto (to reduce its emission of GHGs by 8% from a 1990 baseline by 2010), renewed efforts were begun in 2000 with the Action Plan to Improve Energy Efficiency in the European Community. In 2002, the Energy Performance of Buildings Directive (EPBD) was created in order to meet their Kyoto obligations, and increase energy security by reducing dependence on foreign sources of energy.

The EPBD established the guidelines for energy efficiency in Europe, and contained five major themes:

- Certification of buildings.
- Inspection of boilers.
- Inspection of air-conditioning systems.
- Methodologies for calculating the energy performance of buildings.
- Implementation of minimum energy performance requirements for new buildings and for major renovations.

As of January 2009, twenty-two of twenty-seven member states had fully complied with the directive, and had implemented the directive. The European Commission is now working on a second, updated version of the directive to close loopholes and simplify/clarify issues among member states. The second version plans to remove a threshold of 1000 sq meters for minimum energy performance requirements in new construction and major renovations and requires disclosure of the energy performance certificate at the time of sale or lease of the building in question.

In Australia, the approach to energy efficiency is a mix of market-based regulations, disclosure and financial incentives. Each of the Australian states began white certificate programs (known in the United States as "Cap and Trade") which would pressure the emitters to reduce emissions, or seek/purchase the white certificates of others. For example, starting in 2003 the state of New South Wales began a carbon-dioxide-trading program known as the Greenhouse Gas Abatement Scheme (GGAS). Under the program, major emissions sources of GHGs where to either reduce their emissions, or purchase offset credits (transfer rights) known as New South Wales Green House Gas

Abatement Certificates (NGACs). Under the GGAS program, building owners earn NGACs by improving the energy efficiency of their buildings.

These programs were a pre-cursor to the national carbon-emissions-trading program called the Carbon Pollution Reduction Scheme which was slated to begin on July 2010. The program lost public support however, and was never implemented.

In 2006 Australia revised the Building Code of Australia (BCA), proscribing more aggressive energy standards for nearly all aspects of building construction and for the major components within them (including heating and ventilation systems, insulation, and plumbing).

The state governments of Australia sought to meet the improvement in the BCA by creating complementary programs which supported the national effort. In New South Wales, this came in the form of the Building Sustainability Index (BASIX), a potential performance certification system utilizing an online tool component to configure and measure the energy efficiency of a given design.

The BASIX program was also tied to the Australian Green Star Program (NABERS), a five star rating system along the lines of the US Building Council's Leadership in Energy Efficiency and Design program (follows), wherein buildings are assigned a rating based on meeting criteria that can be fulfilled in a number of ways.²

In November of 2010, Australia also passed the Building Energy Efficiency Disclosure Act of 2010, which requires sellers or lessors of office space of 2,000 square meters or more to obtain and disclose an energy efficiency rating. The act requires each building falling within the guidelines to obtain a Building Energy Efficiency Certificate which is then valid for 12 months, as well as businesses consuming more than 0.5 petajoules, or 139 GWh per year, to perform Energy Efficiency Opportunities every four years.³

Australia has also sought to create grant programs for

2 Sustainability Unit - NSW Department of Planning. (2006). "BASIX - Building Sustainability Index." Retrieved May 01, 2011, from <https://www.basix.nsw.gov.au/information/about.jsp>.

3 Australian Government. (2011). "Commercial Building Disclosure." Retrieved July 20, 2011, from <http://www.cbd.gov.au/>.

increasing energy efficiency, but the budget has been very constrained. In 2008, the national government allocated AU\$90m (US\$64m) for competitive grants for energy efficiency improvements to buildings. The government was also considering a "Green Depreciation" program which would allow accelerated depreciation for buildings meeting particular energy efficiency criteria.⁴ Under the proposed program, building owners would be able to defer taxes on the building in exchange for immediate improvements in energy efficiency.⁵

American Efficiency Efforts: Rating, Labeling and Disclosing

American efforts to reduce the emissions from the commercial building sector have been similar to those in Europe and Australia in some ways - in that all three tend to be rooted in either performance or asset based programs. In the United States however, much of the policy and implementation differences stem from land use planning and development regulations (property law), which generally emphasize the inherent autonomy of the owners, and more narrowly define the role and scope of the regulatory or planning authorities which might seek to guide their behavior.

Historically, this relationship was defined by cities seeking to impose regulation to achieve a particular result - first via zoning laws and then through city ordinances. Depending upon the type of effort put forth by the city, the regulatory impact (upon the owners) could then be redressed or exempted via legal actions (litigation) or via pressure placed upon the regulatory body. This relationship can clearly be seen in the interactions between owners and the regulatory bodies in actions arising from recent growth management laws, and the owner's argument of their subsequent "loss of property value" as a result of the regulation.

In the United States, this public-private interaction has resulted in an interesting third component to the performance or asset based approaches, that of the intermediary role, or "public-private partnership" wherein the long term goals of the regulatory body are made more palatable to the property owners via engagement either directly between the two, or with

the assistance of a neutral third party. As we'll see, the goals of the regulatory body can also be achieved via policies pursued through the private market by appealing to the needs of the owners themselves.

From the following survey of programs, the reader should gain a sense of similarity of the policy's origin, goal, direction of development, and an understanding of where the ultimate resolution might exist. The following survey is provided in a more-or-less chronological order.

Energy Star

Energy Star (ES) is a performance-based rating and benchmarking system, begun in the early 1990s by the US Environmental Protection Agency (EPA) as an attempt to reduce GHGs by focusing on increasing efficiencies at power plants. Developed by John Hoffmann in 1995, the program initially began by identifying and labeling energy efficient computer products. By 2006 the ES label is now found on more than 40,000 products of all types, including major appliances, office equipment, lighting, home electronics and many others; with most using 20% to 30% less energy than similar units. In 2006, about 12% of new homes carry the ES label, and an approximate \$14 billion in energy costs were estimated to have been saved - in that year alone. The ES label is now found in Australia, Canada, Japan, New Zealand, Taiwan and the countries of the European Union.

