Patterns of Placement and Design for Affordable Housing in Durham, North Carolina

by

Lisa Jill Miller

A Masters Project submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Regional Planning in the Department of City and Regional Planning.

Chapel Hill

2007

Approved by:

______________________________

ADVISOR
# TABLE OF CONTENTS

ACKNOWLEDGEMENTS 7

ABSTRACT 8

CHAPTER 1: INTRODUCTION 9

ABSTRACT FROM RENEE RAY’S FALL 2006 MASTER’S PROJECT 11

CHAPTER 2: LITERATURE REVIEW 12

NIMBY MITIGATION 12
ROLE OF DESIGN 14

CHAPTER 3: RESEARCH DESIGN AND METHODS 15

CHAPTER 4: COMMUNITY-WIDE SITING 16

PROXIMITY TO EXISTING INFRASTRUCTURE 16
DECONCENTRATION OF SUBSIDIZED HOUSING 19
REHABILITATION FOR AFFORDABLE HOUSING 20

CHAPTER 5: AFFORDABLE HOUSING ADAPTABLE DESIGN AND DESIGN 23

ADAPTABLE FOR AFFORDABILITY 23
ACCESSORY DWELLINGS 24
SMALL, EFFICIENT HOUSE PLANS 25

CHAPTER 6: PATTERN DETERMINATION 27

PATTERN DETERMINATION PROCESS 27
EXAMPLE PATTERN DETERMINATION PROCESS 28

CHAPTER 7: DURHAM’S PATTERN BOOK 31

INPUT GATHERED 31
ROLE OF THE PATTERN BOOK 33
DURHAM PATTERN BOOK CONTENTS 34

REFERENCES 35
List of Figures

Figure 1. Map showing the results from the location efficiency calculations. 18
Figure 2. Screen shot of the attribute table showing the tally of parcel suitability. 18
Figure 3. Close-up of suitable parcels and subsidized housing concentrations. 19
Figure 4. Close-up of suitable parcels and vacant land locations. 19
Figure 5. Two houses part of Habitat for Humanity’s HOPE VI rehabilitations. 22
Figure 6. The Flexabilt Home built in San Antonio, Texas built in 1952 by Frank Robertson (Friedman, 2002, p. 29). 23
Figure 7. Transformations of the basement of a dwelling (Friedman, 2005, p. 80-81). 24
Figure 8. Examples of habitable roof forms (Friedman, 2005, p. 56). 24
Figure 9. Axonometric drawings of MacDonald’s cottage prototype (1996, p.47, 49, and 69). 24
Figure 10. Ground floor plan of a lot with a one story ADU (Friedman, 2005, p. 72). 25
Figure 11. Diagram of levels of connectivity between residence and ADU (Friedman, 2005, p. 71). 25
Figure 12. Plan view diagrams of three neighborhood contexts in Santa Cruz (Santa Cruz Planning and Community Development department, 2003, p. 12). 25
Figure 13. Examples of ADU placement for context-sensitivity (Santa Cruz Planning and Community Development department, 2003, p. 17). 25
Figure 14. Prototype of detached ADU over an existing garage (Santa Cruz Planning and Community Development department, 2003, p. 24-25). 25
Figure 15. The Winslow, a 1,128 square foot, one-story Folk Victorian style home (Tightlines Small House Design). 26
Figure 16. The Four Square, a 1,167 square foot, two-story Prairie style home (Tightlines Small House Design). 26
Figure 17. The Bailey, a 1,184 square foot, one-and-a-half-story bungalow style home (Tightlines Small House Design). 26
Figure 18. 1990 Grow home floor plan (left) and model (right) (Friedman 2001, p. 45). 26
Figure 19. Bois Franc development of Grow Home model in St Laurent, Quebec (Friedman 2001, p. 166).

Figure 20. Notre-Dame-de-Grace (left) and Longueil (right) developments of Grow Home model in Montreal, Quebec (Friedman 2001, p. 66).

Figure 21. Map of context of the infill site at 610 Watts Street.

Figure 22. Aerial photograph of infill site at 610 Watts Street.

Figure 23. Plan view sketch of neighborhood characteristics adjacent to site.

Figure 24. Sketch of neighborhood street section adjacent to site.

Figure 25. Photographs of the structures directly surrounding the site at 610 Watts Street.

