A METHOD FOR ADAPTIVE REUSE SITE PRESELECTION

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BY
REBECCA ARLENE AHLERS

D.ARCH COMMITTEE
HYOUNG-JUNE PARK, CHAIRPERSON
DWIGHT MITSUNAGA
JAMES DATOR

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DEDICATION

To my loving husband Scot, for empowering me to follow a dream. I look forward to returning the favor.

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ABSTRACT

As we embark on the future, we must prepare now to meet the needs we anticipate. Every day new buildings are constructed and old buildings become obsolete. Demand for new property sectors shifts and the supply must be transformed in response. There are two options for our built environment to meet these new demands. Option one: underutilized buildings can be renovated for in-demand uses. Option two: a new building can be constructed on an empty site or where an underutilized building once stood. The opportunities and constraints that come with each option vary case-by-case. This doctorate project recognizes the potential benefits of adaptive reuse (e.g., time and money savings, historic preservation and environmental sustainability), and establishes a method for site preselection to enable the pursuit of adaptive reuse success. Current research on this topic looks at the decision between the two options by evaluating every potential adaptive reuse project individually. This doctorate project uses a series of steps to filter away unsuitable properties, so that an optimal site can be selected, without having to analyze a seemingly endless number of potential properties. This method begins by narrowing the search area to the neighborhood level, using Smart Growth principles. Next, obsolete property sectors are identified in order to establish a building supply. This doctorate project focuses on the need for affordable housing to establish building demand. Therefore, multi-family residential is considered for the adapted end-use. Feasibility drivers are then established to narrow the pool of potential sites further. Lastly, the remaining potential properties are compared to find an optimal site for adaptive reuse. This process is demonstrated in Honolulu, Hawaiʻi. While there are many cities facing similar challenges, Honolulu is hypersensitive to change. Applying the process in this environment demonstrates the potential effectiveness of the method; so that it can be easily adapted in other locales.

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CHAPTER 1 INTRODUCTION

As time passes, the future becomes the present. Tomorrow is shaped by our actions today. We prepare for the future we anticipate, so that we can produce the outcome we desire. It is difficult to imagine the future without envisioning its respective built environment. Dense cities, comprised of tall buildings and busy streets, are a popular prediction. Whether this forecasted future is true or false, we cannot know for sure. However, we do know the future is revealed one day at a time. The city is transformed one structure at a time. The life span of each building is staggered to create a collection of perpetually young and old buildings. As new buildings are added, pre-existing buildings continue aging until they are either removed or renewed. Deciding the fate of each building is no easy task. It requires a detailed investigation of every alternative outcome, so that the possibilities can be compared and selected.

The criteria for this decision vary according to the goals of the project developer. The feasibility for each alternative (i.e., adaptive reuse, doing nothing, or demolishing and redevelopment), is determined according to the potential benefits of each option. Adaptive reuse is infamous for being inefficient and complex. While, design flexibility and modern amenities are the hallmark benefits touted by redevelopment. With this in mind, many developers avoid an adaptive reuse option before giving it fair consideration. In some cases, however, adaptive reuse is a feasible option with benefits that exceed redevelopment potential. Careful analysis, on a case-by-case basis, of every alternative shows the benefits that are unique to each option. Adaptive reuse projects can cost less and take less time than new construction. Adaptive reuse can also preserve cultural heritage and extend the economic life of a building, maximizing the potential of its physical life. Furthermore, adaptive reuse decreases the amount of material added to our already growing landfills. Demolition and redevelopment cannot achieve these benefits. Nonetheless, when project goals include a larger, modern facility, this may be something adaptive reuse cannot achieve. This decision-making dilemma is presented at the beginning of every project. Developers that seek a feasible adaptive reuse project from the beginning must often wade through a long list of potential properties, analyzing the alternatives for each one before selecting a site with promising characteristics. This doctorate project recognizes the intensity of this process and offers a site preselection method that allows a developer to identify and preselect an appropriate adaptive reuse site with the ideal characteristics for success.

1.1 SCOPE AND METHODOLOGY

This doctorate project focuses on the transformation of buildings to meet the ever-changing demands of the population. Adaptive reuse is offered as a strategy to meet the persistent need for affordable housing. Inevitably, most property sectors experience a rise and fall of popularity. Housing, however, remains under-supplied in many cities. With its high construction costs, land scarcity and minimum wage currently below the national average, Hawaiʻi is an ideal location to examine strategies that may be attempted in other locations with similar needs.

To provide adequate affordable housing in any community, all aspects of the issue (i.e., housing availability and poverty) must be addressed. This research focuses on strategies for increasing the availability of housing. A combination of strategies is necessary to accomplish this task. This doctorate project investigates another means of providing housing, in order to supplement and strengthen efforts already underway. Concepts and examples from other cities are used to understand and construct the site preselection method presented in this doctorate project.

The method involves a sequence of steps. The determination made at each step informs the criteria used in the step that follows. This doctorate project describes, in sufficient detail, the process for determining the criteria in the first, second and third steps of site preselection. In the fourth step, which pertains to feasibility, this doctorate project focuses on one of the possible criteria (which is determined in the preceding step). The criterion of focus was chosen for its difficulty and predominance in real life situations. The other possible criteria (which are the subject of step three) are considered in step four; however, they are not presented as thoroughly nor resolutely as the criterion of focus. Preliminary processes for executing the fourth step are suggested for the less common criteria. Future research is needed to develop step four of the site preselection method, so that any criterion determined in step three can be pursued. The diagram in Figure 1 depicts the flow of criteria from one step to the next. In chapter 5, the method is demonstrated hypothetically. The determinations of each step are highlighted in Figure 1.

The material presented in chapter 2 of this doctorate project uses interpretive historical research to understand various aspects of adaptive reuse. These areas of research include: Smart Growth, affordable housing, building obsolescence, reuse feasibility and technical challenges. Authors specializing in each aspect are referenced to develop a preliminary understanding of adaptive reuse success and failure. Then in chapter 3, precedents and case studies are used to provide real examples of the various research aspects. Each aspect of research supports a step in the method proposed in chapter 4. The method is derived from the research, precedents and case studies, so that the characteristics of successful projects become the criteria for site selection.

1.2 DOCTORATE PROJECT OUTCOME

This doctorate project contributes to the existing body of knowledge regarding adaptive reuse and affordable housing strategies. The outcome provides a method for various developers to follow, whether they are property investors, government organizations or community leaders. The proposed method is outlined in Figure 1. Each step of the method is derived from preliminary research and supported with precedents and case studies. The first two steps work as a filter to narrow the pool of potential adaptive reuse candidates. Similarly, the third step works as a filter that narrows the criteria for step four, property comparison. In the fifth and final step, an ideal property selection is justified and adaptively reused.

Step one narrows the property search by geographic location. This step begins at the state level and ends with the selection of an ideal neighborhood for adaptive reuse. Smart Growth principles provide some of the necessary criteria for area selection. Ultimately, the goal of this step is to locate an optimal neighborhood among numerous options. This step precedes all other steps because it has the capacity to eliminate the greatest number of less-than-ideal properties. However, if a developer has preselected a neighborhood of interest, the criteria presented in step one can be used as a checklist to ensure the neighborhood of interest is minimally qualified, rather than optimal by comparison.

Step two narrows the property search according to real estate trends. Predetermined categories, called property sectors, are compared to determine which sector is over-supplied. When demand for a specific building type diminishes, the potential for obsolescence increases. For adaptive reuse, a building that has reached the end of its useful life, with physical life remaining, is preferred over a building that is either still useful or has suffered significant physical deterioration. The pool of potential adaptive reuse candidates should include property sectors that are obsolete or are trending towards obsolescence. All other useful, or in-demand, property sectors are eliminated from the search. If, after filtering by property sector, there are too many candidates remaining, eliminate building types that are dissimilar to the proposed new use. This step yields a manageable number of potential adaptive reuse sites.

Step three determines the criteria that used to compare the properties remaining for consideration. There are various drivers of feasibility. Some buildings are better suited for reuse than others, depending on the goals of the project. Since the definition of success varies by developer, a primary feasibility driver is selected in this step. The selected driver determines the criteria used to compare the potential properties. This doctorate project concentrates on economically driven adaptive reuse. Financial motivation is perhaps the most common driver.[1] As such, it is the focus of the next step.

Step four involves an evaluation of each property. The evaluation criteria allow the properties to be prioritized. As previously mentioned, the focus of this doctorate project is on economic criteria. At this step in the method, any of the remaining properties may be considered for adaptive reuse. A comparison of the options allows the optimal site to be selected.

[1] Rabun, *Building Evaluation for Adaptive Reuse and Preservation*, 39.

Step five is the final step. Before executing an adaptive reuse project, a design proposal is necessary. The design details allow a thorough evaluation of the project in order to justify the adaptive reuse option and ensure that it is more beneficial than demolition and redevelopment. This doctorate project demonstrates a potential design with sufficient detail to show justification of adaptive reuse.

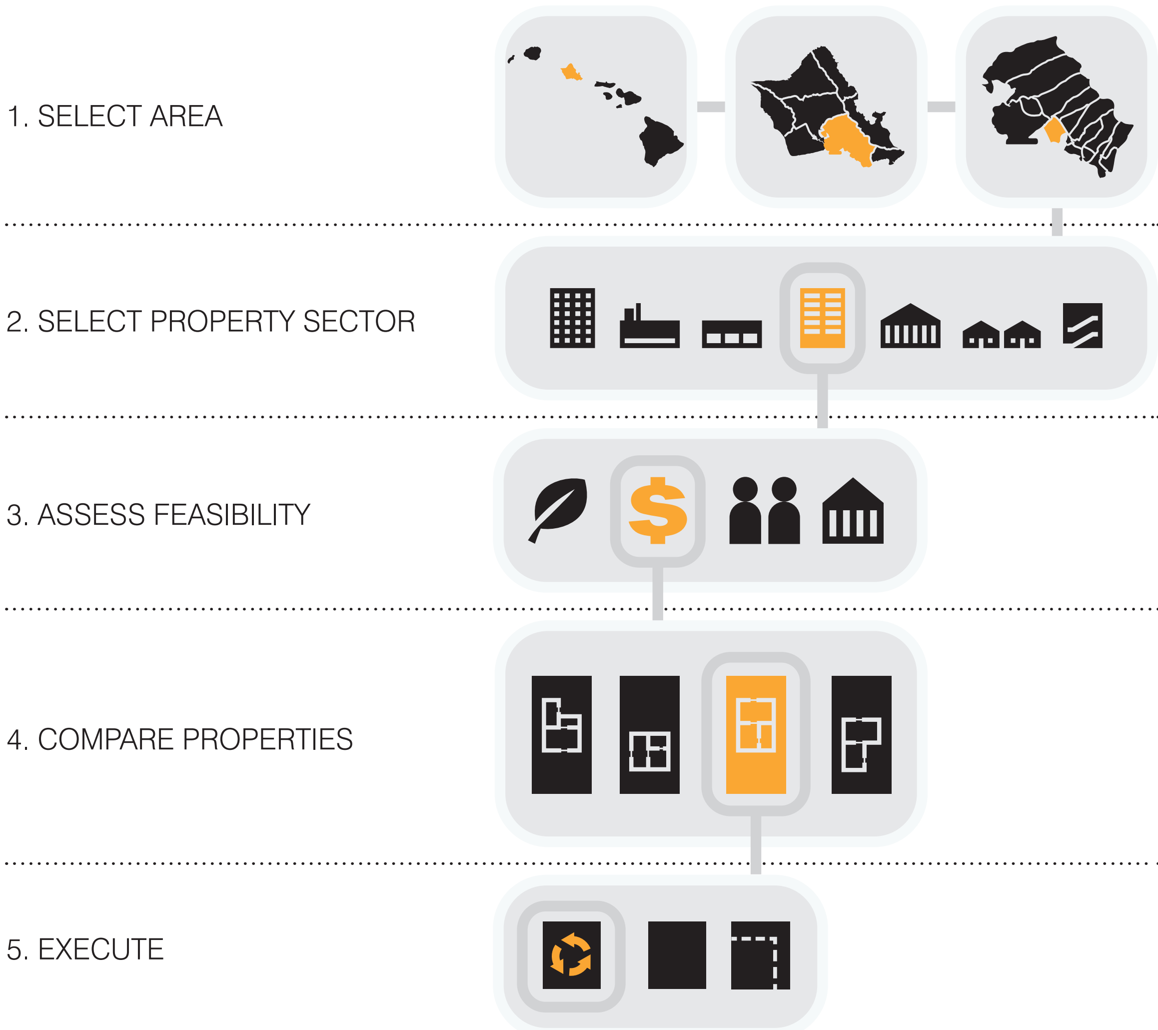

FIGURE 1 METHOD FOR ADAPTIVE REUSE STRATEGY

PART ONE

CHAPTER 2 RESEARCH ASPECTS

2.1 INTRODUCTION

Adaptive reuse is a subject of much debate. Opinions on the matter vary depending on you ask. Some people in the building industry prefer the “clean slate” of new construction, while others have made adaptive reuse their specialty. Despite the lack of consensus, the topic is well documented. Various authors have provided decision-making methods that evaluate the options for individual buildings. In order for these methods to be applied, a set of criteria is examined for each building in question to determine the potential for successful reuse. The criteria vary from author to author, but the purpose is similar. Rather than use a set of criteria to make a decision, this doctorate project uses criteria to preselect a site. The aspects of research that allow an optimal site to be preselected are investigated in this chapter. Each section presents the supporting research for a step of the proposed method.

2.2 FUTURE DEMAND

The future is unknowable. Nevertheless, it is shaped every day. Urban planners, policy makers and real estate developers have a major impact on the physical environment, which affects the millions of people who live in cities across the United States. Urban Sprawl has decentralized many cities over the past few decades. As a counterpoint to this land use practice, Smart Growth seeks to limit the horizontal creep of civilization in favor of more compact urban settings. This concept prepares for growth without encouraging sprawl and the negative impacts it has on public health and the environment.

SMART GROWTH

The concept of Smart Growth is helpful in setting some underlying principles. It guides communities that are planning and already experiencing growth towards a future that benefits a range of interests. Some goals for Smart Growth communities include: health, safety, pedestrian-orientation, diversity, sustainability, and profitability.[1] To achieve these goals, Smart Growth implements a set of principles. The list includes: Mixed land uses; compact building design; variety of housing opportunities; walkable neighborhoods; attractive communities with a strong sense of place; preservation of critical environmental areas; strong development of existing communities, variety of transportation choices; predictability, fairness, and cost effective development decisions; and community and stakeholder collaboration in development decisions.[2] The list is long, but the principles are complementary in working towards the aforementioned goals.

There are many trends and emerging issues forecasted by urban planners and futurists. In a list of six major issues confronting the notion of city as it is defined today, Smart Growth was named first.[3] Many of the subsequent issues listed have a more narrow focus (e.g., sustainability and health) that are easily encompassed by the Smart Growth concept. Because this doctorate project considers the urban environment in the future, it is beneficial to investigate the Smart Growth concept as a framework for this doctorate project.

With the variety of interests supported by Smart Growth, many of the proposed strategies accomplish multiple goals. For example, by providing various forms of mass transit (i.e., one strategy proposed by Smart Growth), traffic is reduced, connectivity is increased, people are empowered by options, pedestrian safety is enhanced, and the list goes on.[4] All of these benefits are propagated from one strategy. Of the list of strategies, some are meant to encourage affordable housing.

AFFORDABLE HOUSING PRODUCTION

Smart Growth critics have hypothesized that planning principles such as preservation of open space and limitation on sprawl actually causes land scarcity, which

[1] National Center for Appropriate Technology, *Why Smart Growth*.
[2] Smart Growth Network, "This is Smart Growth," 4.
[3] Inayatullah, "City Futures in Transformation," 655.
[4] Smart Growth Network, "This is Smart Growth," 12-13.

results in affordable housing shortages.[1] However, research shows that a lack of affordable housing is not specifically induced by Smart Growth practices.[2] Nevertheless, planners must be mindful of the impact land development practices have on the availability of housing and ensure that demand does not outpace supply. Where the innate planning principles of Smart Growth overlook affordable housing production, legislation takes over. The inclusion of affordable housing by real estate developers is often mandated by local governments. To enhance the capacity of Smart Growth to provide sufficient housing supply, thereby making it affordable, the planning principles that encourage affordable housing must be maximized.

Currently, new construction is the prevailing method for accomplishing the task of housing production. As our built environment grows in response to increasing population, it becomes important to consider how buildings that no longer serve their original purposes efficiently can be reused. More and more, redevelopment of urban sites maximizes site potential, creating a dense built environment. However, one study points out that increased density is not a characteristic of affordable housing availability.[3] This suggests that constructing new housing in the urban environment is not the only solution. Affordable housing strategies that maintain density are a worthwhile endeavor. Adaptive reuse of obsolete buildings offers the potential for a variety of housing options, without increasing the existing density. Although new construction is also capable of providing housing without increasing density, redevelopment that demolishes and rebuilds the same floor area as the pre-existing building yields limited net benefits (NB) and therefore is less likely to be implemented.[4] Rather, new construction typically seeks to increase floor area, maximizing site potential and ultimately increasing density, while sacrificing open space. Figure 2 depicts a generic comparison between the expected outcomes of adaptive reuse versus redevelopment.

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[1] Weiss, "Preface: Smart Growth and Affordable Housing," 168.
[2] Ibid.
[3] Aurand, "Density, Housing Types and Mixed Land Use," 1015.
[4] See section 2.4 for definition of net benefits.

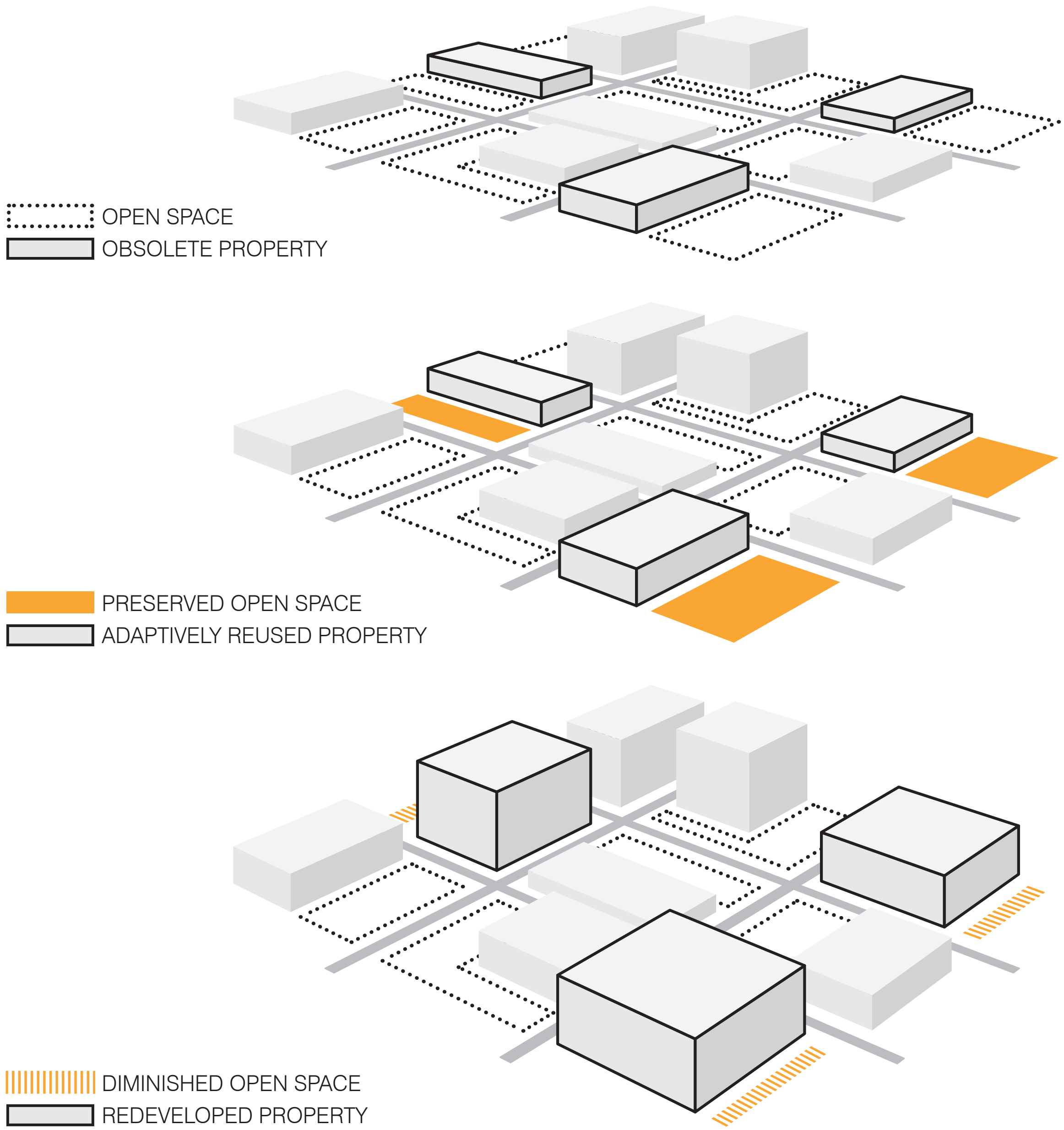

FIGURE 2 DEVELOPMENT COMPARISIONS

Cities constantly evolve in response to a myriad of pressures. Over time demographics change and the supply and demand balance shifts. When faced with the decision to replace buildings that no longer meet the demands of the city, planners and developers must decide whether to demolish and redevelop, or to adaptively reuse an existing structure. This doctorate project considers the potential for adaptive reuse to transform the building supply to meet new demands. Although demolition and redevelopment can have the same effect, that is, trading obsolete built space for sought-after built space, adaptive reuse can sometimes accomplish this task faster, for less money and without increasing density.

Three Smart Growth principles that are meant to encourage affordable housing, among other goals, are density, variety of housing types, and mixed land use.[1] These strategies have been analyzed for their effectiveness. The results of the analysis suggest interesting relationships between the form and function of the city for each of the strategies. To understand the results, affordable housing is not considered in finite terms, but as portion of the overall housing cost spectrum. Housing supply across the spectrum can be balanced to match the demand, or it can be imbalanced creating shortages for the lower income earners. The study looks at the overall housing stock based on price, but also at the balance of the stock, to see whether it meets the demand appropriately.

With regard to residential density, the measurement is defined by the amount of residential development relative to a given geographical area. The research shows that when residential density increases, the supply of housing types increases, but the same cost imbalance is maintained.[2] This means that increasing density alone does not create a more even distribution of housing prices. So as the population increases, the lack of affordable housing could very well persist.

As for the mixed land use strategy, there were effects seen in the balance of housing prices, however this happens as a consequence of another undesirable occurrence. First, it is helpful to understand the type of mixed-use implementation that is being tested. In this study, mixed-use development includes commercial, residential and industrial land uses. This study finds that when the proportions of mixed-uses are increased relative to residential uses, the balance of affordable housing does shift in favor of lower-income earners.[3] However, the absolute number of affordable homes in the stock

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[1] Aurand, "Density, Housing Types and Mixed Land Use," 1015.
[2] Ibid., 1030.
[3] Ibid.

does not increase overall. The shift in balance is the result of a decreased number of other unit types. The author speculates this may be the unintended consequence of more expansive housing types being displaced by the new mixed-uses.

The last strategy reported provides a promising outlook for its effect on affordable housing. Increasing the variety of housing types means to provide a range in unit sizes and configurations. That is, providing multi-unit living environments, which tend to have smaller unit sizes, in combination with living environments of lower density, for example town homes and single family homes. In Hawai'i, another typical, lower density living environment that may apply to this category, is the low-rise apartment building. Although the unit sizes are small, they do provide lower density and an alternative living environment. In this strategy, it seems the key is to increase variety, thereby creating affordable sub-markets.[1]

As Honolulu continues to grow, the increased need for housing is met with a typical high-rise condominium response. While this does effectively increase the density and often comes with amenities that resemble mixed-use, it does little to increase the variety of housing types that allow affordable sub markets to occur naturally. Inclusionary zoning often requires developers to provide a certain percentage of units at an affordable rate. However, this rate does not supply the full spectrum of housing prices that are being demanded by the population.[2]

AFFORDABLE HOUSING DEFINITION

If striking the perfect balance between affordable and market rate housing is so challenging, why should planners and policy makers make affordable housing a priority in urban development?

For many Americans, access to decent housing is a constant struggle that has profound effects on their dignity and quality of life. For this reason, it is paramount that

[1] Aurand, "Density, Housing Types and Mixed Land Use," 1022.
[2] Helbert Hastert and Fee, Planners, *Affordable Housing Trend Report.*

people of all socioeconomic tiers are provided options in the housing market. According to Alan Mallach, there are two overriding components to the challenge of ensuring affordable housing. Combined low wages and lack of housing availability, undoubtedly leads to affordable housing shortages[1]

The notion that housing can have a severe impact on one's life has inspired many policymakers to adjust their perspective on housing. For example, affordable housing used to be considered an end goal in and of itself; the purpose being to provide shelter. In an effort to elevate the issue many policymakers have reconceived the notion of housing as a means to a new end—an end goal of economic independence.[2] The negative impact of a family or individual's housing cost-burden justifies the provision of affordable housing.

Unfortunately, the term *affordable* has become a buzzword that many developers use to garner public support. Providing so-called affordable housing does not typically address the needs of families and individuals at the very bottom of the socio-economic spectrum. Households that hover just below median income typically qualify for privately developed affordable housing. Encouragement for developers to build housing and lease it to residents that earn less than the area median income (AMI) is provided by the Department of Housing and Urban Development (HUD) insured mortgages. The duration of these mortgages, secure the affordable rent stipulation.[3] For those who still cannot afford the regulatory low prices, there are housing assistance programs and public housing options.

AMI is a measurement used to characterize the financial resources of mid-range households, within a predetermined geographic limit. Although household income varies significantly, 30 percent of one's income is a reasonable percentage to spend on housing. For people whose income falls below the AMI, it is not easy to find housing that is less than or equal to this percentage. This often means residents pay a higher percentage of their household income towards housing. Going beyond the expected 30 percent can cause

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[1] Mallach, *A Decent Home*, 1.
[2] Newman, *Beyond Bricks and Mortar*, 1.
[3] Lydersen, "Keeping Kukui Gardens."

people to experience a cost-burden, which affects poor families disproportionately.[1] It seems reasonable to suggest that for people well below the AMI, finding affordable housing is often an unsurmountable challenge and a struggle that strains their finances to the extent that other areas of their life are made to suffer.

Public housing is another option for people in the lowest income brackets. However, this solution often delivers a new set of problems. One of the most traumatic impacts of public housing is that of social stigma. The physical characteristics of public housing are often easy to recognize. The uniformity and scale of the projects give a pervasive compound-like feeling amidst an eclectic urban environment.[2] A strong sense of identity is sometimes looked upon favorably, but not if the identity is associated with diminished resources and economic instability. In stark contrast to public housing, properties developed independently, without affordability clauses, express the distinction of personality, choice and opportunity. The unfortunate consequence of stigma contradicts the purpose of housing regulations, which seeks to uplift and empower people. When stigma is internalized, it creates self-doubt.[3] Moreover, stigma perpetuates discrimination based on race, gender, health status and behavior. Reinforcing negative associations through the built environment can only hinder efforts to make affordable housing available to all people. If this problem is ever going to be solved it will be through society's empathy and understanding, rather than harsh indifference.

As a means of avoiding social stigma and the negative consequence that typically follow, housing agencies have employed alternative strategies for providing housing assistance. Programs that provide vouchers for rent subsidy allow people to choose housing that works best for them. This gives autonomy to the household, which can simulate the feeling of choice and opportunity that people seeking market rate housing have. One of the greatest benefits to programs like Section 8 and Hope VI is that they decentralize poverty.[4] Instead of having concentrated populations of poor people, where

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[1] Lydersen, "Keeping Kukui Gardens."
[2] Vale, *Reclaiming Public Housing*, 7-9.
[3] Ibid., 14.
[4] Schuller and Thomas-Houston, *Homing Devices*, 102.

services lack and crime abounds, communities include diverse ages, incomes, and family types. Albeit helpful, HUD's role in these programs is somewhat passive. Funds in the form of grants and subsidies are simply distributed to public and private entities and it is up to that entity to make optimal use of the funds. Another, more active option for HUD is to seek scattered-site public housing.[1] Although property investment is typically a function of private industry, HUD is engaged in other ways, such as the aforementioned capacity of mortgage insurer.

The need to decentralize the availability of affordable and low-income housing remains important, based on the powerful negative identity associated with public housing projects. That is why scattered-site affordable housing is a worthwhile option for increasing housing availability, in order to reduce the cost for low-income individuals. Adaptive reuse of existing buildings for housing has the positive side effect of being naturally scattered throughout the city.

MEETING DEMANDS

Smart Growth has been embraced by numerous municipalities hoping to cultivate vibrant and prosperous communities. It has the best intentions for the future. However, its strategies for the provision of affordable housing, one of its self-proclaimed goals, need to be enhanced and promoted more fervently in order to achieve the level of housing availability necessary to allow for affordability.

This doctorate project supports the Smart Growth agenda and offers a complementary strategy for planners, policy makers and real estate developers, which encourages the production of housing in accordance with other Smart Growth objectives. Smart Growth approaches to providing affordable housing include new construction and adaptive reuse. However, adaptive reuse is uniquely suited to create a better balance between housing and other uses, without increasing density nor sacrificing open space. Naturally, viable candidates for adaptive reuse are found in dispersed locations throughout

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[1] Schuller and Thomas-Houston, *Homing Devices*, 109.

an urban setting. Therefore, conversion of these sites helps to decentralize affordable housing options. A viable candidate for adaptive reuse meets various feasibility concerns, which is the topic of section 2.4. If feasible sites can be preselected and converted into a variety of housing options, Smart Growth initiatives for affordable housing are maximized.

2.3 FUTURE SUPPLY

Trends in the built environment vary from city to city. Many factors cause some property sectors to experience high vacancy rates, while others experience shortages. Because of these fluctuations in real estate trends, property values fluctuate. Property owners and managers respond to these value fluctuations in a variety of ways. In an ideal scenario, the supply of suitable building types would equal the demand for each property sector. However, all buildings embark on a slow march towards obsolescence as they devalue or depreciate over time, regardless of continuous reinvestment.[1] There are many aspects of building performance. There are many opportunities for a building to become obsolete.

A pre-existing building may be less marketable than a new building depending on its property sector. The inability to compete, leads to early economic obsolescence. When a building's physical state is no longer adequate for its intended occupancy it may be considered physically obsolete. As cities age and industry trends shift, a building is likely to experience functional obsolescence. Any given property can experience a combination of failures causing it to become underutilized. This doctorate project looks at each property sector to find areas where building supply exceeds demand, in order to be reused to meet housing needs.

The Urban Land Institute (ULI) is a nonprofit organization based in the real estate discipline that facilitates research and education worldwide. The organization represents the entire spectrum of land uses and provides resources and insight according to the following property sectors: industrial, public space, mixed-use, retail/entertainment, office,

[1] Bryson, "Obsolescence and the Process of Creative Reconstruction," 1443.

hotel, residential, resort/second home, and hotel.[1] These categories offer a framework for analyzing the potential real estate trends that make various property types more-or-less viable for adaptive reuse.

This doctorate project focuses on current property types outlined by the ULI that do not serve a housing function. Housing is proposed end-use, once adapted.

INDUSTRIAL PROPERTY OBSOLESCENCE

Many of our cities today have an oversupply of empty and underused industrial buildings. These buildings are often located in urban districts or waterfront areas, as is the case in Hawaiʻi, where access to transportation routes is a major planning factor.[2] Although typical locations provide a strategic advantage for industrial purposes, the buildings and types of activities that take place in industrial zones are not harmonious with other more enjoyable activities associated with recreation. As industrial activities lose momentum, the areas become a wasted opportunity for more viable development. This historic trend begins with the impetus of the city. Industrial growth, which naturally led to an increase in industrial property development, was elemental to the formation of our earliest urban environment.[3] Initially, the manufacturing industry attracted other business and service activities, which allowed the urban economy to diversify and shift from its original focus on industrial activity, to more valuable activities that support the inhabitants of the city.[4]

Manufacturing is one of two major activities described by the term industrial. The other activity is distribution. Both of these endeavors have been greatly affected by advances in technology and will likely continue being transformed.[5] Four major innovations greatly affect the physical environment in manufacturing and distribution. The first advancement is embedded intelligence.[6] Technology has allowed us to design and build

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[1] Urban Land Institute, *Economy & Capital*.
[2] Tang, "Industrial Property, Market Initiative and Planning Policy."
[3] Ibid.
[4] Ibid.
[5] Thompson, "Information and Communications Technology and Industrial Property."
[6] Ibid.

products that are increasingly useful and they are shrinking in size. Hand-held electronics have replaced countless bulky, unsophisticated products. As the items being produced get smaller, so does the spatial requirement for their manufacture. The second advancement affecting the physical industrial environment is robotics.[1] With more manufacturing processes being conducted by robotic devices there are fewer employees needed to operate tools and assist the process. With fewer employees requiring ancillary services, the overall spatial requirement for facilities is reduced. The third advancement pertains to telecommunications.[2] Supply management in the past was imprecise and required making a large supply in advance of demand. Now, items can be produced in response to precise sales activities. This reduces overstocking and subsequently uses space more efficiently. The last advancement changing the physical industrial environment is smart tagging.[3] This advancement primarily changes the manufacturing side of industrial activity. Item tracking, or the ability to pinpoint the location of a given item en route, has become commonplace. Just as advanced telecommunications have allowed processes to provide for efficient use of space, so does item tracking. Routes and volumes can be more precisely refined to make the process faster, ultimately using less space for less time.

With all these trends and technologies changing the needs and functions of our industrial environment, the capacity for industrial buildings to retain value and avoid obsolescence is limited. Although industrial buildings could be renovated for the same purpose of industrial activity, they are often requiring less and less space, which in the long term creates building surplus. Ultimately every city has to contend with its own trends and issues of incompatible zoning.

PUBLIC PROPERTY OBSOLESCENCE

Obsolescence in public buildings is as much a result of changing functional requirements as it is a result of complicated organizational management. Public buildings include: hospitals, museums, postal headquarters, assembly halls, and many other

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[1] Thompson, "Information and Communications Technology and Industrial Property."
[2] Ibid.
[3] Ibid.

government-run facilities, such as schools.[1] There are a variety of functions that can be supported by these different building types. Naturally, each building type experiences factors for obsolescence that relate specifically to the building use. For example, a museum may need to adapt to new exhibition practices, a hospital may need to accommodate advanced equipment or research, or a post office may need to downsize as revenues are lost to private competitors. There is however one difficulty they all share as public institutions. They all require the coordination of multiple agencies and various tiers of government approval to make changes. Complications arise from this bureaucratic entanglement as early as the project planning phase and continue through the operation, maintenance and reuse of a facility.[2]

In order to avoid or at least postpone obsolescence, administrators and building operators must anticipate the changes that are required to remain relevant. This requires some analysis and initiative on behalf of the governmental body that oversees the facility in question.[3] In the private sector this effort is profit driven. Trend analysis and speculation is driven by an interest in return on investment. In the public sector, accountability to the tax-payer is a major driver. However, that same sense of accountability requires government oversight and coordination that can paralyze change.

When public buildings are deemed obsolete, long after their usefulness has begun its decline, they have some options. If the building is not a historical structure of advanced age, then demolition and rebuilding for the same use or a new use could be an option. Alternatively, if the building is in good condition, or has historical value, it can be renovated for the existing use, or adapted to a new use. Although public building obsolescence results from specific issues according to building usage, it is useful to understand the organizational difficulties they have in common as a property type.

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[1] Douglas, *Building Adaptation*.
[2] Committee on Facility Design, *The Fourth Dimension in Building*.
[3] Ibid.

MIXED-USE PROPERTY OBSOLESCENCE

Many cities offer a mixed-use environment, where living, working and recreation can all be found within a short distance. This development type is analyzed where it occurs as one single property type with multiple uses. An example of this property type might include a building with retail on the ground floor with offices above and the remainder consisting of residential units. It seems this type of building is more resistant to total debilitating obsolescence.[1] Flexibility is inherent to the mixed-use environment because as one function begins to lose its momentum, other more viable functions can continue successfully. Having a combination of uses adds value to the building where rental markets are more sensitive to change.[2]

Portions of a mixed-use building are more likely to become obsolete and thus ripe for adaptive reuse, than an entire building. In the case where an entire building is useless, demolition and reconstruction becomes a viable option. If only a portion of the building is eligible for reuse, it does not make sense to demolish the entire building and redevelop. Not until the entire building becomes obsolete would this be a consideration.