ES has developed a performance rating system for commercial, institutional, multi-family buildings and manufacturing facilities. Based on a scale of 1 to 100, the ratings are used for benchmarking the energy efficiency of building types of like size, construction and other characteristics. The rating and benchmarking system is voluntary, and is facilitated by using a free on-line management tool called Portfolio Manager

Portfolio Manager creates profiles of buildings owned, managed or held for investment, and establishing a wide enough set of parameters, is able to assist the users in "...developing investment priorities, identifying under-performing building, verify efficiency improvements, and receive EPA recognition for superior energy performance."⁶ It does this by establishing a monitoring base from which to measure performance and utilizing data from other buildings, is able to provide a benchmark performance estimate (based on similar

4 Centre for International Economics (2007). Green Depreciation - A preliminary analysis. Canberra, Australia and Sydney, Australia, Property Council of Australia.

5 Charles P. Ries, J. J., Oliver Wise, (2009). Improving the Energy Performance of Buildings, RAND Corp.: pp.1-18.

6 Wikipedia.com. (2011). "Energy Star." Retrieved May 01, 2011, from http://en.wikipedia.org/wiki/Energy_Star

buildings performance) and an overall score for that particular building.

LEED

Leadership in Energy Environmental Design (LEED) is a third party voluntary asset (design) rating system developed in the United States and Canada to evaluate and verify that structures meet various levels of environmental sustainability in their design and construction. Begun in 1998 by Robert Watson and the U.S. Green Building Council (USGBC), LEED acts as a framework of evaluative metrics designed to provide building designers, builders, owners and tenants with tangible and measurable solutions to reduce their contribution to GHGs. The USGBC has since grown to include more than 7,000 projects in the United States and in 30 countries throughout the world, and maintains an accreditation system via the Green Building Certification Institute (GBCI) allowing individuals to become certified practitioners of green building.

In 1998, the LEED system sought to support the incorporation of green technologies within new construction. The first three versions of the LEED system were for new construction, and took just over ten years to the tune the ratings metrics into an effective system of evaluation. Currently, the LEED rating system is broken down into five sub-sections which cover major aspects of the built environment; focused on construction area or construction type. They cover:

- Design & Construction
- LEED for New Construction (LEED-NC)
- LEED for Core & Shell (LEED-CS)
- LEED for Schools (LEED-SCH)
- LEED for Healthcare
- LEED for Commercial Interiors (LEED-CI)
- LEED for Existing Buildings: Operations & Maintenance (LEED-EB)
- LEED for Neighborhood Development (LEED-ND)
- LEED for Homes

Each of the sub-sections of the LEED system contains major categories for evaluation and point assignment. These categories include

Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, and Indoor Environmental Quality. Each category in turn has individual conditions which must be met in order to obtain a variable number of points. The total number of points earned determines the LEED Status that the building will maintain: LEED-Silver, LEED-Gold or LEED-Platinum.

Each of the LEED categories maintains a library of rating systems guides, checklists, addenda listings, minimal program requirements and ratings system forms for users to complete. Most of the rating systems are self-explanatory, and provide a number of solutions that users can choose in order to obtain the credit for that category, and ultimately, the overall LEED rating itself.

For example, under the 2009 LEED-NC, SS Credit 2: Development Density and Community Connectivity category, a structure can earn a total of five possible points. The stated intent of the sub-section is "...to channel development to urban areas with existing infrastructure, protect green fields, and preserve habitat and natural resources." This indicates what the broader, underlying goals of the requirement are, and gives the applicant a contextual understanding of how the given condition should be met.⁷

In this example, the requirements section then provides the applicant with two possible choices for the site of the proposed project - each itself providing a number of possible condition choices that can be selected in order to fulfill the requirement. In this case, both requirements are aimed at building in areas where construction has also occurred; where existing infrastructure and other services have already been established, and where unit density average is fairly high; thus the suggested options all fulfill that condition in different ways, giving the applicant a number of choices.

The LEED system has been fairly successful during the time of its operation, and has mostly been criticized for its complexity in earlier versions. As time has progressed, the USGBC has been active in simplifying and clarifying its requirements, resulting in a growing list of LEED rated properties and a wider variety of LEED categories from which to address the plethora

⁷ USGBC Program Committee (2011). LEED-NC Program Guide for 2009. Washington, DC, US Green Building Council; pp.20-21.

building conditions to be met.

More substitutive claims against the LEED system include the seemingly less rigorous manner in which buildings may obtain points (for small items such as bicycle racks), and the impression the overall rating may give building owners, operators and prospective owners (that the impression it provides overstates the actual degree of sustainability or efficiency the building possesses). Specific discussion of how the LEED system compares to other systems will be presented later in this paper.

Architecture 2030

Architecture 2030 (A2030) is a professional advocacy organization and movement established to create and shape the discussion of ongoing efforts to reduce the amount of GHGs resulting from the construction and operation of commercial buildings. Founded by New Mexico architect Edward Mazria in 2003, the movement seeks to actively challenge the global building industry to reduce GHG emissions both in the materials chosen to construct commercial properties and within the design of the building itself; ensuring the structure would last longer and operate more efficiently over its life cycle.

In order to spur the needed changes in the method and manner in which commercial buildings are constructed, A2030 began the 2030 Challenge (2030C) in 2005. 2030C seeks to challenge the architecture and building communities to design, construct and retrofit existing buildings to meet much higher efficiency standards. To meet the new standards, the 2030C proscribes series of dated emissions reductions based on performance benchmarks for those specific buildings.

To this end, the 2030C targeted three over-arching goals in pursuit of reducing GHG emissions.⁸ First, the 2030C stipulates a series of specific targeted reductions within a given timeframe:

- That all new buildings and development be designed to use 50% of the fossil fuel energy they would typically consume – half the national average for that building type as benchmarked by the U.S. Department of Energy.
- That, at a minimum, an equal amount of existing building area be renovated annually to use 50% of the amount of fossil fuel energy that it is

currently using.

- That the fossil fuel reduction standard for all new buildings be increased to 60% in 2010, to 70% in 2015, to 80% in 2020, to 90% in 2025, and finally, to 100% (thereby becoming “carbon neutral”) in 2030.
- All new and renovated developments/neighborhoods/towns /regions immediately adopt and implement a 50% reduction standard below the regional average.
- Vehicle Miles Traveled (VMT) for auto and freight and
- Water consumption

The 2030C contends that many/most of the stated numeric goals above can be achieved via changes to the standard of design given new buildings; to incorporate passive standards of design which in and of themselves can significantly reduce the GHG emissions . Such changes vary from one region of the country to another, and can be dependent upon local climate, but generally include considerations such as:

- The shape of a given building and orientation to the sun;
- The roof/exterior colors and their associated reflectance values;
- The amount of glazing, the location of glazing and the types of glazing used within the structure;
- Shading strategies designed to reduce solar gain and/or glare;
- Daylighting strategies present for interior and perimeter zones;
- The insulation values found in the walls, floors, roof and foundation of the building;
- The general amount mass of within walls and floors;
- Use of passive heating, cooling and ventilation strategies;
- Specification of more efficient plant equipment;
- Specification of eco-friendly products throughout the structure.