Figure 26. Photographs and sketches of elements on structures surrounding 610 Watts Street.

Figure 27. Schematic plan incorporating setbacks, lot definition, and massing into design.

Figure 28. Schematic elevation incorporating window proportions, porch details, and roof forms into design.

Figure 29. Photograph of existing streetscape and multi-family building at 610 Watts Street.
List of Tables

Table 1. List of data inputs for “location efficiency” mapping. 

Table 2. Table from the *Durham Comprehensive Plan* showing the allowable subsidized housing concentration areas and thresholds.

Table 3. Table of detailed observations from the pattern determination process.
ACKNOWLEDGEMENTS
There are many people whose help was necessary in the completion of this Masters project. I would like to thank the following individuals and their organizations for their input, support and guidance:

Durham Affordable Housing Coalition: Rich Lee

Durham Area Designers: Steve Gaddis and Dan Jewell

Durham City-County Planning department: Frank Duke, Keith Luck, Kathleen Snyder, Laura Woods, Sara Young

Durham Community Development department: Larry Jarvis, Shep Smith, and Susan Solakian

Durham Habitat for Humanity: Miguel Rubiera

Preservation Durham: Carrie Mowry

Raleigh Community Development department: Doug Bethune

Self - Help: Lanier Blum and LaVett Saddler

UNC Planning department: Mai Nguyen, advisor, and Renee Ray
ABSTRACT
The steady rise of housing costs at a higher rate than income inflation is creating problems of housing affordability throughout the United States (Joint Center for Housing Studies of Harvard University, 2005). The City and County of Durham, North Carolina is working to encourage entities to address this issue of affordability in several ways through the Housing Element of their recently adopted Durham Comprehensive Plan (2005). This Master’s Project was undertaken to work towards one of the strategies proposed in the plan, creating an Affordable Housing Pattern book. This pattern book will guide affordable housing developers in the integration of subsidized units into the surrounding community. This project specifically addresses community-wide affordable housing placement, site level design considerations and the process for determining neighborhood patterns.

The community-wide level of affordable housing patterns is important for several reasons. This topic addresses siting to reduce transportation costs and the corresponding increase in affordability. This project begins to identify these “location efficient” areas in Durham using a variety of variables in an Arc GIS analysis. A brief discussion follows to determine the ways in which goals of “location efficiency” and the policy of deconcentrating of subsidized housing in Durham can coexist. Finally, rehabilitation for the provision of affordable housing within existing infrastructure is explored. Since rehabilitation emphasizes development of affordable housing within existing infrastructure, it becomes more important to find ways to fit within the established existing surroundings, some of which have existed for more than a century.

Once an appropriate site for an affordable housing development is chosen, the small-scale patterns of site-level dwelling design must be considered. The first concern addressed is creating homes to adapt with households’ life stages, allowing families to remain in their communities as they change. The second, in the vein of working within existing infrastructure, is promoting accessory dwelling units as affordable housing options. The final consideration for this section is the design of small, efficient homes that are affordable, yet livable.

The pattern determination process set out in this project explains in more detail the process necessary for determining the character of existing surrounding structures of affordable housing infill development and provides the tools for assessments of this nature. This process for pattern determination is intended to be included in the Planning department’s final affordable housing pattern book. This section will work to inform affordable housing developers of how to determine existing development patterns and create compatible new construction. An example infill site pattern determination process is provided in this section as well where the neighborhood fabric is assessed according to the process established and the necessary elements to introduce into the design of new construction are determined.

The final chapter of the project discusses the process for creating Durham’s pattern book in addition to detailing the input that has been gathered thus far in this research. The first portion summarizes the advice obtained from individual interviews and a focus group discussion to inform the pattern book development. The next section discusses the role that the pattern book should take - whether regulatory, incentive-based, or voluntary. The final section sets out a table of contents for the final affordable housing pattern book product that the planning department creates.
CHAPTER 1: INTRODUCTION

The steady rise of housing costs at a higher rate than income inflation is creating problems of housing affordability throughout the United States (Joint Center for Housing Studies of Harvard University, 2005). Government, non-profit and for-profit entities are attempting to house the less fortunate in our society through a variety of subsidization programs and policies. The City and County of Durham, North Carolina is working to encourage entities to address this issue in several ways through the Housing Element of their recently adopted Durham Comprehensive Plan (2005). Some of the strategies discussed in the plan to better develop affordable housing include:

- Provide density bonus to developers who choose to include 15% affordable units (3.1.1a.)
- Research the legality of inclusionary zoning in North Carolina (3.1.1b.)
- Encourage public-private partnerships (3.1.1c.)
- Create an affordable housing pattern book (3.1.1d.)
- Create energy efficiency programs (3.1.1e.)
- Provide incentives to developers to provide 15% affordable units (3.1.3c.)
- Locate affordable housing near employment opportunities, service centers and transit corridors (3.1.3d.)
- Promote deconcentration of subsidized housing (3.3.1a) and
- Allow accessory dwellings on single family residential property (3.6.1b.)

This Master’s Project was undertaken to work towards one of the strategies proposed in the Durham Comprehensive Plan (2005), creating an Affordable Housing Pattern book.¹ This pattern book would guide affordable housing developers in the integration of subsidized units into the surrounding community. To guide in the creation of an affordable housing pattern book, this Master’s Project will develop the scope, focus, and content of an Affordable Housing Pattern book for Durham. The combination of this work with the efforts of Renee Ray’s Fall 2006 Master’s Project for the Department of City and Regional Planning at the University of North Carolina - Chapel Hill, will provide significant insight into pattern books and their potential use within an affordable housing framework. Ray’s project begins the work of understanding the broader history of pattern books, other communities’ experience with developing pattern books, and a brief examination of Durham’s historic development context. An abstract from her Master’s Project is included at the end of this section and the entire work can be found in the F. Stuart Chapin, Jr. Planning library at the University of North Carolina - Chapel Hill.

Contents
One of the most important reasons for working on the integration of affordable housing into the community is the ability to mitigate not-in-my-back-yard (NIMBY) attitudes with these actions. Because NIMBY attitudes often present strong barriers to affordable housing development the mitigation of this opposition is essential. The various forms of NIMBY opposition will be discussed in the literature review in Chapter Two. The last portion of this review looks specifically at the ability of design to mitigate some of these issues. Next, Chapter Three describes the research methods undertaken for this project.

¹The Durham Comprehensive Plan can be found at the following site: http://www.durhamnc.gov/departments/planning/comp_plan/dcp_03.pdf
The remaining chapters provide the results of the research from this project. Chapter Four looks at considerations for community-wide siting of affordable housing, including proximity to existing infrastructure, scattered site location strategies, and rehabilitation of abandoned and historic structures. Then, Chapter Five considers the design of individual affordable housing projects, including the way a house adapts as family circumstances change, the use of accessory dwelling units, and small, efficient housing designs. Chapter Six provides details of the process for understanding community patterns and creating complementary affordable housing design. This section includes the completion of an example of the pattern development process on an existing site. Finally, Chapter Seven discusses the process for creating the Comprehensive Plan objective of an Affordable Housing Pattern book, including a suggested table of contents for the end product based upon the work of this project. The Appendices includes visual examples of affordable housing developments of varying character. Appendix A includes examples of context-insensitive affordable housing within Durham and looks at the undesirable elements of these designs. Appendix B includes examples from Durham and elsewhere of existing context-sensitive developments. The latter examples can be drawn from in order to better understand how to create this type of compatible design in Durham’s affordable housing developments.
Abstract from Renee Ray’s Fall 2006 Master’s Project
This master’s project provides the background research for an affordable housing architectural pattern book for Durham, North Carolina. An introduction describes the current housing situation in Durham and why an affordable housing pattern book will improve the quality of the built environment. Chapter 1 is a literature review that describes how the best pattern books have played a role in creating beautiful, valuable built environments in the United States. Before the widespread availability of pattern books, most buildings were constructed by people with little or no architectural knowledge. They constructed dwellings using the tools at hand and rudimentary skills. Pattern books brought architectural design within reach of middle-class Americans, allowing them to build high-quality houses modeled on prevailing architectural trends. The rise of pattern books roughly coincided with the Industrial Revolution. Technological innovations such as balloon-frame construction and mass-produced items like the wire nail made buildings cheaper and stronger. The rising wealth of the middle class enabled growing numbers of Americans to afford their own house. Large numbers of pattern book houses were built in the century they were most popular, roughly 1830-1930.