RETAIL PROPERTY OBSOLESCENCE

The retail environment is well known for its shopping mall format. These conglomerations of shops and eateries can be found in any American city of various sizes. The physicality of the shopping mall has evolved over time. The following provides an overview of mall transformation. In the 1950s, the enclosed mall concept was introduced. Then in the 1970s, the enclosed mall was scaled for regional proportions. In the 1980s, the outlet mall, consisting of stores for exclusively manufactured items, provided a new shopping experience. By the 1990s, malls had become entertainment and lifestyle centers.

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[1] Childs, Riddiough, and Triantis, "Mixed Uses and the Redevelopment Option."
[2] Ibid.

They served a greater purpose than connecting consumers and goods. In the 2000s, small-scale retail has increased in popularity. [1]

Online shopping, also known as e-commerce is a phenomenon that many speculate will have an impact on the physical shopping environment. Although, increasing online sales has changed the way physical retailers do business, it has not been a simple detriment. As previously mentioned, shopping has become a form of entertainment, especially in American culture. As such, online and in-person shopping venues are seen as complementary to one another, not detrimental to one another.[2] Enhancing the entertainment aspect of the shopping experience is an effective strategy for maintaining the relevance of the physical retail environment.

Although the prognosis for retail environments may seem positive, there are some factors that have caused some shopping malls in the United States to suffer premature building obsolescence. These factors could be location related, meaning the overall consumer activity in a given location has shifted or declined. In this case building tenants cannot make enough profit to lease space, resulting in vacancy and ultimately building obsolescence.

OFFICE PROPERTY OBSOLESCENCE

Office property, like other property types, has very specific forces that affect building obsolescence. The same factors that stimulate office building production are also the factors that lead to its inability to last.[3] New office buildings can provide the latest in office amenities and services, leaving older buildings less desirable. As the expectations and requirements of office managers increase, so does the competition between leasable office spaces.[4] As the trend continues, the lifespan of buildings have become increasingly shorter. The reduced lifespan over time results from functional obsolescence as an office building, not from being structurally dilapidated. In the 1950s and 60s office buildings

[1] Muhlebach and Muhlebach, "A Shopping Odyssey: In Retail Market, the Only Constant is Change."
[2] McCarthy and Worzala, "E-Commerce and Retail Property in the UK and USA."
[3] Pinder and Wilkinson, "The Obsolescence of Office Property."
[4] Ibid.

typically lasted between forty to fifty years and today some buildings are demolished after only twenty to thirty years.[1]

While conversion from office use is an option for property owners, it is not one that many owners are eager to undertake, because it comes with the understanding that their office building has experienced a significant loss in value.[2] Every city experiences trends in office building supply under different micro circumstances. As a result, the rent or value gap stimulates conversion from office use to other functions at different rates.

HOTEL PROPERTY OBSOLESCENCE

Every property type has unique expectations for success. In the case of hotel properties, consumer expectations are a major factor contributing to the obsolescence of any given hotel building. Hotels are vulnerable to premature obsolescence, meaning a hotel can become obsolete before its structural integrity is anywhere near compromised. Furthermore, when a hotel becomes prematurely obsolete, guests are less willing to patronize.[3] Without guests to fill the rooms, profits suffer and property value plummets.

Premature Obsolescence results from several factors, including: outdated style or unfashionable image; shift in consumer preferences; or market-relocation where the surrounding area is no longer desirable.[4] Under these circumstances, hotels have some options for avoiding or reversing obsolescence. However, when the problem is related to property location, little can be done to maintain a successful hotel. Issues resulting from changing consumer preferences and building fashion can be remedied by renovations that allow the hotel to stay more competitive. Another option would be to adaptively reuse the hotel for a new purpose. This is not without its challenges. Hotels are a very specific building type, which requires intensely specific building interior design. This makes retrofit for a new use very expensive. Therefore, the purchase price of the hotel must be low in

[1] Pinder and Wilkinson, "The Obsolescence of Office Property."
[2] Heath, "Adaptive Reuse of Offices for Residential Use."
[3] Berg, "Obsolete Hotels."
[4] Ibid.

order for the project to be feasible.[1] This condition makes adaptive reuse prohibitively difficult in many cases, except when reuse involves another type of living arrangement, where the existing interior services are utilized.[2] Housing therefore, is an appropriate reuse for hotels, given that it provides the most feasible opportunity for the property.

IDENTIFYING SUPPLY

This doctorate project is interested in adapting obsolete properties for in-demand uses. Section 2.2 establishes the need to increase housing supply in the urban environment, in order to increase affordability. Assessing obsolescence trends according to property type allows developers to identify sectors where supply exceeds demand. This supply can then be converted to meet current demands.

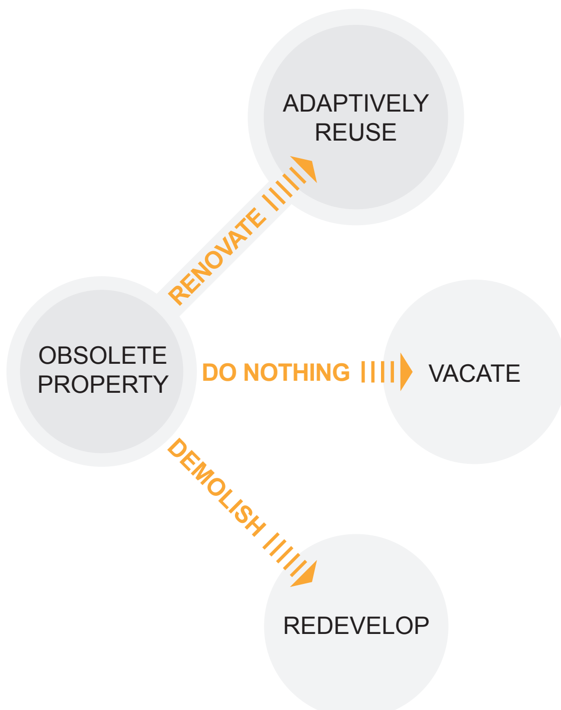

FIGURE 3 OBSOLETE PROPERTY OPTIONS

[1] Berg, "Obsolete Hotels."
[2] Ibid.

While it is true that only some obsolete properties are viable candidates for adaptive reuse, all adaptive reuse properties involve obsolete properties. In order to preselect properties for adaptive reuse, properties with a remaining functional life can be eliminated from consideration. This section provides a look at the factors that contribute to the prospects of obsolescence for each property sector. While it is important to analyze property sectors according to their local real estate market, industrial and office properties are uniquely prone to building obsolescence.

2.4 REUSE FEASIBILITY

There are four major criteria to consider in the adaptive reuse decision-making process. Each of the four criteria has been independently examined by various authors. This doctorate project focuses on the diagram shown in Figure 4. In this model, each category of criteria is considered for its capacity to drive the decision to adaptively reuse. In any given project, the criteria for consideration is not necessarily weighted equally. The goals and objectives of each project determines whether the decision is guided by economic concerns, environmental concerns, social concerns, or governmental concerns.

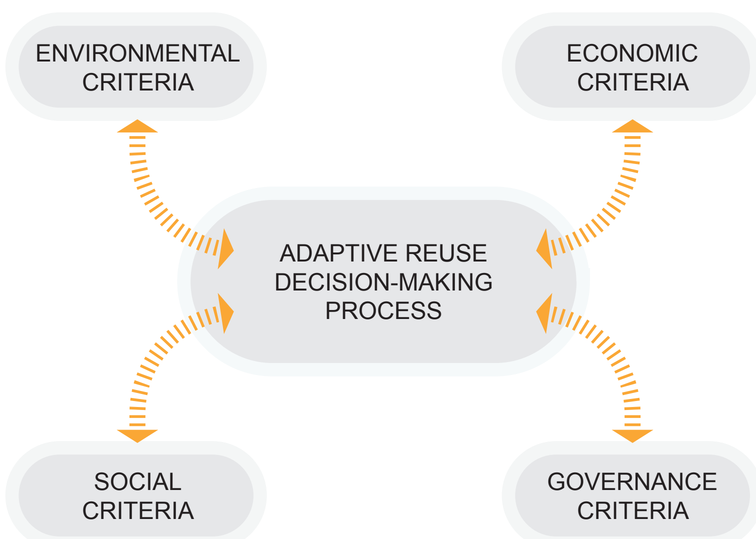

FIGURE 4 ADAPTIVE REUSE DECISION-MAKING PROCESS MODEL[1]

[1] Bullen and Love, "The Rhetoric of Adaptive Reuse or Reality of Demolition," 222.

ENVIRONMENTAL DRIVERS

Sustainability is a universal issue for the built environment in the 21st century. This includes the topic of adaptive reuse. There are many environmental benefits to renovating a building as opposed to demolishing and redeveloping with a new building. To see the benefits one must consider the use of resources in construction. In this way, a building is seen as a renewable resource that not only saves the old building materials from ending up in a landfill, but also requires fewer new materials to be produced, which generates a lot of embodied energy and waste.[1] Reusing an existing structure also minimizes disturbance to surrounding buildings compared to the demolition of a building.[2]

Comparison between the obsolete property options (i.e., adaptive reuse, vacancy and redevelopment), on the basis of environmental sustainability must weigh the ecological benefits of each option. On the one hand, new buildings can have highly efficient systems, low-maintenance materials and renewable energy sources. On the other, salvaging a pre-existing building keeps the demolished materials from sitting in a landfill and significantly reduces the need for new materials. Both of these options are capable of accomplishing sustainability goals. Although most sustainability achievements can be measured (e.g., energy used, saved or produced), it may be difficult to compare the value of one benefit to another when the unit of measure is not the same (e.g., kilowatt-hours of energy versus cubic feet of raw material). One method that begins to allow some comparison is the cost of conserved energy (CCE) equation:

$$CCE = \frac{a(n,d) \cdot I_{measure}}{\Delta E_{year}}$$

where

$I_{measure}$ = the investment cost, or additional cost, of an energy-conserving measure (in a monetary unit),

[1] Bullen and Love, "The Rhetoric of Adaptive Reuse or Reality of Demolition," 222.
[2] Ibid.

ΔE_{year} = the annual energy conserved by the measure (in a physical unit, e.g. kWh), and

$a(n,d)$ = the capital recovery rate defined as follows:

$$a(n,d) = \frac{d}{1 - (1+d)^{-n}}$$

where

d = the real interest rate in absolute terms, and

n = the useful life time of the measure (in years).[1]

The CCE formula calculates the cost of various energy saving measures compared to the actual energy saved, so that the measure, which save the most energy for the least investment, can be implemented.[2] This formula has been used to create a method for determining the decision to renovate versus demolition and redevelopment. The decision weighs the profitability of energy saving renovations versus the cost to demolish the pre-existing building and construct a new one in its place.[3] The design flexibility that is inherent to new construction permits the use of new, highly efficient systems. Therefore, adaptive reuse is a more favorable option than demolition and redevelopment when the pre-existing building has a low cost of conserved energy, compared to the cost to tear down and rebuild.

ECONOMIC DRIVERS

The decision to adaptively reuse a building rather than demolish and rebuild is typically evaluated for economic sense. This includes an assessment of the value of a renovated building, less the cost of renovation, compared to the value of a new building, less the cost of demolition and construction. There are other economic criteria to consider.

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[1] Petersen and Svendsen, "Method for Component-Based Economical Optimisation."
[2] Morelli, Harrestrup and Svendsen, "Method for a Component-Based Economic Optimisation," 306.
[3] Ibid., 308.

Adaptive reuse of an existing building allows many existing attributes to be maintained: building market value, commercial viability, and marketing of nostalgic features.[1]

Projects that are driven by economic factors require an evaluation and comparison of the available options. Meaning, the financial implications of demolition and new construction area weighed against the financial implications of adaptive reuse. The most self-evident method for economic evaluation is the net benefits (NB) formula. Net benefits can also be expressed as net savings (NS) and can be considered in present value or annual value terms, where net benefits,

> …measures the amount of net benefits from investing in a candidate project instead of investing in the foregone opportunity. [It] is computed by subtracting the time-adjusted costs of an investment from its time-adjusted benefits. If NB is positive, the investment is [cost effective]; if it is zero, the investment is as good as the next best investment opportunity; if it is negative, the investment is [not cost effective].[2]

For this doctorate project, the Present Value (PV) model for net benefits is used. The following equation allows the determination of NB:

$$PV\,NB_{A1:A2} = \sum_{t=0}^{N} \frac{(B_t - \bar{C}_t)}{(1+d)^t}$$

where

$PV\,NB_{A1:A2} =$ NB, (i.e., benefits net of costs), in present value dollars, attributed to a given alternative, A1, compared to those of a mutually exclusive alternative, A2 (which may be the alternative of doing nothing),

$B_t =$ relevant benefits (i.e., positive cash flows such as revenues or other advantages which are assigned a dollar

[1] Bullen and Love, "The Rhetoric of Adaptive Reuse or Reality of Demolition," 222.
[2] Ruegg and Marshall, *Building Economics*, 34.

value) associated with a given alternative, A1, less relevant benefits for a mutually exclusive alternative, A2, in a period *t*, and

$\bar{C}$ = relevant costs (i.e., negative cash flows) associated with a given alternative, A1, less relevant costs for a mutually exclusive alternative, A2, in a period *t*.[1]

The value for the variable (*d*) = discount rate. This allows a comparison between a present and future amount. This is effectively the reverse of compounding.[2]

Although this formula is straightforward in its application, gathering and estimating the values needed to compute the outcome is time consuming. An accurate estimate of the relevant benefits requires careful examination of comparable properties to determine present value. Likewise, an accurate estimate of relevant costs may require a detailed design scheme for both a reuse and redevelopment option. If the majority of economic evaluations favor new construction, developers may not consider an adaptive reuse option and instead accept new construction as a forgone conclusion. With a preselection process that eliminates unlikely candidates in advance, economic evaluation is a worthwhile endeavor, favoring adaptive reuse more often than not.

SOCIAL DRIVERS

Adaptive reuse has been an attractive option in the historic preservation sector of architecture. Buildings that become functionally obsolete (i.e., buildings that have exceeded their useful life) for one reason or another may retain their cultural value as a historic asset. In order to preserve the physical presence of these buildings, adaptive reuse is an option that allows buildings to regain some functionality. Other practical issues concerning the social criteria for adaptive reuse includes: retention of existing urban fabric,

[1] Ruegg and Marshall, *Building Economics*, 36.
[2] Ibid., 109.

avoiding long-term vacancy, area stabilization and encouragement for local community growth.[1]

In order for a building to be designated as historic and therefore worthy of preservation despite potential financial loss, there are some criteria to be met. When a building that is at least fifty years old is under consideration for demolition or renovation, the property is evaluated for historic significance according to the criteria set forth by the US Department of the Interior, National Park Service. The criteria for evaluation are as follows:

> The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:
>
> A. That are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> B. That are associated with the lives of significant persons in or past; or
>
> C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> D. That have yielded or may be likely to yield, information important in history or prehistory.[2]

When the feasibility of a project is driven by social benefits, a measure of cultural value may supersede the value of environmental sustainability or economic profit. The criteria for historic registry offers one means of evaluating the merits of an individual

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[1] Ruegg and Marshall, *Building Economics*, 109.
[2] National Park Service, *How to Apply the National Register Criteria for Evaluation*.

building, so that the decision to adaptively reuse, versus demolish and redevelop, is based on the social contributions of preservation.

GOVERNANCE DRIVERS

Opportunities and constraints are presented by the governing authorities associated with any building development, including housing development. Two important regulatory bodies to consider are: The Department of Housing and Urban Development (HUD); and the International Code Council (ICC), which is responsible for the International Building Code (IBC). In order to demonstrate the proposed method in Hawaiʻi, the Honolulu Department of Planning and Permitting (DPP) is also important. Honolulu's DPP is responsible for the Revised Ordinance of Honolulu (ROH). Included in the ROH, is a chapter of Land Use Ordinance (LUO). Although HUD is responsible for many regulations, they also provide many opportunities. The ICC and DPP are generally regulatory bodies, rather than sources of opportunities. Nevertheless, an understanding of how they govern the built environment is crucial for success. Details regarding the aforementioned regulatory bodies can be found in appendix A.

Governmental organizations can also provide incentives for adaptive reuse through the relaxation or formulation of policies.[1] Tax incentives can also be used help to offset the cost of adaptive reuse.[2] The economic benifits of any adaptive reuse project should prove viability. In the case of many older buildings, cost to repair and renovate an existing structure can increase with age. In an effort to encourage the adaptive reuse of historic buildings and stimulate the economy, tax incentives often provide developers with the encouragement they need to renovate an existing building rather than demolish and build new.[3]

Tax incentives are meant to protect community assets for future generations when the economic justification is not there. Additionally, rehabilitation projects create more job

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[1] Bullen and Love, "The Rhetoric of Adaptive Reuse or Reality of Demolition," 222.
[2] Wichman, *The Economic Benefits of State Historic Preservation Investment Tax Credits*.
[3] Ibid.

opportunities than new construction due to the labor intensity.[1] Consequently, creating more jobs stimulates the economy. As a result of job creation, there is an increase in tax revenues that offset the funds allocated for tax credits.[2] According to one study, "[e]ach $1 million in state tax credits leverages approximately $5.35 million total economic output."[3]

Tax credits for rehabilitation are already making an impact on affordable housing for the economic benefits they provide to developers and communities.

> The Rhode Island Economic Policy Council found that 89% of the increased employment and housing generated by the tax credit for the period 2002 to 2006 took place in census tracts where household incomes are below the statewide median, and rehabilitation projects are estimated to provide more than 750 subsidized housing units over the next twenty years.[4]

There are other benefits to be seen in the revitalization of neighborhoods and the attraction of new commerce.[5] Ultimately, tax credits may seem like a cost to the government that favors developers, but the cultural and economic benefits are extended to the surrounding communities.

FEASIBILITY DRIVER ASSUMPTIONS

Whether the decision to adaptively reuse a pre-existing building is driven by environmental, economic, social or governmental benefits, criteria specific to each driver must be used to determine the feasibility of the decision. Evaluation based on specific criteria ensures the decision to reuse, or redevelop, provides the sought after benefits of the selected feasibility driver. An evaluation that is driven by environmental concerns may require measurement of energy efficiency or material reuse versus disposal. Economic evaluation—which is possibly the most straightforward of all the drivers—compares the fiscal profitability of adaptive reuse to determine feasibility. When social benefits are the

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[1] Wichman, *The Economic Benefits of State Historic Preservation Investment Tax Credits*, 2.
[2] Ibid., 4.
[3] Ibid.
[4] Ibid., 8.
[5] Ibid., 6-9.

basis of evaluation, historic value may indicate whether adaptive reuse is a worthwhile endeavor. The government often drives feasibility by providing tax incentives and regulation amendments. It is difficult to define criteria for evaluating a project based on its capacity to satisfy governmental goals. The objectives of various agencies may determine the criteria on a case-by-case basis.

2.5 TECHNICAL CHALLENGES

There are many challenges inherent to the adaptive reuse process. Unlike the typical concerns of new construction, these challenges are unique to renovation. There are three major categories of design challenges. Each category involves a complex set of issues, to be addressed individually. The design challenges are: design flexibility and creativity limitation, collabortion difficulties and incomplete information.[1] The challenges posed by design rigidity and restricted creativity are essentially restrictions caused by space limitations. These physical limitations include dimensional elements as wells as historic elements, both of which should be incorporated into the new design.[2] The second category, collaboration difficulties, consists of two major types of issues: organizational and economic. Organizational issues include the challenge of collaborating with people across many disciplines, with disparate skills and backgrounds in order to achieve various design goals.[3] Economic issues include a broad range of concerns that encompass government regulations (pertaining to approvals processes and planning), stakeholder and agency collaboration dificulties. The last category, incomplete information, includes issues related to building assessment, lack of guidance, or a lack of documentation for the pre-existing structure.

Each of the challenges are investigated in chapter 3, under section 3.6, which provides precedent studies that represent the challenges discussed in this section.

[1] Alauddin and London, "Design Management: Challenges for Adaptive Re-use," 353.
[2] Ibid.
[3] Ibid.

DESIGN RIGIDITY AND CREATIVITY LIMITATIONS

Structural systems that may have been originally designed for efficiency in one use may not be efficient for alternative uses, such as housing. The ensuing challenge varies depending on the pre-existing building type. Some structural concerns are bay size, floor-to-floor height or overall ceiling height, irregular column placement, etc. This doctorate project focuses on end-uses that typically require smaller dimensions compared to the pre-existing use. The transition to retrofit smaller structural or interior finish members into an oversized space does, however, come at a cost. Because the size of structural members available vary significantly, so does the cost to retrofit, making certain buildings more ideal than others. In some case the structural capacity of an existing structure may be insufficient for the new use, in which case the viability of reuse may need to be reconsidered.

Another major design flexibility challenge results from incompatible building systems. This includes mechanical, electrical and plumbing (MEP). When beginning any adaptive reuse project, all building systems in use must be identified and evaluated. Each system has different criteria which must be assessed to determine the scope of the challenge, in order to develop an appropriate solution.

When evaluating the existing mechanical system of a building the performance and suitability of the system should be considered. Available space is important because many older buildings may have tighter floor to ceiling dimensions, which can make it difficult to introduce new horizontal air flow systems. These ducts can require upwards of 30 inches of vertical space.[1] An important component to the efficiency of any mechanical system (e.g., HVAC) is the thermal resistance of the building envelope. Assessing insulation values of the building can be challenging when the walls are a closed system and the material composition is unknown.[2] Also, in some cases it may be desirable to maintain an existing finish, which could prohibit additonal layers of supplemental insulation. Additionaly,

[1] Rabun, *Building Evaluation for Adaptive Reuse and Preservation*, 141.
[2] Ibid., 143.

mechanical systems which are designed to create zones that can be controlled separately, may not provide the same scale and location of zones that are appropriate to the new use.[1]

Electrical systems, which inlcudes the electrical power systems, lighting systems, communication systems, fire/security systems and vertical transportation, should be evaluated for their performance and suitability.[2] The spatial challenges for electrical systems are far less than the challenges posed by mechanical systems. Nevertheless, there must be an appropriate amount of space dedicated to accessible panel boxes.[3] For residential conversions, which are the focus of this doctorate project, the power density is typically lower than in commercial buildings.[4] Availability of natural light in an existing structure may not be within the designer's control. It may be pre-determined by the existing openings, which might not be adaptable. In order to provide adequate light without designing redundancy into the system, the new system must first consider the existing conditions.

COLLABORATION CHALLENGES

Urban planners often use zoning as a method for grouping compatible functions into areas or districts. As trends in building usage fluctuate, buildings in areas that are not zoned for residential (or for mass housing) may be ideal based on many other factors, such as building type compatibility. However, the area surrounding the building for reuse may lack the necessary services that are ideal for an urban residential development. Furthermore, other uses in close proximity may present audible or visual nuisances to residents. Although vacant buildings may be cheaper to acquire and present fewer time constraints, there may be additional vacancies that are typically associated with crime and vandalism.

The governing authorities previously discussed present several complex challenges to adaptive reuse. Because many of these factions organize their regulations according to

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[1] Rabun, *Building Evaluation for Adaptive Reuse and Preservation*, 145.
[2] Ibid., 96-101.
[3] Ibid., 96-107.
[4] Ibid., 110.

function, reusing a building for a new usage often puts the building into a new class of buildings with entirely new standards governing the available options. For example, the IBC has separate regulations, categorized by use, that apply to accessibility and egress issues, fire separation and building envelope openings.

INCOMPLETE INFORMATION CHALLENGES

As with any renovation, an architect begins with a set of record drawings. These drawings, however, are often less-than-accurate. In some cases, depending on the age or organization, there are no record drawings at all. In which case, the architect must conduct a survey of the building to produce measured drawings. Typically, this requires extensive field work to gather dimensions, followed by more work to draw up the plans. Furthermore, unless the investigation of the building includes probing past the building finishes, the architect may not have a complete picture of the building elements.

As-built or measured drawings, when available, are the assumptions that allow a renovation or reuse design to be made. After construction begins and sections of the building are removed or disassembled, surprising deviations from the drawings may be revealed. When this happens, depending on the type of unforeseen element, the architect is forced to go back to the drawing board. This takes time and money, affecting the budget and schedule.

Preservation of existing building elements is often time and labor intensive. It requires skilled assistance, raising the cost even further. For large-scale projects, the task of preserving parts of the building may become inefficient. Preservation tasks also require an additional level of coordination and supervision to ensure that timelines overlap wherever possible. This additional layer of management presents a challenge to the budget. When the timeline is delayed, there could be detrimental impacts on financing.

Existing buildings past a certain age are more likely to contain hazardous materials. Some common materials include lead paint and asbestos. These materials have special requirements for abatement. This can cause time delays in preparing the building for renovation, and additional time spent to collect and test samples. Depending on the quantities found, special consultants must be contracted to conduct the abatement. In certain conditions the hazardous material can remain, if it is encapsulated. While this may not be the most appropriate option, it may be the least expensive.

Because adaptive reuse often involves replacing some building elements such as windows or other finish materials, it is important to understand the limitations made to value engineering. Most design projects are governed by cost and in the end design elements are value engineered to get as close to the desired outcome as possible for the least amount of cost. Essentially this is a cost to function ratio that allows the value engineer to make difficult decisions that make a project affordable. With an adaptive reuse project there is often a need to use the same material or element that was previously used. There may be several reasons for doing this. Some reasons are more easily avoided than others. For example, one reason could be to maintain a certain aesthetic or fulfil historic preservation requirements. Another reason may be to provide a specific dimension or opening to accept a new product. As our society strives to meet new energy standards, many materials or elements may need to be upgraded. When this is required, there are additional factors for decision-making beyond product efficiency and cost.

CHALLENGE ASSUMPTIONS

The old adage, “expect the unexpected,” is ever poignant to the topic of adaptive reuse. Like any project, contingencies help to resolve the unexpected challenges of dealing with a pre-existing building. A look at previous adaptive reuse projects shows that some challenges occur more often than others do. Familiarity with the predominant challenges presented in this section aids strategy development and contingency calculation, which increases the likelihood of adaptive reuse success.

2.6 SUMMARY

Successful adaptive reuse involves the renovation of a pre-existing building that has exceeded its useful life, for a new in-demand purpose. Smart Growth principles are used to recognize the need for affordable housing. Research shows that this is effectively done by providing a variety of housing types (e.g., providing multi-family housing among single-family residential). Based on the Smart Growth agenda, this doctorate project asserts that housing is an ideal end-use for adaptive reuse success.

Based on the aforementioned definition of adaptive reuse success, it is time to consider repurposing the property when a building has reached the end of its useful life. In order to fulfill this requirement, only properties that exhibit signs of obsolescence should be considered for adaptive reuse. Research on the various property sectors explains the prospect of obsolescence and the factors that cause a building's useful life to dwindle. Industrial and office property showed an increased likelihood of obsolescence and therefore stand out as potential candidates when selecting sites for adaptive reuse.

Within a given property sector, the specific characteristics of a building (e.g., its size, age, cultural significance, location, etc.) make it more-or-less feasible for adaptive reuse. When determining which building, among a pool of potential candidates, has the greatest capacity for success, a more specific definition of success is required. Therefore, criteria for evaluating the potential sites should correspond to the primary driver of feasibility, whether it is environmental, economic, societal or governmental. Research on each feasibility driver is provided so that potential properties can be evaluated and prioritized accordingly.

Despite the factors that make any property predisposed to adaptive reuse, there are inevitable challenges in the process. The most commonly encountered issues are categorized and explained. Whenever the decision to adaptively reuse a pre-existing building is made, a unique design strategy, which responds to all the expected challenges, is sure to follow. Unlike new construction, adaptive reuse projects are constrained by the dimensions and materials required by the original use. Restrictions on design creativity are exacerbated by additional compliance issues. Collaboration with various regulators and industry specialists is required to see any adaptive reuse project through, from start to finish. Along the way, as more information about the pre-existing building is revealed, unexpected issues may arise. Depending on the information available about the building, these challenges may consume a large portion, if not all, of the project's contingency fund.

The research aspects presented in this chapter begin to narrate the story of adaptive reuse. In the next chapter, the story is illustrated by precedents and case studies pertaining to concepts discussed thus far.

CHAPTER 3 ADAPTIVE REUSE PRECEDENTS

3.1 INTRODUCTION

The research provided in chapter 2 provides a framework for understanding many important adaptive reuse aspects. In this chapter, precedents are used to demonstrate the previously examined concepts. Section 3.2 provides relevant examples of building obsolescence where the pre-existing structure was converted into multi-family housing on a large scale. Each of the property sectors discussed in section 2.3 are represented. The projects reviewed in section 3.3 were selected for their respective feasibility drivers. Each of the four drivers from section 2.4 are represented. Case studies from Honolulu's Kaka‘ako neighborhood are presented in section 3.4. These projects were investigated at greater depth in order to devise a method of economic evaluation that is consistent with an economic feasibility driver. Finally, in section 3.5 of this chapter, precedents that exemplify the technical challenges of adaptive reuse are presented.

3.2 PROPERTY SECTOR OBSOLESCENCE

In section 2.3, mixed-use and public buildings were presented as the least anticipated property for adaptive reuse when other options present themselves. Mixed-use buildings are resistant to functional obsolescence because adaptation and updating is an ongoing process for these buildings. Public buildings face another challenge. Unlike mixed-use buildings, they are at risk of obsolescence when maintenance is neglected. Without economic incentive to keep buildings in good condition, it is often too easy for these buildings to fall into disrepair. In order for adaptive reuse to be a success, an active, supportive government agency is needed. The following precedents show the potential for each of the property sectors (i.e., industrial, public, mixed-use, retail, office and hotel) to be converted into housing. The projects were selected for their appropriateness of type and size. The examples demonstrate conversion to housing on a large scale, with most cases involving multiple buildings, where efforts were championed by local government. It is important to investigate projects at this scale, because the intent of this doctorate project is to enable multiple instances of building conversion in order to sufficiently increase housing supply to lower the cost.

THE STACKS COTTON MILL IN ATLANTA, GA

In Atlanta, Georgia, there is an industrial complex that has faced many of the same challenges outlined in section 2.3. Originally, this collection of industrial buildings served as a productive cotton mill operation, but as the economy of Atlanta changed and technology advanced, the old complex became obsolete. In 1996, the site was purchased by a construction company. For more than twelve years, they have been renovating the industrial buildings into residential lofts.

FIGURE 5 CONVERTED COTTON MILL COMPLEX[1]

The new residential community is called *Stacks*, because the original smoke stacks from its operational days have been retained, although they are no longer in use. The total budget for the renovation was fifty million dollars, partially funded using low income tax credits.[2] In order to qualify for this incentive the project provides 40 percent of the 206 phase one units for low to moderate-income workers, for a period of 15 years.[3] The project has been largely regarded as a success and residents have expressed their appreciation for the diversity among tenants and owners.

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[1] Left and right: Black, "The Story of Stacks," 40.
[2] Ibid., 40-48.
[3] Ibid.

PUBLIC BUILDING IN COUNCIL BLUFFS, IA

The city of Council Bluffs, Iowa has been successful in identifying their surplus stock of vacant public buildings. As a result they have adopted a measure to promote adaptive reuse focused on housing. Many of the public buildings for adaptive reuse are located in residential areas. Rezoning of these areas allows adaptive reuse projects to create multi-family housing opportunities among the existing single-family residences.[1]

FIGURE 6 CONVERTED SCHOOL BUILDING AND NEWS BUILDING[2]

Only buildings that still have value are considered for reuse, with an emphasis on integrating the new housing types into the surrounding community. The ultimate goal of this initiative is to ensure a variety of housing types. This goal is aligned with the findings presented in section 2.2 regarding Smart Growth. Research shows that in increase of housing types is effective in creating affordable housing.

MIXED-USE REDEVELOPMENT IN LOS ANGELES, CA

In 1999, the city of Los Angeles adopted an Adaptive Reuse Ordinance for encouraging the conversion of existing, underutilized commercial properties for housing use. The measure was part of an effort to increase the downtown population. The city

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[1] Community Development, *City Planning Commission Communication*.

[2] Left: Business Intuit, *Elementary & Middle School*; right: Schemmer, *Nonpareil Building Restoration*.

needed to add 1,500 to 3,000 new units to the downtown area and managed to convert twenty-two existing properties into 3,400 housing units.[1]

FIGURE 7 CONVERTED MIXED-USE BUILDINGS[2]

The new ordinance helped to accomplish this goal by eliminating many of the regulations that made adaptive reuse previously difficult. They also switched to performance-based fire rating requirements, as opposed to specifying construction assemblies.[3] The adaptive reuse program also creates special incentive areas, standardizes dwelling unit sizes, allows for partial conversion, and requires no new parking.[4] Unfortunately, this housing effort has had some unexpected results. Regulations have become very relaxed, which primarily provides a benefit to property developers and not necessarily occupants, resulting in a lack of affordability for the new units.[5]

ARCADE SHOPPING MALL IN PROVIDENCE, RI

In Providence, Rhode Island a former shopping mall, called Arcade Providence, has been adaptively reused for housing. The mall was closed in 2008 and began its

[1] Anderson, "Downtown: Housing LA's Future."
[2] Left: Civic Center News, *Adaptive Reuse Ordinance*; right: Decoma, *Toys Lofts.*
[3] Anderson, "Downtown: Housing LA's Future."
[4] City of Los Angeles, *Adaptive Reuse Program*.
[5] Bullen and Love, "Residential Regeneration and Adaptive Reuse."

renovation into forty-eight micro-loft apartments in 2012.[1] The budget for the renovation was eight million dollars. Of the forty-eight units, thirty-eight will range between 225-450 SF and ten will be larger three bedroom units.[2]

FIGURE 8 CONVERTED SHOPPING MALL[3]

The project provides economy-sized lofts at an economical price. Leases start at 550 dollars per month.[4] Income from the housing units will make the new Arcade self-sustaining. On the ground level, there will be seventeen new stores and restaurants, with the second and third floor for residential use.[5]

OFFICE BUILDINGS IN NEW YORK, NY

From 1995 to 2004, sixty-one office buildings were converted to 6,500 residential units in New York City. The surge in conversion was driven by the infamously tight housing market and a large stock of obsolete office properties.[6] Conversions included a range of building sizes, from low-rise to high-rise construction. For the low-rise conversions, tax-abatements help to fund the adaptive reuse effort.

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[1] Rosenfield, "Refurbishing America's Shopping Mall."
[2] Meinhold, *Nation's Oldest Indoor Shopping Mall*.
[3] Left and right: Ibid.
[4] Ibid.
[5] Pina, *Historic Arcade to Reopen with Stores First*.
[6] Beauregard, "The Textures of Property Markets."

FIGURE 9 CONVERTED OFFICE BUILDINGS[1]

Like many imbalances in the real estate market, responding to a trend can often create a trend of its own. As seen in the case of New York City, conversion of surplus office buildings eventually reduced the vacancy rates of office properties and conversion slowed.[2]

HOTELS IN VANCOUVER, BC

In downtown Vancouver, adaptive reuse of obsolete hotels provides an opportunity for affordable housing in an underserved niche of this housing market. According to the Smart Growth research previously presented, it is important to provide a range of housing types in order to meet the demands of every income level. Efforts by the British Columbia Housing Authority meet the need of its lowest earning citizens by providing single room occupancy (SRO) units that have been converted from former hotels. Thirteen hotels were purchased by the Housing Authority in the last five years.[3]

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[1] Left: Satow, "Another Financial District Building Coverts to Residential"; right: Jankiewicz, "Time to Change: Office Conversions."
[2] Beauregard, "The Textures of Property Markets."
[3] BC Housing, *Renovation project moves ahead on Downtown Eastside*.

FIGURE 10 CONVERTED HOTELS[1]

The SRO units are intended for a range of occupancy durations. Tenants are provided a single private room for short or long-term arrangements. Typically, in older hotels a single room does not provide a private bathroom or kitchen.[2] Many newer hotels provide private bathrooms and in these situations, the accommodations may be more comfortable. The scope of this doctorate project includes design, approval by the British Columbia Housing Authority, permitting, structural/envelope renovation, inspection, and acceptance by government authorities.