⁸ Vazquez, A. (2006) “Sustainable By Design: Setting A Timetable: The 2030 Challenge.” Today’s Facility Manager.

Secondly, following the changes to the standard of design, the use of more active strategies may be employed in order to reduce the emissions level further. Active strategies include the use of technologies such as:

- Photovoltaic panels for electrical generation;
- Solar water heating;

Finally, after the preceding efforts have been exhausted, if the numeric goals are still not met, the owners/operators of the buildings choose to purchase renewable energy from a centralized power source. (Vazquez 2006) Collectively, these efforts are seen as a viable method of moving toward the significant type of GHG reduction that is required under Global Warming.

The American Institute of Architects (AIA) was the first group to adopt the 2030C, with the agreement of roughly 80,000 members. By May of 2006, the US Conference of Mayors (USCM) unanimously adopted it, resolving their member city executives to pursue aggressive reductions in fossil fuel usage within buildings owned or operated by their cities. USCM Resolution 50, submitted by the Mayors of Chicago, Miami, Seattle and Albuquerque, committed their cities to meet the 2030C goals, and to actively pursue the same standards in the retrofitting of city properties.

Following the lead of the USCM, other groups began to adopt the 2030C:

"To date, the 2030 Challenge has made a significant national impact and has been adopted by many organizations including: The U.S. Green Building Council, The American Society of Heating, Refrigerating and Air-Conditioning Engineers, Royal Architectural Institute of Canada, Ontario Association of Architects, Congress for the New Urbanism, American Solar Energy Society, Society of Building Science Educators, Association of Collegiate Schools of Architecture, National Wildlife Federation, Union Internationale des Architectes, American Society of Interior Designers, and numerous universities, businesses, professional offices, and organizations nationwide.

Government at all levels has also risen to the 2030 Challenge. In August 2006, the

*U.S. EPA Target Finder incorporated the 2030 Challenge targets for building energy reduction into their web-based calculator. In December 2007, after being passed by the Senate and the House of Representatives, the Energy Independence and Security Act became law with the President's signature. Section 433 of this bill requires that all new federal buildings and major renovations meet the energy performance standards targets of the 2030 Challenge. California's Long Term Energy Efficiency Strategic Plan released in September 2008 includes two "Big Bold" strategies in line with the 2030 Challenge: to have all residential buildings achieve zero-net-energy use by 2020, and to have all commercial buildings achieve zero net energy use by 2030. The American Clean Energy and Security Act of 2009 was passed by the U.S. House of Representatives and contains national building energy code language shaped by the 2030 Challenge. Other governmental adopters include: The National Governors Association, The National Association of Counties, International Council for Local Environmental Initiatives, the states of Minnesota, Illinois, New Mexico, Washington State, and numerous cities and counties."*⁹

For a complete list of current adopters to Architecture 2030 and the 2030 Challenge, please go to: http://architecture2030.org/2030_challenge/adopters_firms_organizations

Clinton Climate Initiative

The Clinton Climate Initiative (CCI) is one of several foundations/advocacy groups under the umbrella group the William J. Clinton Foundation, begun by President Clinton after leaving the White House in 2000, seeking to "...strengthen the capacity of people throughout the world to meet the challenges of global interdependence."¹⁰

Founded in 2006, the CCI functions as advocacy group

9 Architecture 2030. (2011). "Architecture 2030 Adopters." from http://architecture2030.org/2030_challenge/adopters.

10 Wikipedia.com. (2000). "Clinton Foundation." Retrieved May 14, 2011, from http://en.wikipedia.org/wiki/Clinton_Foundation.

and information clearinghouse which seeks to fight Global Warming with pro-business or business-oriented policies. The CCI creates strategic alliances with other advocacy groups, the private sector and governmental agencies in order to overcome the barriers typically found in trans-border problem resolution. In doing so, the CCI is able to achieve full buy-in from all stakeholders, often at lower cost to the public sector, than through regulation alone.

For example, in 2006 the CCI developed an alliance with the Large Cities Climate Leadership Group, a group of cities taking steps to reduce GHGs and adapt to changes brought by Global Warming.¹¹ Since cities contain about 50% of the Earth's human population, consume more than 75% of the Earth's energy, and create more than 80% of the Earth GHGs, pursuing the largest cities on the planet would go a long way in reducing the GHGs.

Since 2007, the CCI has continued the effort, with the creation of other programs such as the 1Sky Project, tasked at accelerating Federal policy, and targeting an 80% reduction in GHGs by 2050, and 2009 developed the Climate Positive Development Program (CPDP). Teamed with the USGBC, the CPDP seeks to promote "climate positive" urban growth policies which encourage actions to reduce GHGs.

Also in 2007, the CCI Energy Efficiency Building Retrofit Program was launched, seeking to join the efforts of large cities, building owners, energy service and technology companies and banks and investment groups to increase the efficiency of the existing building stocks and reduce the GHG emission rates. The CCI works to identify large scale, high visibility energy efficiency projects, and then marries them to the logistical, technical and financial resources necessary in order to achieve results.

Working with the major stockholders, CCI provides interested property owners with three major areas of information/logistical support:

"Project Development and Contracting Support - CCI offers assistance to building owners throughout the project development process in order to design and implement best-in-class energy efficiency projects. CCI's

support services include: defining financial and other project goals, incorporating best practices into project design and development, adapting contracting tools and templates for partner use, and providing technical assistance in review of supplier materials and proposals. CCI's processes are designed to reduce project cost, development time, and business risk.

Access to CCI's Building Technology Partnerships - Decisions about replacing building technologies and systems are often based upon "lowest first cost" rather than "true cost" analysis, thereby overlooking significant benefits such as energy efficiency or maintenance cost savings. CCI helps building owners engage with suppliers to assess energy efficient options for building systems and technologies. Building owners working with CCI can access information and discounted pricing on a range of best-in-class energy-efficient products, including heating, ventilation and cooling, building envelope, and lighting technologies.