The analysis of pattern book literature is followed in Chapter 2 by case studies of several recent pattern books that have been influential in shaping the built environment. These case studies describe the characteristics that the best new pattern books share. The results from publication of two pattern books are also included.

Chapter 3 is a history of Durham that focuses on how the city’s creation, industrial growth, and postwar decline shaped the built environment. Founded in 1850 as a railroad stop, Durham quickly became a thriving industrial city because of the popularity of its brightleaf tobacco. The town grew exponentially between 1870 and 1900, and its prosperity continued until the end of World War II. Durham’s decline occurred because of the population’s shift from the city to the suburbs, a lack of investment in the businesses in the city, and a number of urban renewal projects that destroyed many of the historic buildings in the core. In the past few years, however, a resurgence of investment downtown and the rehabilitation of several aging neighborhoods near the core have encouraged hope that Durham will soon be a thriving city again.

Chapter 4 defines the scope of the pattern book and the purpose it will serve for Durham’s residents. It details the four architectural housing styles that are most prevalent in Durham’s historic neighborhoods: vernacular mill houses, Victorians, Colonial Revivals, and Arts and Crafts. Each section gives a brief history of the origin of the style, examples of neighborhoods in Durham with houses built in that style, and photographs highlighting some of the most common details.

The paper concludes with some recommendations for Durham. The city should examine the successes and setbacks other municipalities have had with their own pattern books. Durham should strive to imitate the success that those places have had. The city currently has a number of strong, stable historic neighborhoods as well as opportunities for more growth and stability in other neighborhoods. Creating a pattern book of Durham’s houses can help revitalize the city and preserve the heritage of those historic communities.
CHAPTER 2: LITERATURE REVIEW

*With the exception of scarce financial resources, NIMBYism is the single greatest obstacle to the development of affordable housing.*

-Jaimie A. Ross²

The patterns of appropriate siting and design of affordable housing researched in this project can work towards mitigating opposition to these developments. In an attempt to understand how to effectively site affordable housing within a community, the presence of not-in-my-back-yard (NIMBY) attitudes must be addressed. The NIMBY acronym refers to opposition by residents and/or public officials towards additional or different kinds of housing in their communities (Advisory Commission on Regulatory Barriers to Affordable Housing, 1991). This type of opposition is often cited as a significant barrier to development of new affordable housing units. This chapter provides examples of NIMBY opposition and possibilities for mitigating those attitudes. The final portion of the chapter explores specifically the role of design in the mitigation of opposition.

**NIMBY mitigation**

There are many reasons stated for the desire to block affordable housing development. A widespread concern is that affordable housing development will decrease the property values of nearby single family homes. Another familiar fear is that new development and resulting increase in density will overburden infrastructure and services, including roads, sewers, schools, water supply and social services. Fears include increased noise, congestion and crime. These fears often exist whether new housing is affordable or market rate (Pendall, 1999). Another reservation is that affordable housing developments will have inferior management, leading to dilapidated property and undesirable tenants (Galster, 2003). Many residents are interested in preserving aesthetic characteristics of their communities and are therefore concerned about the lack of context considerations in affordable housing design.

One of the concerns not often expressed by those opposing new development is the desire to preserve homogeneity of one’s neighborhood. This can be an underlying reason for opponents to express more legitimate NIMBY concerns, but often results from race/ethnicity and/or class discrimination (Pendall, 1999; Advisory Commission on Regulatory Barriers to Affordable Housing, 1991).

Since new housing development, affordable or not, so frequently comes up against NIMBY opposition, it is important to acknowledge some of the tactics that have proved to help mitigate and deflate this resistance in particular projects. The first point to understand is that NIMBY attitudes are often in the form of only a few strong opponents. A study conducted by Housing Illinois in April 2003, found that two-thirds of residents actually support creating affordable housing in their neighborhood. An article by Kevin Jackson (as cited in National Low Income Housing Coalition, 2003, p. 9) on this study states that the real challenge for overcoming opposition is “to turn a passive majority into a more active force to advance affordable housing.” Opponents are almost always more vocal and active in trying to stop development than supporters are in trying to encourage affordable housing, therefore to encourage supporters to