OBSOLESCENCE EVIDENCE

Each of the precedents illustrated the potential for any building sector to be successfully converted into housing. As described in section 2.5, building challenges vary according to the requirements of their former uses. This was evident in the precedents. Various strategies were employed to overcome their respective challenges. In some cases, government regulations were revised or relaxed and in other cases, the outcome itself was non-traditional. For example, many of the projects produced compact unit sizes that increased the variety of housing types available. In every case, the properties being converted had experienced some type of obsolescence. When faced with this condition,

[1] Left and right: BC Housing, *SRO Renewal Initiative,* 1.
[2] Ibid.

the corresponding developers preferred adaptive reuse to redevelopment. Each project was driven by one or more of the feasibility drivers from section 2.4. Precedents that explore the force of the feasibility drivers are presented in the next section.

3.3 SPECIAL INTERESTS

In section 2.4, four driving forces for feasibility are presented. The feasibility drivers are: the environment, economy, society and government. Each precedent in this section was driven primarily by one of the aforementioned drivers. Examination of these projects elucidates the fundamental motivation for each driver.

PARKWAY LOFTS IN BLOOMFIELD, NJ

It may seem implausible for a building to be adaptively reused strictly for reasons of environmental sustainability. However, "going green" can provide added benefits to an already economically viable conversion. The developers of the New Jersey Parkway Lofts had the notion they wanted to go "twice green" with the adaptive reuse of the former General Electric factory. They went "once green" for saving the existing building from the landfill and "twice green" for designing an energy efficient building in the end.[1]

FIGURE 11 PARKWAY LOFTS[2]

[1] Chen, "Adaptive Reuse Makes Buildings Better with Age."
[2] Left and right: Parkway Lofts, *Gallery.*

It seems the developer's intent is to translate their environmental consciousness into profits to whatever extent possible. The new building will be energy efficient, seeking certification from the US Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) program. The developers feel this level of energy efficiency is attractive to tenants.[1] With any luck, rental sales will be proof-positive for this theory.

The first phase of this project will provide 365 market rate rental units.[2] The former brownfield site has an estimated sixty million dollar renovation budget. [3] Amenities that make residential use a possibility include: ample floor-to-ceiling heights, on-site underground parking and ideal proximity to transit options.[4]

This project owes its economic viability to the existing conditions. Because the building has a structural and spatial configuration that is conducive to residential use, conversion is not as cost prohibitive as it might be if the original facility required more extensive renovation and building adaptation efforts.

WESTBETH LANDMARK IN NEW YORK, NY

In New York City, the Westbeth Landmark provides an excellent example of a socially driven adaptive reuse project. Ultimately, the social importance of the building was leveraged to gain the financial support required to make the project feasible. Westbeth Landmark is an affordable housing complex for 350 working artists, with a total of 383 units.[5] The building itself is more than 120 years old and has the distinction of being the site of many inventions, including chain broadcasting, the vacuum tube and the transatlantic telephone.[6]

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[1] Chen, "Adaptive Reuse Makes Buildings Better with Age."
[2] Ibid.
[3] Ibid.
[4] Parkway Lofts, *Press.*
[5] Berman, "Westbeth Landmarked!"
[6] Robledo, "Enforcing Utopia."

FIGURE 12 WESTBETH LANDMARK[1]

The building was held in high regard by the community due to its prominent historic significance. After the building was initially converted into a housing complex, the surrounding neighborhood embarked on a transition from industrial to residential composition.[2] As the surrounding area increased in value, as most properties do in New York City's tight housing market, the rental rates for artists were kept low.

Seeing the social importance of providing an affordable environment for the artist community, local citizens sought protection for the building through the Greenwich Village Society for Historic Preservation. The organization led a coalition of community groups to seek landmark status for the building, which would essentially protect the building and allow it to qualify for much needed financial support. There are many costs associated with the maintenance of older buildings, especially those operating on extreme budget constraints due to reduced rental rates.

Westbeth affordable housing illustrates the driving force of social importance and historic value to a community. Apart from the cultural significance of this building, the economic support it garnered helped to make adaptive reuse a viable option. This project

[1] Left and right: Greewich Village Society, *Westbeth Atrists Center Landmarked.*
[2] Robledo, "Enforcing Utopia."

used its social importance to influence government agencies towards regulation that ultimately allowed the building to obtain the economic viability every project requires.

500 SENECA AND THE PLANING MILL IN BUFFALO, NY

In the other feasibility precedents, government plays an ancillary role to the other drivers. Typically, government agencies offer status, to protect a building from demolition for reasons of historical or cultural value. The government might also provide financial incentive towards adaptive reuse, making the cost of renovation economically viable. In this precedent, the government is an aggressive supporter for the adaptive reuse of a pair of industrial buildings.

The Erie County Industrial Development Agency (ECIDA), whose purpose is to encourage commercial development, was instrumental in securing several tax abatement packages for developers towards the adaptive reuse of two former industrial sites.[1] In addition to tax incentives totaling nearly 1.5 million dollars in funds for both projects, the Regional Development Corporation approved 1.25 million dollars in financing for one of the projects.[2]

FIGURE 13 500 SENECA AND THE PLANING MILL[3]

[1] Buffalo Rising, "IDA Approves Incentives For Pair."
[2] Ibid.
[3] Left and right: Ibid.

A key component to the reuse of 500 Seneca, a former box factory, will be the Buffalo Collaborative Opportunities and Management Enterprises (BCOME) nonprofit job training center. Both buildings will include mixed-use tenants, ranging from commercial to residential.[1] In order to provide additional residential amenities and garner financial subsidy from government agencies, developers are lining up for city-funded street improvements.[2]

In addition to the tax abatement packages from local government, the project will utilize preservation tax credits from the National Register of Historic Places. There have been many different avenues for the government support of this project. When public-private interests dovetail, it seems doors open and projects are made possible.

COOK COUNTY HOSPITAL IN CHICAGO, IL

This next project exemplifies the importance of economic comparisons between redevelopment and adaptive reuse. The building is currently on hold due to budget restrictions. Analysis of the building's options showed the economic feasibility of converting the former hospital into 320 residential units including a provision for parking. The total cost of the adaptive reuse renovation was projected at 84.5 million dollars.[3] Demolition alone for the project would cost upwards of 30 million dollars, with additional money required to construct new housing units. Although demolishing the existing building would provide the freedom to construct a more structurally efficient building that is purposed specifically for housing, maximization of the site would require more spending overall, than an adaptive reuse project.

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[1] Buffalo Rising, "IDA Approves Incentives For Pair."
[2] Ibid.
[3] Antunovich Associates, *A Reuse Plan for Cook County Hospital.*

 

FIGURE 14 COOK COUNTY HOSPITAL[1]

Thus, the value of an adaptive reuse outcome, less the cost of renovation, must be compared to the value of a new building, less the cost demolition and construction. A comparison such as this assumes that either option is affordable to the developer. In this case, the developer is a government agency with a smaller budget than a private developer with more financial resources. With limited funds, the optimal solution involves maximizing the budget, rather than maximizing the site's potential. Adaptive reuse was proposed for the obsolete hospital, in order to provide housing for medical professionals.[2] The existing structure is ideal for conversion into housing. By virtue of its floor-to-floor height, windows and existing spatial layout, renovation efforts are less intense than, for example, an abandoned warehouse or a shopping mall. This can potentially make renovation much more affordable and therefore less cost prohibitive.

As with the previous case study, this former medical facility is appreciated by the surrounding community for its historic value. The hospital is more than one hundred years old and has been the shooting location for popular television and film.[3] Although a new state-of-the-art facility has functionally replaced the old hospital, people feel the remaining building should be preserved.[4]

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[1] Left and right: Allen, *Cook County Hospital.*
[2] Antunovich Associates, *A Reuse Plan for Cook County Hospital.*
[3] Grimes and Loo, "What will happen to Chicago's abandoned landmarks?"
[4] Ibid.

FEASIBILITY EVIDENCE

Each of the precedents demonstrated the force of various feasibility drivers. In each case, there was one primary consideration that propelled the project towards the decision to reuse, rather than redevelop. Upon further investigation, it seemed that while each project had unique motivations, they all required economic viability. That is, the projects could not have happened if a net financial loss was expected. Furthermore, in each case the primary driving force dealt specifically with economic motivations. In the case of Cook County Hospital, the primary feasibility driver was explicitly economic. The Parkway Lofts were driven by environmental concern and the implicit marketability of the “going green” phenomenon. Assuming renovations that incorporate environmental sustainability efforts are popular among prospective environmentally conscious tenants. Westbeth Landmark’s advanced age made the project an economic challenge to the community trying to save it. But for economic reasons, they were motivated to see the project through. They wanted to secure affordable housing for resident artists. The effort to reuse 500 Seneca and the Planing Mill were largely driven my governmental agencies and the development agenda they were trying to achieve. This feasibility driver exerted its force through much needed tax incentives. In summation, all the precedents show that there is not one single driver. The projects were driven to some degree by all the forces, with one driver as the primary force and the others in supporting roles.

3.4 PROJECT ECONOMY IN KAKA‘AKO

The research presented in this section offers a detailed understanding of the practical challenges facing adaptive reuse. Case studies from Honolulu’s Kaka‘ako neighborhood illustrate the variation from one adaptive reuse project to the next. Because every building has specific dimensions, physical conditions and spatial organizations, a unique set of constraints exists for every potential adaptive reuse project, which can make design and construction a cost prohibitive endeavor. With an understanding of how each adaptive reuse project is justified economically and the factors that determine the level of adaptive reuse, a theory for assessing properties can be generalized.

CASE STUDY METHOD

Case studies provide a better understanding of buildings that have been successfully converted to new uses. The projects presented in this section offer valuable examples of success and failure.[1] Of the many architectural research methods available, case studies provide a collection of palpable information. Studying actual examples of any architectural phenomena allow us to analyze theories in practice. The research method for the Kakaʻako case studies is guided by five general characteristics. The five significant characteristics of a case study are:

> 1) a focus on either a single or multiple cases, studied in their real life contexts; 2) the capacity to explain causal links; 3) the importance of theory development in the research design phase; 4) a reliance on multiple sources of evidence, with data needing to converge in a triangulating fashion; and 5) the power to generalize to theory.[2]

With these characteristics in mind, the case studies to follow have been examined at an equitable level, using various sources of information ranging from news reports, empirical analysis and insider perspectives.

SCOPE AND LIMITATIONS

The sample area is limited to the neighborhood of Kakaʻako. The process proposed in section 4.2 emphasizes the selection of a specific neighborhood for intervention. Applying an adaptive reuse strategy to multiple pre-existing sites within a given area makes a greater impact. The ongoing development and revitalization of Kakaʻako has included a diverse range of development strategies including new construction and adaptive reuse at various building scales. The level of activity in this neighborhood makes it an excellent site for investigating various adaptive reuse projects within a specific area.

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[1] Kopek, Sinclair, and Matthes, *Evidence Based Design*, 121.
[2] Groat, *Architectural Research Methods*, 346.

The island of O‘ahu is divided into eight plan areas: North Shore, Ko‘olauloa, Wai‘anae, Central O‘ahu, Ko‘olaupoko, ‘Ewa, Primary Urban Center, and East Honolulu.

FIGURE 15 O‘AHU PLAN AREAS[1]

The Primary Urban Center consists of several neighborhoods. Each neighborhood has very distinct characteristics. There is a range of demographic trends, cultural identities, prevailing markets and access to amenities. Within this planning area there are eighteen different neighborhoods: Kaimukī; Diamond Head, Kapahulu, St. Louis; Pālolo; Mānoa; McCully, Mō‘ili‘ili; Waikīkī; Makiki, Lower Punchbowl, Tantalus; Ala Moana, Kaka‘ako; Nu‘uanu, Punchbowl; Downtown; Liliha, Kapālama; Kalihi-Palama; Kalihi Valley; Moanalua, Aliamanu, Salt Lake, Foster Village; Airport area; Aiea; and Pearl City.

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[1] Map redrawn by author; original map source: The Honolulu Department of Planning and Permitting, *Planning*.

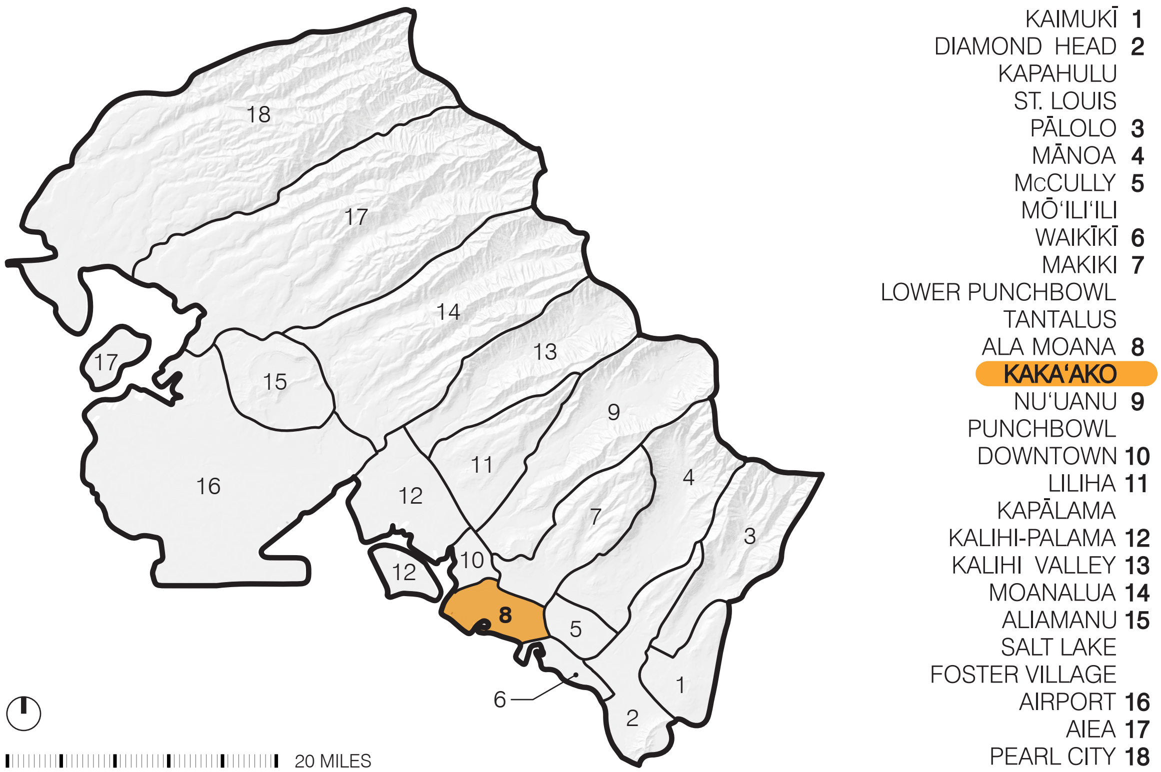

FIGURE 16 NEIGHBORHOODS OF THE PRIMARY URBAN CENTER[1]

Of all the neighborhoods in the Primary Urban Center, Kakaʻako has a unique character that embraces a culture of reinvention and creativity. It is precisely this sense of style and vision that encourages adaptive reuse. Development in this neighborhood is controlled by the Hawaiʻi Community Development Authority (HCDA). Unlike the other neighborhoods of Honolulu, this has allowed the development of Kakaʻako to proceed with a more comprehensive vision. The HCDA serves as an important source of adaptive reuse information, as they were in the process of converting a former brewery into office space at the time of this research.

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[1] Map redrawn by author; original map source: The Honolulu Department of Planning and Permitting, *Planning*.

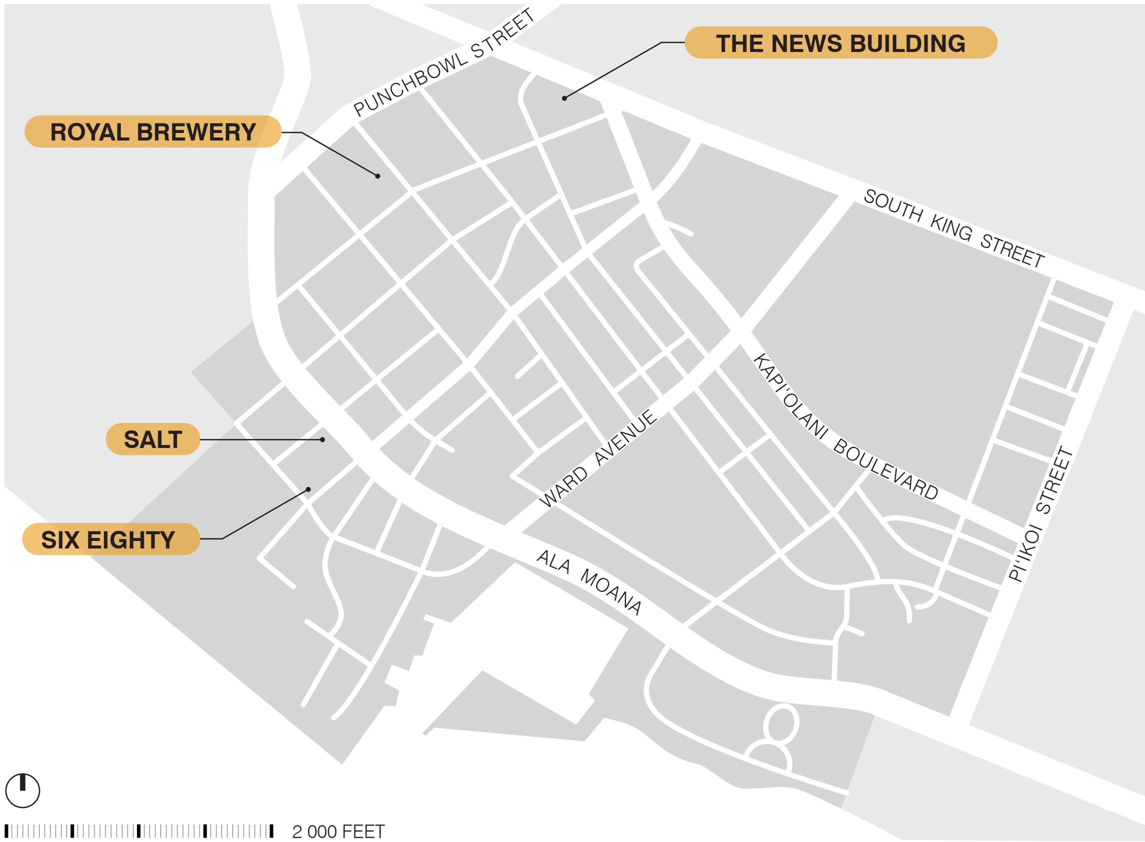

FIGURE 17 KAKA'AKO MAP WITH PROPERTY LOCATIONS

The following outline provides a framework for creating an appropriate profile of each case study. The study begins with a description of the project location to provide an explanation of the context. The project background, including client, designer and other influential parties follows. The project program and goals is included in the project background section. Visual information accompanies the text wherever possible, to further illustrate the projects. Important lessons for the doctorate project are presented in the analysis section. In section 4.5, the case studies' analyses are synthesized to generalize a theory for assessing the level of adaptive reuse that is economically justified.

ROYAL BREWERY

Insider Perspective:

Anthony Ching, Director of the HCDA; Amy Mutart, Project Manager

The site is located at 547 Queen Street in Kakaʻako, within the mauka area of the Kakaʻako community development district. Adjacent to the former brewery is the Kakaʻako Fire Department. On the other side, there are mixed-uses on the ground level with the Honuakaha development above. Across the four lanes of street traffic directly in front of the building, there is a small-scale retail development. The sidewalks bordering the site provide a walkable environment.

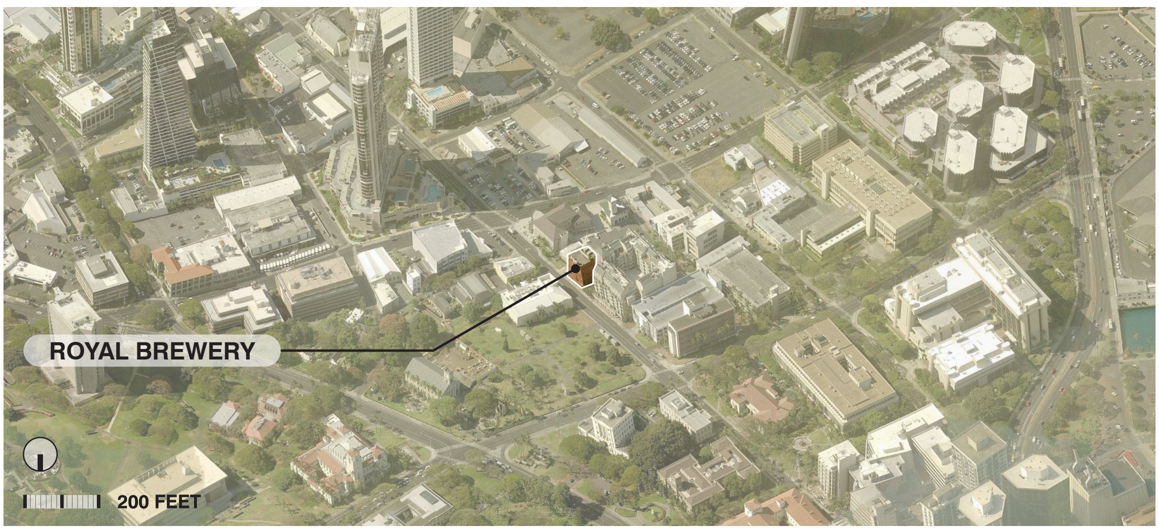

FIGURE 18 ROYAL BREWERY SITE AERIAL[1]

PROJECT BACKGROUND

The building known as the Royal Brewery has spent the majority of its life as an operational beer factory. With the exception of two short years when it served as a community center, the remainder of the building's life has been spent vacant.

[1] Image adapted by author; original image source: Bing, *Bing Maps*.

In 1899, just a year after Hawai'i was annexed by the United States, an unknown architect from New York designed the Royal Brewery with its steel frame and eighteen inch thick concrete walls clad in red brick.[1] The Honolulu Brewing and Malt Company commissioned the grand structure with fine masonry details including brick arches and corbels.[2] In the year 1900, the brewery was opened and beer went into to local production for the next sixty years. In 1960, the brewery was shut down and remained vacant for several decades. In 1969, the building was nominated for placement on the National Register of Historic Places.[3] The survey of the building conducted for its nomination stated that, "the building is in good basic structural condition although it has received no maintenance since it last produced beer in 1960."[4]

In 1990, the still vacant building was sold to the Hawai'i Community Development Authority (HCDA). The building was supposed to anchor a large redevelopment of the surrounding site. The new use for the adjacent site was to provide affordable senior housing, with the former Royal Brewery complementing the new development by providing a community center. The surrounding development of ninety condominium units and 151 elderly units cost a reported twenty-eight million dollars.[5] Renovation of the Royal Brewery cost the state 2.5 million dollars and included the replacement of beams and flooring.[6] In 1996, the project was completed. Catholic Charities elderly services opened its community center in the newly renovated space but its tenancy was short-lived. Lingering fumes from the termite treatments during renovation made the space unsuitable for occupants.[7]

[1] Burlingame, "Building the Royal Brewery Took Fine Masonry Skills."
[2] Historic Hawaii Foundation, *The Royal Brewery.*
[3] Riconda, *The Royal Brewery*.
[4] Ibid., 2.
[5] Asato, "Chemical to Keep Out Termites has Kept Humans Out Instead."
[6] Gomes, "State will Pay $6M to Fix Royal Brewwery Building."
[7] Ibid.

FIGURE 19 ROYAL BREWERY POST-1996 RENOVATION[1]

Since 1998, when the last Royal Brewery inhabitants left, the building has been vacant. The state agency that controls the property has made several attempts to rectify the renovation mishap. Attempts include, "installing blowers, removing flooring materials and windows on the top three floors, and trying to mask the smell with apricot-smelling oils."[2] In 2011, after a long legal battle with the contractors involved in the renovation, the HCDA received one million dollars in settlement. With no options left but to replace the beams and flooring, the HCDA sought funding to make the necessary repairs. Estimated at 4.9 million dollars for the repairs and an additional 1.2 million dollars to allow for unexpected expenses, the Board Members voted in 2013 to spend up to 6.1 million dollars in repairs.[3]

The agency, which controls the government-owned property, plans to move into the property upon its completion, reserving one floor for community activities. The agency currently pays 173 thousand dollars per year for rent in a privately owned building.[4]

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[1] Left and right: Asato, "Chemical to Keep Out Termites has Kept Humans Out Instead."
[2] Ibid.
[3] Gomes, "State will Pay $6M to Fix Royal Brewery Building."
[4] Ibid.

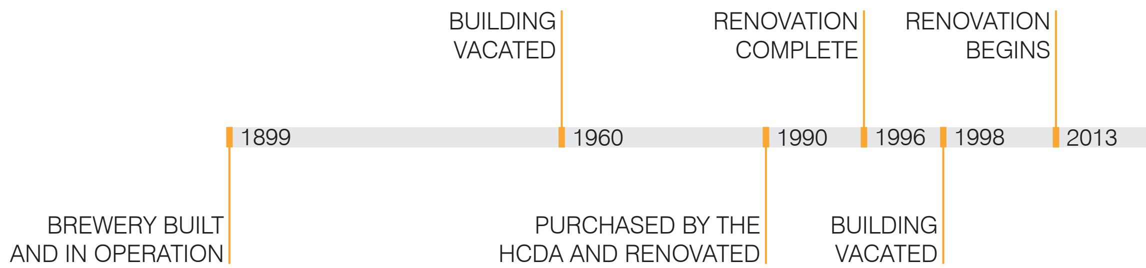

FIGURE 20 ROYAL BREWERY TIMELINE

PROJECT CHALLENGES

The factors influencing the decision-making process for this building are not typical to a privately owned building with no historical significance. The provenance of the Royal Brewery and state laws that prohibit it from being sold to a private entity have limited the options available to the agency in control of its fate. Deciding whether to remodel the space for a new purpose was not weighed against a redevelopment option. According to Anthony Ching, the director of the HCDA (owner and future occupant of the building), the HCDA was compelled to initiate a second round of renovations to the building in order to see the project through and end the prolonged and unfortunate vacancy.

Much of the previous renovation is being replaced by the current renovation. The floor system installed only twenty years ago is being replaced by a newer steel structure and floor system. The toxic termite treatment of the 1990s renovation made the wood glulam beams and floor structure unsalvageable. The new steel beams and decking is being installed using the same floor heights so that the egress staircases installed in the 1990s can be maintained.[1]

The HCDA director pointed out some of the primary challenges. The building, having been built over 100 years ago, for an entirely different purpose, did not have adequate circulation and accessibility. New elevators had to be retrofitted into the space, as well as egress stairs and exits to the exterior of the building. Because the new use for

[1] Ching, Mutart, and Neupane, interview by author, *Adaptive Reuse of the Royal Brewery*.

the building includes two different functions (assembly and office), the space requires fire separation measures between the new floors that are being constructed.[1]

FIGURE 21 ROYAL BREWERY INTERIOR RENOVATION PROGRESS[2]

Although the floor-to-ceiling heights were not dictated by the original building, the HCDA is limited by the floor-to-ceiling heights of the previous renovation. This is a similar situation to most adaptive reuse projects, where original building usage dictates less than optimal floor intervals. When programming the space, there are different mechanical and electrical requirements for each floor. Providing space for this equipment in the renovation must suffice with the existing floor-to-ceiling heights, whereas with new construction, the intended building program and necessary ductwork might influence the floor-to-ceiling heights and ultimately more-or-less overhead space could be provided to accommodate equipment.[3] As a result of this limitation, some ceiling heights will be lower than preferred.

ANALYSIS

For its age and type, reuse of this building was far from economically efficient. However, the preservation of this building, if only its façade, was historically valuable. The

[1] Ibid.
[2] Left and right: by author.
[3] Ching, Mutart, and Neupane, interview by author, *Adaptive Reuse of the Royal Brewery*.

circumstances that allowed this adaptive reuse project to proceed, despite its lack of financial sense, can be attributed to the public (versus private) nature of the client. The HCDA does not have the same for-profit agenda that would prevent most developers from considering the reuse of such an old building. Furthermore, converting the building from a light industrial brewing facility to a mixed-use office facility has required an extensive renovation, including the removal and replacement of the entire interior. Although it was necessary to make the space useable, this approach is not an efficient reuse of material.

THE NEWS BUILDING

Insider Perspective:
Debbie Akau and Ryan Harada, Downtown Capital LLC Project Managers

The site is located at 801 South Street in Kakaʻako, within the mauka area of the Kakaʻako community development district. The site is bordered on two sides by main thoroughfares. Diagonal to the site is a complex intersection with a third major route intersecting the border streets. The adjacent site included (prior to demolition) a light industrial building and a parking lot. Across three lanes of street traffic and two lanes of on-street parking there is an office complex called Kawaiahaʻo Plaza. Directly in front of the building, across six lanes of two-way traffic, there is another office building with mixed-uses on the ground floor. Although the sidewalks bordering the site are ample and shaded, the scale of the roads and establishments do little to encourage walkability.

FIGURE 22 NEWS BUILDING SITE AERIAL[1]

PROJECT BACKGROUND

Also known simply as the *Honolulu Advertiser building*, this 1930 Beaux Arts-style building was occupied by Hawai'i's longest running newspaper. When the newspaper merged with the Honolulu Star-Bulletin in 2012, it moved its advertising and administrative offices. In 2010 the Historic Hawai'i Foundation placed the building on its endangered list as result of the Advertiser's owner expressing his wishes to sell and redevelop the site and its adjoining two acres.[2]

FIGURE 23 ORIGINAL NEWS BUILDING[3]

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[1] Image adapted by author; original image source: Bing, *Bing Maps*.
[2] Historic Hawaii Foundation, *Honolulu Advertiser Building*.
[3] Ibid.

The 78,400 square feet building includes a portion of building constructed of concrete block in 1963 to house the printing press operation and storage.[1] The two buildings share a physical connection that makes them one building distinguishable by their roofing types. The older portion of the building has a hipped roof with Spanish tile. The addition, which would now have aged more than 50 years, has a flat roof, but mimics the façade details and proportions of the original building.

FIGURE 24 STREET VIEW OF ORIGINAL NEWS BUILDING AND ADDITION[2]

After the building was listed for sale and a long-awaited purchase was pending, hope was given that the building may be retained and reused. In 2012:

> Joseph Haas, the senior managing director at CB Richard Ellis, which had the property listing, confirmed that the property was under contract, but would not disclose any information until it was a done deal…" He stated, "It's a nice building, it functions, and it works. I'm not personally involved [in the transaction], but I would venture to say that the people who buy that property will probably put a development on it, or more than one development. The Advertiser building will most likely be left alone and leased, probably to office users.[3]

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[1] Historic Hawai'i Foundation, *Historic News Building Threatened by Developer.*
[2] Google Inc., *Google Earth*.
[3] Historic Hawaii Foundation, *Honolulu Advertiser Building*.

The building's location in the Kakaʻako neighborhood could benefit from adaptive reuse for a multitude of uses, including housing. However, it was not to be. This case of adaptive reuse demonstrates the value of site maximization (an economically driven perspective) over historic importance.

The original portion of the building, which remains protected for its historic significance, is considered separate from its building addition and site, as it is recorded on a distinct parcel.[1] Therefore, preservation of the building will include the Spanish tile roofed portion of the structure and not the flat roofed addition. Reuse of the existing building will likely occur after the remainder of the site is redeveloped. Were there no restrictions imposed based on historic importance, this project would undoubtedly consider no adaptive reuse portion. Instead, the site will feature a minor reuse component and a major new construction component.

The site is currently owned and under construction by Downtown Capital LLC. The project was intended to provide workforce housing for the Kakaʻako neighborhood.[2] Workforce housing, which is not *affordable* housing, but rather complementary to it, provides housing priced for families and individuals earning up to 140 percent of the area median income. People in this income bracket often earn more than will allow them to qualify for affordable housing and too little to afford market rate housing. The plan includes two towers to be constructed consecutively. Sales from the first tower will provide reassurance for the construction of the second tower. The tower(s) will reach 46 floors in height, with 635 units in a mix of residential types.[3]

In 2013, the 1963 addition to the Advertiser building was demolished to allow for construction of the first tower, which is currently in progress. Later that same year the second tower was approved by the Hawaiʻi Community Development Authority (HCDA).

[1] Historic Hawai'i Foundation, *Historic News Building Threatened by Developer.*
[2] Gomes, "Sale Pending for News Building."
[3] Segal, "$200M Kakaako Condo Project OK'd."

The price range for the second tower is higher than the first tower (360K to 690K dollars compared to 250K to 550K dollars) and provides fewer units, at a total of 410.[1]

FIGURE 25 NEWS BUILDING WITH BEFORE AND AFTER TOWERS RENDERING[1]

[1] Gomes, "Kakaako 'Workforce Housing' Condo Tower Approved."

The remaining portion of the Honolulu Advertiser building, which has not been carved away to provide space for one the parking garages accompanying the new towers, is slated for sale to Hawaiian Dredging construction company. Hawaiian Dredging, a historic corporation in its own right, tentatively plans to restore the architectural features and base its headquarters in the old building.[2]

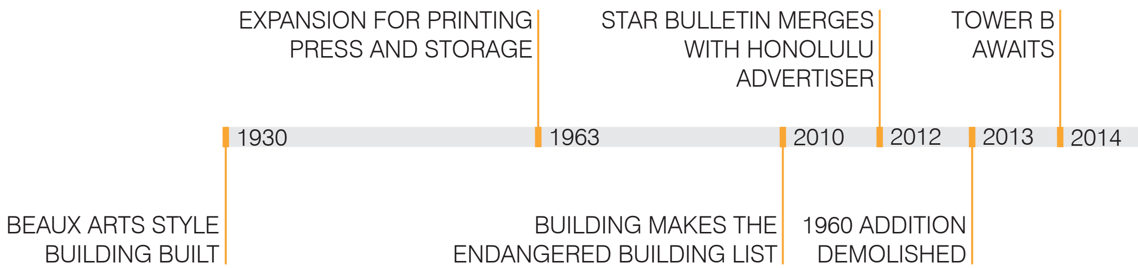

FIGURE 26 NEWS BUILDING TIMELINE

PROJECT CHALLENGES

Ultimately, the challenges of adaptive reuse for this project were too great to allow for a successful renovation of the entire site. As a result, the existing warehouse of the former News Building was demolished. The historic status of the office portion of the News Building protects it from demolition and it will therefore eventually be renovated. The former use of the News Building was primarily office type. The potential new occupants, Hawaiian Dredging Construction Company, will likely use the building for its administrative headquarters, in keeping with its original usage as an office building.

According to the developers, keeping even a small portion of the existing building presented an added challenge to the redevelopment of the site. In constructing the new tower(s), the equipment to prepare the site and construct the building had to be carefully phased and arranged on the site to prevent damage to the historic remnant.[3] As the construction continues, the logistic preparations will become increasingly complicated. The

[1] Top: image adapted by author; original image source: Google Inc., *Google Earth*; bottom: Hawaiian Dredging Construction Company Inc., *801 South St*.
[2] Star-Advertiser Staff, "Demolition Advances on News Building in Kakaako."
[3] Akau and Harada, interview by author, *801 South Street Development Project*.

new development had many restrictions that applied specifically to the new construction component and would otherwise not apply to the reuse of the existing building. The HCDA imposes restrictions to protect the view channels that ultimately affect the building form and its placement on the site. Working around the existing building footprint and the HCDA requirements compounds the challenges for developers. The HCDA also wanted the developers to incorporate a podium style design, however because the goal of this project was driven so strongly by economic efficiency, the developers used a more structurally efficient system that uses a separate building for parking.[1] Therefore, two different structural systems could be used, each one being the most efficient for its intended use.

Despite the developer's best efforts to salvage some of the material used in the portion of the building to be demolished, reuse was minimal. The developers tried to reach out to organizations in Hawai'i that they believed could reuse the materials. However, with the exception of some wood flooring, the materials were unwanted by many local builders and outlets, including Re-Use Hawai'i.[2]

ANALYSIS

This project is consistent with the notion that private enterprise must keep the bottom line for any project in mind. Profitability is the key to success. When it comes to the decision whether to adaptively reuse or demolish for new construction, the potential outcomes of each option are weighed against each other. No matter the cost efficiency, cultural value or environmentally sustainable aspects of reusing an existing building, if the potential for large-scale development outweighs the benefits of adaptive reuse, it will always bring more reward to the developer. As in the case of the News Building site, the only portion of the historic building to remain is that which they were compelled to keep.