Financial Advisory Assistance - CCI works with financial institutions and other providers of capital around the world to help building owners procure financing for projects on competitive terms. CCI can provide financial modeling support, solicit interest from capital providers, review proposals, and assist, where appropriate, in the negotiation process. CCI also helps public and private financial institutions develop sustainable, scalable, and market-driven solutions for financing retrofits across entire building market segments."¹²

Currently, CCI is working on projects totaling more than 500 million square feet of commercial office space in more than 20 cities, preventing the release of more than 120,000 tons of GHGs into the atmosphere annually.

Adopted by the City of Chicago in 2008, the Chicago Climate Action Plan (CCAP) is a strategy to reduce or mitigate GHG emissions by 80% (based on 1990 levels) by 2050. The plan sought to achieve this goal in five ways:

- Energy Efficient Buildings

11 Wikipedia.com. (2011). "Large Cities Climate Leadership Group." Retrieved May 21, 2011, from http://en.wikipedia.org/wiki/Large_Cities_Climate_Leadership_Group.

12 Clinton Foundation (2009). CCI's Energy Efficiency Building Retrofit Program. New York: pp.2-6.

Appendix 4.0 - Energy Monitoring Programs

- Clean & Renewable Energy Sources
- Improved Transportation
- Reduced Waste and Industrial Pollution
- Adaption to Climate Change

Accounting for nearly 70% of Chicago's GHG emissions, building energy usage was a primary target of the CCAP. Creation of a more efficient building strategy reduced that amount by 30%, and provided a host of other benefits, including the creation of new employment (via energy retro-fitting of buildings), reduced energy bills for property owners, among others. Actions called for the retro-fitting of 50% of Chicago's building stock (both commercial and residential) with updated standards of energy efficiency; the conservation of water via improvements in buildings resulting from retrofits; increasing the number of green roofs; and updating Chicago's Energy Conservation Code to current standards.

Addressing clean and renewable energy sources, the CCAP called for upgrades to power plants, higher efficiency standards, and increased distributed generation sources (via co-generation or smart grid technologies). These strategies resulted in 34% of the efficiencies gained in this area, and the associated reduction in GHG emissions. (Chicago Department of Environment 2008)

Transportation changes included increased investment in transit by the city, incentives for increased ridership, expanded bicycle and pedestrian routes through the city, improved movement of freight, improved fleet efficiency, and switching to cleaner, more sustainable fuels such as bio-diesel.

Finally, reduced waste and adaption strategies played a central role in the CCAP as well. These policies included the switch to alternative refrigerants, sequestering of storm water, employing cool roof technologies and increased vegetation to reduce the impact of heat islands, and substantial outreach to both businesses and residents in order to plan for the future and make additional changes.

In 2010 a summary report for the CCAP was issued, wherein lessons learned from plan implementation were reviewed. Among the findings was the acknowledgement that adaption and mitigation must be together in any action plan, and that the plan must realistically view the impacts of inaction in regard to

Global Warming. The report also highlighted some of the research that had been accomplished, its cost to the creation of the plan, and how that research might be of benefit to other cities – both those near Chicago and to others around the country.¹³

Chicago DeCarbonization Plan

In 2007, Chicago architecture firm Adrian Smith + Gordon Gill created the Chicago DeCarbonization Plan (CDP), itself an attempt to provide a workable methodology to implementing the CCAP. In providing this context it was the goal of the CDP to not only meet the goals of the CCAP, but also to meet those of the 2030C: a 100% reduction in carbon emissions for new and renovated buildings by 2030. (Adrian Smith + Gordon Gill Architects 2009)

In order to achieve these goals, the CDP articulated eight strategies which they felt would enable the city of Chicago to meet its goals:

"Eight Strategies of the CDP:

- *Buildings: Investigating how existing structures could be upgraded to improve energy efficiency, increase the value of aging building stock and tap in to the potential to transfer excess energy loads back to the grid; all while offsetting the need for new construction;*
- *Urban Matrix: Increasing the residential density of the Loop by enhancing amenities, adding schools and services and converting aging office buildings to residential;*
- *Smart Infrastructure: Examined how energy could be generated, stored, distributed and shared;*
- *Mobility: An assessment of transit and connectivity;*
- *Waste: An examination of the waste stream, and the city systems for reducing, recycling and disposal;*
- *Community Engagement: Proposed various programs to engage citizens in the green agenda;*

13 Chicago Department of Environment (2010). Lessons Learned: Creating the Chicago Climate Action Plan.

Appendix 4.0 - Energy Monitoring Programs

- *Energy: An examination of existing and new energy sources.”*

The concepts and proposals put forth in the CDP included the creation of a below-grade pedestrian walkway, making the Loop more walkable during harsh weather conditions; creation of below-grade inter-modal axis way on Monroe Street for residents, visitors and commuters; repurposing the existing Loop underground tunnels for waste removal; extending the Chicago riverwalk and bicycle paths within the Loop; and the creation of a public school text, *The Green City*, which would provide a primer on urban design and decarbonization

The CDP itself was an offshoot the firms work on the greening of Chicago icons such as the Willis Tower (formally the Sears Tower), as well as their work on the Energy Development Master Plan in Dubai, UAE.¹⁴ That plan envisioned a development of large, mixed use towers which would carry a LEED rating of platinum for community design, and would include a business center, luxury residential lofts and a myriad of amenities for pedestrians. Mention AIA award here?

Better Buildings Initiative

The Better Buildings Initiative (BBI) is part of the 2011 American Recovery and Reinvestment Act (ARRA), an effort on the part of the Administration of President Barack Obama to address both the issues of Global Warming as well as the stagnating economy. The plan includes goals of energy improvements in the commercial building sector of more than 20% by 2020, reduce the energy bills of businesses and home owners by about \$40b per year and by updating the series of incentives and challenges to the private sector to make the upgrades happen.

Specifically, the plan calls for a variety of proposals which will encourage the private sector to increase the energy efficiency of the existing commercial building stocks. These proposals include:

- A redesign of existing tax deductions for commercial building energy efficiency upgrades for owners and real estate investment trusts (REITs)
- Increased access to financing options for commercial retrofits, including increasing the loan limits set by most lenders. The proposal also includes federal loan guarantees via the US

14 Adrian Amith + Gordon Gill Architects (2007). *Energy Development Master Plan - Dubai, UAE*.

Department of Energy for energy retrofits at community critical structures such as hospitals, schools and related structures.