² (as cited in National Low Income Housing Coalition, 2001, p. 5)
become more outspoken there needs to be more opportunity for community input on a given project. Offering a venue for residents to come together and express their concerns and to have their opinions and ideas considered can bring supporters out of the woodwork and convert opponents into supporters. One specific opportunity for involving the community is through a design charrette or similar participatory process. Michael Pyatok, an architect who has designed many affordable housing developments, recommends meeting with the community before making any design decisions. Pyatok (as cited in National Low Income Housing Coalition, 2001) suggests taking steps to involve residents early in the process of creating a collective vision for the design to create support for the project once people have invested their time, energy, and ideas into the final result. Affordable housing developers can use this opportunity to address residents’ fears with specific actions or elements included in the project plan.

Community education about the proposed affordable housing development is also very important. Sometimes opponents will spread destructive rumors about a development in an attempt to build opposition. In these instances, holding a community meeting is helpful because you have the chance to disseminate correct information about the project. Often resistance is because of the fear of the unknown. Providing the community with information about the potential residents of the development (maybe even introduce them to an individual) and showing the residents examples of successful affordable housing elsewhere can reduce resistance by creating a known entity. Communicating openly with the community to try to build trust is essential because opposition will be more fierce if there is a lack of transparency (National Low Income Housing Coalition, 2003).

One issue that has been researched heavily in an attempt to assuage resident concerns is the effect of affordable housing on surrounding property values. Unfortunately, even with the extensive amount of research on this topic in the last several decades, the effect of affordable housing on property values is still unclear. In an examination of both primary studies and secondary reviews of the various studies, the results vary. Schaffer and Saraf (as cited in National Low Income Housing Coalition, 2003, p. 21) find that a review of the major studies on property values since 1995 “overwhelmingly conclude[s] that well-managed, well-designed affordable housing developments do not negatively impact nearby property values.” However, Galster et al’s (2003) findings from studies conducted through the 1980s conclude that “there was no sizeable or statistically significant impact” (p. 78) or, in some instances, a positive impact. The author goes on to cite four specific studies published in the 1990s concluding “that with certain circumstances and certain kinds of developments, subsidized housing…can create severe effects on nearby property values” (p. 79). A recent review article by Nguyen (2005) finds that property values can be detrimentally affected by affordable housing in certain circumstances. This review suggests that the effect of affordable housing on property values can be mitigated when:

1) affordable housing is sited in healthy and vibrant neighborhoods,
2) the structure of the affordable housing does not change the quality or character of the neighborhood,
3) the management of affordable housing is responsive to problems and concerns, and

---

Although the magnitude of the effect of affordable housing on property values is unclear, all of the review studies suggest that the quality of design can mitigate the effect on property values.

**Role of Design**

Design has a special role in affordable housing development and the mitigation of related NIMBY issues. An appropriate, context sensitive design does not magically remove all opposition to a given project, but can go a long way to build support. As mentioned above, one of the ways to avoid negatively impacting property values is through matching the quality and character of the neighborhood you are building in. In addition, the poor reputation of public housing aesthetics can often be a source of NIMBY opposition from surrounding residents (National Low Income Housing Coalition, 2001). Pyatok (as cited in National Low Income Housing Coalition, 2001, p. 6) discusses the importance of well-designed affordable housing for the long-term good of the housing:

> The more that people are proud of where they live – and they can see the difference between just barracks and a really handsome place – the greater the likelihood that they are going to work harder at taking care of it, and the greater the likelihood that neighborhoods will accept it into their back yards.

Although affordable housing is typically denser than other developments, many architects are trying to find creative ways for affordable housing to fit within an existing neighborhood. They are carefully studying the character of the surroundings in order to find ways to incorporate similar aesthetic elements into the affordable dwellings. In some cases, this means creating what looks like a large house as several apartment or condo units. In other cases this means matching the existing character along the street front, but then creating the density in the interior of the site. One more important caveat from Pyatok (as cited in National Low Income Housing Coalition, 2001, p. 7) is that “we do what we can to fit into the context, but we’ll do that only if the context has its merits.”