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[1] Akau and Harada, interview by author, *801 South Street Development Project*.
[2] Ibid.

SALT

Insider Perspective:
Hazel Go, Architect

The Salt project, which is located on the same block as the Six Eighty Ala Moana project, is located in the mauka area of the Kakaʻako community development district. The block is bordered on three sides by minor roads and on one side by a major thoroughfare. The adjacent usages are mixed, but primarily retail.

FIGURE 27 SALT SITE AERIAL[1]

PROJECT BACKGROUND

This project, which is still in its early phases, is another part of the same development plan presented in the Six Eighty Ala Moana project. This project covers the adaptive reuse of multiple buildings located in a single block. In keeping with the characteristic and recent history of the Kakaʻako neighborhood, this block features industrial buildings and the accessory building types that usually cluster in industrial areas.

[1] Image adapted by author; original image source: Bing, *Bing Maps*.

The project gets its name, *Salt*, from the site's former life in the 1700s, when the area was used for salt ponds built by the Native Hawaiians.[1]

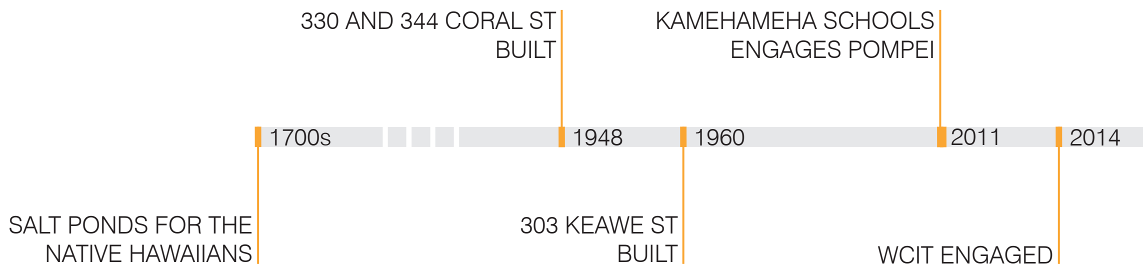

FIGURE 28 SALT TIMELINE

The current buildings on the block are slated for adaptive reuse. They will be transformed into a range of retail and restaurant tenants. There will be thirty-five to fifty tenants in seventy-six thousand square feet of leasable space. Although the development touts walkability and human scale, the project will also include a 267-stall parking garage nestled where it will not interfere with the storefronts and pedestrian spaces. An open plaza will be transformed from an area currently used as on-grade parking. The plaza will include water features, seating and greenery. [2]

FIGURE 29 AERIAL RENDERING OF SALT BLOCK DEVELOPMENT[3]

[1] Creamer, "Kakaako's Building Boom."
[2] Gomes, "Kamehameha Schools Begins Construction this Month on Salt Complex in Kakaako."
[3] Pompei A.D. LLC., *What We Do*.

FIGURE 30 PERSPECTIVE VIEW OF EXISTING BUILDING AND PROPOSED SALT RENOVATION[1]

FIGURE 31 PERSPECTIVE VIEW OF EXISTING BUILDING AND PROPOSED SALT RENOVATION[2]

[1] Left: Our Kaka'ako, *A New Neighborhood by Kamehameha schools*; right: Pompei A.D. LLC., *What We Do.*
[2] Top: Our Kaka'ako, *A New Neighborhood by Kamehameha schools;* bottom: Pompei A.D. LLC., *What We Do.*

The project blends adaptive reuse and new construction. Where some of the buildings could not be efficiently reused, demolition and new construction will provide for uses that would not otherwise be easily incorporated into the reuse plan. For example, the parking structure, which is not typically the result of adaptive reuse, will be constructed where an existing building that was not fit for reuse once stood. The newly constructed elements of the development will incorporate a design aesthetic and character similar to the gritty industrial atmosphere cultivated by the original buildings.

PROJECT CHALLENGES

There were many challenges presented by the adaptive reuse of this block. Similar to previous projects covered, the need to bring the existing buildings within current codes was an issue. The anticipated new loads required the structure to be recalculated. Many of the buildings also required updates to their structure because they were constructed in 1948. Because the building occupancies are changing, they must adhere to a new set of standards. Furthermore, many of the new uses are being classified as *assembly*, which has the most stringent requirements.[1]

Parking, which has not been covered by the other case studies, was also required. In terms of zoning, this is often based on building usage type. A change in the occupancy type requires a change in parking allowances. This challenge is being met with the construction of a new parking structure.[2]

Other codes also require updates. New energy codes create compliance issues. For example, new insulation for roofs will be required. ADA guidelines will also require some careful redesign. However, accessibility challenges have not been a major hindrance. Construction staging for renovation is also complicated by adaptive reuse. Difficulties accessing the construction site add to the cost of renovation. Furthermore, the

[1] Go, interview by author, *Adaptive Reuse of the Salt Project.*
[2] Ibid.

infrastructure and utilities provided to the site must be upgraded at the developer's expense.[1]

ANALYSIS

This project is guided by a combination of economic efficiency and a desire to cultivate an authentic experience. This is evident in the use of both adaptive reuse and traditional construction methods. This project is on-going and will likely inspire similar projects in the vicinity. In this way, it has contributed to the culture of the district and will propagate benefits to the community that extend beyond its own efforts.

SIX EIGHTY

Insider Perspective:
Bob Oda, Kamehameha Schools Senior Project Manager

As its name indicates, this property is located at 680 Ala Moana Boulevard in the Kakaʻako neighborhood of Honolulu. The property is located on the south western-most border of the mauka area of the Kakaʻako community development district. The property is bordered on two sides by streets, one of which is a major thoroughfare. Diagonal and across the minor street, there are car dealerships. Directly across the major route in front of the building there is a large mixed-use office building. The remainder of the block is the previously discussed Salt project, consisting of light industrial and retail use.

[1] Go, interview by author, *Adaptive Reuse of the Salt Project.*

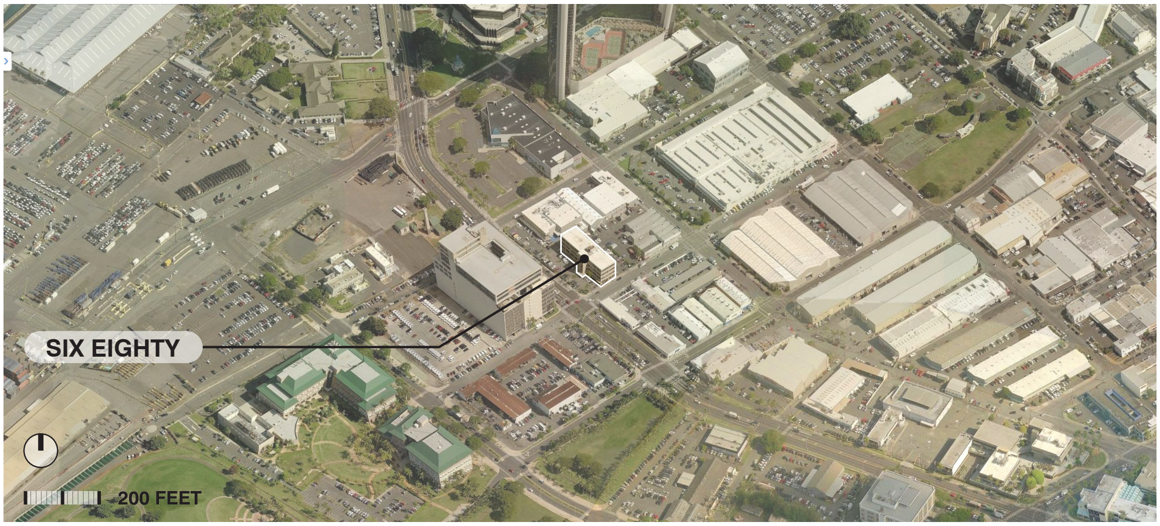

FIGURE 32 SIX EIGHTY SITE AERIAL[1]

PROJECT BACKGROUND

This adaptive reuse project is one part of a larger redevelopment effort that includes twenty-nine acres of land. The plan includes a mix of building types and uses, including seven towers. The plan was approved in 2009 by the state, for the development of 2,750 homes.[2] Of that estimated total, fifty-four units are provided by the reuse of the former office complex known as *Six Eighty*. The original building was built in 1960 and had aged fifty-one years when it began the process of conversion to affordable housing.

FIGURE 33 SIX EIGHTY BEFORE RENOVATIONS [3]

[1] Image adapted by author; original image source: Bing, *Bing Maps*.
[2] Gomes, "Condo Tower Project Slated for Kakaako Site."
[3] Left: Kamehameha Schools, *Kamehameha Schools*; right: KakaakoNet, *Kakaako*.

In addition to the 54 units available on the second through fourth floors, the ground floor provides retail amenities to service local residents as well as people driving in from other neighborhoods. The apartments, which range in size from 304 to 613 square feet, are available at rates lower than the federally declared *affordable* cost as determined by the Department of Housing and Urban Development (HUD).[1] Affordable housing, which is typically aimed at providing housing priced for individuals at or below median income, risks missing a larger demographic of the population who earn significantly less.

The greater masterplan, which includes Six Eighty, is creating a unique sense of community that includes a diverse assembly of residents and commerce. In the spirit of inclusion, there are several requirements to qualify for tenancy at Six Eighty. Residents cannot earn more than Honolulu's median income, "may not have owned a majority interest in a principal residence during the last three years, may not have assets above a certain value and must live in the rental unit."[2]

Conversion of this former office building was completed in only ten months. The project makes use of pre-existing building features that were once suited for office tenants. The existing concrete shell was retained with generous ceiling heights of twelve feet, featuring exposed structural and mechanical elements.[3]

FIGURE 34 SIX EIGHTY RENOVATED INTERIOR [4]

[1] Gomes, "Renovated Office Building Ready to Take in Residents."
[2] Ibid.
[3] Chang, "First Residents moving into Kamehameha Schools' Kakaako."
[4] Left and right: Ibid.

FIGURE 35 SIX EIGHTY RENOVATED EXTERIOR[1]

Other amenities for residents include, "stainless steel appliances including refrigerator, electric range and oven, above range microwave, through-the-wall air conditioning unit and water heater. Laundry facilities are located on each floor… two recreational rooms – a game room and a media room – as well as a recreational deck with barbecue and lounge areas."[2]

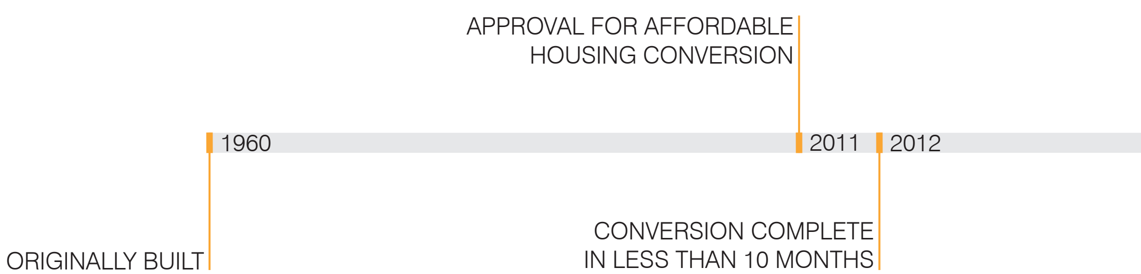

FIGURE 36 SIX EIGHTY ALA MOANA TIMELINE

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[1] Architects Hawaii Ltd., *Six Eighty Ala Moana.*

[2] Chang, "First Residents moving into Kamehameha Schools' Kakaako."

PROJECT CHALLENGES

This project provides an important illustration of the potential of former office buildings to be reused for housing. Many of the challenges presented by this project are universal in adaptive reuse and not specific to the conversion from office to housing. Code compliance, as with all projects, required specific renovation measures. Because this project implements smaller residential units as opposed to commercial-sized offices, the individual spaces had to be reconfigured. Changing the layout of the spaces and occupancy types required the construction of new interior partitions and ultimately updated fire separations.

Once the scale of an adaptive reuse project reaches a certain magnitude, it must comply with new regulations. Where additional allowances and bonuses may have been achieved in the past, those same allowances cannot be put back into the design if the renovation scale surpasses the defined threshold.

ANALYSIS

Office buildings are at risk of functional obsolescence in advance of their physical obsolescence and they often have a compatible floor-to-ceiling structure that eases the renovation requirements for reuse as housing. This is one reason why this specific conversion type is favored. The Six Eighty Ala Moana project outcome is consistent with the notion that buildings of sound structural condition and suitable floor configurations are convertible to housing with fewer complications and expenses compared to other building types.

KAKA‘AKO EVIDENCE

A formula for determining the economic viability of any given project, or how to decide between alternative projects, is provided in section 2.4. Essentially, the formula calculates the profitability of a project by subtracting the cost of investment from the projected value. With adaptive reuse, the cost of investment varies depending on many factors. As the cost of investment increases, the projected net value decreases. In order for a project to produce a positive net value, there are limitations on the cost of investment. For each of the Kaka‘ako case studies, the level of adaptive reuse (i.e., the percentage of the existing building that was renovated, rather than demolished) was determined by factors affecting the project economy. Section 4.5 presents a method, derived from these case studies, which allow a property to be evaluated for its project economy, in order to determine an appropriate level of adaptive reuse.

3.5 CONFLICT MITIGATION

There were three categories of technical challenges presented in section 2.5. They were: design flexibility challenges and creativity limitations; collaboration challenges; and incomplete information. The following precedents were taken from an Opportunities & Challenges report by the Heritage Council of Victoria. The projects show that adaptive reuse projects can have a successful outcome, despite the challenges.

SCHOOL OF ARCHITECTURE AND DESIGN IN LAUNCESTON, AUSTRALIA

FIGURE 37 DIESEL WORKSHOP POST-RENOVATIONS[1]

[1] Left and right: ArchitectureWeek, *Sustainable Reuse.*

The University of Tasmania's School of Architecture and Design, which reused a 1950s diesel workshop at the Inveresk Railyards in Launceston, was confronted with structural insufficiency and incompatible space dimensions. The new use required more floor space, which was added by dividing the existing floor-to-ceiling space with more floors. However, the new floors if constructed using substantial methods could not be supported by the existing columns. Therefore, the additional floors had to be constructed of lightweight timber structure.[1]

RESERVOIR GARDENS IN PADDINGTON, AUSTRALIA

PADDINGTON RESERVOIR POST-RENOVATION[2]

The Paddington Reservoir Gardens, which reused a former reservoir as a new urban park, provides an example of structural challenges caused by redundant structure. The pre-existing site had infrastructure that was no longer to be used. However, rather than demolishing the structure, the intent was to reuse the facility. Because the structure was unsafe, it had to first be stabilized before any work could proceed. The additional steps that were taken to overcome this challenge would not have been required if the decision were made to demolish the pre-existing facility.[3]

[1] Clark, *Adaptive Reuse of Industrial Heritage: Opportunities & Challenges*, case study 11.
[2] Left and right: Untapped Cities, *Babylon reborn: Sydney's Paddington Reservoir Gardens.*
[3] Clark, *Adaptive Reuse of Industrial Heritage: Opportunities & Challenges*, case study 9.

CANBERRA GLASSWORKS IN KINGSTON, AUSTRALIA

FIGURE 38 POWER HOUSE POST-RENOVATION[1]

The Canberra Glassworks facility, which reuses a former power house, was forced to comply with the restrictions of new building codes because the occupancy changes were quite drastic. The previous usage required large equipment and only a few people. The new usage required space for glass artists, support staff and tourists.[2]

RIVER STUDIOS IN WEST MELBOURNE, AUSTRALIA

CONCRETE WAREHOUSE POST-RENOVATION[3]

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[1] Left: E-Architect, *WAF Awards Shortlist 2010*; right: Enable Canberra, *Virtual Accessibility Tour*.
[2] Clark, *Adaptive Reuse of Industrial Heritage: Opportunities & Challenges*, case study 6.
[3] Left and right: Creative Spaces, *River Studios | Case Studies*

The River Studios, which provides artist workspace in a former concrete warehouse along the Maribyrnong River, did not comply with current building codes. Depending on the scale of the project, renovations would have to include bringing the building up to code. In order to avoid this prohibitive measure, the new users were accommodated with temporary interior structures.[1]

CHALLENGES EVIDENCE

Despite the challenges, the projects in this section exemplify successful adaptive reuse of a pre-existing building. The primary feasibility drivers for these projects were both social and governmental. The Heritage Council of Victoria, an independent statutory body, encouraged the buildings to be salvaged in order to preserve the cultural heritage for future generations.[2] The major challenges experienced in these precedents were related to: limitations on creativity caused by the pre-existing space dimensions; and collaboration with other building authorities that impose requirements for the conversion. When working within the parameters of a pre-existing building, there are limitations to design creativity that do not occur in new construction. However, these precedents show that overcoming challenges is a creative endeavor in its own right.

3.6 SUMMARY

The precedents and case studies presented in this chapter provide “real world” examples to complement the research in chapter 2. Understanding theories in practice allows the research concepts to be assembled into a methodology. Having investigated the aspects of adaptive reuse that make it a viable option, this doctorate project presents a method for preselection that allows public and private developers to locate potential adaptive reuse properties. The criteria for preselection are derived from the lessons learned in this precedent study.

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[1] Clark, *Adaptive Reuse of Industrial Heritage: Opportunities & Challenges*, case study 10.
[2] Heritage Council Victoria, *What We Do*.

PART TWO

CHAPTER 4 METHOD FOR ADAPTIVE REUSE SITE SELECTION

4.1 INTRODUCTION

In a sense, each step works like filter. When applied, the filter eliminates unsuitable properties, so that an optimal candidate is identified in the end. Each filter selects properties according to specific characteristics derived from the research and precedent studies. Criteria for preselection considers: the surrounding context, the type of building to reuse, the proposed new use, and the drivers of feasibility. As a means of efficiency, the steps (or filters) are ordered so that a maximum number of unsuitable properties are eliminated foremost. The first step narrows the geographic search area. The second step eliminates property sectors where demand exceeds supply. The third step determines the primary feasibility driver. And the fourth step evaluates and ranks the remaining properties according to the primary feasibility driver. In the final step, the decision to adaptively reuse is justified and executed

4.2 AREA SELECTION

Smart Growth principles provide the necessary guidance for selecting the appropriate area to begin the narrowing process. As discussed earlier, Smart Growth is an important standard for the future of any sprawling city. It encourages growth without spreading the footprint of the city beyond a sustainable boundary.

In this preselection process, it is important to begin by narrowing the area being considered for adaptive reuse projects. This doctorate project assumes that there are multiple areas in question and so this step is provided to select the optimal area for success. However, if the area has been predetermined this step may be skipped. In which case, the process begins by narrowing the property search according to property sector, which is covered in section 4.3.

The process of narrowing the area begins at the level of metropolitan statistical area (MSA), or metro area. Boundaries for metro areas in the United States are determined by the Office of Management and Budget Affairs (OMB). From there, the appropriate plan area is selected. Then finally, the neighborhood is selected. The search for a potential adaptive reuse site is then carried forward within the preselected neighborhood.

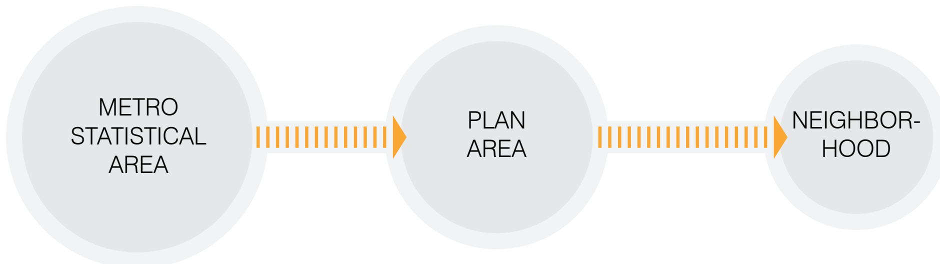

FIGURE 39 AREA SELECTION

Area designations vary by locale. Therefore, these levels of selection may require some interpretation when applied to various places. For example, the plan area that contains the urban core may be referred to as the *city proper* in some locales. The following images provide an example of how the levels of area selection might be applied in various places. The first example shows the levels applied to the state of Hawaiʻi. The second example shows how the levels could be applied in the state of Illinois. The maps in the diagrams are shown proportionate to one another's actual size, for accurate comparison. The first map in the diagram, of the state, shows the metro area selection highlighted in dark gray. The second map in the diagram, of the metro area, shows the plan area selection highlighted in dark gray. Lastly, the third map in the diagram, of the plan area, shows the neighborhood selection highlighted in dark gray.

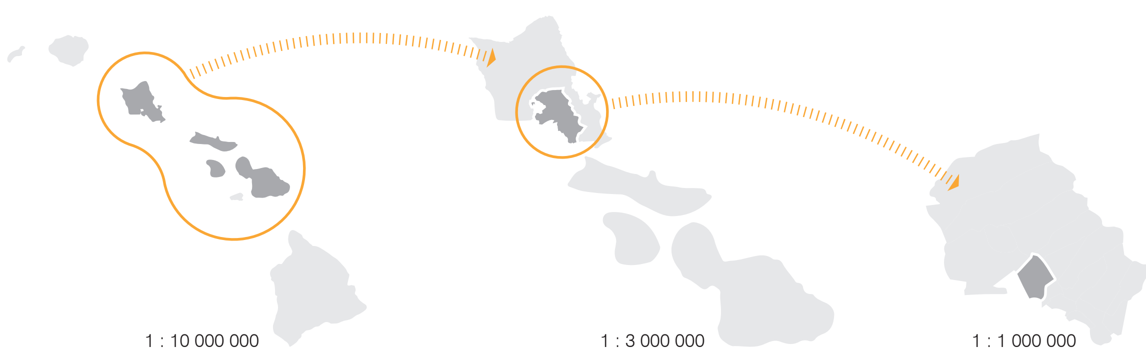

FIGURE 40 AREA SELECTION IN HAWAIʻI

Because the terminology may differ from place to place, it is more important to understand the scale of the selection as it relates to the criteria. Note the similar scale in selection depicted in the following diagram.

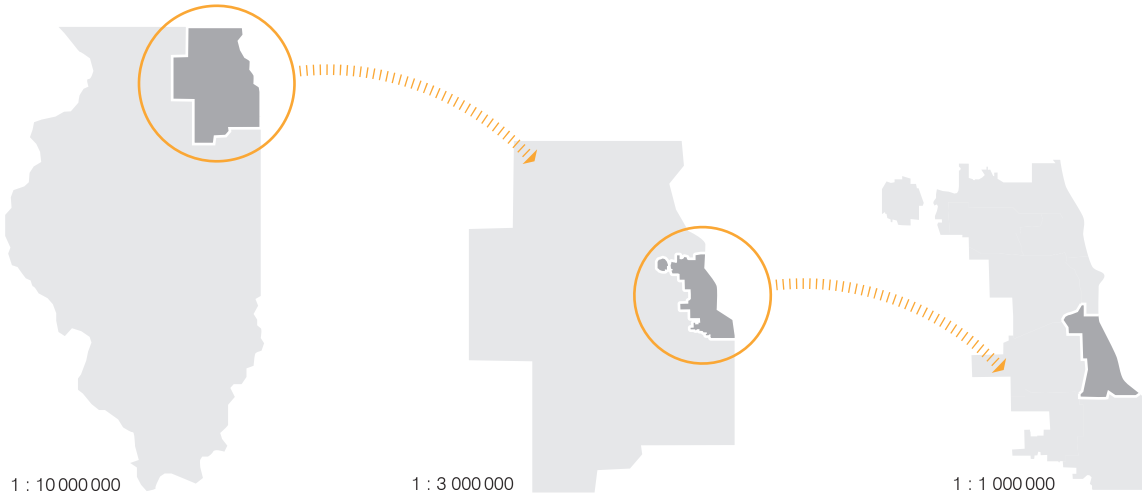

FIGURE 41 AREA SELECTION IN ILLINOIS

METRO AREA SELECTION

Surveys conducted by the US Census Bureau confirm the assertions made in section 2.2, that our population is shifting from rural to urban dwelling.[1] Centralization of people in urban areas creates demand on the cities. Smart Growth offers strategies to meet the demands without increasing the geographic area of the city.

[1] United States Census Bureau, "Census.gov."

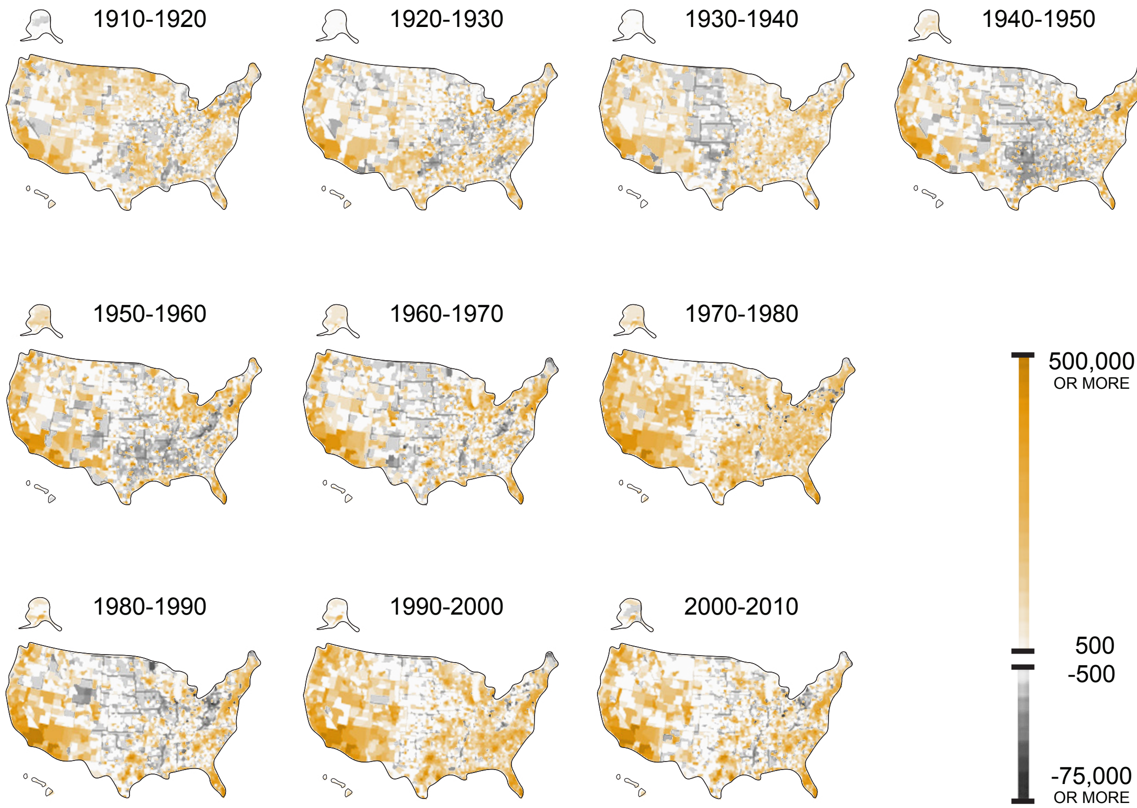

FIGURE 42 RURAL LIVING TO URBAN LIVING SHIFT[1]

The proposed method for site preselection begins at the metro area level. Adaptive reuse of pre-existing buildings is a strategy that responds to shifts in supply and demand. When the supply of one property type exceeds demand, properties in that sector are at risk of obsolescence. In order to meet the needs of the area, the property must be either redeveloped or adapted to a new use that is in-demand. In order for redevelopment or adaptive reuse to be profitable, there must be a need for the proposed end-use. Selecting an area with a growing population indicates increasing demand on some property sectors. Section 4.3 discusses the selection of property sector based on obsolescence. Therefore, adaptive reuse strategies are more efficient and effective in areas were the population trend is one of growth. Based on these criteria, it is appropriate to begin the site

[1] Diagram redrawn by author; original diagram source: United States Census Bureau, "Census.gov."

preselection process in a metro area where the population is increasing. The following image shows the current delineation for the metro areas in the United States.

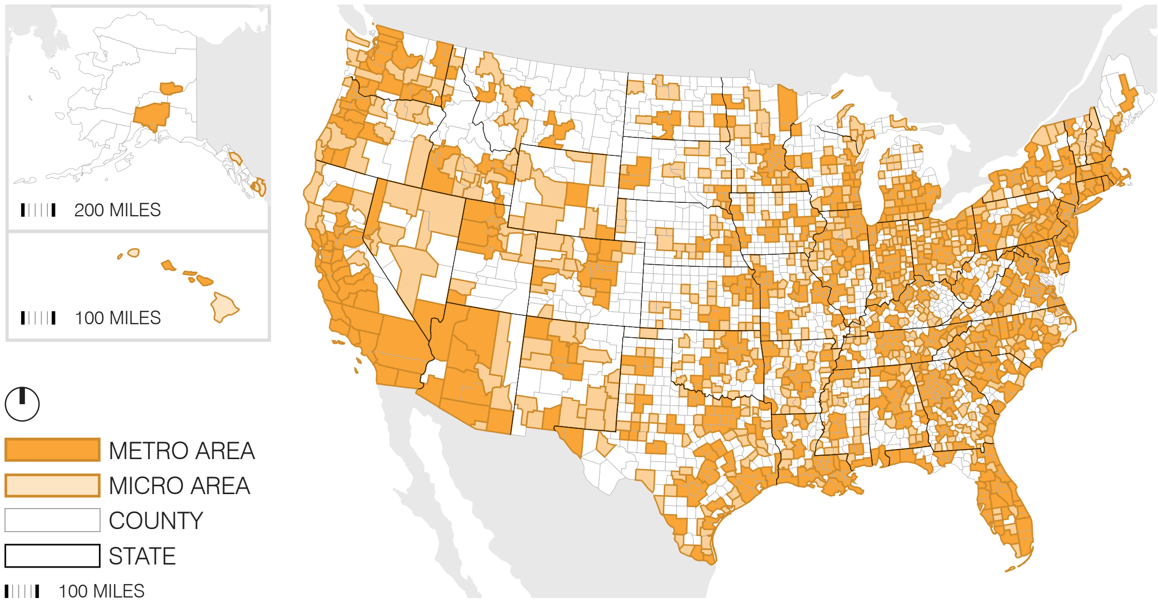

FIGURE 43 METROPOLITAN AND MICROPOLITAN STATISTICAL AREAS OF THE UNITED STATES[1]

PLAN AREA SELECTION

Metro areas are divided in various ways. This doctorate project uses the term *plan area*, to describe the next level of division to be selected. Each metro area typically has one area where the population is centralized. This is called the *urban core*. Surrounding the urban core, there is an area commonly known as *suburban development*. The goal of Smart Growth is to maintain the boundary of the urban core and prevent sprawl.

[1] Diagram redrawn by author; original diagram source: United States Census Bureau, *Metropolitan and Micropolitan Statistical Areas.*

FIGURE 44 SMART GROWTH VERSUS URBAN SPRAWL

Throughout the metro area, there may be a range of development types that fade from urban to suburban, and possibly fade further to rural. Once the delineation of plan areas within the metro area has been identified, each plan area can be characterized by population and environment. The urban core is characterized by dense population and a mature built environment that includes a diverse mixture of uses. The plan area that includes, or consists of, the urban core is the optimal area to continue the site preselection process.

NEIGHBORHOOD SELECTION

The final step in narrowing the geographic area for site preselection is at the neighborhood level. Until this point, the characteristics for finding the optimal area have dealt primarily with population and development density. Although adaptive reuse can take place anywhere, areas were the population is increasing and the built environment is mature ensure the availability of potential adaptive reuse sites with enough people to demand the new use.

After selecting a metro area and plan area that provides the essential population and built environment, the criteria now focuses on specific features to determine the optimal neighborhood. There are three important characteristics to look for when selecting a neighborhood for adaptive reuse success: access to transit, proximity to restaurants/shopping, and availability of schools and libraries.[1] Selecting the appropriate neighborhood is accomplished through a process of elimination.

Any neighborhood that does not have access to transit can be eliminated. Transit is an important component to many successful cities. The definition of transit may include variety of options, including bus, subway and rail. A walkable neighborhood is also a positive point. If public transit is not available, then parking becomes a crucial feature.[2] However, when adapting a building for a new use, parking requirements may increase beyond the capacity of the site. Therefore, in the interest of Smart Growth and avoiding additional parking burdens, only neighborhoods with proper public transit should be selected.

As previously mentioned, proximity to restaurants and shops are important for successful adaptive reuse.[3] There are different benefits of these establishments depending on the intentions of the adaptive reuse project. In the case of housing, shops such as grocery, drug stores and clothing, provide convenience to residents. When the new use is office or commercial, places to eat lunch are also a benefit to the area.[4] Having these supporting services in the area make the neighborhood attractive and marketable. They also indicate a mixture of uses, which is an important Smart Growth principle. Neighborhoods with unsatisfactory shops and restaurants should be eliminated from the search.

Schools and libraries are important amenities for families. When the proposed new use is housing, including units of two or more bedrooms, then close proximity to children's attractions are beneficial.[5] Other features intended for children and families, such as parks and theaters, are also desirable. This doctorate project intends to use adaptive reuse as a strategy for increasing the availability of housing. Therefore, the inclusion of schools and libraries is necessary for an optimal neighborhood.

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[1] Reiner, *How to Recycle Buildings*, 17.
[2] Ibid.
[3] Ibid., 17-18.
[4] Ibid.
[5] Ibid., 18.

The criteria for area selection that has been outlined so far ensures the optimal context for adaptive reuse success, without specific regards to the new use. Because the profit margin on an adaptive reuse project is often narrow, it is important to consider areas that are conducive to success. When finalizing the neighborhood selection, it is important to ensure that the new use is in-demand. This doctorate project looks at increasing housing availability as a strategy to lower costs within a given plan area. So any remaining neighborhoods in the preselection process are ranked according to their need for housing. It is possible to adjust this method to find adaptive reuse properties for other new end-uses, besides housing. In any case, the last step to find the optimal area for site preselection is to ensure that the new use, in this case housing, does not have a supply in excess of its demand. Alternatively, if a new end-use has not yet been proposed, then in-demand property types for selected neighborhood could inform the decision.

SUMMARY

The first step works to filter away the largest number of sites, by creating a boundary for the search area. This is done by selecting successively smaller geographic areas according the characteristics that make one area more ideal than another for adaptive reuse. As previously mentioned, if an area has already been selected, then this step can be used to ensure the area is minimally qualified, rather than optimal by comparison.

After selecting a metro area where building demand is generally increasing, the search is narrowed to include the plan area that contains the urban core. Because the metro area often includes the less dense suburban area surrounding the city, it is important to focus on the plan area that contains the city proper. Finally, while there may be several neighborhoods where adaptive reuse has a high likelihood of success, criteria to select the optimal neighborhood is used to narrow the search. This criteria includes: access to transit, availability of shops, restaurants, schools and libraries.

FIGURE 45 METHOD FOR ADAPTIVE REUSE STRATEGY: STEP 1

4.3 PROPERTY SECTOR SELECTION

In the previous step, the area for site preselection was narrowed to allow for a manageable search range. The next step is meant to eliminate as many unsuitable property sectors as possible. In order to do this, real estate reports that provide data according to the property sectors (i.e., industrial, public, mixed-use, retail, office and hotel) are used. Trends that show a persistent decline in rental rates or persistent incline in vacancy are major indicators of property obsolescence. Successful adaptive reuse transforms surplus building stock so that it can be used to meet new demands. In this step, building supply, in excess of demand, is located. If there are multiple property sectors with comparable obsolescence trends, then the property sectors are ranked according to building type similarity (i.e., building types that are most similar to the new use). Building type similarity is measured by the degree of change required to transform the pre-existing building for its new use.

OBSOLETE PROPERTY SELECTION

Real estate analysis looks at vacancy statistics and fluctuations in rent prices to determine market trends for various property sectors. As discussed in section 2.3, public buildings and mixed-use buildings present unique difficulties for adaptive reuse and are therefore not preferred. In the case of public buildings, the process is inherently bureaucratic and therefore tends to be inefficient for large-scale application. Where mixed-use buildings are concerned, the process of adaptive reuse is ongoing. Naturally, mixed-use properties are less likely to experience overwhelming building obsolescence, because individual operations can be replaced incrementally over time, allowing the building as a whole to maintain its relevance.

The remaining property sectors, industrial, retail, office and hotel require individual real estate analysis, pertaining to the specific neighborhood to determine which property sectors are in too great of supply. If there is a single property sector that is distinctively more suitable for reuse, based on its vacancy rates and rent prices, then that is the optimal property sector to select. If there are multiple property sectors that are suitable for reuse, then building type similarity may become a factor.