- Federal grants to state and local governments who streamline their standards and procedures for permitting, encouraging commercial upgrades.
- Challenging private sector CEOs and University Presidents to become showcase studies - leaders in their field - in energy retrofits. To commit to a series of actions in making their own spheres of influence more amenable to additional gains in energy savings and efficiency, and in doing so, become eligible for public recognition, technical assistance, and best-practices sharing via a network of peers.
- Implementing reforms which will seek to increase transparency on energy performance, including the creation of a Building Construction Technology Extension Partnership - itself modeled on the successful Manufacturing Extension Partnership at Commerce - and finally, by providing workforce training in areas such as energy auditing and building operations.

The proposed initiatives seek to building on existing successes such as the AARA investment in the Weatherization Assistance Programs, Better Buildings and the Energy Efficiency and Conservation Block Grant - which targets more than 600,000 residential structures to be retrofitted for energy efficiency. In addition, the effort supports proposals such as the HOMESTAR program, the improvement of government-owned buildings by the General Services Administration (GSA) - to become carbon neutral by 2030 - and grants to support innovation in the field - such as those provided to the Penn State-led Greater Philadelphia Innovation Cluster - the winner of the federal Energy-Regional Innovation Cluster (E-RIC).

Finally, the BBI serves in conjunction with the Executive Order signed by President Obama directing federal agencies to achieve net zero energy by 2030 and to pursue high-performance and sustainable design principles for all new construction and alterations. At least 15% of existing buildings need to meet this order by FY2015.¹⁵

15 The White House (2011). *President Obama's Plan to Win The Future by Making American Businesses More Energy Efficient through the "Better Buildings Initiative"*. Wash-

Benchmarking and Disclosure Laws: Washington State, the City of Seattle

In May, 2009, Washington Governor Christine Gregoire signed the Efficiency First bill (SB5854) into law. SB5854 requires the rating and disclosure of energy use of all commercial buildings within Washington State. The bill also made major improvements to the state energy code and energy performance standards and retrofits for public buildings.

SB5854 requires the owners of nonresidential buildings to rate their buildings energy performance using ES software (Portfolio Manager). Nonresidential buildings greater than 50,000 SF are required to disclose beginning January 1, 2011, and nonresidential buildings greater than 10,000 SF are required to rate and disclose starting January 1, 2012.

SB5854 also prohibits state agencies from signing new leases or renewing existing leases in a private building that has an EB rating of less than 75. An exception can be made when a building owner agrees to undergo an energy audit and make energy retrofits with the first year of the state lease, however.

Buildings which are owned by the state, which were greater than 10,000 SF were required to be benchmarked by July 1, 2010. Energy audits are also required for state buildings with EB ratings of less than 50, and associated energy retrofits must be in place by 2016.

On January 25, 2010, the Seattle City Council passed ordinance CB116731, establishing a means of assessing energy performance and data reporting for non-residential and multi-family buildings within the city. On February 1, 2010 Seattle Mayor Mike McGinn signed the ordinance into law.

CB116731 requires that nonresidential buildings are to be benchmarked annually, with the City of Seattle being the recipient and holder of the data.¹⁶ It also requires that multifamily buildings energy usage be rated and disclosed. In addition, the rating data must also be furnished upon request to existing tenants of benchmarked buildings.¹⁷

ington, DC.

16 City of Seattle (2011) "Energy Disclosure Ordinance identifies energy waste, gives property owners and tenants tools to improve energy efficiency." News Advisory.

17 Institute for Market Transformation. (2011). "Washington State and Seattle Energy Performance Laws." Retrieved

May 01, 2011, from <http://www.imt.org/rating-washington.html>.

APPENDIX 5.0 - GREEN BUILDING CONSIDERATIONS

Section Summary

This section explores those elements and principles that are determined to be common in development of sustainable buildings. This section covers common design and building issues, as well as site placement and use of new materials and methods.

ELEMENTS & PRINCIPLES OF THE HEB

This section outlines some of the most common components and principles found in HEBs, and discusses several of the issues relating to each of them. This list is not exhaustive, and like the discussion of building efficiency itself, the components that might be found within any HEB are likely to reflect the particular circumstances of that project or site.

Site & Local Environmental Conditions

Even at the most elemental levels, the role that the building site and the immediate environmental conditions play in the success of the HEB are undeniable. The level of importance of any of these elements is very much dependent upon the particular locale of the site, and the goals of the HEB project itself.

Site Placement & Solar Access

The placement of the building upon the site, and the shape or massing of the building is critical in the development of the HEB. In seeking to maximize the use of all resources on the site (light, air, water), the manner in which the building itself engages the site can make or break the ultimate success of the HEB. The building placement is dependent (among other things) upon the geographic location of the site, its relative latitude and orientation to the sun, future projects which might impact the HEB, and the major program elements of the project itself.

Solar access should be considered at the outset of the project, as should the potential for future projects which might neighbor the site and deny or otherwise change the assumed conditions regarding the quantity and quality of sunlight that the building receives. The degree and quantity of solar access alone can determine the ease or difficulty with which a building may utilize daylighting, passive heating, passive cooling, and a host of other HEB strategies.¹

¹ Tobias, L., and George Vavaroutsos et al (2009). Retrofitting Office Buildings to be Green and Energy-Efficient: Optimizing Building Performance, Tenant Satisfaction,

Local Climate & Environmental Conditions

In addition to the placement of the HEB upon the site, initial consideration should first be given to the local climate where the project is to be located. Factors such as the maximum/minimum temperature severity of the site, prevailing wind and weather patterns, typical levels of humidity and other factors such as seismic activity must be factored into the HEB's design and building systems.

Existing Site Assets or Obstacles

Beyond the local climate and solar access, the other major considerations (to be given) are those other elements which might already exist on the site, or otherwise be integral to it. Elements such as the slope of the topography, degree of covering by forest, presence of water (surface or sub-surface) and type of soil (degree of compaction, need for piling or other foundational support) are just a few elements to consider.

Building Footprint

The footprint of the building in question is also an elemental component of the HEB. The footprint - or general shape of the building - can easily determine the ease or difficulty in pursuing an HEB. Typically, buildings with a footprint that allows for the easy access of light and air provide a much better starting point for an HEB than those which do not.