The opportunity for municipalities and non-profits to hire an architect to design each affordable housing development is, in most cases, financially impractical. However, there is no reason for these entities not to study and learn from the work pioneering architects are doing in the affordable housing realm in order to apply these concepts to their own local work. Michael Pyatok of Pyatok Architects, Inc., Donald MacDonald of Donald MacDonald Architects, and David Maurer of Tightlines Small House Design are examples of such architects committed to well-design affordable housing that are potential resources for local affordable housing developers.4

---

4 Further information on the above firms and examples of their work can be accessed on the web at [www.pyatok.com](http://www.pyatok.com), [www.donaldmacdonaldarchitects.com](http://www.donaldmacdonaldarchitects.com), and [www.tightlinesdesign.com](http://www.tightlinesdesign.com).
CHAPTER 3: RESEARCH DESIGN AND METHODS

To best integrate affordable housing into existing communities it is important to look at two levels of incorporation. The first is on a large-scale or community-wide level. This concept is addressed by *Durham Comprehensive Plan* (2005) Objective 3.3. This objective recognizes the desirability of locating affordable housing near existing employment opportunities, service centers and transit corridors. Consideration of the various financial aspects involved in transportation to work or services can significantly impact the affordability of different housing locations. This aspect is discussed in depth in a publication called “The Affordability Index” and is a significant consideration for ensuring that subsidized development is in fact affordable. This project will begin the work of determining suitable sites for future affordable housing development using an ArcGIS analysis that ranks the suitability of parcels based on proximity to various uses to determine the best locations for new subsidized units. Since many areas of a municipality within proximity to these desired uses are within an already developed area, the role of rehabilitation of existing structures, as well as accessory dwelling units, are considered within this work as well.

The second aspect of affordable housing integration pertains to the design and siting of specific dwellings on a given parcel. Once appropriate areas of the community for affordable housing have been determined, then parcel based context-sensitivity acts to help integrate these units into the existing community fabric. These site level considerations include such items as prevailing setbacks and landscaping patterns, scale and massing patterns, and the architectural elements of surrounding structures. To best determine a process for site-level pattern determination, a site was chosen and analyzed based on context-sensitivity to produce an example design. Furthermore, a pattern book dedicated to *affordable* housing should consider plan view aspects of dwelling design. These aspects include the adaptability of homes, or the ability to flux with the changing needs of families or individuals through life changes, and efficient use of space, both of which act to increase affordability. The research conducted on patterns of both community and site levels in this project will inform the creation of Durham’s affordable housing pattern book.

---

5 *Durham Comprehensive Plan* Objective 3.3 is to “Prevent concentrations of subsidized housing, and locate subsidized housing in proximity to employment opportunities, service centers and transit corridors.”
CHAPTER 4: COMMUNITY-WIDE SITING

The siting of affordable housing at a community-wide level is important for several reasons. This section looks at increasing affordability through siting to reduce transportation costs and begins to identify these “location efficient” areas in Durham. A brief discussion follows to determine the ways in which goals of “location efficiency” and deconcentration of subsidized housing can coexist. Finally, rehabilitation for the provision of affordable housing within existing infrastructure is explored. Since this section emphasizes development of some sort of affordable housing within existing infrastructure, it becomes more important to find ways to fit within the established existing surroundings, some of which have existed for more than a century.

Proximity to existing infrastructure

The Center for Transit-Oriented Development and Center for Neighborhood Technology (2006), in conjunction with The Brookings Institute, recently published a report entitled, “The Affordability Index: A New Tool for Measuring the True Affordability of a Housing Choice.” The research behind this article includes transportation costs in calculating housing affordability ([Housing costs + Transportation costs]/Income = Affordability index). The index was created and tested on the seven county area surrounding Minneapolis/St Paul and found that more than half of the households spend over $10,000 annually on transportation. Twin Cities households spend roughly 40% of their pre-tax income on housing and transportation together and nationally, transportation is the second largest household cost – averaging 19% of a household budget. This research is significant because, currently, the amount of housing subsidy per household is tied only to housing costs and income. In addition, it shows that true housing affordability depends heavily on easy access to jobs, goods and services, and public transit. This statement is echoed in other sources as well. For example, Friedman (2005) argues that “to lower household expenses and a reliance on private cars and to prevent urban sprawl, initiators of affordable housing should locate their projects within or next to populated areas, amenities, and public transit routes” (p. 39). Friedman goes on to champion infill housing for its potential to revitalize run down areas in addition to having lower land costs and existing infrastructure, which further reduces development costs.