BUILDING TYPE SELECTION

Any property sector can be adaptively reused. This was demonstrated in section 3.2. However, not all building types present the same opportunities and constraints. Depending on the property sector, the functions of that sector require a specific building type. The activity that each room is intended for dictates the size of room required. Although buildings contain multiple rooms, it is the size of the individual room that limits or allows adaptive reuse. The room, or space, is the module that is multiplied to make an entire building. Property sectors, arranged in descending order according to typical room size, show degree of change required to create an appropriately scaled room for the new use. See Figure 54.

Beginning with the industrial sector, which requires the largest amount of space in terms of clear height and clear width, precedents show that conversion results in wasted space and the need for efficient space division. Figure 46 shows the typical conditions of The Stacks Cotton Mill precedent, where newly constructed partitions are required to divide the space. Additionally, excess volume results from ceilings that are too high. Although these conditions may be aesthetically pleasing, they contradict efficiency.

FIGURE 46 TYPICAL INTERIOR CONDITIONS FROM ATLANTA INDUSTRIAL BUILDING [1]

Of all the property sectors, public uses are next to industrial space. They do not require as much space as industrial. However, they require more space than the other property sectors. Figure 47 shows the typical conditions of public buildings in the Council Bluffs precedent, where, to a lesser extent than the industrial buildings, the pre-existing spaces consist of large volumes.

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[1] Left and right: Black, "The Story of Stacks," 40-48.

FIGURE 47 TYPICAL INTERIOR CONDITIONS FROM COUNCIL BLUFFS' PUBLIC BUILDINGS[1]

Next to public buildings in size, is mixed-use property sector. Although the spaces required by this use vary in size, they are smaller than the typical public buildings presented and larger than the remaining property sectors. Figure 48 shows the typical conditions of a building from the Los Angeles precedent study of the mixed-use property sector. Note the excessive volume resulting from adaptive reuse.

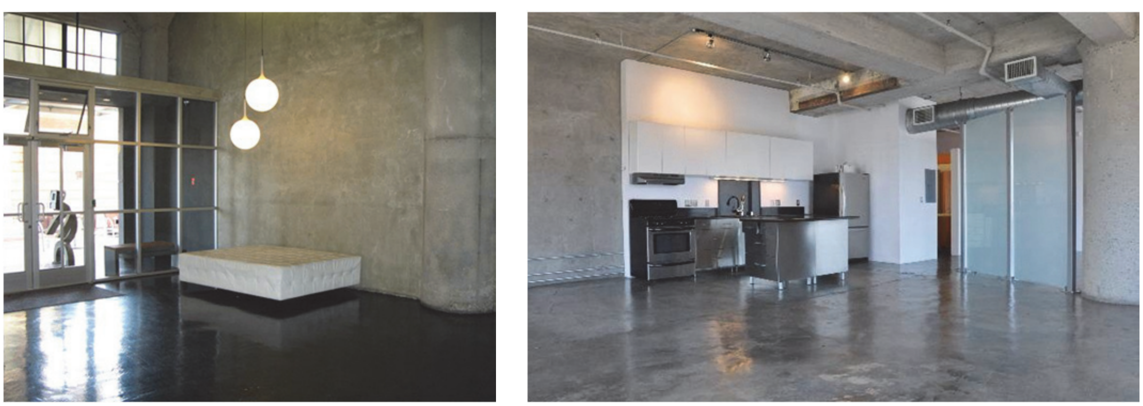

FIGURE 48 TYPICAL INTERIOR CONDITIONS FROM LOS ANGELES MIXED-USE BUILDING[1]

[1] Left: The Daily Nonpareil, *Former Nonpareil Building Gets New Life;* right: The Daily Nonpareil, *Future Goal Remains to Modernize C.B. Schools.*

Among the various property sectors covered, retail is mid-range in terms of spatial scale. The typical size of space required for retail use, as presented in the Providence Shopping Mall precedent, is large enough for conversion to the remaining property sectors, but is too small for many industrial, public or mixed-uses. Figure 49 shows the division of space required for a range of retail spaces. The ceiling heights are generous, but not as excessive as industrial, public and mixed-uses.

FIGURE 49 TYPICAL INTERIOR CONDITIONS FROM REUSED RETAIL SPACE[2]

The office property sector can require a range of space sizes, depending on the specific office type. In order to organize the properties sequentially, the typical size of an office space comes after retail. Figure 50 shows the reuse of office space and the reasonable proportions that result from conversion due to their similarity of scale.

[1] Left: Lofty Finds, *Toy Lofts in Los Angeles*; right: Top LA Condos, *Toy Factory Lofts*.
[2] Left: Northeast Collaborative Architects, *J. Michael Abbot Selected to Speak;* right: Rosenfield, *Refurbishing America's Shopping Mall.*

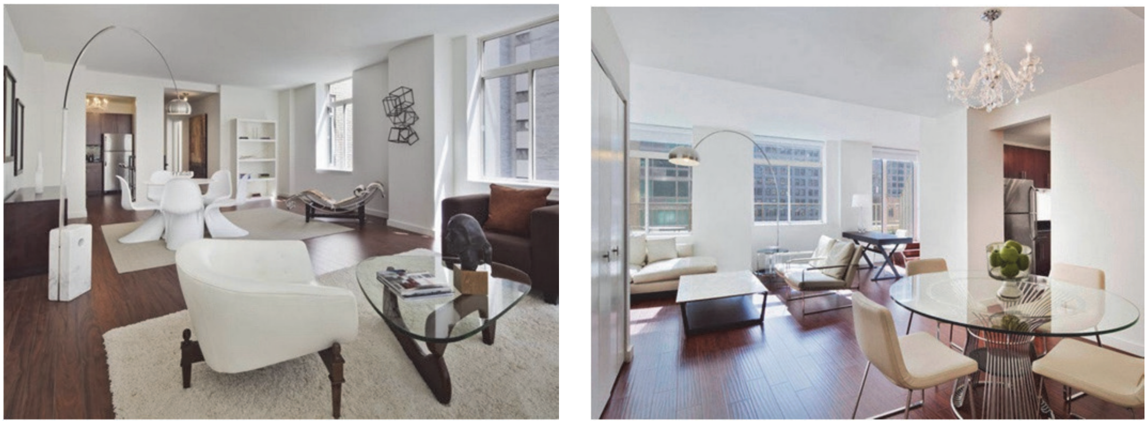

FIGURE 50 TYPICAL INTERIOR CONDITIONS FROM NEW YORK OFFICE BUILDING[1]

This doctorate project looks specifically at conversion to housing. Therefore the housing property sector serves as a point of reference for the other property sectors when ordering them according to spatial scale. Industrial, public, mixed-use, retail and office properties typically require larger divisions of space than housing. Larger spaces required by the pre-existing use, result in wasted space for the new use. Likewise, when the space is too large, more partitions are required.

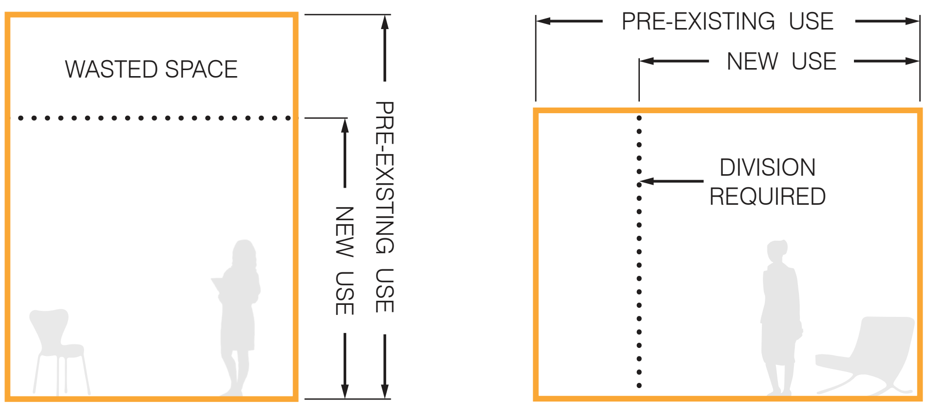

FIGURE 51 CHANGING LARGE SCALE OF SPACE (ROOM SECTION)

Unlike other property sectors, the space required of hotel use is typically smaller than standard housing. As the hotel precedent shows, conversion from hotel to housing

[1] Left and right: Renaissance 100 John Street, *Gallery*.

results in smaller-than-normal unit sizes. The single room occupancy (SRO) units in the precedent show how limiting it is to convert a building with pre-existing spatial divisions that are smaller than what is required by the new use.

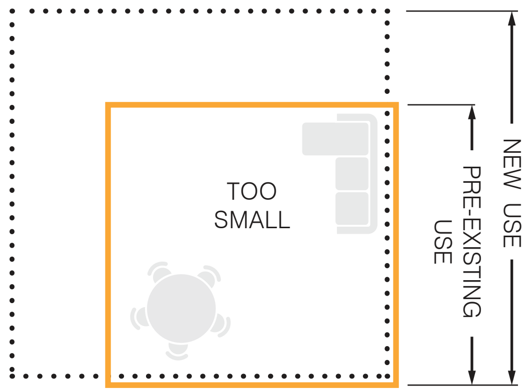

FIGURE 52 CHANGING SMALL SCALE OF SPACE (ROOM PLAN)

Figure 53 shows the tight quarters that result from converting from a hotel to housing. The SRO unit type is a valuable housing type, despite its unconventional size and lack of amenities. SRO units serve an important segment of the population.

FIGURE 53 TYPICAL INTERIOR CONDITIONS FROM VANCOUVER HOTELS[1]

It makes sense that the conversion from one use to another is encouraged when the spatial scale moves from large to small. The scale in Figure 54 shows the order of

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[1] Left: BC Housing, *Gastown Hotel First Building to be Complete Under SRI;* right: The Vancouver Sun, *Vancouver's Ranier Hotel Will Continue to be Served.*

property sectors by space required. Having this order allows us to generalize the degree of change required for adaptive reuse depending on property sector.

FIGURE 54 SPATIAL SCALE DETERMIND BY PROPERTY SECTOR

This scale is useful in narrowing the number of potential property sectors, insofar as the property sector furthest on the scale from the proposed new use can be eliminated. For example, if the decision between two obsolete properties compares industrial and office and the proposed new use is housing, then office properties are favored over industrial properties based on the degree of change required.

SUMMARY

The second step filters away less-than-ideal sites by property sector. It does this according to building obsolescence and building type similarity. Property sectors that are trending towards obsolescence are favored over buildings that have some useful life remaining. This is determined by analyzing local real estate trends in the preselected neighborhood. Furthermore, property sectors, where the pre-existing building type is similar to the type required by the new use, are preferred over dissimilar building types. The degree of change required to transform the rooms for a new function increase proportionate to dissimilarity. In an effort to ease the process of transformation and reduce the number of candidates for consideration in the next step, the obsolete property sector with the building type most suitable for the new use is selected.

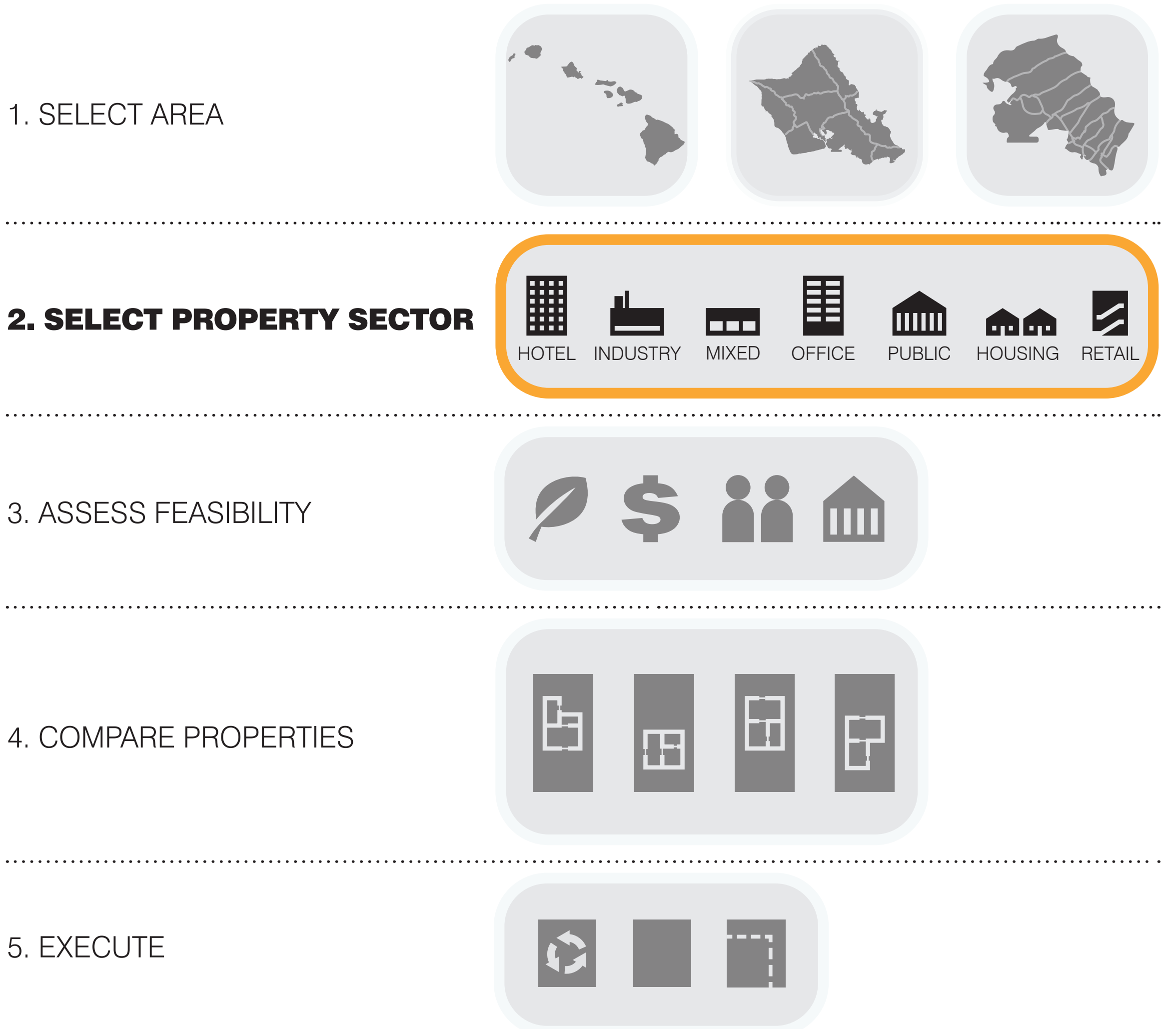

FIGURE 55 METHOD FOR ADAPTIVE REUSE STRATEGY: STEP 2

4.4 FEASIBILITY ASSESSMENT

Figure 4 in section 2.4, depicts the four feasibility drivers (i.e., the environment, economy, society and government) as having separate and equitable influence over the decision to adaptively reuse. However, the precedents studies show that each decision criteria works in concert with the others. In fact, some criteria drive the decision-making process only insofar as they satisfy other more important criteria. This is often the case with the criteria for economically driven decision-making. For example, environmental sustainability may be a concern for developers, but more importantly, energy savings may equate to dollar savings. Ultimately, the economic feasibility of a decision may allow other ancillary criteria, such as environmental motivations, to be included in the reasoning process. The following diagram provides a variation of the decision-making process model in Figure 4.

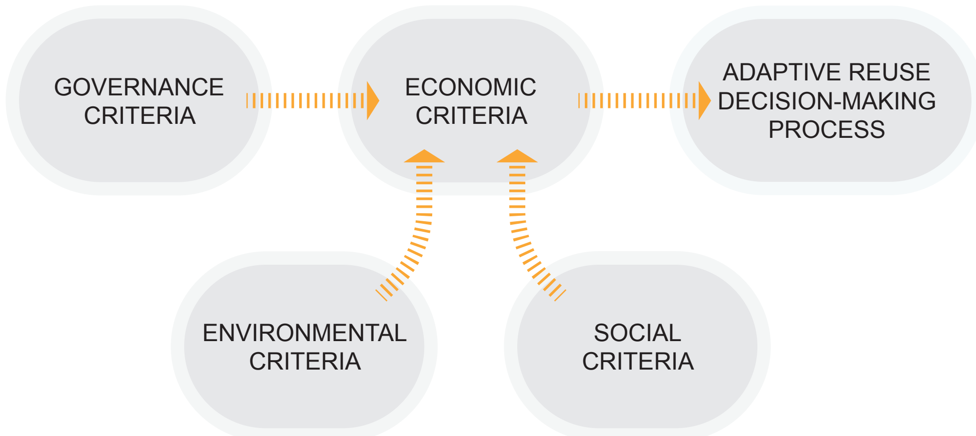

FIGURE 56 VARIATION OF ADAPTIVE REUSE DECISION-MAKING PROCESS MODEL

This model shows the importance of economic criteria with the other criteria playing a supportive role. Governance, which can also be a forceful driver in the decision-making process, is also at the top to demonstrate its weight in the process. Although government agencies can effectively force developers to pursue an adaptive reuse option, they can also strongly encourage it. They do this by providing financial incentives, relating these criteria back to project economy.

If analysis of the feasibility factors reveals a different feasibility driver to be paramount, then the diagram can be restructured to depict the primary concern for the project. The determination of which feasibility driver to have at the top, with the remaining drivers in supporting roles, is important because it determines the criteria for comparing the individual properties in the next step. Alternative models are depicted in the following diagrams.

FIGURE 57 ALTERNATE VARIATIONS OF ADAPTIVE REUSE DECISION-MAKING PROCESS MODEL

Economic criteria were demonstrated in the precedents as having the most impact. However, to show how the other criteria could be satisfied if there were another feasibility driver considered paramount, the benefits to each criteria are provided in section 2.4.

SUMMARY

The third step assesses the drivers of feasibility for the project at hand. Depending on the project and the type of developer pursuing adaptive reuse, this assessment may be simple, or it may require some careful consideration of what is most important. The conditions of the locale may also influence the assessment. For example, in an area where the cost of construction is exceptionally high, economic factors may reign. Or perhaps cultural heritage is a main attraction in the area. In this case, social value may outweigh other aspects. Ultimately, the selection involves some introspection on behalf of the developer and the surrounding context.

The selection performed in this step is an important precursor to the evaluation that occurs in the next step, wherein the properties are prioritized according to their potential for success. The primary feasibility driver defines the criteria used to qualify a project as *successful*.

FIGURE 58 METHOD FOR ADAPTIVE REUSE STRATEGY: STEP 3

4.5 PROPERTY COMPARISON

Depending on the primary feasibility driver selected in the third step, the properties selected in the second step are compared and prioritized. In section 2.4, a preliminary method for evaluating properties, according to each feasibility driver, is presented. This doctorate project focuses on the economy as a primary feasibility driver. Therefore, this step compares properties on that basis. A formula for calculating the economy of a project was presented in section 2.4, alongside the other feasibility drivers. Although this method gives a fair comparison of project economies, it requires a detailed evaluation of the pre-existing building and a preliminary renovation design to determine the optimal economic selection. The Kakaʻako case studies presented in section 3.4, were used to generalize a means of economic evaluation that measures three major building factors. The measurement of each factor (i.e., building age, site potential and building type) is averaged to suggest the level of reuse of the pre-existing building. The assumption is that a greater level of reuse is more efficient because more of the pre-existing structure is salvaged, which translates to less waste and more preservation of capital or initial investment. On the adaptive reuse end of the scale, which translates to 100 percent level of reuse, an ideal pre-existing building is new, built to the maximum size allowed and is a building type that is similar to the new use. On the redevelopment end of the scale, which translates to 0 percent reuse, a building potentially requires complete demolition. Properties at this end of the scale may have extremely old buildings, built to a fraction of the allowable size and have a building type that is drastically dissimilar to its new use.

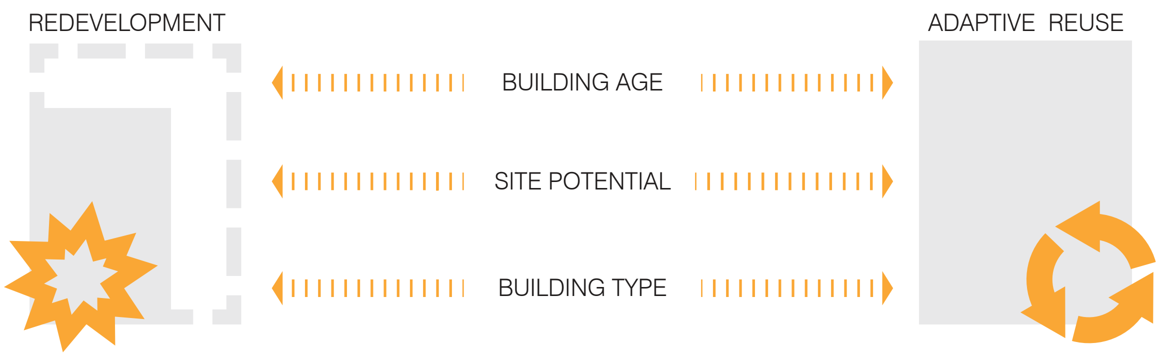

FIGURE 59 DECISION TO DETERMINE THE LEVEL OF REUSE VERSUS REDEVELOPMENT

To understand the basis for each of these scales, a summary of the Kakaʻako case study findings are provided for each factor. After a detailed description of each scale and the method for quantifying the assessment of each factor, the proposed method of the assessment is applied to each of the case studies to demonstrate the reliability of the assessment. The result of each assessment suggests the level of adaptive reuse for each project according to the proposed method. This result is then compared to the actual project outcome.

FACTORS OF BUILDING AGE

Depending on building age, the severity of the technical challenges range from prohibitive to inconvenient. For example, the Royal Brewery, which was the oldest building examined, required the most extensive renovation. Although its structural condition was reasonable for its age, its incompatibility with current codes and unfortunate prior renovation defects, required a complete removal of the building's pre-existing interior and subsequent replacement with a new interior. Essentially, only the ground floor and building façade remained. While this has allowed for the adequate preservation of the historic presence of the building in its context, it presents an inefficient reuse of the building as a whole.

Generally speaking, the older a building is, the more unreliable it is for adaptive reuse. This has a definite economic impact. There are some dates worthy of note regarding a building's age. The first concern of many aged buildings is hazardous material (hazmat). Renovation of any building before 1989 potentially requires asbestos removal. In 1989, this substance was largely banned from use in construction materials. However, since the early 1970s, as people became more aware of the dangers, less inclusive bans on the material brought about a decline in use.[1]

Another noteworthy time period for building age is that of historic approval. Once a building is older than fifty years it requires review to establish historic value. Not all buildings aged fifty years or older are historically valuable. However, regardless of their perceived significance, the building requires the approval of the historic board in order to proceed on any demolition or renovation. This time period is used to determine the scale for assessing a building based on age. In the coming decade, the same buildings that require costly hazmat abatement, such as asbestos, will also require historic review. Therefore, the fifty-year mark provides a parameter in constructing a method for building assessment.

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[1] United States Environmental Protection Agency, *U.S. Federal Bans on Asbestos*.

On the end of the scale that encourages a complete adaptive reuse, the value is set at fifty years old. A building that is fifty years old therefore receives the highest possible score (in terms of building age), towards adaptive reuse. (Note: the final assessment involves an average of the scores for site potential and building type.) The lower limit of the scale is set at one hundred years. This parameter was determined by the case study findings. In the case of the Royal Brewery, the building had aged approximately one hundred years from the time of its original construction to its first adaptive reuse.

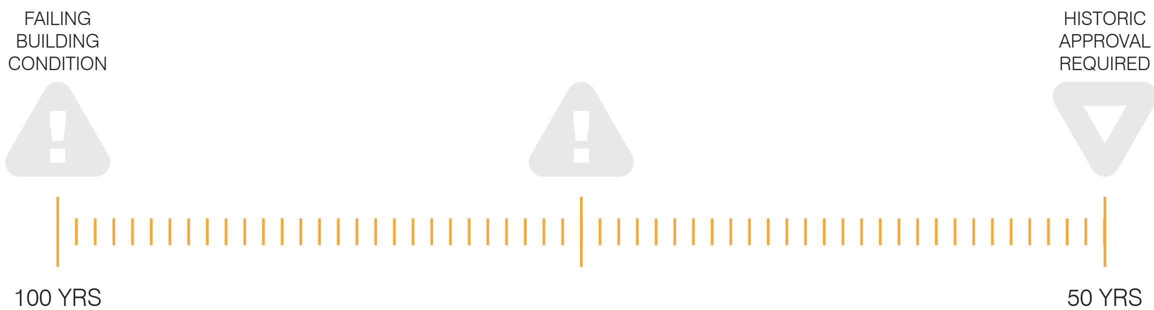


FIGURE 60 BUILDING AGE SCALE

Buildings that fall outside the range of this scale can still be assessed. The value will simply weigh the average of the three factors more heavily. Limiting the range of this scale to fifty years allows a building within this range to receive a fair value that produces a reasonable outcome. Buildings that are deemed historic (i.e., that are at least fifty years old) are protected by the historic society and therefore complete demolition is prohibited. When a building is much older than the minimum fifty years, as is the case of the Royal Brewery, a low level of reuse is pursued. The Royal Brewery is proof positive, because the interior was completely demolished and only the ground floor and façade were maintained.

FACTORS OF SITE POTENTIAL

The reuse of any given site is subject to comparison with new construction. Because the economy of the decision is paramount, the value of a building in its post-renovation state, less the cost of renovation, is compared to a building that maximizes potential of the site, less the cost to demolish and rebuild. When large-scale development is allowed and the pre-existing building represents minimal development, adaptive reuse will likely be dismissed. In the case of the News Building, the portion of the site that was not deemed historically significant enough to be saved was ultimately demolished to make way for a parking garage that will be accessory to a new residential tower on the property.

The scale for this factor ranges from 0 to 100 percent. New construction in an area where there is a high demand for real estate usually incorporates the maximum square footage allowed. Whereas buildings that were developed decades ago sometimes occupy only a fraction of what is currently allowed. This may be due to an increase in floor area allowance or height limits. In some cases, the demand for real estate has increased since the original construction. When the pre-existing building was constructed, it may have been sized to meet the demands of that time period. Then when the demand increases, the building remains undersized.

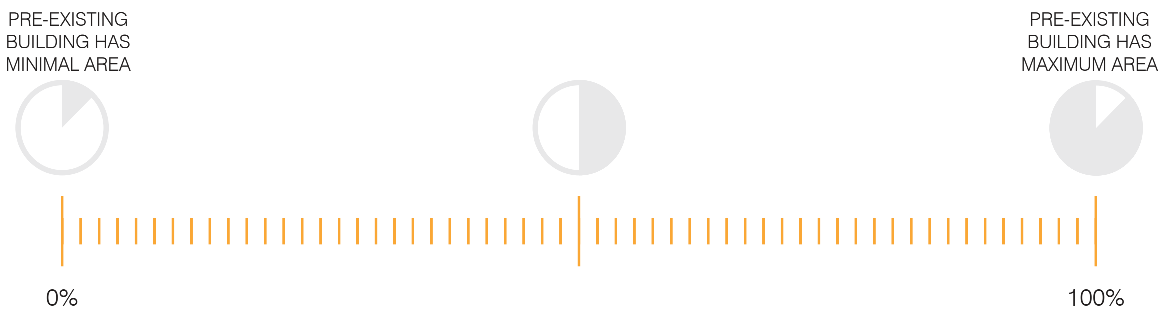


FIGURE 61 SITE POTENTIAL SCALE

The measurement of site potential is based on the allowed floor area ratio (FAR). This is a ratio of building square feet to site square feet. This value is typically given as a decimal number. For example, a building that has a pre-existing FAR of 1.00, when the zoning code allows up to 2.00, would be assessed to have developed 50 percent of its site potential on the scale provided.

FACTORS OF BUILDING TYPE

Building type similarity has implications for adaptive reuse cost. Of the buildings examined in the case studies, industrial and office, building types are represented. When comparing the Salt project and Six Eighty (which is part of the same overall development plan) the adaptive reuse of these comparably aged buildings show disparate levels of challenge. This is attributable to the change in occupancy they endured in reuse. Six Eighty, which converted a former office building into housing was completed on a short timeline and with seeming-less code compliance issues compared to the reuse challenges of the Salt industrial buildings to mixed-use and retail.

Beyond the variation of reported challenges, the final outcomes of these projects incorporate different levels of new construction with adaptive reuse. The Six Eighty project reuses the former office structure entirely. The Salt project blends a higher proportion of new construction with adaptive reuse. Many instances of new construction required the demolition of an existing structure, because adaptive reuse was not feasible.

In section 4.3, assumptions regarding building type were made. The precedent studies show the degree of change as it corresponds to building type.

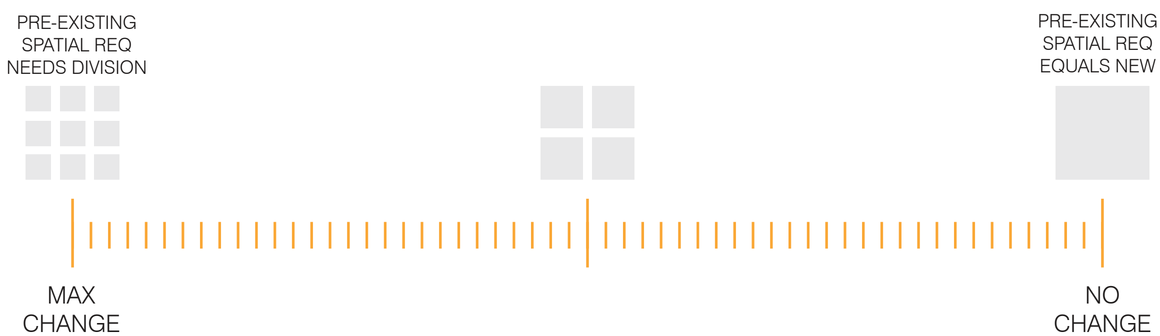
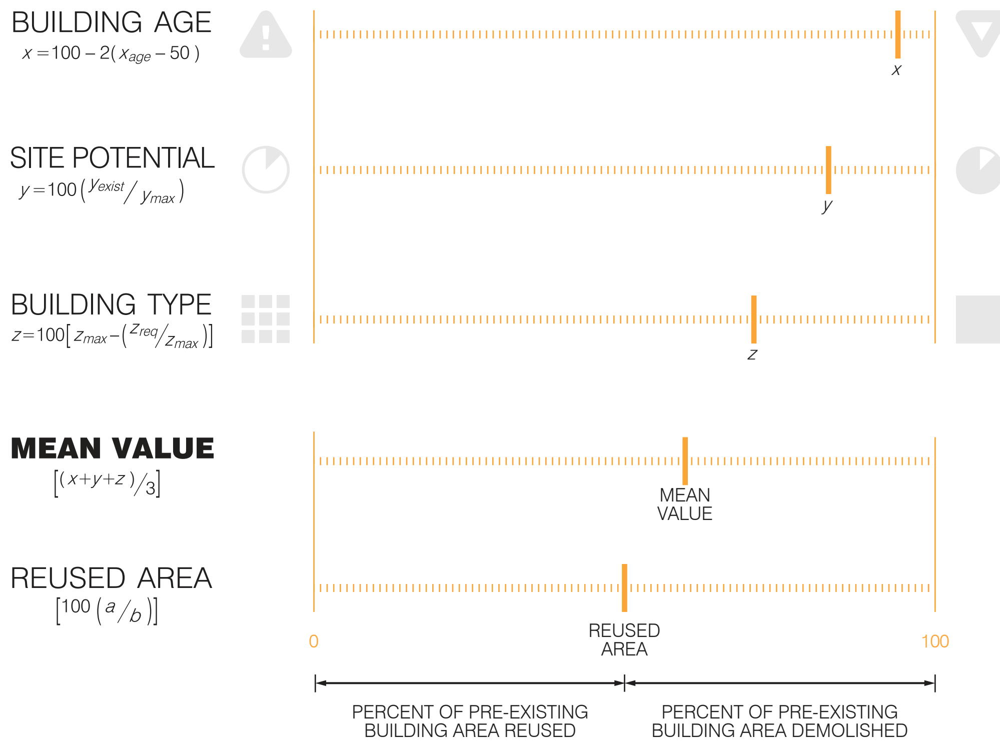


FIGURE 62 BUILDING TYPE SCALE

The assumption is that different property sectors typically require building types that are specific to their respective sectors. For example, the industrial property sector often requires buildings with large spans that provide ample open space and high clearances, while the hotel property sector requires buildings with the smallest division of space to accommodate a minimal amount of furnishing and activities. The remainder of the property sectors examined by the precedent studies fall somewhere in between. See figure 54. In adaptive reuse, the division of space is most feasible in one direction. Larger open spaces can be divided to create smaller spaces, but working in the opposite direction is much more difficult. For example, to create a warehouse from a pre-existing hotel is not a likely scenario. To assess the required change in building type, the pre-existing use and the proposed new use are located on the scale in Figure 54. The degree of change between two building types represents the value assessed on the building type scale in Figure 62. For example, the adaptive reuse of a warehouse for a hotel would require a maximum amount of change, but to adaptively reuse a shopping mall for a hotel would generally require half the effort that would be required to convert an industrial warehouse.

RELIABILITY OF THE ASSESSMENT

Using the aforementioned scales, each factor (i.e., building age, site potential and building type) is assessed for the Kaka‘ako case studies and given a value. These values are averaged to suggest the level of reuse that is economically justified. For a listing of specific data and calculations, see Appendix B **Calculations**. Figure 63 is a diagram key. It defines the essential elements of the diagram. There is a diagram provided for each case study.



WHERE,

x_{age} = MEAN AGE OF PRE-EXISTING BUILDING AT BEGINNING OF ADAPTIVE REUSE,

y_{exist} = PRE-EXISTING F.A.R., CALCULATED AS THE PRE-EXISTING FLOOR AREA DIVIDED BY THE LOT AREA,

y_{max} = MAXIMUM F.A.R., CALCULATED AS THE ALLOWABLE FLOOR AREA DIVIDED BY THE LOT AREA,

z_{req} = CHANGE REQUIRED, CALCULATED AS THE VALUE OF THE NEW USE LESS THE VALUE OF THE PRE-EXISTING USE, AS DETERMINED USING FIGURE 54,

z_{max} = MAXIMUM CHANGE POSSIBLE, AS DETERMINED USING FIGURE 54,

a = PRE-EXISTING FLOOR AREA TO BE ADAPTIVELY REUSED, AND

b = PRE-EXISTING FLOOR AREA TOTAL.

FIGURE 63 EVALUATION FOR ECONOMY DIAGRAM KEY

The Royal Brewery project demolished a majority portion of the pre-existing floor area. The building has aged more than one hundred years. In contrast to its undesirable age factor for reuse, the building has a floor to area ratio (FAR) beyond the maximum allowed. Having exceeded its site potential, a newly constructed building would not allow as much floor area. The new use, which is office, requires a moderate degree of change in spatial organization and scale from its previous industrial use. The data points are plotted on the scale in Figure 64 to show how they contributed to a mild level of adaptive reuse.

The suggested level of adaptive reuse for this project compared to the actual level of reuse is within 5 percent.

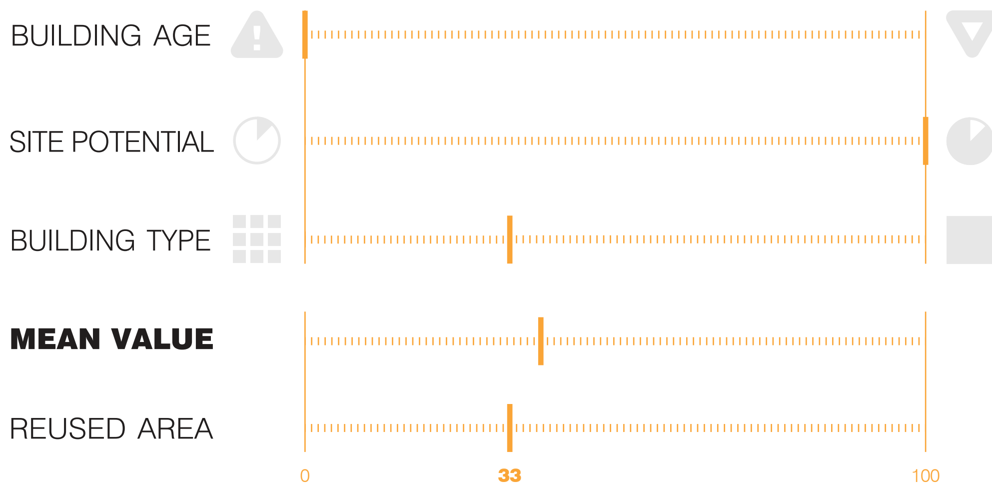


FIGURE 64 EVALUATION FOR ECONOMY OF THE ROYAL BREWERY

The following diagram shows the reuse of only one third of the pre-existing floor area. The building was essentially "gutted" with only the ground floor remaining and new floors constructed to provide a more appropriate spatial scale and configuration for the new use.