Multi-story buildings with large floor plates (deeper than 35') for instance, will have difficulty in providing air to the interior without substantial heating-ventilation-air conditioning (HVAC) systems, or light without extensive lighting systems.

Historically speaking, buildings which were constructed prior to World War II (WW2) tended to pursue a footprint which resembled the shape of an alphabet letter, allowing the building's interior easy access to light and air. Pursued primarily because of a lack of

and Financial Return. Washington D.C., Urban Land Institute.

active conditioning and lighting systems, the technology which would allow a departure from those shapes would not appear until after WW2.

While not a complete list, those building footprints shape resembling letters of the alphabet such as C, E, F, T, U, L, or O were once a very common approach to delivering light and air without active conditioning or lighting (Figure 10.1). This is because the general requirement in delivering air and light to any interior zone of a building (without active systems) requires the building footprint to be fairly shallow - to approximately 30'-35' in single loaded corridor, and 50'-60' in double-loaded corridor buildings.

Building Elements of the HEB

Any given building is constructed of thousands of components, each having an impact upon the degree of efficiency that building might possess. Elements such as doors, windows and the materials used to construct the building each play a role in the overall efficiency, and the manner in which they are employed may also be a contributing factor.

The age and period of construction/manufacture are also critical, in that over any given time span, the very nature of all products changes - both in the manner and materials used in their construction, and the understanding of how they are constructed influences the building's operation and resulting level of efficiency.

Building Envelope: Method, Material & Period of Construction

The broadest of the components for consideration is that of the building envelope, or the exterior wall system - that which separates the interior of the building from the exterior. Traditionally, the walls on the exterior of a building were load-bearing; that is, the walls themselves carried the weight of the wall as well as of the building above them. Because of this, commercial buildings were often constructed with very heavy, thick walls, possessed smaller windows, were commonly made of materials such as masonry or stone and were typically not built higher than a few stories.

Starting in the 1920s, the combination of elevator technology and improvements in steel framing began to change the common building configuration. These elements, combined with the need for more space on a single parcel, literally pushed the building up and

created the first high rises in commercial building. Since the steel frame of the building was providing structural support, the exterior walls of the building - the building envelope - could be considered separately from the structural elements.

Frame construction in this manner revolutionized the design and construction of commercial buildings, and encouraged the transformation of the building envelope from masonry and stone eventually to glass and steel - developing what would eventually become known as a 'curtain wall'. The result was that the building envelope of larger commercial buildings became thinner over time, with view glazing taking up a greater percentage of the gross wall area. Eventually, the viewing window/wall became the primary

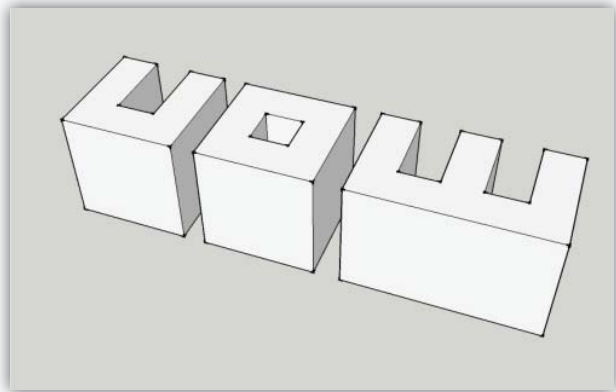


Figure 10.1 – Alphabet Building Shapes: Allowing light and air deep into the interior of buildings. Source: <http://planetgreen.discovery.com/fingers.jpg>.

element of focus of curtain walls in taller buildings, while the smaller buildings continued to be typically constructed of masonry exteriors and structural frames made of wood, steel or concrete.

When this change in construction initially occurred, the energy demands of the new high-rise buildings were not that great. Primarily, the energy was consumed in the heating of occupied spaces and in the vertical transportation within the building. Ventilation was primarily achieved via operable windows, and the lighting requirement was still very low - between 22 and 43 lux (neither air conditioning nor lighting systems had been invented yet), and the facade of the buildings maintained very low glazing-to-wall ratios of approximately 20% to 40%.²

² Oldfield, P. (2009). "Five Energy Generations of Tall Buildings: An Historical Analysis of Energy Consumption in High-Rise Buildings." *The Journal of Architecture*

The early high rise building also lacked thermal insulation within their exterior walls and the materials chosen for the exterior was traditional in nature, commonly stone and/or masonry. The lack of insulation was mitigated by the total amount of building materials used however, because by adding a great deal of mass to the building (both in the exterior materials and in the heavy plaster interior finish), thermal stability was created that would have otherwise been lacking. As a result, during the winters these buildings were able to hold heat fairly well, and during the summer they retained a good amount of cooling, based in this mass alone.

By the 1950s, with the full advent of modernism, many new large and medium sized commercial buildings began to be constructed with curtain walls made of steel frames and glass rather than the more traditional stone or masonry. Large multistory buildings also began increasing their floor plates to 100' feet or more in depth in response to the increased availability of new fluorescent lighting systems.

The fluorescent lighting systems, when combined with the glass curtain wall, often sealed from the outside environment, necessitated the use of large HVAC systems to push fresh air deep into the interior. Not

only this, but because of the thin curtain walls, one side of the building - the shaded side - would often need to receive heating, while the other side - the sunny side - would need to receive air conditioning to keep it cool. The overall result were buildings with deep floor plates, workspaces lit only with artificial/ florescent light, poor air quality owing to the requirement of large HVAC systems, and vastly increased use of energy to support it all. (Figure 10.2)

In addition, once the demands of cooling caused by the glass curtain wall became evident, dark window tinting was employed, resulting in lowering the cooling demand, but also in the further decrease of lighting levels for the occupants! Window construction will be discussed in the Windows & Doors subsection below.

Other Elements

Building Foundation

Building foundations should be insulated to reduce/ prevent thermal transfer. Depending upon the depth and the type of foundation used, several inches of rigid foam insulation between the bottom of the foundation and the earth below will reduce heat



Figure 10.2 – Average Building Energy Use - 86 NYC Buildings from 1950-1970 Source: Oldfield, P. (2009)

transfer significantly. However, the amount of heat loss via foundation transfer is commonly minimized by the eventual heating of the earth outside of it, making foundation insulation (all others being equal) potentially less critical than the other portions of the envelope.