Another term for the siting concern in question is “location efficiency” which has been the basis for the newly created Fannie Mae backed “Location Efficient Mortgages.” The Institute for Location Efficiency (2003) describes location efficient communities as, “neighborhoods where residents can walk from their homes to stores, schools, recreation, and public transportation” (p. 1). The idea is that this proximity will result in fewer miles driven and vehicle trips taken. With this increase in walkability, residents can spend less of their income on transportation costs and therefore have a greater portion of their finances to dedicate to housing costs (Institute for Location Efficiency, 2003).

Regardless of the fact that this program exists currently in only four metropolitan areas across the United States, Durham can take this factor into account in the siting of subsidized housing now to help low-income residents free a portion of their income. In fact, the Durham Comprehensive Plan (2005) calls for the identification of “appropriate locations for affordable rental housing in proximity to employment opportunities, service centers and transit corridors” (p. 3-4). This idea is also taken into account in the North Carolina Housing Finance Agency’s (NCHFA) site selection criteria of their Qualified Allocation Plan (QAP) (2006). These
standards consider the “availability, quality and proximity of services, amenities and features” in awarding financial assistance to a proposed subsidized housing development (North Carolina Housing Finance Agency, 2006, p. 9). This section of the QAP discusses the desirability of residential uses balanced with retail and amenities, as well as a “similarity of scale and aesthetics/architecture” with the surrounding built form (North Carolina Housing Finance Agency, 2006, p. 9). In addition to other well-served portions of the city and county, both the redeveloping downtown and the newly created compact neighborhood development tiers could provide opportunity for focused subsidy of housing for our neediest citizens. If incentives can be created through this process, these two areas of the city should be specifically targeted to take advantage of their “location efficiency.”

Mapping Location Efficiency in Durham County, North Carolina

This section begins the mapping and analysis work needed to attain the Durham Comprehensive Plan (2005) objective that deals with finding Future Subsidized Housing Locations near the aforementioned amenities. The first portion will detail the process of mapping “location efficiency” in Durham. The second section will analyze the maps to determine specific areas of Durham City and County that are most “location efficient.” The final section will compare this “location efficiency” map to vacant parcels, in addition to census block groups with subsidized housing concentrations over the thresholds discussed previously.

Process

In order to create a suitability map for placement of affordable housing, several steps were taken. The variables used in the development of the suitability map were compiled from the elements mentioned in the Durham Comprehensive Plan, Fannie Mae’s Location Efficient Mortgage, or NCHFA’s QAP. In addition, the variables used were restricted to any available from Durham’s GIS data. The point files and shape files listed in the table below were all given the indicated buffer areas around either the point or parcel location to create its walkable area. The Congress of New Urbanism (2001) has adopted a “walkable catchment” standard as a five- to ten-minute walk or a ¼ - ½ mile radius. The standard of ¼ mile was used as a default in creating buffers. However, the practical walking distances when carrying groceries, for instance, may diminish. Therefore, a few uses were given a 1/8 mile walkable distance. Furthermore, it was assumed that for items where daily use is not likely, police and fire stations for instance, the higher end of the above range, ½ mile, would be sufficient. For the employment center data, the process of manipulation was a little different, because the number of jobs in a location is important, not just the number of employers. Since this point data contained the number of employers per business, a density map of employment was created. The density map, in raster format, needed to be transformed into feature data for the following location scoring process, therefore, the information was re-classed to indicate employment centers with a density of 2,000 employees or more within the search radius. Shape files were created that overlay those portions of the raster and used as the employment center areas.

A very simple process was then used to score parcels based on their location within one or more of the buffer layers. Using the “select by location” tool, selections were made from the “parcels”

---

6 The Spatial Analyst toolbar in ArcGIS has a “density” function. The input in the “number of employees” field was used to create the density map; the search radius was set at approximately 6,200 square feet and the cell size was set to 50.
data if the centroid of the parcel lies within the buffer layer being used. Then, using the priority of each use given in Table 1, that number was assigned to a field for all the selected parcels in the attribute table. These steps were repeated until the parcel attribute table contained fields for each buffer layer that indicates location inside or outside each buffer layer for each parcel in the county. The same “selection by location” was then done with parcels whose centroid lies within the employment center areas defined above. Once all of the variables were computed, the scores for each of the fields for all of the parcels were summed to create a final “suitability” score field.