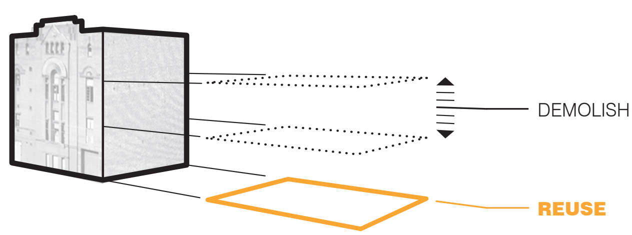


FIGURE 65 DIAGRAM OF THE ROYAL BREWERY'S REUSED FLOOR AREA

A majority portion of the News Building was demolished to make way for residential new construction. The building was comprised of an original structure and an addition that was built later. The age of the original building was both a detriment and encouragement to adaptive reuse, in that it presented many technical challenges despite its historic value. The site, which was quite large, was significantly underutilized. The original industrial portion of the building would have required an extensive reconfiguration of space and thus was not a desirable condition for adaptive reuse as housing. The data points are plotted on the scale in Figure 66 to show how they contributed to a mild level of adaptive reuse. The suggested level of reuse for this project compared to the actual level of reuse is within 3 percent.

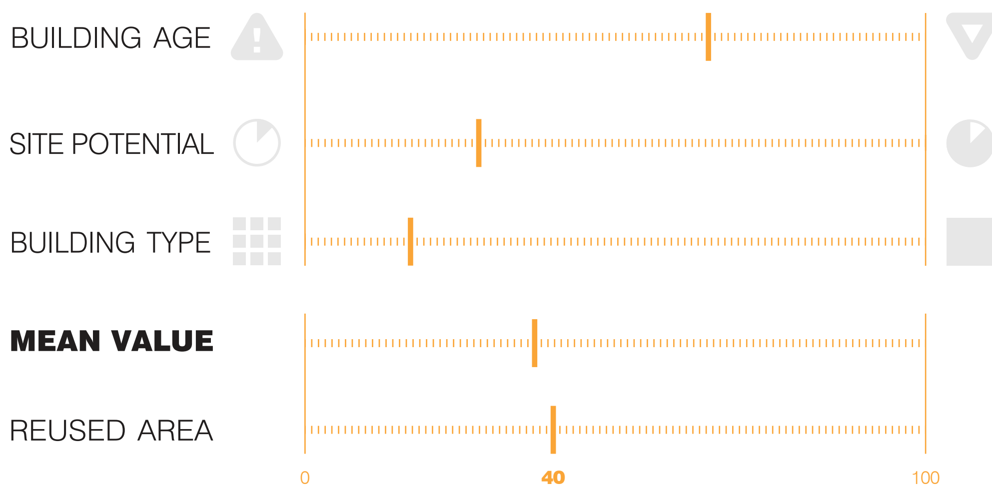


FIGURE 66 EVALUATION FOR ECONOMY OF THE NEWS BUILDING

The following diagram shows the reuse of the historic portion of the News Building and the demolition of a slight majority of the total floor area.

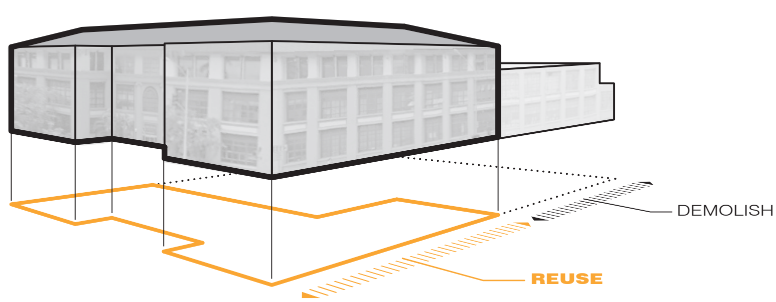


FIGURE 67 DIAGRAM OF THE NEWS BUILDING'S REUSED FLOOR AREA

The Salt project involves a mix of adaptive reuse and new construction, requiring some demolition. The pre-existing buildings have aged enough to require historic assessment, but not enough to present severe technical challenges. The site is developed to just more than half of its potential. The new use for this site involves retail and entertainment (i.e., shops and restaurants) converted from industrial spaces. The data points are plotted on the scale in Figure 68 to show how they contributed to a mild level of adaptive reuse. The suggested level of reuse for this project compared to the actual level of reuse is within 2 percent.

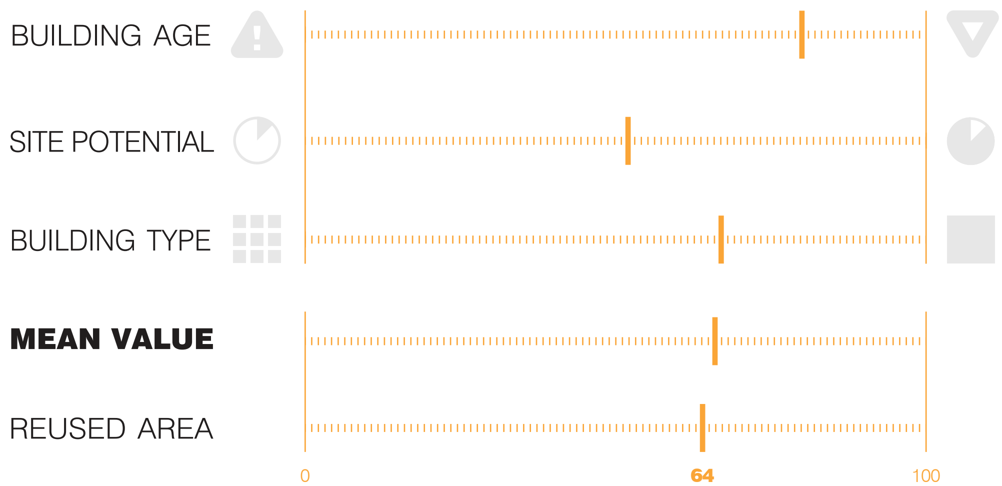


FIGURE 68 EVALUATION FOR ECONOMY OF SALT

The following diagram shows the reuse of some of the buildings, while others were demolished. The demolished buildings will make space for newly constructed structures that complement the adaptively reused buildings.

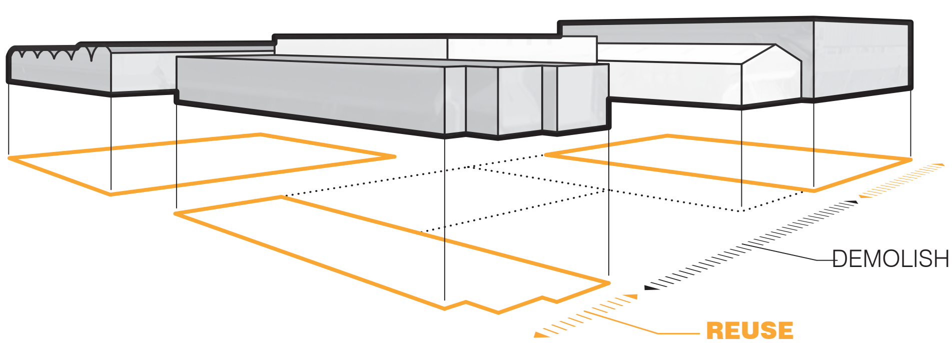


FIGURE 69 DIAGRAM OF THE SALT PROJECT'S REUSED FLOOR AREA

The Six Eighty Ala Moana project involved a complete adaptive reuse of the pre-existing office building. Of all the case studies, it was the youngest building and required the least degree of change for its new use of housing. Furthermore, it was developed to a relatively high percentage of its potential (second only to the Royal brewery). The data points are plotted on the scale in Figure 70 to show how they contributed to such a high level of adaptive reuse. The suggested level of adaptive reuse for this project compared to the actual level of reuse was the most disparate of all the case studies, but is still within eleven percent.

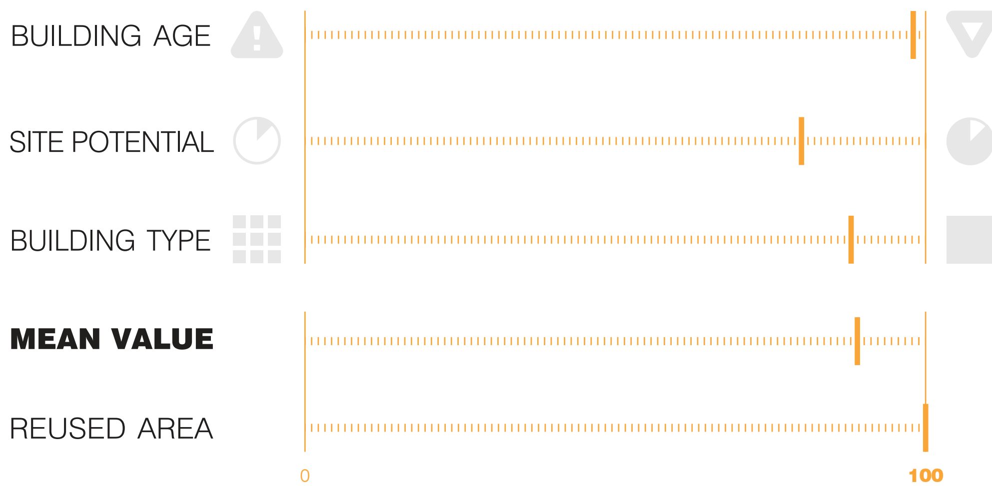


FIGURE 70 EVALUATION FOR ECONOMY OF SIX EIGHTY ALA MOANA

The following diagram shows a complete reuse of the pre-existing floor area. The project required no additional floor area in the form of new construction. A portion of the rooftop was converted to recreation space for the building residents. However, this does not qualify to be counted as *floor area* under Honolulu's Land Use Ordinance (LUO) definition.

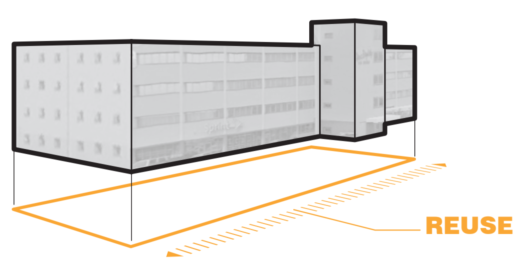


FIGURE 71 DIAGRAM OF SIX EIGHTY'S REUSED FLOOR AREA

When analyzing the feasibility of a project, there are four primary contributors to a project's redevelopment versus reuse outcome. These factors, which are the topic of section 2.4, are the environment, economy, society and government. The precedent studies in section 3.3 identify the economy as the ultimate driving force in supporting or denying adaptive reuse. This assumption was substantiated by the Kakaʻako case studies. In each project, the economy of the project weighed on the decision to adaptively reuse and to what extent the pre-existing building could be maintained.

The economic feasibility of any potential project can be estimated after a thorough examination of the building and careful design budgeting. However, when trying to preselect a potential building it may not be possible to carefully calculate the economic justification for each site in order to compare multiple properties accordingly. Therefore, from the case studies a general theory for property assessment is made. This assessment relies on the three major factors that affected the economic judgment in each case study (i.e., building age, site potential and building type). This assessment is the fourth step in the process.

PROPERTY COMPARISON

In order to determine the optimal property for adaptive reuse each building must be evaluated according to its age, site potential and degree of change required. The mean value of these factors allows the properties to be ranked in order of their expected reuse efficiency. A higher level of reuse produces less waste and maximizes the initial investment in the pre-existing building. Therefore, higher efficiency is preferred. The equation for mean value is as follows:

$$\textit{Mean Value} = \left[\frac{(x + y + z)}{3} \right]$$

where

$x = \quad 100 - 2\,(x_{age} - 50)$, where

x_{age} = mean age of pre-existing building at the beginning of adaptive reuse;

y = $100\ (y_{exist} \div y_{max})$, where

y_{exist} = pre-existing FAR, calculated as the pre-existing floor area divided by the lot area, and

y_{max} = maximum FAR, calculated as the allowable floor area divided by the lot area;

z = $100\ [z_{max} - (z_{req} \div z_{max})]$, where

z_{req} = change required, calculated as the value of the new use less the value of the pre-existing use, as determined using figure 54, and

z_{max} = maximum change possible, as determined using figure 54.

TIE-BREAKING

If there are two properties that receive the same mean value, the individual values for the factors determine priority. Assuming two properties have an equivalent average, the building with the highest value on the site potential scale should be selected. This factor is the most objective in its characterization of the property. The floor area used to determine the value is discrete and is not affected by other circumstance. For example, while building age is a helpful determinant for the general condition of a building, circumstantial influence, such as building maintenance and construction quality, has some effect on the general building condition. If the value assessed for site potential is also equal, then the property with the most recently constructed building has priority. Challenges that arise from building age are more likely to go unforeseen than challenges resulting from disparate spatial requirements. The likelihood of these challenges increase with age. Additionally, as part of the second step discussed in section 4.3, the properties being compared may have the same value for the building type factor. In which case, this factor cannot determine priority alone.

WEIGHTED FACTORS

Alternatively, the developer may decide which factors are most important. For example, they may want to give weight to some factors, over others, in order to adjust the mean value. If this is the case, the following equation provides a means of doing so:

$$\text{Adjusted Mean Value} = \left[(S_x)x + (S_y)y + (S_z)z \right]$$

where

$$1 = [(S_x) + (S_y) + (S_z)]$$

and

S_x = the significance factor for the value of x,

x = see equation for mean value,

S_y = the significance factor for the value of y,

y = see equation for mean value,

S_z = the significance factor for the value of z, and

z = see equation for mean value.

When significance factors are applied, the mean value changes to reflect an uneven weight for the x, y and z values. In this case, the adjusted mean value no longer represents the anticipated level of adaptive reuse. This anticipated level, as previously noted, is an indicator of adaptive reuse efficiency. When the mean value is calculated without significance factors applied, the properties being compared are prioritized according to anticipated adaptive reuse efficiency (i.e., anticipated level of reuse).

Therefore, calculating an adjusted mean value, with significance factors applied, prioritizes the properties according to the significance of one factor over another.

VALUATING SIGNIFICANCE FACTORS

To determine the value of each significance factor, the developer must decide which of the building factors [i.e., building age (*x*), site potential (*z*) or building type (*z*)] is most important and to what degree it is more important than the other factors. Figure 72 illustrates a scenario where the factors are equally important, depicted as a pie chart. In this case, the sites are prioritized according to the anticipated level of reuse and the mean value is simply calculated as the average of the *x*, *y* and *z* values. However, if the adjusted mean value equation were applied to this scenario, each significance factor would have a value of 0.33, which is represented as 33 percent of the pie chart in Figure 72.

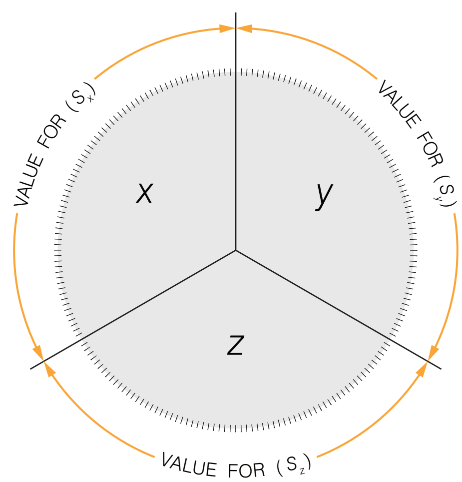


FIGURE 72 EQUAL SIGNIFICANCE FOR ALL FACTORS

If multiple sites produce the same mean value, necessitating a tie-breaker, or the developer feels one building factor is more important to them, then the balance between the factors may be shifted. Figure 73 provides an example scenario where the application of a significance factor produces an adjusted mean value.

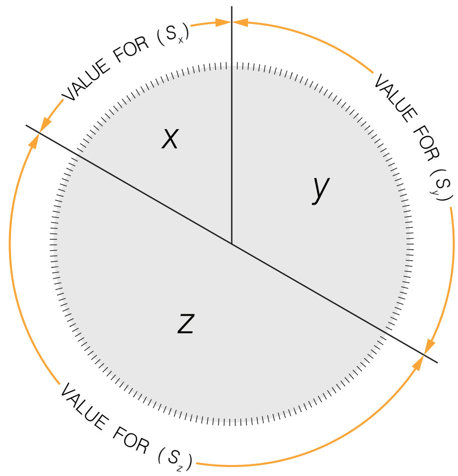


FIGURE 73 UNEQUAL SIGNIFICANCE FOR ALL FACTORS

When the values for each significance factor are combined, they should total 1, represented as 100 percent of the pie chart in Figure 73. In this example, the individual significance factors are: $(S_x) = 0.17$, $(S_y) = 0.33$, $(S_z) = 0.5$; representing 17 percent, 33 percent and 50 percent of the pie chart, respectively. The valuation of the significance factors is at the discretion of the developer, based on their specific goals.

SUMMARY

The fourth step compares properties to determine priority and select the optimal site, assuming all the remaining candidates in the search are acceptable. The primary feasibility driver from the third step is carried forward to determine the criteria used to compare the properties. This doctorate project uses project economy for comparison. Three property factors allow the economy of a project to be evaluated. These factors are: building age, site potential and building type similarity. Each factor is evaluated. Then all three values are averaged to achieve a mean value for the given property. Higher values, individually or on average, indicate higher potential for efficient adaptive reuse. The property that has the highest mean value is the optimal preselection for adaptive reuse.

In circumstances where there are multiple properties with equivalent mean values, there are two methods for selecting only one. The first method is to select the property (among those tied for the highest mean value) that has the highest value for site potential, meaning it has fulfilled the greatest percentage of site potential. If there are multiple properties with equivalent mean values and equivalent site potential values, then the most recently constructed building is preferred. The second method for distinguishing between properties with the same mean value is to calculate an adjusted mean value. This gives preference to one variable over another so that one or more variable(s) has more influence over selection than the other(s). This method requires the discretion of the developer to decide how much weight to assign the individual values.

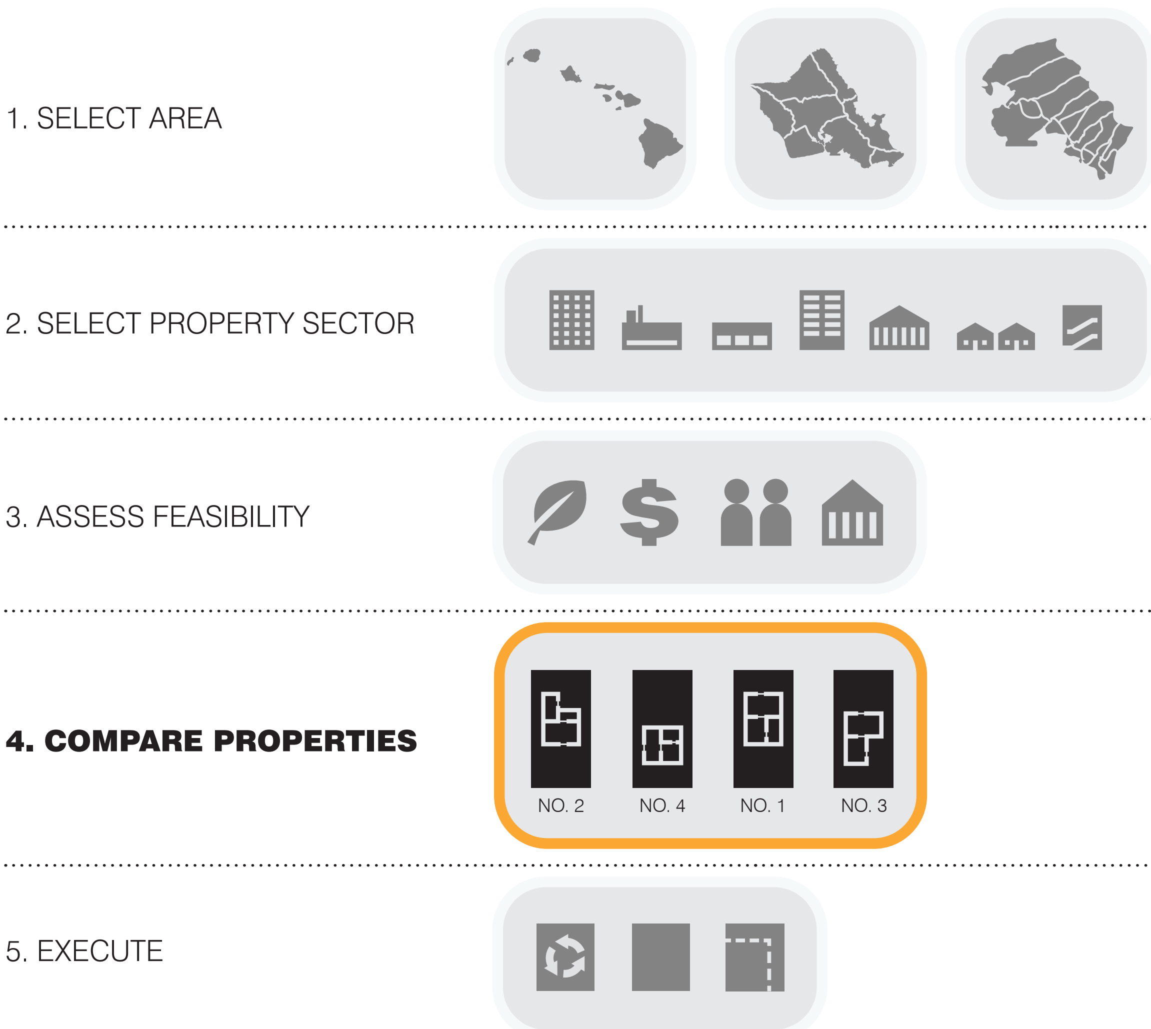


FIGURE 74 METHOD FOR ADAPTIVE REUSE STRATEGY: STEP 4

4.6 JUSTIFY AND EXECUTE

The fifth and final step in the preselection method proposed by this doctorate project is to justify the outcome of step four and execute a design scheme. Justification is required to ensure the preselected site will achieve the developer's goals. In chapter 1, this doctorate project asserts that many of the current decision-making methods for determining whether to renovate or demolish require a lot of effort to produce preliminary designs for comparing the outcomes. These decision-making processes must be applied on a case-by-case basis, often to several properties, until a decision in favor of adaptive reuse is delivered. To avoid applying this process unnecessarily, the method proposed in this chapter allows a site with favorable conditions and characteristics to be preselected. This final step applies an established decision-making process in order to justify the decision to adaptively reuse. For feasibility that is driven primarily by concern for project economy, the net benefits (NB) equation is an appropriate calculation for justification. This equation is presented in section 2.4 and is demonstrated in section 5.6 to justify site preselection in Hawaiʻi.

In order to calculate the net benefits for comparison, a preliminary design must be executed. In general, the higher level of precision given to the design, the greater likelihood the comparison will be accurate. More design detail allows for more consideration of the cost and benefits of each proposed option. Minimally, the cost to renovate and the value after renovation should be estimated. Additionally, in order to compare, the cost to demolish the pre-existing building, the cost to construct a new one and the value of the new building must also be estimated. If the net benefits of the adaptive reuse option are positive, then the project is justifiable. If the net benefits of adaptive reuse are greater than demolition and redevelopment, then the adaptive reuse option is optimal.

CHAPTER 5 HAWAI‘I METHOD DEMONSTRATION

5.1 INTRODUCTION

The process of identifying the ideal property for adaptive reuse is effectively a process of narrowing the options according to the goals and intentions of the project. For this doctorate project, the provision of affordable housing has been an ongoing goal. Although this has been an underlying factor, there are many important aspects of adaptive reuse that drive the narrowing process. This doctorate project demonstrates the method of preselection in the state of Hawai‘i.

The process begins with area selection, following the prescribed sequence in section 4.2: metro area selection, followed by plan area selection and ending with neighborhood selection. The next step is to determine an appropriate property sector for building supply. The third step identifies a primary feasibility driver, based on issues specific to Hawai‘i. The fourth step compares potential adaptive reuse sites, in order to preselect the optimal candidate. In the final step, the preselected property is justified using calculations based on a preliminary design proposal.

5.2 AREA SELECTION

This doctorate project begins at the state level. The location of Hawai‘i was chosen for two reasons. First, this is the base of operation for this research and therefore it provides access to the necessary resources for applying the proposed method. Presumably, if this process is applied in other locales, the entity conducting the site preselection would have similar access to their area of investigation. Secondly, it is intended for the proposed method to be used as a strategy for increasing the availability of housing in a Smart Growth scenario. The conditions in Hawai‘i exemplify the need for Smart Growth and additional housing strategies. With its limited land area and increasingly expensive housing market, a strategy applied in its extreme conditions demonstrates potential.

METRO AREA SELECTION

The Office of Management and Budget (OMB) has delineated the metro area for the state of Hawaiʻi. Metro areas consist of one or more counties. In this case, each island is also its own county. The island counties of Oʻahu, Molokaʻi, Lanaʻi and Maui are part of the metro area. There is only one metro area within the state. Therefore, it is not necessary to compare its population growth to other metro areas. Instead, the island county of Oʻahu, which has the highest population density and growing, is the target of our plan area search.

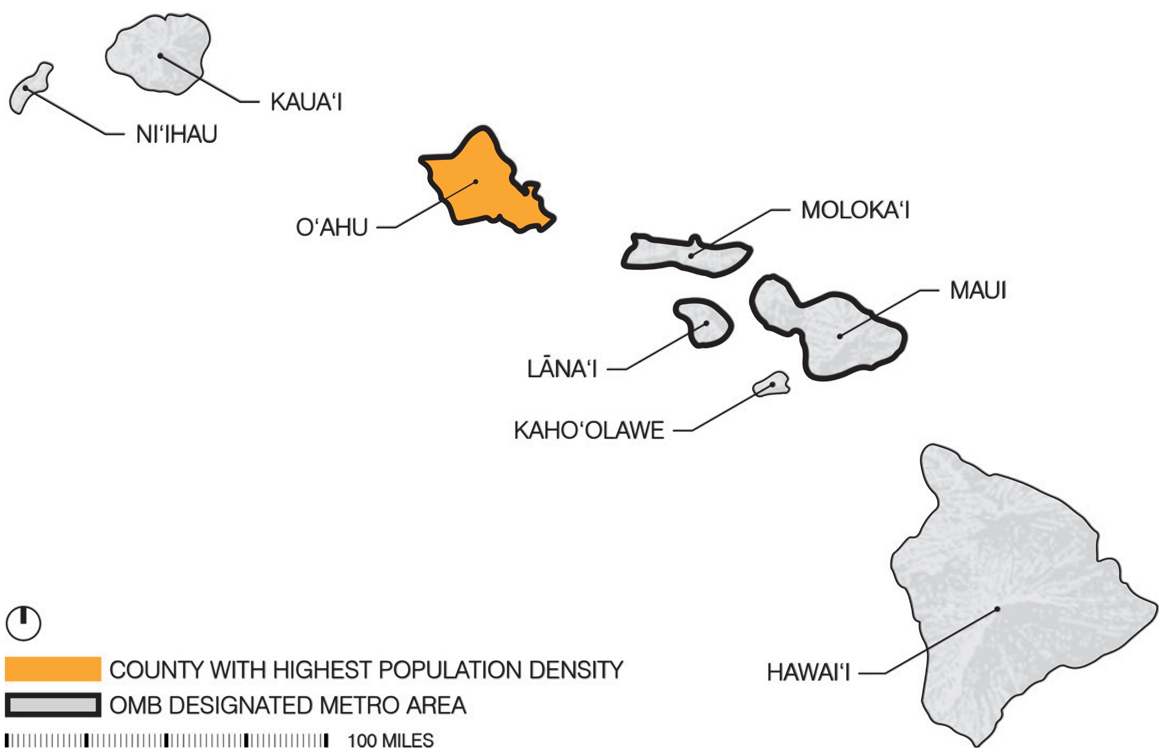


FIGURE 75 HAWAIʻI METRO AREA

PLAN AREA SELECTION

The island of Oʻahu is divided into eight plan areas: North Shore, Koʻolauloa, Waiʻanae, Central Oʻahu, Koʻolaupoko, ʻEwa, Primary Urban Center and East Honolulu.

In order to grow the city according to the principles of Smart Growth, the Primary Urban Center (PUC) is an ideal area for increasing the availability and variety of affordable housing. According to an affordable housing report for Honolulu, the cost of transportation, when coupled with the cost of housing, adds to the expense of living in Hawai‘i.[1] Planners should consider this combined cost when developing the city. Providing housing with accessibility to transit is a key factor for selecting the area. For these reasons, the PUC is selected.

The Primary Urban Center provides specific opportunities for adaptive reuse development, as opposed to sprawling new development. The development plan for the PUC states:

> The PUC is essentially "built-out" – i.e., there is no reservoir of vacant land designated for future urban use. New housing is developed on lands which are underutilized or where it is not economical to maintain the existing uses or structures. This occurs primarily in older in-town districts where land values are relatively high, and there is a strong market demand for higher use.[2]

This means that new development options in this area often require the demolition of existing buildings. This doctorate project questions this step and offers adaptive reuse as an alternative to demolition when it is an economically viable alternative.

[1] Helbert Hastert and Fee, Planners, *Affordable Housing Trend Report.*
[2] Primary Urban Development Center, *Development Plan*.

FIGURE 76 O'AHU PLAN AREAS[1]

NEIGHBORHOOD SELECTION

The Primary Urban Center consists of several neighborhoods. Each neighborhood has very distinct characteristics. There is a range of demographic trends, cultural identities, prevailing markets and access to amenities. Within this planning area there are eighteen different neighborhoods: Kaimukī; Diamond Head, Kapahulu, St. Louis; Pālolo; Mānoa; McCully, Mōʻiliʻili; Waikīkī; Makiki, Lower Punchbowl, Tantalus; Ala Moana, Kakaʻako; Nuʻuanu, Punchbowl; Downtown; Liliha, Kapālama; Kalihi-Palama; Kalihi Valley; Moanalua, Aliamanu, Salt Lake, Foster Village; Airport area; Aiea; and Pearl City.

[1] Map redrawn by author; original map source: The Honolulu Department of Planning and Permitting, *Planning*.

Among these neighborhoods, access to mass transit can significantly reduce the cost of living. This sentiment is echoed in a book detailing the appropriate characteristics for recycling buildings. The author notes three primary characteristics: access to transit, proximity to restaurants/shopping, and availability of schools and libraries.[1] Using these factors to narrow the property selection, neighborhoods that do not have access to transit can be eliminated. The remaining neighborhoods are: Ala Moana, Kakaʻako; Downtown; Kalihi-Palama; Airport area; Aiea; and Pearl City.

Of the six neighborhoods remaining, one is currently in the early phases of large-scale redevelopment. According to the same source for the recycling of buildings, areas with planned developments should be avoided.[2] Areas that are reserved for planned redevelopment typically indicate areas that are in decline and in need of renewal. These areas may be riskier for adaptive reuse projects. Stable areas are preferred. In order to narrow the neighborhood prospects in Honolulu, the Ala Moana/Kakaʻako area can be eliminated due to ongoing redevelopment efforts.

As discussed in section 4.2, proximity to restaurants and shops are important for successful adaptive reuse.[3] In a survey conducted of all the neighborhoods regarding access to shopping and restaurants, some neighborhoods reported more access to these types of establishments. In the Aiea/Pearl City area, the highest percentage of residents felt they had sufficient access to restaurants and shopping. In Kalihi-Palama and Downtown, there were also a large percentage of residents satisfied with the shopping and restaurant availability. See percentages in Table 1.

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[1] Reiner, *How to Recycle Buildings*, 11.
[2] Ibid.
[3] Ibid., 17-18.

TABLE 1 COMMUNITY SURVEY RESULTS FOR RESTAURANTS AND SHOPPING

	Rank Order	Percent to Respond Positively
Aiea/Pearl City	1	96.5
Kalihi-Palama	2	91
Downtown	3	90
Airport Area	4	<

Source: National Research Center, Inc. Community Survey. Survey, Department of Planning and Permitting, Honolulu: City and County of Honolulu, 2011-2012.

Regarding schools and libraries, Kalihi had the largest percentage of residents that found sufficient resources in their neighborhood. Aiea/Pearl City came in a close second. Downtown residents were less likely to report positively about their access to schools and libraries.

TABLE 2 COMMUNITY SURVEY RESULTS FOR SCHOOLS AND LIBRARIES

	Rank Order	Percent to respond Positively
Kalihi-Palama	1	98
Aiea/Pearl City	2	96
Downtown	3	85
Airport Area	4	<

Source: National Research Center, Inc. Community Survey. Survey, Department of Planning and Permitting, Honolulu: City and County of Honolulu, 2011-2012.

The Airport area does not provide appropriate schools or libraries for the introduction of adaptive reuse. To select the ideal situation for all amenities Aiea/Pearl City and Kalihi-Palama present the best conditions for adaptive reuse.

Either of the remaining neighborhoods provides suitable conditions for adaptive reuse. For the purpose of this research, affordable housing remains a concern. When comparing the availability of affordable housing in these areas, one neighborhood presents a much greater need. According to a report from the Affordable Housing Advisory Committee:

> As the fourth most expensive metropolitan market in the nation, the median Honolulu home sold for $620,000: 9.15 times Honolulu's area median family

income (AMI) of $67,750! The metropolitan area with the highest median home price is San Jose, CA at 1.08 times their median income of $105,500…[1]

Using this same metric to understand the problem on a neighborhood-basis shows that Kalihi-Palama has a much higher median home value when compared to the median income. In the Aiea/Pearl City area, the average home value and median income are less disparate in terms of affordability.

TABLE 3 MEDIAN INCOME VERSUS MEDIAN HOME VALUE

	Median Home Value ($) *	Median Household Income ($) **	(Median Home Value) ÷ (Median Household)
Aiea/Pearl City	330,728 / 290,341	64,457 / 66,501	5.13 / 4.37
Kalihi-Palama	297,188	31,627	9.4

* Source: Census Bureau Selected Housing Characteristics: 2000 Oahu
** Source: Census Bureau Selected Economic Characteristics: 2000 Oahu

In order to focus the efforts of this doctorate project and show the potential impact of adaptively reusing properties for affordable housing, the neighborhood of Kalili-Palama provides an appropriate site for investigating an adaptive reuse strategy.

[1] Affordable Housing Advisory Committee, *Report and Recommendations.*

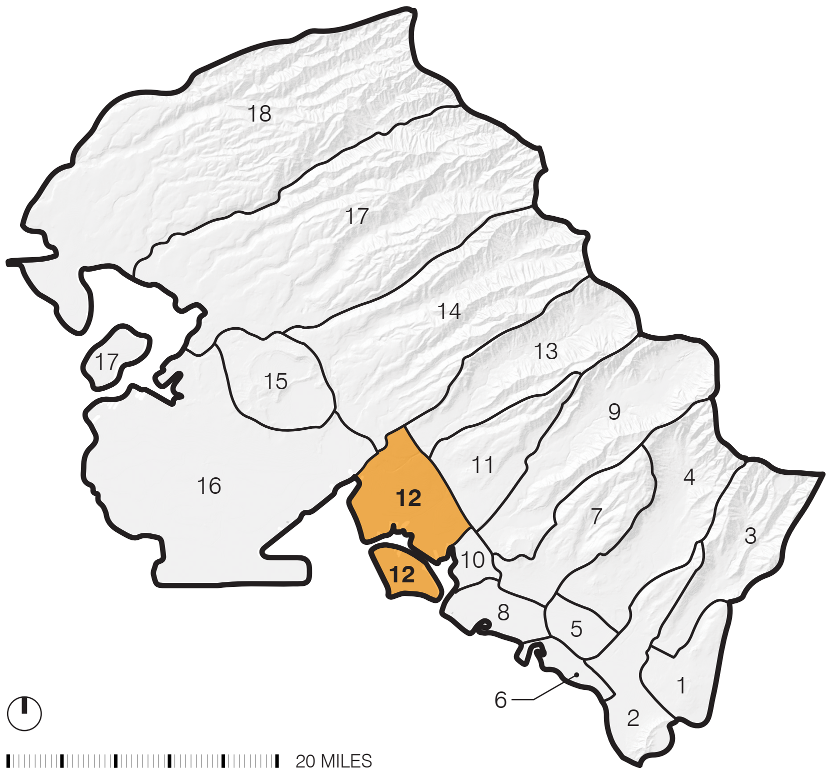

FIGURE 77 NEIGHBORHOODS OF THE PRIMARY URBAN CENTER[1]

5.3 PROPERTY SECTOR SELECTION

Of the many property types affected by a range of obsolescence factors, there are some more prominent in Hawaiʻi than others. Local real estate analysis can provide some clues as to which property sectors are most prone to building obsolescence. Furthermore, buildings that provide the most opportunity for adaptive reuse are highlighted. As discussed in section 2.3, public buildings and mixed-use buildings present unique difficulties for adaptive reuse and are therefore avoided. Consequently, the four property sectors for analysis are: industrial, retail, office and hotel.