Roof Systems and Insulation

In most commercial buildings, flat or low sloping roofs are typical. The primary concern for the roof essentially comes down to three elements: making it water tight, making it highly insulated and reducing the impact of the building's presence, both in terms of the degree of heat buildup as a result of solar radiation, and/or the water runoff coming from the roof during rain storms.

Commercial roofs are most often made water tight by utilizing a roof system - that is, a series of layered membranes and sealants designed to adhere to each other and thus seal out water infiltration. Water infiltration into the roof layers may come as a result of leaks from rooftop penetrations (air vents, exhaust stacks, drains, etc) or failures in either the materials

themselves, or in the manner in which they were joined.

Historically, a traditional layered roof system was made up of multiple layers of roofing felt (asphalt impregnated paper) and hot tar, finished with an inch or so of small ballast stone in order to protect it from solar damage (Figure 10.3). In the last few decades, rubberized roofing systems have become popular due to the ease of installation and good track record of minimizing leaks.

In addition, rubberized roofing systems permit the use of lighter pigments within the upper sealing layers, making the roof more reflective of solar radiation, and thus reducing the amount of heat generated by the roof itself, as well as the amount of heat penetrating down into the roof structure and building below.

Insulation within the roof area may occur above or below the sealed roofing system. Insulation installed below the sealed roof system was historically made up of vented compartments containing fiberglass batting and/or rigid polystyrene board. More recent types of insulation are found above/outside the roofing system

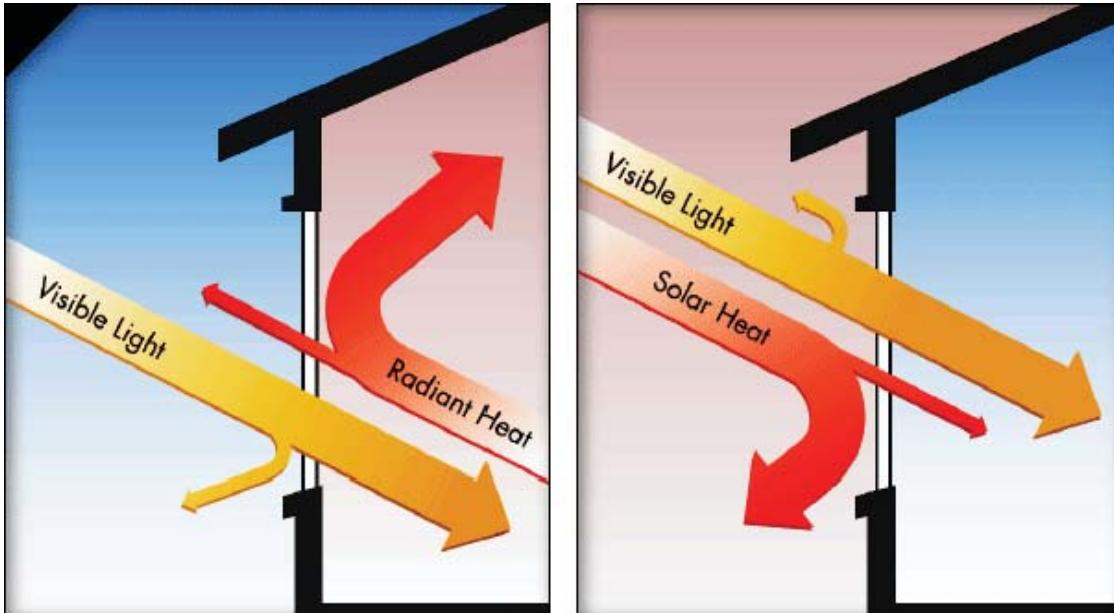


Figure 10.4 – Components of Modern Multipaned Windows. Source: <http://179windows.wordpress.com/tag/low-e/>.

and are typically made up of closed cell (water proof) polystyrene board and some protective layer above it for solar degradation and physical protection from foot traffic, etc

In addition to the conventional roofing system discussed above, a recent option developed for building owners consists of utilizing a living or green roof above the sealed roofing system. The green roof is actually a system consisting of a thin layer of planting medium and various types of vegetation (grasses mostly). The convention behind green roofs is to provide:

- A natural filter or temporary storage area for rain water; to filter it before it leaves the roof and/or retain it within the medium in order for it to be evaporated, thus reducing the amount of storm water runoff.
- A natural layer of insulation to the roof. Depending upon the depth of the growing medium and the roof configuration, insulation values can rise to as high as XR per inch of depth.
- A natural reflector of solar heat. It reduces the heat island effect coming from buildings using more traditional, radiation-absorbing roofing

methods/materials.

Doors, Windows & Skylights

Beyond the energy losses arising from poor roofing insulation, the weakest link in preventing thermal heat loss comes from exterior doors, windows and skylights. Glass panes contained in doors and windows have a thermal conductivity over 40 times greater than air alone, making them a primary source for heat loss.³ This section looks at the changes to the panes contained in doors, windows and skylights, made in an effort to become more energy efficient.

Originally, commercial buildings and homes maintained doors, windows and skylights containing single panes - or a single layer of glass. Because of the thermal properties of glass, the consumption of energy rose dramatically because the conductance of both heat and cold - arising from winter heating losses and from solar gain - were considerable. As a result of this, during the 1950s, the use of single pane glass in commercial curtain walls resulted in very inefficient and thermally unstable buildings.

³ Liu, A. (2007). A Study of Double Pane Windows and Heat Flux. Department of Mechanical and Aerospace Engineering. San Diego, CA, University of California, San Diego: 11. p.2

Tinting of glass was first used in an attempt to reduce the amount of solar gain experienced by glass curtain walls. Curtain walls constructed from more lightly colored, more traditional materials, such as stone or masonry provided the needed mass and reflection to avoid such gain and the accompanying heat. Since the typical glass curtain wall was inoperable, vast amounts of energy inefficient active cooling had to be employed to overcome the building heat, necessitating additional HVAC resources to keep the interior environment comfortable.⁴

A study conducted in 1977 showed that in the period from the 1950s to the 1970s, energy use for buildings with glass curtain walls more than doubled. The study showed that those buildings constructed in the late 1960s had energy use demands more than double of similar buildings constructed less than twenty years before - in the early 1950s.⁵

After the energy shortage resulting from the 1973 OPEC Embargo, building energy codes were improved, and an emphasis was placed on reducing the loss of energy - via heat or cooling. As a result, low emissivity, double paned windows were developed and became the new standard in commercial buildings. Low emissivity or 'Low-E' windows work by having a thin plastic film which filters infrared radiation on the exterior, and another which prevents thermal transmission on the interior. Between the two panes of glass is a sealed chamber filled with inert gas such as argon or krypton, which provide additional thermal insulation.

In this manner, solar gain is prevented by not allowing infrared radiation to pass through the exterior pane, thus having both panes prevents thermal passage of energy. Low-E windows have now become the standard in both commercial and residential applications - in windows, doors, and skylights alike (Figure 10.4 on page 94).

4 Oldfield, P. (2009). "Five Energy Generations of Tall Buildings: An Historical Analysis of Energy Consumption in High-Rise Buildings." *The Journal of Architecture* 14(FIG_A02.04.00). p.598

5 Stein, R. G. (1977). "Observations on Energy Use in Buildings." *Journal of Architectural Education* 30(3): pp.36-41.

Building Principles of the HEB

The following section will outline some of the more commonly known principles surrounding the HEB. Many of these ideas are not new; many were simply placed on hold following WW2, and were rarely implemented until just recently. For the sake of simplicity, I will restrict my discussion of these principles to the specifics of this locale - to Seattle, Washington; at approximately 48° north latitude. Variations in these principles are possible elsewhere in the country (however some degree of variation may apply).

Daylighting Capabilities

Daylighting is little more than utilizing the light provided by the sun to illuminate the interior of a building to a useable level (Figure 10.5 on page 95). Daylighting strives to maximize all levels of light from various orientations and at different times of year to eliminate or reduce the use of artificial (electric) lighting. Daylighting has been with man since the construction of his first shelter, but was on hiatus in the United States from the end of WW2 until the early 1990s.

Daylighting a space can utilize a number of different mechanisms, the success of which is largely dependent upon the relative latitude of the building, and the time of day and year. Generally speaking, when developing a daylighting strategy, one strives to minimize the negative aspects of sunlight (glare, solar gain) while maximizing the useful aspects of it (higher light levels for tasks). Again, for the sake of this discussion, I will assume our location at Seattle, Washington - at 48° north latitude.

What follows is a general description of some of the major aspects of daylighting, with an expanded discussion of each where appropriate.

- Orientation and Building Footprint - Generally speaking, for a commercial building seeking a workable daylighting strategy, the first principle to follow would be the orientation of the building relative to the sun's path throughout the year, and a corresponding thin building footprint which allows for daylighting of workspaces. For Seattle, that would mean a building which is generally narrow, and is oriented east-west; with its longer lines facing north and south, and its east and west ends being more opaque to avoid direct glare. In these cases, a reduction in glazing or the type of glazing

(clerestory versus view glazing for example) may be called for.

- Glare/Solar Gain - Access to the sun alone is not enough; if the access is too great or the wrong type, the resulting space can become overheated or suffer from light which is uncomfortably bright for human use.
- Light Balance - The light in the day lit space should be even in nature - not all from one side of a space. Both sides providing light are needed to reduce the presence of unusable dark areas.
- Light Levels and Uses - The level of daylighting available to users within the space needs to be tied directly to the expected uses within the space. Work spaces tend to need higher amounts of usable light on work surfaces, while transitory areas (hallways, etc) require only very low light levels.
- North Light - Light coming from the north can be a positive force, however it tends to be weaker and needs to be balanced with other types from other locations.
- Glazing - The glazing types, as mentioned above, should be matched to the light availability and the requirements of the space they are lighting. In many cases, reduced glazing may be appropriate. In all cases, a minimum of double-paned glazing should be utilized to reduce thermal transfer.
- Skylights - Horizontal glazing can offer wonder overhead lighting options, but must be balanced with the orientation to the sun and sky (to minimize glare and maximize light) as well as the potential for heat transfer.
- Atriums - Open interior light wells can allow light to penetrate deep into a structure, however the dimensions have to be great enough (relative to the depth penetrated) to ensure access. Also, atriums can contribute to heat loss.
- Lighting Controls - Controls on electrical lighting should be joined to daylighting to ensure that when daylight is available for use in a space, the electrical lighting is shut off to conserve energy.
- Light Shelves - Casting sunlight deep into a space, light shelves are an effective tool at both providing light and providing shading of direct

sunlight into a space. The penetration of light into a space is dependent upon direct sunlight striking the light shelf surface.

- Reflective Surfaces - The color and shade chosen in interior spaces should be light in nature to ensure the bouncing of daylight from one area of a space to another. Dark surfaces tend to absorb light instead of reflecting it.

Other HEB Principles

In addition to daylighting, the following also serve as basic principles to creating a HEB, whether from new construction or from retrofitting.

- Shading Capabilities - Providing some amount of shading on wall exteriors which receive excessive sunlight can assist in reducing cooling loads within a building.
- HVAC & Ventilation Systems - Use of more efficient ventilation systems, particularly zone-controlled systems which are managed for night cooling and economizer cycles provide excellent energy efficiencies.
- Passive Heating/Cooling - Better yet, creating spaces which create natural ventilation, either via cross ventilation (operable windows) or stack effect ventilation provide low energy fresh air.
- Rain Harvesting/Gray Water - Utilizing a green roof or a roof which harvests water is preferred to channeling the water directly into water treatment systems. Harvested water may be used for irrigation of plantings, flushing toilets, etc. In addition, the collection, filtration and reuse of gray water (from sinks, washers, etc) can greatly reduce the demands on fresh water systems.
- Low VOCs - The use of materials which contain low/no amounts of volatile organic chemicals reduces the demand for air changes within a space, lowering energy demand on HVAC and ventilation systems and creates a healthier environment.
- Embodied Energy - The reuse of buildings and materials with high-embodied energy ensures that the energy that it took to create those materials/structures in the first place is not lost, but will instead be continuously utilized.

- Source/Generation of Energy - Consideration of the source of energy plays a large role in the overall reduction of GHGs. Hydro and other forms of low/no GHG-creating means of generation should be the first to be utilized; with an emphasis on reduction/discontinuance of those generation means which contribute GHGs to the environment (coal, oil, natural gas, etc).
- Building Commissioning - The commissioning and re-commissioning of buildings is critical; testing to ensure that the predicted operational profile is in fact that which has resulted. Interface systems which inform the occupants of the a building when environmental systems are running, or when they might use passive systems can be part of the commissioning process.