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[1] Photo Credit: Map redrawn by author; original map source: The Honolulu Department of Planning and Permitting, *Planning*.

OBSOLETE PROPERTY SELECTION

A 2011 Market Opportunities Study outlined the prospects of these four property types in the Kalihi-Palama area.[1] Although the island of Oʻahu is known for its tourism, Kalihi-Palama is overwhelmingly industrial. As such, the market study for this area reported no hotels in the area.[2] The market fundamentals of the industrial sector are relatively healthy with a vacancy rate of only 1.9 percent:

> …[b]ecause many of these businesses appear to be economically healthy, there may not be a compelling reason for many of those properties to be redeveloped for any other use in the near term, particularly since the rents that might be supported by alternative uses are generally not yet sufficient to justify the high costs of new construction.[3]

With regard to office buildings, most of these properties are located in the Downtown neighborhood with a vacancy rate of 13 percent.[4] Kalihi-Palama, which is located just outside of Downtown, has limited prospects for office development in the immediate future:

> ...[T]here will be limited opportunities for new office development given the high cost of construction and the projected slow recovery in the economy. As the economy stabilizes over the longer term and more healthy growth patterns return, there will likely be demand for new office space.[5]

Although an increase in office demand is anticipated in the long term, it is questionable whether existing stock will be able to provide adequate supply. Therefore, building obsolescence can be speculated. According to the report, "[p]otential new growth

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[1] Keyser Marston Associates, Inc., *Market Opportunities Study*.
[2] Ibid., 9.
[3] Ibid., 10.
[4] Ibid., 8.
[5] Ibid., 9.

industries for office space in Honolulu include high tech, life sciences/biotech, and dual defense contracting."[1] Office properties that are obsolete now, will only decline further.

Retail space in the Kalihi-Palama neighborhood can be characterized in the following way:

> …[t]here is a significant presence of big box retail adjacent... In addition, there is a significant amount of neighborhood-serving convenience retail which includes grocery stores, pharmacies, and eating and drinking establishments.[2]

Big box retail aside, much of the low-density retail development has aged thirty years or more and is in much need of reinvestment.[3] Although the condition of the existing retail calls for renovation, new uses to replace retail are questionable. The retail market in Kalihi-Palama is stronger than most cities on the mainland. However, rents in the area are generally lower than other areas in Honolulu, due to the age of the existing buildings.[4]

Given the analysis provided for this neighborhood, it seems existing office spaces would respond to adaptive reuse the most successfully in the current market. Although each property must be considered for its individual merits, the market study for office property indicates a general over-supply of office property in the area.

5.4 FEASIBILITY ASSESSMENT

Construction cost in Hawai'i is above the national average.[5] There are many contributing factors. Building materials that are manufactured off-island must be shipped to Hawai'i, which multiplies the cost of most goods. As if Hawai'i's geographic isolation were not costly enough, the islands' limited land area constricts the supply of real estate, further inflating the cost to purchase property and store materials. Factor in market issues of competition and foreign investment, and it is easy to see why the cost of construction is so

[1] Keyser Marston Associates, Inc., *Market Opportunities Study*, 9.
[2] Ibid., 7.
[3] Ibid.
[4] Ibid.
[5] RSMeans, *Square Foot Costs*.

high the state. These concerns undoubtedly worsen the challenge of providing affordable housing.

In order to demonstrate the site preselection method, without a specific developer to determine the project goals, this doctorate project considers the economy of construction a primary feasibility driver. This assessment determines the criteria used to compare the potential adaptive reuse properties.

5.5 PROPERTY COMPARISON

In order to locate an appropriate property within the Kalihi-Palama neighborhood, it is first necessary to locate all the potential properties. This search has been narrowed to include only office properties. There may be any number of potential property types, but rather than analyze every property the search is limited to office, because research of the area indicates there is an appropriate supply of that property type.

Potential properties require some minimum characteristics in terms of building obsolescence. In order to identify obsolete office properties in the area, this research relies on real estate services that list buildings for sale or lease. From these listings a building's vacancy rate is obtained, which is indicative of the building's value in its pre-existing condition. Four properties were identified in the Kalaihi-Palama area as obsolete office properties. Figure 78 depicts the four selected properties. The top left images is 390 North School Street. The Top right image is 1339 North School Street. The bottom left image is 1610 Kalani Street. Lastly, the bottom right image is 2119 North King Street.

FIGURE 78 POTENTIAL KALIHI-PALAMA PROPERTIES[1]

Figure 79 shows the location of all four properties in the Kalihi neighborhood and their respective proximities to major roads. The key in the bottom right of the image locates the plan area within the metro area and the neighborhood within the plan area.

[1] Top left and right; bottom left and right: by author.

FIGURE 79 KALIHI-PALAMA MAP WITH PROPERTY LOCATIONS

The properties are best understood in a matrix that compares the characteristics that make them more-or-less ideal for adaptive reuse. The characteristics included in this comparison have been accumulated from various sources.

TABLE 4 PROPERTY COMPARISON MATRIX

	Address	390 North School Street	1339 North School Street	1610 Kalani Street	2119 North King Street
A	TMK	17018007	16005021	15028049	12011142
B	Lot size	23,899	18,887	3,547	14,145
C	Sq Ft	8,118	7,771	3,840	12,768
D	FAR	0.34	0.41	1.08	0.9
E	Allowable FAR	0.74	2.50	1.5 - 2.5	2.5
F	% of FAR Built	46	16	43 - 72	36
G	Height Limit	30	60	60	100
H	Year Built	1956	1959	1967	1973
I	Zone	A-1	B-2	IMX-1	BMX-3
J	Bldg Tax Value ($)	304,100.00	721,800.00	171,600.00	1,242,800.00
K	Land Tax Value ($)	843,600.00	1,193,100.00	514,000.00	819,600.00
L	Total Value ($)	4,500,000.00	2,999,000.00	685,600.00	2,062,400.00
M	Price per Sq Ft ($)	554.32	385.92	178.54	220.27
N	Parking	4 stalls on-site with potential for overflow	14 stalls on-site	4 stalls on-site with limited street parking	24 stalls-on site
O	Distance to Rail	21 min. walk 15 min. bus	23 min. walk 18 min. bus	4 min. walk	13 min. walk 7 min. Bus
P	Notes on Street Condition	Sidewalk access, off one way street. Surrounded my residential with some small specialty retail and a grocer in walking distance.	Sidewalks on all sides, fronts busy intersection, with gas station/C-stores on other three corners. Bus stops nearby. Strong business/ residential mix in the area.	Sidewalks are broad and integrate hardscaped yard as parking. The surrounding area is industrial, but well-kept and seemingly quiet. Upper floor is currently used for housing.	Good sidewalks with landscaped setback. Area is very mixed with business and residential. There is a strong presence of live-work properties in the vicinity.

Row Source:
A – C Honolulu Department of Planning and Permitting (DPP) property information
E Honolulu Land Use Ordinance (LUO)
G Honolulu Land Information System (HoLIS)
H Honolulu DPP building permit records
I – K Honolulu DPP property information
O Google Inc.

Access to transportation was important in narrowing the selection of neighborhoods. Therefore, it is evaluated for each property. Measurement of the distance from each property, in terms of time to walk or bus ride, to the nearest rail station concludes that 1610 Kalani Street and 2119 North King Street have the most convenient proximity for future residents.

Each property has parking available based on its current function or the requirements that were in effect when the building was built. The properties with the most available parking allow more units to be achieved. For sites that do not have sufficient parking on-site, nearby open space can be contracted to provide parking that satisfies the LUO requirements.[1] By comparison, 1339 North School Street and 2119 North King Street allows the greatest freedom to provide the maximum number of dwelling units. More information regarding parking requirements is provided in appendix A.4, **Table 7**.

FACTOR ASSESSMENT

Using the method provided in section 4.5 to assess the factors of building age, site potential and building type similarity, the properties can be compared for their expected level of adaptive reuse, in order to determine their adaptive reuse efficiency.

In terms of building obsolescence, the age of the building is important as an indicator of physical condition, which can have a direct impact on maintenance and renovation costs. Comparing the age of the building allows an assessment of physical obsolescence.[2] By comparison, 1610 Kalani Street and 2119 North King Street were built most recently, in 1967 and 1973 respectively.

The lot size provides a basis for comparing the building area. This allows the floor area ratio (FAR) to be calculated. Each property has an allowable FAR, which is determined by the zone where it is located. Comparing the FAR of a property to the

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[1] Office of Council Services, "Revised Ordinance of Honolulu," Chapter 21, Sec. 21-5.390.
[2] Langston, Yung, and Chan, "The Application of ARP Modelling to Adaptive Reuse Projects ," 239.

maximum allowable FAR demonstrates whether the existing building maximizes the site potential.

Table 4 shows the existing FAR and potential FAR for each property. Row F shows the percentage of allowable FAR achieved. This percentage indicates whether the property has untapped potential that would benefit from demolition and redevelopment.

All of the potential properties belong to the office property sector. Therefore, they require an equitable degree of change based on their pre-existing building type. The following diagrams show the expected level of adaptive reuse based on the factors assessed.

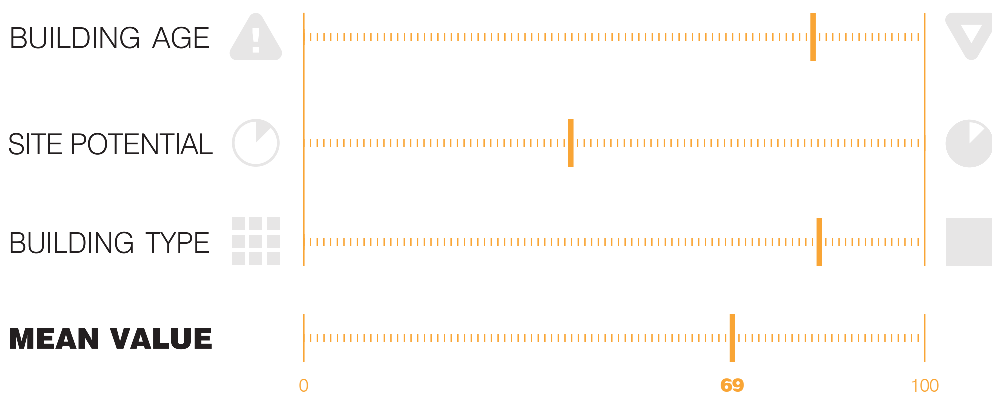

FIGURE 80 EVALUATION FOR ECONOMY OF 390 NORTH SCHOOL STREET

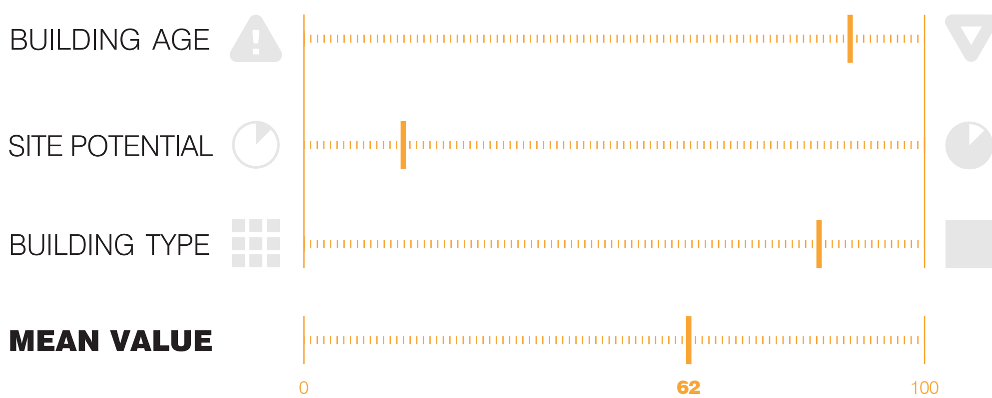

FIGURE 81 EVALUATION FOR ECONOMY OF 1339 NORTH SCHOOL STREET

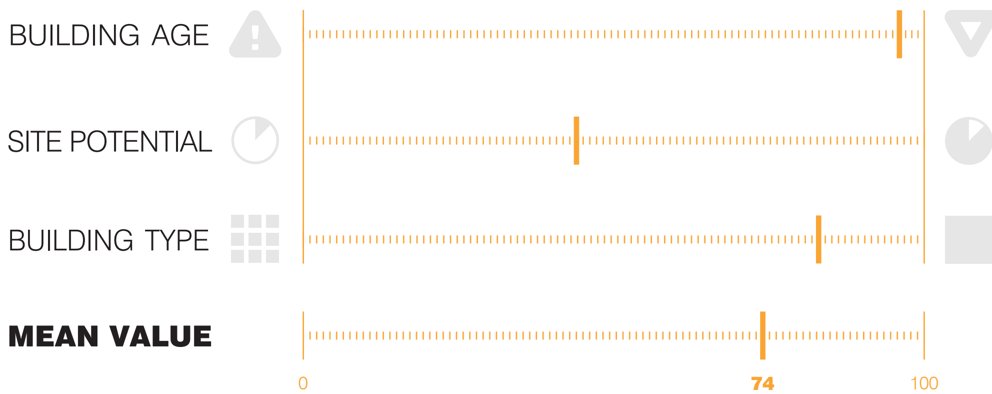

FIGURE 82 EVALUATION FOR ECONOMY OF 1610 KALANI STREET

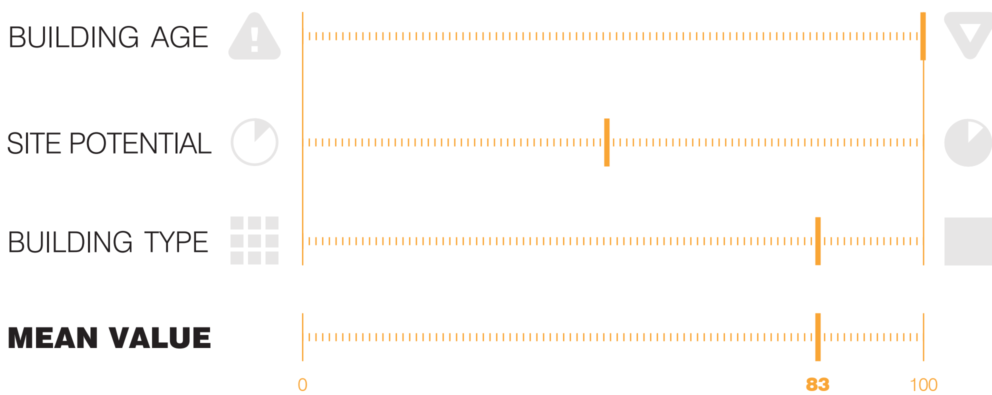

FIGURE 83 EVALUATION FOR ECONOMY OF 2119 NORTH KING STREET

The mean value is calculated for each property, based on the three factors. Although any of the buildings could be successfully reused, this step in the method shows which of the properties is potentially the most efficient. Efficiency is defined as the level of reuse. A higher mean value indicates a higher level or reuse, which in turn, means a more efficeint adaptive reuse of the pre-existing property.

Of the four properties compared in this evaluation, the property located at 2119 North King Street in Kalihi-Palama is expected to have the highest level of adaptive reuse, at 83 percent, and therefore is most efficient adaptive reuse option.

TABLE 5 TARGET PROPERTY SELECTION

				
Address	390 North School Street	1339 North School Street	1610 Kalani Street	2119 North King Street

5.6 POTENTIAL DESIGN OUTCOMES

In order to show the results of the proposed site preselection method, preliminary design diagrams are provided. The estimated 83 percent reuse of the pre-existing floor area is shown in Figure 84. Adaptive reuse of this building could include more than the estimated 83 percent. Doing so would potentially increase the project's net benefits. However, for the purpose of justifying an adaptive reuse option, net benefits is calculated using only the percentage of pre-existing floor area that is suggested by the mean value of the building factors (i.e., building age, site potential and building type similarity).

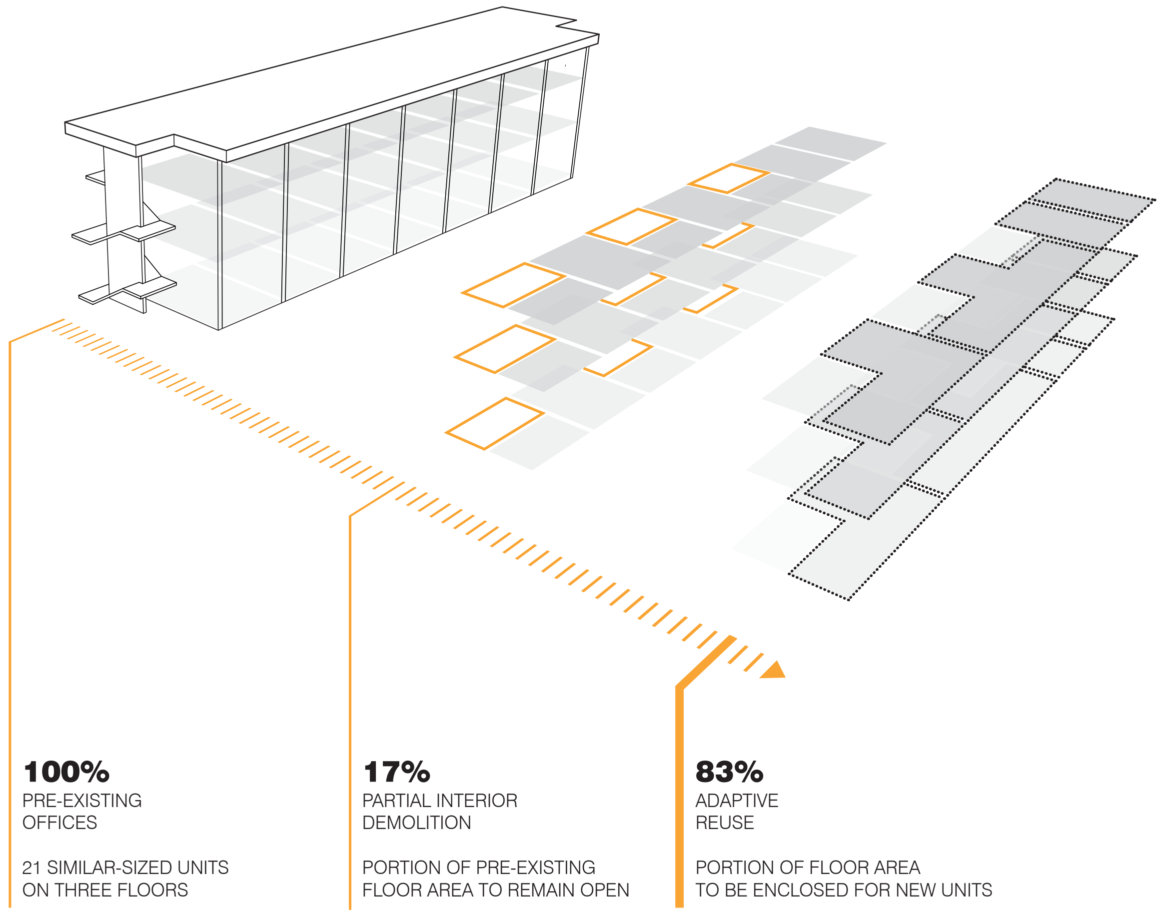

FIGURE 84 APPLIED LEVEL OF ADAPTIVE REUSE

In step two, the method prescribes a preference for building types that have a similarity between the former use and the new use. The pre-existing office building type is suitable for reuse as housing. The floor-to-floor height is appropriate and needs no modification. The structural bay is also compatible with the new use, requiring no major structural modifications. The diagram, in Figure 85, highlights the major building elements and characteristics that allow for efficient reuse. These advantages are the result of effective site preselection.

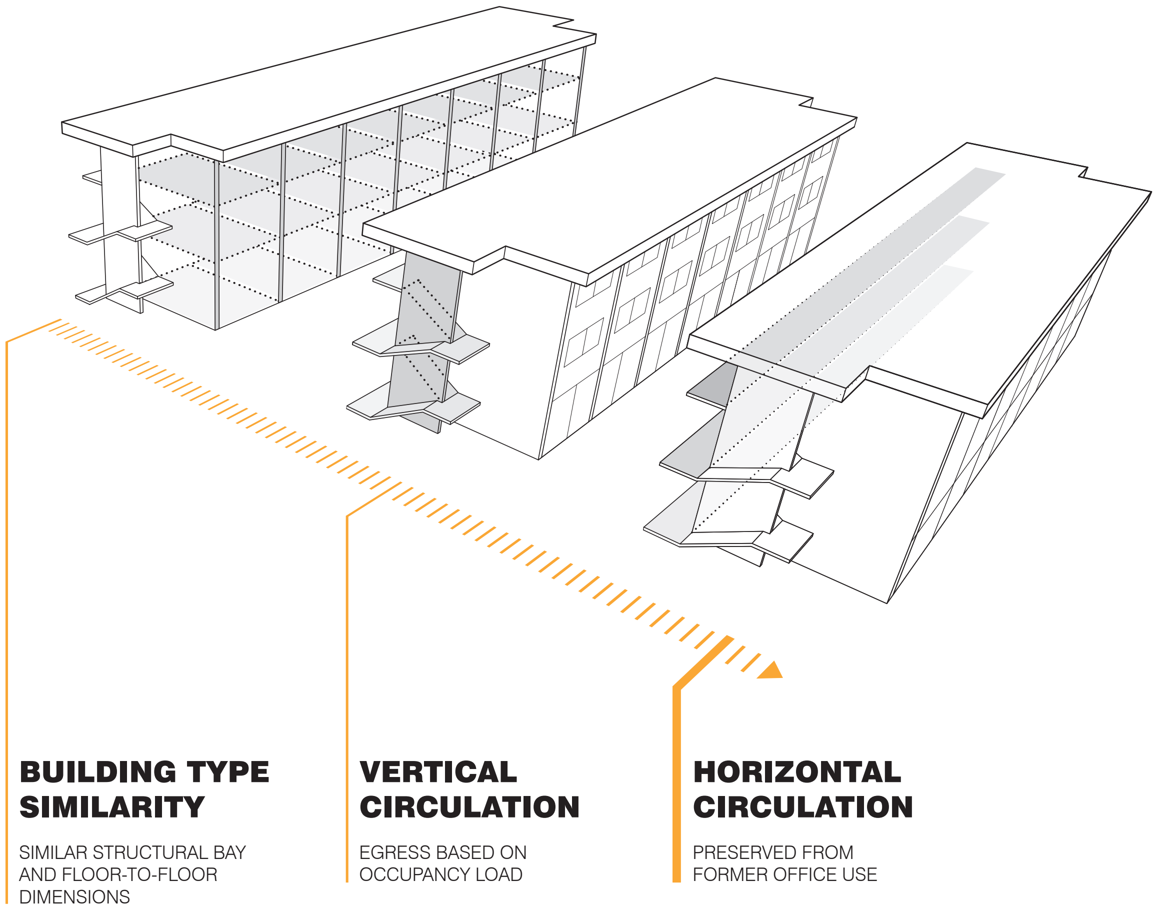

FIGURE 85 BUILDING TYPE SIMILARITY

The removal of interior partitions, in order to accommodate the new unit configuration is shown in Figure 86. Minimal additions and subtractions contribute to a cost efficient reuse of the pre-existing building. If the building were not previously used for office and instead had drastically dissimilar building type, adaptive reuse would likely require more additions and subtractions to the interior and exterior.

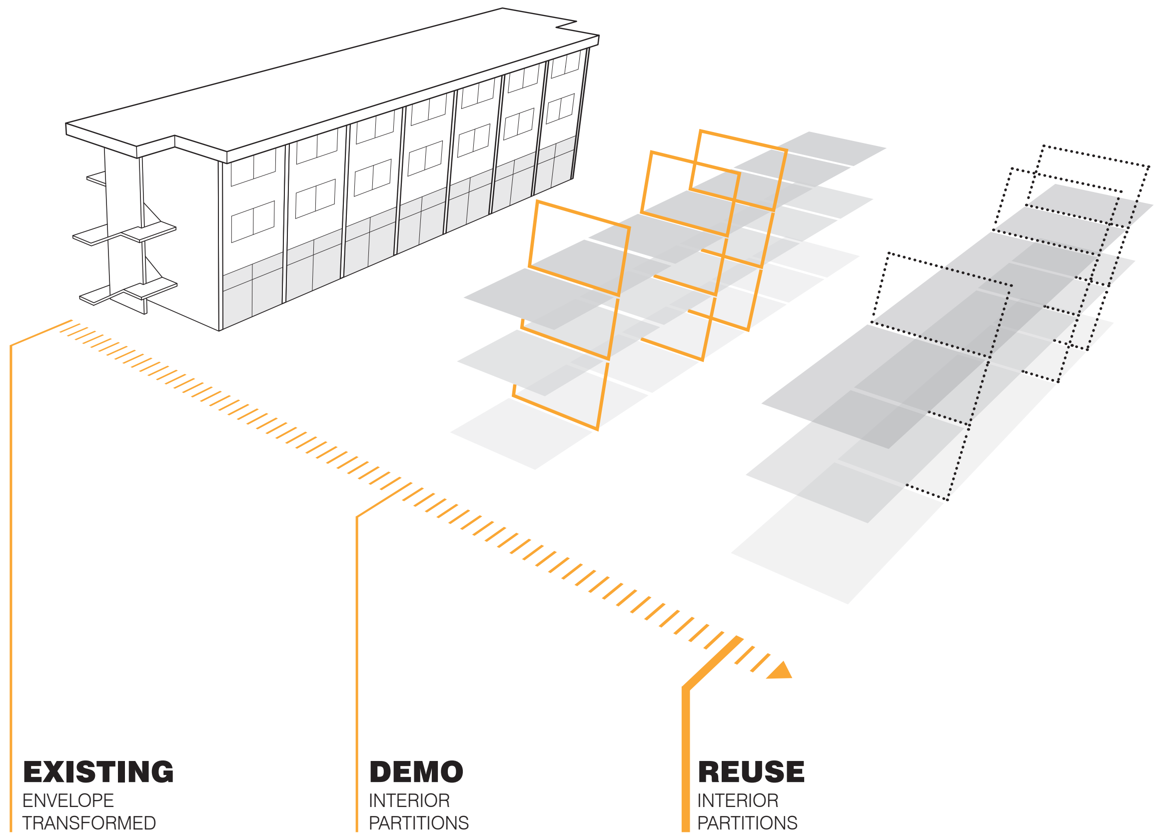

FIGURE 86 DEGREE OF CHANGE FROM PRE-EXISTING TO NEW USE

JUSTIFICATION OF SITE SELECTION

In section 2.4, a method for comparing the economy of adaptive reuse versus redevelopment is presented. Comparison between properties requires a thorough investigation of the pre-existing building, the determination of value, a proposed renovation design and a proposed redevelopment plan. In order to decide whether a property should be adaptively reused or redeveloped the net benefits of every available property within any given area must be compared. Ultimately, the option with the greatest net benefits is selected. Locating an optimal site for adaptive reuse using this process is undoubtedly exhausting and potentially time-prohibited.

The method proposed in chapter 4, to preselect a potential adaptive reuse site, is meant to circumvent the repetitive application of the net benefits equation, in order to find a property that is suitable for adaptive reuse. Rather than applying this calculation to every property in search of a potentially successful adaptive reuse project, the preselection method allows the number of candidates for adaptive reuse to be narrowed, so that the net benefits calculation is only necessary as a means to justify the preselected site.

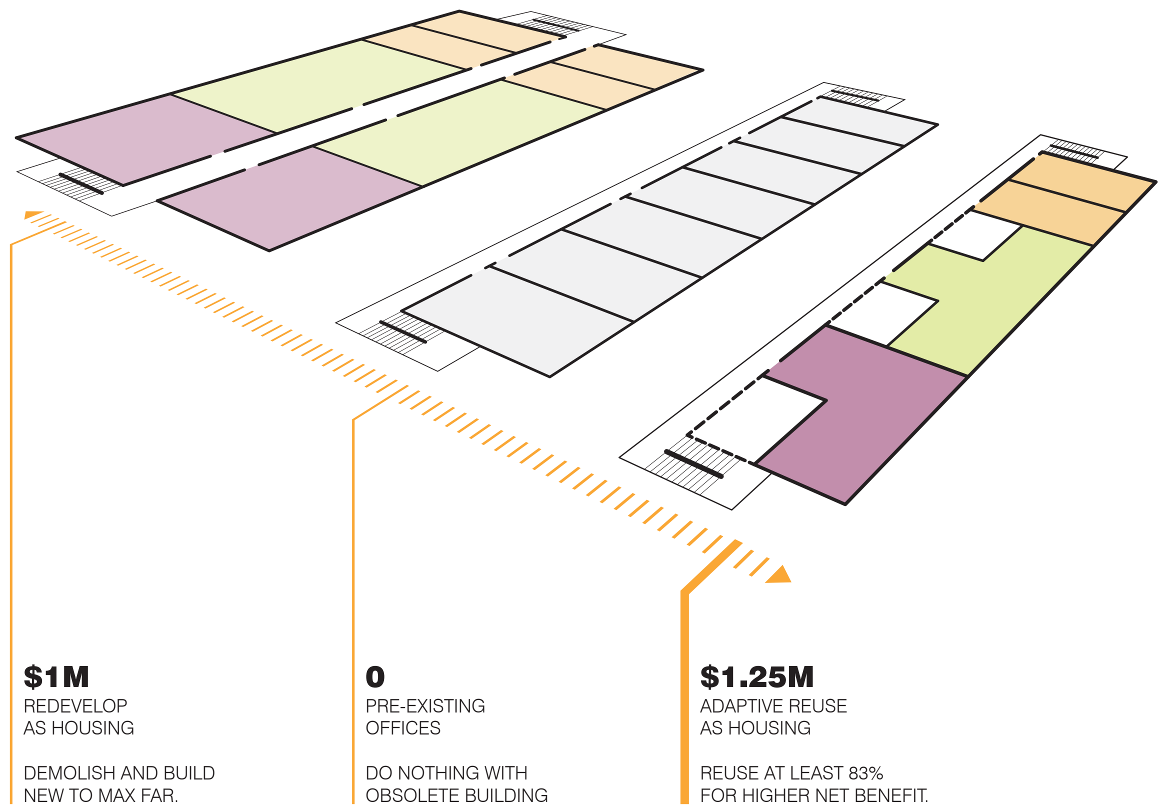

FIGURE 87 NET BENEFITS COMPARISON

Figure 87 shows a net benefit comparison of the adaptive reuse option versus the redevelopment option. The data for these calculations was derived from real estate sales comparable to an adaptive reuse project and a new construction project. Calculations are provided in appendix B. Preliminary floor plans were created in order to estimate the relevant benefits and costs. These drawings are provided for reference in appendix C.

In order to compare the adaptive reuse option to a demolition and redevelopment option, a generic design is produced for constructing a new building on the site that maximizes the allowable FAR.

Figure 88 shows the final step in the method for adaptive reuse site preselection. In the end, the process shows a preference for adaptive reuse, versus doing nothing or demolishing and redeveloping.

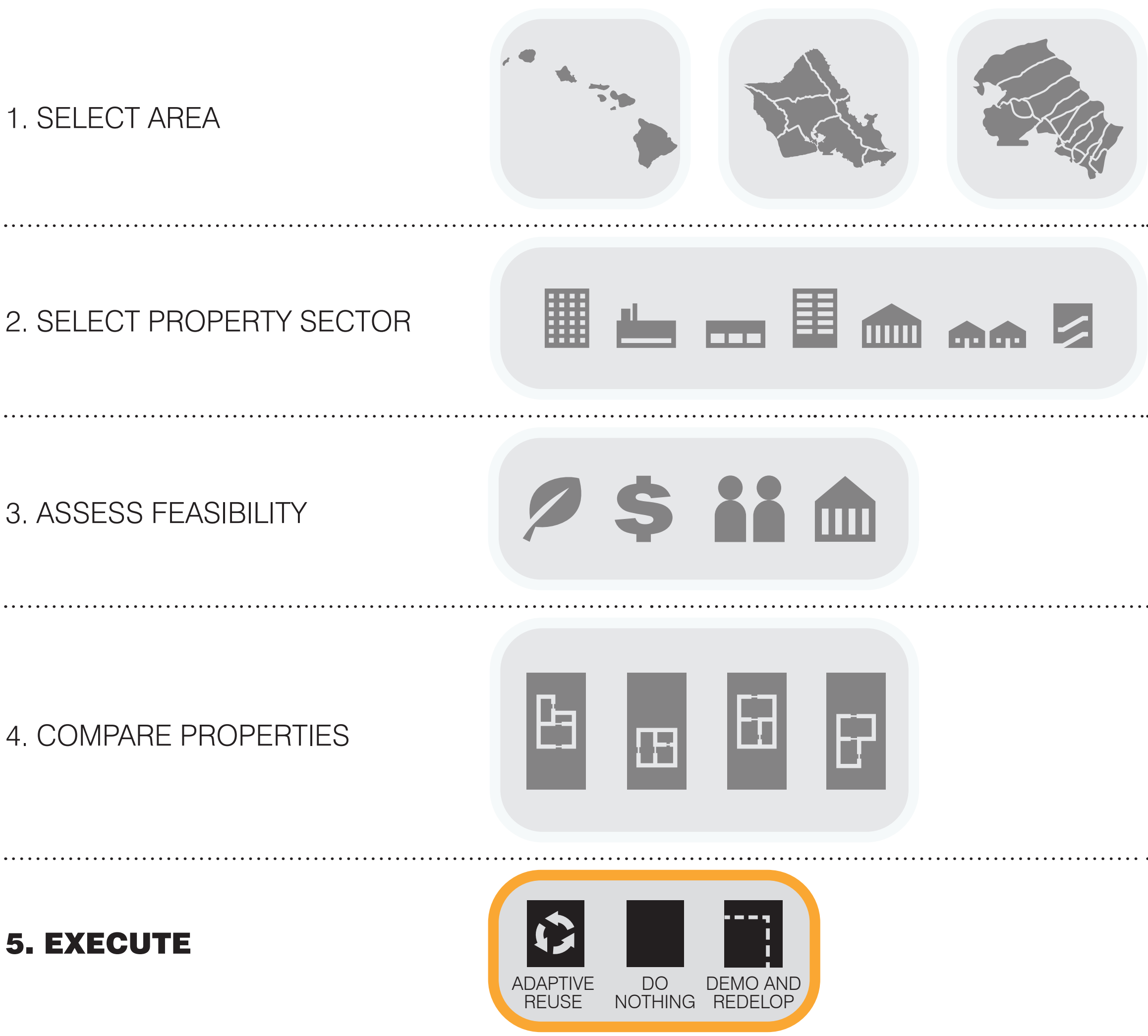

FIGURE 88 METHOD FOR ADAPTIVE REUSE STRATEGY: STEP 5

CHAPTER 6 DISCUSSION

This doctorate project creates a method for adaptive reuse site preselection. The method allows the user to locate a property with the qualities necessary for success. Current research in this area deals with decision-making tools that offer a framework for evaluating individual properties according to their adaptive reuse potential, or to compare an adaptive reuse option to demolition and redevelopment. This doctorate project offers a process of elimination and the efficiency of narrowing the pool of candidates with each step, instead of evaluating numerous properties, only to discover that many of them are not ideal candidates for adaptive reuse.

6.1 FUTURE RESEARCH

The scope of this doctorate project cannot demonstrate the application of all the possible criteria. Some areas would benefit from additional study. Figure 89 shows the focus of this research on economic criteria and housing as an end-use. Additional research is needed to develop other site pre-selection criteria. It would also be helpful to demonstrate and test this method of end-uses other than housing. Moreover, there have been many advances in building technology that could increase the efficiency of this preselection method and the adaptive reuse process.

FIGURE 89 RESEARCH FOCUS FOR METHODOLOGY

ALTERNATE END-USE

This doctorate project examined the various aspects of adaptive reuse and selected the most important directions to investigate further. For example, this doctorate project looks specifically at using the method as a strategy for increasing housing availability. The process could be adjusted to consider other various new uses in any of the property sectors. Wherever there is a property sector with demand outpacing supply, there is an opportunity to transform the existing supply to meet new needs. Take for example, a hypothetical neighborhood that has a shortage of public schools and the district has a limited budget and timeframe to meet the needs of the local children. Adaptive reuse could allow new schools to open faster and cheaper than new construction. This method could be used to preselect the appropriate site(s). Further examination of alternative end-uses would be prudent to ensure this method can be used to preselect an optimal site.

ALTERNATE FEASIBILITY DRIVERS

This doctorate project focuses on project economy as a primary feasibility driver. Under other circumstances, or when the method is employed by agencies that do not have such economically driven concerns, other feasibility drivers may be paramount. In these cases, a method for comparison that is not based on the net benefits of the project should be developed. A preliminary basis for criteria was offered for the alternate feasibility drivers. However, discrete variables for evaluating the sites would allow the candidate sites to be compared more efficiently and judiciously.

Figure 90 shows additional areas of research that would strengthen the preselection method. Including more detail for the process of preselection based on alternate drivers, for alternate end-uses, would create a more comprehensive tool for developers, governments, community leaders, etc.

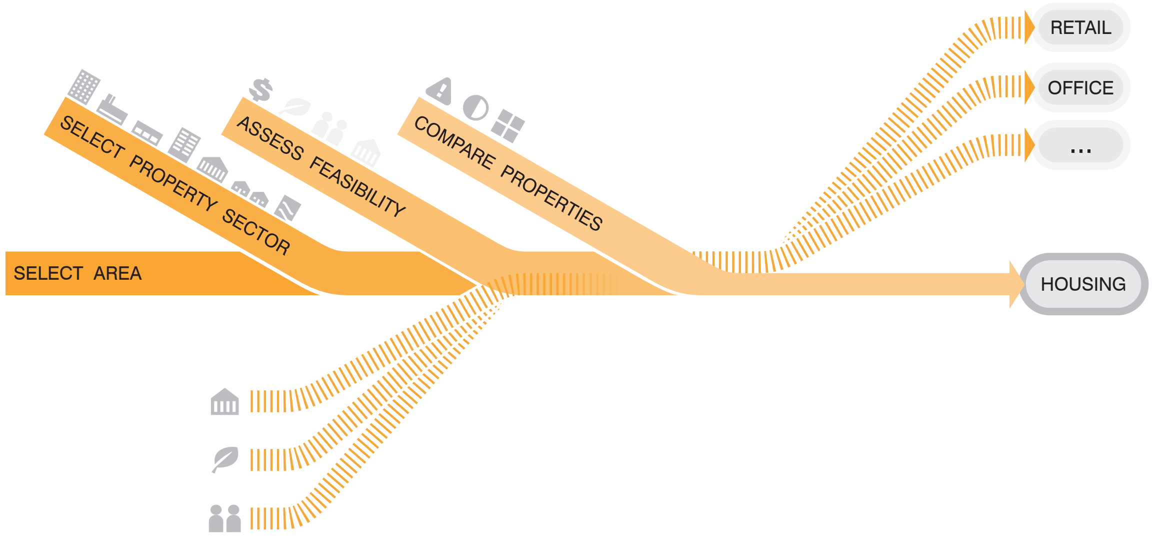

FIGURE 90 FUTURE RESEARCH FOR METHODOLOGY

BUILDING TECHNOLOGY

This doctorate project deliberately considers the future built environment. It considers the ever-growing building supply and the ever-changing building demand. The future will bring more than just building obsolescence. The future brings building technology.

BIM APPLICATION

One of the most revolutionary building tools in recent decades has been building information modeling (BIM). This tool has made many aspects of design and construction more efficient. Three-dimensional digital modeling has been widely used in the past to convey the aesthetic and function of a building, whereas BIM does this and so much more. BIM allows the designer to build a complete digital representation of the future building with detailed components that contain information about function and purpose. BIM is a prevalent tool in the field architecture and in the near future, it will likely be used for every design project. Just as the buildings featured in the precedents and case studies, the buildings that are new today will eventually become old and perhaps obsolete. The BIM files from when the buildings were constructed will be powerful tools for future renovations.

These digital models have the potential to mitigate many challenges resulting from inaccurate or inconclusive record drawings.

BIM can also be useful for providing preliminary design documents. Using BIM, alternative design schemes can be generated more quickly and efficiently, allowing for more efficient and accurate comparison between the options, so that an optimal selection can be made. BIM was used to produce the potential design outcomes presented in section 5.6 and appendix C.

INNOVATIVE AND ADAPTABLE SYSTEMS

Many innovative building systems mitigate some adaptive reuse challenges. A thorough catalogue of the available options would be helpful in creating a preliminary design for comparison. Having this information up front would allow for a more efficient design process, so that some of the challenges requiring extensive research cam be readily solved. Some of these innovations include: wireless technologies, tankless water heating, etc. A comprehensive list would also allow the advantages of certain building types to be identified, so they can be prioritized more highly in the site preselection process.

This research could be organized according to their contribution to building flexibility. Adaptable building systems may have the following characteristics: layered configuration, for ease of access and maintenance; a high level of indeterminacy, to provide for various types of uses; and interchangeability, to allow for standard upgrades over time; separable components, so that integrated systems are flexible to change.[1] These are potential categories for investigation.

6.2 DESIGN DEVELOPMENT

This doctorate project ends with preliminary design diagrams to show the potential outcome. The property selected in the demonstration is worth pursuing for its adaptive

[1] Gosling, Jonathan, Sassi, Naim, and Lark. "Adaptable Buildings: A Systems Approach.".

reuse capacity. In order for this to be successful, further site and building analysis is required to develop a design proposal that meets or exceeds the expectations of this research. Design development in itself provides many opportunities to maximize the benefits of adaptive reuse. Design development has the potential to illustrate the benefits of site preselection further. A basic adaptive reuse design was created for the last step of the method. The design justifies adaptive reuse. Drawings to illustrate the current level of design development are included in appendix C.

6.3 PUBLIC POLICY PROPOSAL

Some of the technical challenges outlined in section 2.5 included collaboration with governmental and regulatory bodies. As a feasibility driver, government agencies in the planning departments may have an interest in encouraging the adaptive reuse of obsolete buildings. The case studies from Kakaʻako show the potential success for large-scale adaptive reuse projects when planning authorities are supportive. There are several ways that some municipalities are already encouraging adaptive reuse.

The Los Angeles precedent in section 3.2 provides an example of less restrictive government. Requirements for parking can be waived or reduced. This is especially helpful if the new use has a much higher parking requirement. In some cases, the desired new use may not be allowed on the site. Planning authorities can waive some restrictions to allow a greater variety of uses in a given zone.

Local governments can increase the economic feasibility of projects, by awarding tax breaks and interest-free loans. Some of these incentives are presented in section 2.4, regarding the government as a driver of adaptive reuse feasibility. Some government subsidies are dependent on affordability clauses. Meaning, if a developer provides housing at a designated affordable rate, for a specified period of time, they will receive certain exemptions and incentives for development. In order to qualify for various incentives there are some design restrictions that must be met. An excerpt from chapter 10 of the Section 8 Handbook, is provided in the appendix, section A.1. This illustrates some of housing quality standards addressed by government agencies such as the Department of Housing and Urban Development (HUD).

APPENDIX A REGULATORY BODIES

A.1 THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

In the United States, the Department of Housing and Urban Development (HUD) is the agency that oversees the housing market and works to create an inclusionary environment for some of the nation's poorest citizens. It does this by implementing several different initiatives. These programs are outlined on the department's website, HUD.gov. The Public Housing Agency, within HUD, is directly responsible for the public housing program. This program is administered in two ways. The first method is by way of rent subsidies. By providing supplemental funds to people whose income is too low to afford housing on their own, the government helps to ensure that people do not pay more than a reasonable portion of their monthly income towards basic and decent housing. The second method used by HUD to ensure a suitable living environment is to literally open the doors of publicly owned housing for low income people to occupy. Both forms of housing are relevant to the topic of this doctorate project.

According to the HUD website, "Public housing comes in all sizes and types, from scattered single family houses to high rise apartments for elderly families. There are approximately 1.2 million households living in public housing units."[1] The scale alone of this disaggregated community makes it an important issue. The website also notes that there is no lifetime limit to living in public housing. This, by no means, implies that individuals and families typically live in public housing indefinitely. That being stated, it seems reasonable to suggest that the government agency puts forth an effort to provide an environment that helps residents to improve on their situation in a way that allows them to eventually move on to more autonomous and fulfilling types of housing, including eventual home ownership. The housing quality standards for the Section 8 program provide one

[1] The Department of Housing and Urban Development, "Public Housing Programs."

example of how HUD ensures a decent living environment. The following thirteen criteria are inspected annually by Public Housing Authorities:

- Sanitary facilities;
- Food preparation and refuse disposal;
- Space and security;
- Thermal environment;
- Illumination and electricity;
- Structure and materials;
- Interior air quality;
- Water supply;
- Lead-based paint;
- Access;
- Site and neighborhood;
- Sanitary condition; and
- Smoke Detectors.[1]

A.2 INTERNATIONAL BUILDING CODE (IBC)

The Revised Ordinance of Honolulu 1990 outlines current regulations for the city and county of Honolulu. Included in this ordinance are chapters that deal specifically with manners related to housing. The sixteenth chapter, titled “Building Code” adopts the 2006 International Building Code.[2]

A.3 ORDINANCE OF HONOLULU (ROH)

Two chapters deal primarily with matters of housing. Chapter 21, titled “Land Use Ordinance” (LUO), states:

Sec. 21-1.20 Purpose and intent.

[1] The Department of Housing and Ubran Development, "Housing Choice Voucher Guidebook."
[2] Office of Council Services, "Revised Ordinance of Honolulu," Chapter 16.

(a) The purpose of the LUO is to regulate land use in a manner that will encourage orderly development in accordance with adopted land use policies, including the O‘ahu general plan and development plans, and to promote and protect the public health, safety and welfare by, more particularly:

(1) Minimizing adverse effects resulting from the inappropriate location, use or design of sites and structures;

(2) Conserving the city's natural, historic and scenic resources and encouraging design which enhances the physical form of the city; and

(3) Assisting the public in identifying and understanding regulations affecting the development and use of land.[1]

There are several articles included in this chapter that referred to a range of building usages. Because this doctorate project deals specifically with adaptive reuse, it is important to understand how changes in usage type are affected by the LUO. Whether or not a building conforms to the restrictions of the LUO, the proposed new use must adhere to the LUO and/or submit for permit. One of the most important regulations in this chapter is outlined in article three. The Master Use Table provided in this section of the LUO provides a matrix of allowable uses in zoning districts. Each use is cross-referenced to show which zone and which permitted use is allowed. Dwelling uses listed as, multi-family are permitted uses in the following zoning districts: Apartment (low, medium and high density), Apartment Mixed-Use (low, medium and high density), Resort and Business Mixed-Use (community and central).

Chapter 27, titled “Housing Code,” states:

Sec. 27-1.1 Findings--Intent.

(a) Findings. The council finds that there are buildings… used for human habitation in the City and County of Honolulu, which are unfit for such habitation due to dilapidation; disrepair; structural defects… lack of adequate ventilation, light or

[1] Office of Council Services, "Revised Ordinance of Honolulu," Chapter 21.

sanitary facilities; uncleanliness; overcrowding; inadequate ingress and egress; inadequate drainage; violation of the health and fire regulations; and violation of other laws…

(b) Declaration of Intent. In view of the foregoing findings the council declares that:

(1) The purpose of this code is to provide minimum standards to safeguard life and limb, health, property and public welfare by regulating and controlling the use and occupancy, location and maintenance of all residential buildings and structures within the city.[1]

This chapter establishes space and occupancy standards that regulate buildings considered as dwellings. Regulations include: minimum dimensions for accessible passage from each dwelling unit to a public street or alley;[2] minimum dimensions for courts and yards, which essentially describes the horizontal distance between buildings;[3] minimum dimensions for habitable space, such as ceiling height, floor area and width;[4] Light and ventilation according to room type as required;[5] and sanitation depending on occupancy type and function.[6] Article nine of this chapter also details regulations for substandard buildings with specific reference to living conditions that impose upon the public health, safety and welfare of the inhabitants. These regulations provide important guidelines for developing suitable housing

A.4 ZONING

Zoning is an important aspect for determining the viability of an adaptive reuse project because these types of projects are driven by the existing and proposed uses of buildings and vicinities. The zone of a building indicates whether there are complimentary

[1] Office of Council Services, "Revised Ordinance of Honolulu," Chapter 27, Sec. 1.1.
[2] Ibid., Chapter 27, Sec. 4.1.
[3] Ibid., Chapter 27, Sec. 4.2.
[4] Ibid., Chapter 27, Sec. 4.3.
[5] Ibid., Chapter 27, Sec. 4.4.
[6] Ibid., Chapter 27, Sec. 4.5.

uses nearby or if the area is unsuitable for the proposed use.[1] Each of the properties is located in a different zone. The allowable uses for each zone are outlined in the Master Use Table of Honolulu's LUO. The purpose of this doctorate project requires that compliance with the Dwellings and Lodgings section as seen in table 6. The existing property zones and proposed uses are highlighted. Further inspection of this chart tells us not only whether our use is permitted, but also if there are other uses that are compatible with the proposed use, which is housing.

[1] Reiner, *How to Recycle Buildings*, 10-11.

TABLE 6 DWELLINGS AND LODGINGS EXCERPT FROM THE MASTER USE TABLE

	Zoning Districts																				
Uses	P-2	AG-1	AG-2	Country	R-20, R-10	R7.5, R-5, R-3.5	A-1	A-2	A-3	AMX-1	AMX-2	AMX-3	Resort	B-1	B-2	BMX-3	BMX-4	I-1	I-2	I-3	IMX-1
Dwellings and Lodgings																					
Boarding Facilities							P	P	P	P	P	P				P	P				
Consulates					P/c	P/c	P	P	P	P	P	P	P	P	P	P	P				
Duplex Units						P	P	P	P	P	P	P	P			P					
Dwellings, owner's or caretaker's, accessory														Ac	Ac		Ac	Ac	Ac	Ac	Ac
Dwellings for cemetery caretakers	Ac		Ac																		
Dwellings, detached, one-family				P	P	P	P	P	P	P	P	P	P			P					
Dwellings, detached, two-family						P	P	P	P	P	P	P	P			P					
Dwellings, multifamily							P	P	P	P	P	P	P			P/c	P				
Farm dwelling		P/c	P/c																		
Group living facilities		C	C	C	C	C	C	C	C	C	C	C				C	Cm				
Guest houses (R-20 only)					Ac																
Hotels													P			Cm	P		Cm		Cm
Roomers/ Rooming				Ac	Ac	Ac															
Special needs housing for the elderly							C	C	C	C	C	C				C	C				
Time sharing								P/c					P								
Transient vacation units								P/c					P								
Vacation cabins	C																				

Key
- Ac = Special accessory use subject to standards in Article 5
- Cm = Conditional Use Permit-minor subject to standards in Article 5; no public hearing required
- C = Conditional Use Permit-major subject to standards in Article 5; public hearing required
- P = Permitted Use
- P/c = Permitted use subject to standards in Article 5

Source: Office of Council Services. "Revised Ordinance of Honolulu," Ch 21 article 3, table 21-3

Of the properties under investigation, the ideal zones for multifamily dwelling are Apartment Low Density (A-1) and Community Business Mixed-Use (BMX-3). These are properties at 390 North School Street and 2119 North King Street, respectively.

The LUO also regulates parking requirements depending on potential use. For example, most dwellings have requirements based on the number, size and type of units. If parking is limited, the number of dwelling units is ultimately limited. Table 7 outlines the requirements that pertain to this doctorate project.

TABLE 7 DWELLINGS AND LODGINGS EXCERPT FROM THE PARKING REQUIREMENTS

<table>
<tr><th colspan="3">Off-street Parking Requirements</th></tr>
<tr><th>Use</th><th colspan="2">Requirements</th></tr>
<tr><td colspan="3">Dwellings and Lodgings</td></tr>
<tr><td>Boarding Facilities</td><td colspan="2">2 plus 0.75 per unit</td></tr>
<tr><td>Consulates</td><td colspan="2">1 per dwelling or lodging unit, plus 1 per 400 square feet of office floor area, but not less than 5</td></tr>
<tr><td>Dwellings, detached, duplex and farm</td><td colspan="2">2 per unit plus 1 per 1,000 square feet over 2,500 square feet (excluding carport or garage)</td></tr>
<tr><td rowspan="5">Dwellings, multifamily</td><td>Floor Area of Dwelling or Lodging Unit</td><td>Required Parking per Unit</td></tr>
<tr><td>600 Sq Ft or less</td><td>1</td></tr>
<tr><td>More than 600 but less than 800 Sq Ft</td><td>1.5</td></tr>
<tr><td>800 Sq Ft and over</td><td>2</td></tr>
<tr><td colspan="2">Plus 1 guest parking stall per 10 units for all projects</td></tr>
<tr><td>Hotels: dwelling units</td><td colspan="2">1 per unit</td></tr>
<tr><td>Hotels: lodging units; and lodging units</td><td colspan="2">0.75 per unit</td></tr>
<tr><td colspan="3">Source: Office of Council Services. "Revised Ordinance of Honolulu." Ch 21 article 6, table 21-6.1</td></tr>
</table>

APPENDIX B CALCULATIONS

TABLE 8 CALCULATION TO DETERMINE LEVEL OF ADAPTIVE REUSE

Project Name	Building Age		Site Potential		Building Type		Mean Value	Reused Area
	Year Built		Pre-existing FAR †		Pre-existing Type ‡		$\frac{x+y+z)}{3}$	$100\left(\frac{a}{b}\right)$ §
	Mean Age *	x **	Max FAR ††	y †††	New Type ‡	z ‡‡		

* mean age of pre-existing building at beginning of adaptive reuse $= x_{age}$

** $x = 100 - 2(x_{age} - 50)$

FAR = floor area ÷ lot area

† pre-existing FAR $= y_{exist}$

†† maximum FAR $= y_{max}$

††† $y = 100(y_{exist} \div y_{max})$

‡ see Figure 54 on page 98

change required = (value of the new type) – (value of pre-existing type)

change required $= z_{req}$, maximum change $= z_{max}$

‡‡ $z = 100[z_{max} - (z_{req} \div z_{max})]$

§ a = pre-existing floor area to be adaptively reused, b = pre-existing floor area total

TABLE 9 CALCULATION OF ADAPTIVE REUSE FOR THE ROYAL BREWERY

Royal Brewery	Building Age		Site Potential		Building Type		Mean Value	Reused Area
	1899		2.8		0		38	33
	115	-30	2.5	112	4	33		

TABLE 10 CALCULATION OF ADAPTIVE REUSE FOR THE NEWS BUILDING

News Building	Building Age		Site Potential		Building Type		Mean Value	Reused Area
	1930-1963		0.7		0		37	40
	67.5	65	2.5	28	5	17		

TABLE 11 CALCULATION OF ADAPTIVE REUSE FOR SALT

	Building Age		Site Potential		Building Type		Mean Value	Reused Area
Salt	1948-1960		1.3		0		66	64
	60	80	2.5	52	2	67		

TABLE 12 CALCULATION OF ADAPTIVE REUSE FOR SIX EIGHTY ALA MOANA

	Building Age		Site Potential		Building Type		Mean Value	Reused Area
Six Eighty Ala Moana	1960		1.1		4		89	100
	51	98	1.4	80	5	88*		

*Floors 2 thru 4 renovated for new use. Ground floor renovated for pre-existing use.

TABLE 13 CALCULATION OF ADAPTIVE REUSE FOR 390 N SHCOOL ST

	Building Age		Site Potential		Building Type		Mean Value
390 N School St	1956		.3		4		69
	59	82	.7	43	5	83	

TABLE 14 CALCULATION OF ADAPTIVE REUSE FOR 1339 N SCHOOL ST

	Building Age		Site Potential		Building Type		Mean Value
1339 N School St	1959		.4		4		62
	56	88	2.5	16	5	83	

TABLE 15 CALCULATION OF ADAPTIVE REUSE FOR 1610 KALANI ST

	Building Age		Site Potential		Building Type		Mean Value
1610 Kalani St	1967		1.1		4		74
	48	96	1.5	44	5	83	

TABLE 16 CALCULATION OF ADAPTIVE REUSE FOR 2119 N KING ST

	Building Age		Site Potential		Building Type		Mean Value
2119 N King St	1973		1.23		4		83
	42	116	2.5	49	5	83	

TABLE 17 NET BENEFITS COMPARISON FOR 2119 N KING ST

	Adaptive Reuse: Housing		Redevelopment: Housing	
FAR	Benefit ($)	Cost ($)	Benefit ($)	Cost ($)
36% (A1)	2.29 M *	1.04 M **	—	—
	1.25 M ***		—	
100% (A2)	—	—	3.97 M †	2.97 M ††
	—		1.00 M ***	

* B_t = relevant benefits (i.e., property value based on comparable sales, which is assigned a dollar value) associated with alternative A1 in a period *t*

B_t = (average sale price per unit) x (units)

B_t = (190,454) x (12)

** $\overline{C}$ = relevant costs (i.e., cost of renovation, which is assigned a dollar value) associated with alternative A1, in a period *t*

$\overline{C}$ = (cost to renovate per square foot) x (floor area)

$\overline{C}$ = (111) x (9,363)

*** $PV\ NB_{A1:A2} = \sum_{t=0}^{N} \frac{(B_t - \overline{C}_t)}{(1+d)^t}$

$PV\ NB_{A1:A2}$ = net benefits (i.e., relevant benefits net of relevant costs), in present value dollars, attributed to a given alternative, A1:A2

† B_t = relevant benefits (i.e., property value based on comparable sales, which is assigned a dollar value) associated with alternative A2 in a period *t*

B_t = (average sale price per unit) x (units)

B_t = (165,542) x (24)

†† $\overline{C}$ = relevant costs (i.e., cost of demolition and new construction, which is assigned a dollar value) associated with alternative A1, in a period *t*

$\overline{C}$ = (cost to build new per square foot) x (floor area) + (cost to demolish pre-existing)

$\overline{C}$ = (155) x (19,100) + (8,207)

Cost per square foot, source: Shipley, Robert, Steve Utz, and Michael Parsons. "Does Adaptive Reuse Pay? A Study of the Business of Building Renovation in Ontario, Canada." *International Journal of Heritage Studies* 12, no. 6 (November 2006): 505-520.

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APPENDIX C PRELIMINARY DESIGN DRAWINGS

FIGURE 91 PRELIMINARY DESIGN FLOOR PLANS

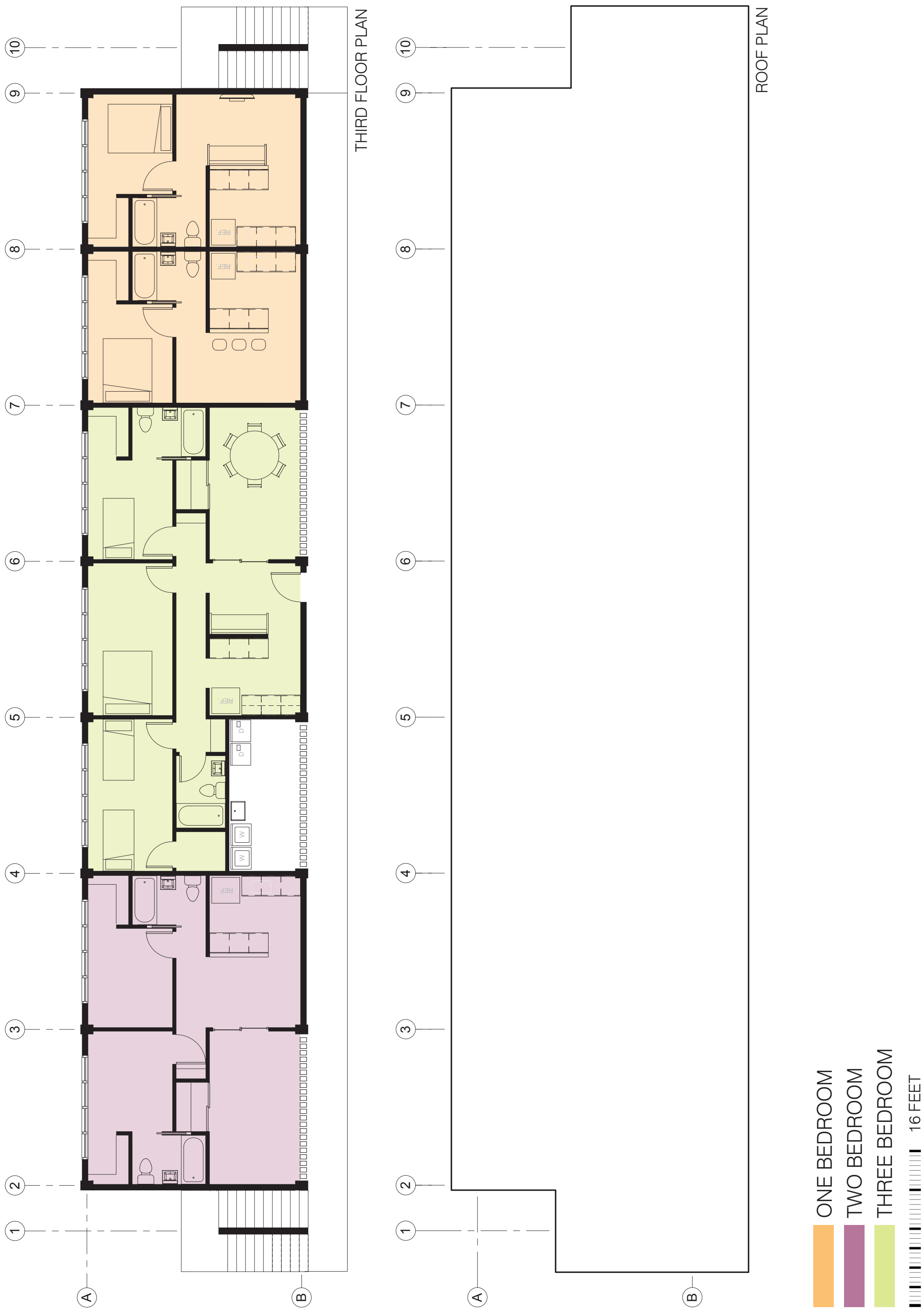

FIGURE 92 PRELIMINARY DESIGN FLOOR PLANS

APPENDIX D PROPERTY SALES COMPARABLES

ReisReports

Clearly Objective.

Sales Comparables

Metro: Honolulu

Section 1 - Subject Property

Subject Property Location

Address	2119 N King
City	Honolulu
State	HI
Zip	96819
Metro	Honolulu
Submarket	N/A
Latitude	21.33346
Longitude	-157.87936

Subject Property Statistics

Property Type	Apartment
Year Built	1973
Size (units)	9,363

Subject Property Amenities

Unit	None Reported
Community	None Reported

Section 9 - Summary Statistics

	Low	Average	High
Number of Units	10	14	20
Number of Floors	3	3	4
Year Built	1964	1967	1974
Time Since Sale (months)	26	35	44
Sale Price	$2,025,000	$2,628,270	$4,500,000
Sale Price Per Unit	$127,885	$190,454	$281,250
Effective Gross Income Multiplier	0.0x	0.0x	0.0x

Total Number of Properties 10

Section 10 - Comparable Group Locations

	Address	Distance From Subject	Submarket	Year Built	Floors	Total Units/Beds	Sale Price	Price Per Unit	Sale Date
1.	1315 N School St Honolulu, HI 96817	0.87 mi.	N/A	1964	3	13	$2,350,000	$180,769	18 Dec 2012
2.	444 Ena Rd Honolulu, HI 96815	4.35 mi.	N/A	1966	3	13	$2,250,000	$173,077	23 Dec 2011[R]
3.	2064 Young St Honolulu, HI 96826	4.19 mi.	N/A	1964	3	15	$2,800,000	$186,667	08 Jun 2011
4.	1315 N School St Honolulu, HI 96817	0.87 mi.	N/A	1964	3	13	$2,150,000	$165,385	20 Apr 2011[R]
5.	624-640 Sheridan St Honolulu, HI 96814	3.46 mi.	N/A	1969	3	16	$4,500,000	$281,250	29 Oct 2010[R]
6.	1341 Kaihee St Honolulu, HI 96822	3.37 mi.	N/A	1965	3	14	$2,025,000	$144,643	05 Dec 2008[R]
7.	1807 Waiola St Honolulu, HI 96826	4.05 mi.	N/A	1967	4	10	$2,100,000	$210,000	04 Aug 2008[R]
8.	1603 Dole St Honolulu, HI 96822	3.68 mi.	N/A	1964	4	12	$3,050,000	$254,167	20 Jun 2008[R]
9.	1463 Lusitana St Honolulu, HI 96813	2.32 mi.	N/A	1974	4	20	$2,557,700	$127,885	02 Apr 2008[R]
10.	1122 Hoolai St Honolulu, HI 96814	3.26 mi.	N/A	1970	3	12	$2,500,000	$208,333	23 Jul 2007[R]

ReisReports
Clearly Objective.

Sales Comparables

Metro: Honolulu

Section 1 - Subject Property

Subject Property Location

Address	2119 N King
City	Honolulu
State	HI
Zip	96819
Metro	Honolulu
Submarket	N/A
Latitude	21.33346
Longitude	-157.87936

Subject Property Statistics

Property Type	Apartment
Year Built	2015
Size (units)	19,100

Subject Property Amenities

Unit	None Reported
Community	None Reported

Section 9 - Summary Statistics

	Low	Average	High
Number of Units	4	17	34
Number of Floors	1	3	8
Year Built	1948	1967	1990
Time Since Sale (months)	24	30	44
Sale Price	$1,000,000	$2,748,000	$6,400,000
Sale Price Per Unit	$120,000	$165,542	$307,500
Effective Gross Income Multiplier	0.0x	0.0x	0.0x

Total Number of Properties 10

Section 10 - Comparable Group Locations

	Address	Distance From Subject	Submarket	Year Built	Floors	Total Units/Beds	Sale Price	Price Per Unit	Sale Date
1.	245 Iolani Ave Honolulu, HI 96813	2.30 mi.	N/A	1987	4	15	$2,300,000	$153,333	28 Feb 2013 [R]
2.	1719 Nuuanu Ave Honolulu, HI 96817	1.94 mi.	N/A	1948	2	34	$6,400,000	$188,235	25 Feb 2013
3.	436 Ena Rd Honolulu, HI 96815	4.35 mi.	N/A	1990	8	33	$4,500,000	$136,364	01 Feb 2013
4.	1315 N School St Honolulu, HI 96817	0.87 mi.	N/A	1964	3	13	$2,350,000	$180,769	18 Dec 2012
5.	1923 Dudoit Ln Honolulu, HI 96815	4.35 mi.	N/A	1960	4	15	$1,800,000	$120,000	04 Oct 2012 [R]
6.	415 Liliha Ct Honolulu, HI 96817	2.29 mi.	N/A	1972	2	6	$1,000,000	$166,667	02 Apr 2012 [R]
7.	444 Ena Rd Honolulu, HI 96815	4.35 mi.	N/A	1966	3	13	$2,250,000	$173,077	23 Dec 2011 [R]
8.	1558 Kalakaua Ave Honolulu, HI 96826	3.78 mi.	N/A	1956	1	4	$1,230,000	$307,500	07 Oct 2011 [R]
9.	611 University Ave Honolulu, HI 96826	4.69 mi.	Outside Delin. Submarkets	1959	3	18	$2,850,000	$158,333	14 Sep 2011 [R]
10.	2064 Young St Honolulu, HI 96826	4.19 mi.	N/A	1964	3	15	$2,800,000	$186,667	08 Jun 2011

GLOSSARY OF TERMS

adaptive reuse	A process of conversion, wherein a building or site is transformed for a use or occupancy that is different from the original design. Contrast **redevelopment**.
affordable housing	Borrowed from the Department of Housing and Urban Development (HUD) to describe the availability of housing at a cost less than or equal to 30 percent of one's income.
AMI	An abbreviation for **area median income**. The term median denotes the middle value within a range of numbers (in this case income), that ascend according to value. The range of income values are derived from all households within a designated geographic boundary.
area median income	See **AMI**.
as-built drawing	As defined by the American Institute of Architects (AIA), drawings prepared by a contractor, showing in red ink, changes to original construction documents. Contrast **measured drawing** and **record drawing**.
building obsolescence	When a building is no longer useful or needed. This research focuses on building obsolescence as it relates to a building's usage. Contrast **physical life**. See **useful life**.
building type	This describes the physical variety of building: low-rise, high-rise, single-span, etc. Contrast **property sector**.
case study	Observational research of exemplary projects using a combination of field study and secondary sources. Used to generalize a theory based on research findings. Contrast **precedent study**.

CCE An abbreviation for **cost of conserved energy**. A measure for comparing the investment in energy efficiency versus the cost of energy itself.

cost of conserved energy See **CCE**.

end-use The new purpose, or function, for which a building is transformed.

FAR An abbreviation for **floor area ratio**. A measure of density. Refers to the built space (in terms of square feet) allowed per square foot of lot area. See **zoning district**.

floor area ratio See **FAR**.

feasibility The probability of success determined by an evaluation of a potential project. Drivers include: the environment, society, government and economy.

height restriction The prescribed limit for a building's highest point. May vary at different locations on a site so that a building must be lower at the periphery of a site. See **zoning district**.

housing types Describes the variety of dwelling sizes and configurations: single-family, multi-family, one bedroom, two bedroom, etc.

infrastructure The physical systems that are essential to support the functions of a site. Amenities of public domain: roads, water supply, power supply, waste removal, etc.

Land Use Ordinance See **LUO**.

LUO An abbreviation for **Land Use Ordinance**. A chapter within the Revised Ordinance of Honolulu. Contains information regarding physical and use-based restrictions on land parcels within the City and County of Honolulu (i.e., the island of O‘ahu).

measured drawing As defined by the American Institute of Architects (AIA), drawings based on measurements of an existing building. Prepared in absence of original construction documents. Contrast **as-built drawing** and **record drawing**.

metro area See **MSA**.

MSA An abbreviation for **metropolitan statistical area**. As determined by the Office of Management and Budget (OMB), a geographic area with a core urban area of 50,000 or more population. Contains the county where the urban core is located and any additional counties with strong social and economic ties.

neighborhood Discrete district within a Honolulu **plan area**. The smallest municipal division. Each district has a duly appointed or elected board of representatives to oversee initiatives pertaining to the district.

new construction A building, assembled of unused materials, on a vacant site.

net benefits Formula to determine the benefits of a project, less the cost of investment. For this doctorate project, benefits and costs are measured in dollars ($).

obsolescence See **building obsolescence**.

physical life The span of time for which a building is considered structurally sufficient. Contrast **building obsolescence** and **useful life**.

plan area Discrete region within the **metro area**. Each region has distinct features in terms of population and environment.

precedent study Research of exemplary projects using secondary sources. Used to support an hypothesis. Contrast **case study**.

preselection A selection, or decision, that is made in advance, according to specific criteria.

property sector Borrowed from the Urban Land Institute (ULI) to categorize a building according to its usage: hotel, industrial, mixed-use, office, public space, residential, resort/second home, retail/entertainment. Contrast **building type**.

record drawing As defined by the American Institute of Architects (AIA), drawings prepared by an architect to reflect changes to a building since it was originally constructed. Contrast **as-built drawing** and **measured drawing**.

redevelopment A process of transformation, wherein new construction replaces pre-existing building(s) of a different use. Contrast **adaptive reuse**.

Smart Growth A philosophy for future growth that responds to urban sprawl. Seeks to defend the natural environment and cultivate an inclusive society.

useful life The span of time for which a building is considered functional and/or marketable. Contrast **physical life**. See **building obsolescence**.

zoning district Category of usage that applies to individual land parcels. Determines physical requirements for a site: **FAR**, **height restrictions**, etc.

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