Results
The suitability map that resulted from the above computations can be seen in Figure 1. The suitability scores for the parcels in Durham County range from 0 to 24. The total possible points a parcel could receive is 28 if it falls within every type of buffer. Figure 1 classifies scores into the following categories: Not suitable (0); Least suitable (1-6); Mildly suitable (7-12); Very suitable (13-18); and Most suitable (19-24). The figure displays the entire county of Durham and the range of suitability based on location. A visible concentration of the “most suitable” parcels occurs near downtown Durham, and can be seen in Figure 1 just north and south of the Durham Freeway. The area on the north side of the freeway stretches from Gregson Street on the western edge to Elizabeth Street on the east and runs about ½ mile north of Main Street. For a ½ mile south of the freeway between Roxboro Street and Alston Avenue, is another concentration of suitable parcels. Another smaller cluster can be identified in the figure that occurs just north of Duke Medical Center and west of the Ninth Street district. This area stretches from the intersection of Hillsborough Avenue and West Main Street to the intersection of these streets with Broad Street on the west side of Duke University’s East Campus. A few other scattered parcels have the “most suitable” score, but the majority of these parcels lie in these three areas. The “very suitable” parcels mainly follow streets radiating out of downtown, with the exception of a few clusters in the southern part of the county.

Analysis
Obviously, the type of amenities within walking distance of the parcels within each bracket varies. Within the most suitable category, the parcels are mainly concentrated near downtown Durham. It is within this area that the amenity variables match up locationally with a significant density of employment, resulting in the highest suitability scores. For the next range of suitability, a much greater dispersal is seen. In this range it is likely that one of the top priority level items is not present, but many of the other variables are present. For example, an overlay of bus routes may explain the linear shape of this classification. Locating Research Triangle Park (RTP) on Figure 1, the area surrounding the intersection of the Durham Freeway and Interstate Hwy 40, illustrates the way the analysis method balances the variety of priorities. RTP is the largest employment center located within the county boundary; however, this area lacks many other desirable uses and amenities for affordable housing development. Therefore, this area does not attain the “most suitable” classification and mainly reaches only a “least suitable” total score. Further examination of the attribute table for a parcel can supply further information on the specific variables in close proximity to that site. Figure 2 shows a screenshot from ArcGIS, showing a portion of the attribute table where these score are listed and tallied.

It is possible that, in certain locations, the Durham Comprehensive Plan (2005) Subsidized Housing location policy (discussed in the following section) may be at odds with the location
efficient argument for placement of affordable housing. To understand the locational relationship between these items, the map in Figure 3 shows census block groups in Durham County that currently have over 20% concentration of subsidized housing. By overlaying this information on the suitability of parcels layer, it is apparent from Figure 3, that there are some areas where the concentrations overlap the suitable locations, presenting a potential conflict in policy. Another possible issue in the location efficient placement of affordable housing development is that the location of vacant land dictates where new housing can be located, with the exception of the rehabilitation or redevelopment of existing structures. Figure 4 displays vacant parcels with hatched lines overlaid on the suitability of parcels layer. As shown in Figure 4, there seem to be fewer, smaller vacant parcels near the downtown area where the highest suitability exists, from a location efficiency standpoint.

This information can begin to inform affordable housing developers and city officials alike on the interaction between “location efficiency” and dispersal goals of new subsidized housing. When the local planning or community development departments are presented with an affordable housing development proposal, a determination regarding the way in which these two policies interact at that given site. Then, with additional background information on the character of the surrounding neighborhood, the appropriate policy can be given priority consideration. This research can then be brought to elected officials in the approval process to foster understanding on this topic and potentially accelerate the process. Furthermore, if city and county staff have the opportunity to encourage new affordable development at specific sites, it is important to consider both the dispersal policy and the location efficiency policy in that determination.

Deconcentration of subsidized housing
As discussed in the preceding literature review, an important concern for mitigation of NIMBY issues is the deconcentration or scattering of subsidized housing. The Durham Comprehensive Plan (2005) addresses this concern head-on with Objective 3.3.1 (Distribution of Subsidized Housing). The policies under this objective call for specific thresholds, above which no further subsidized housing development should occur within a given census block group. These thresholds vary based upon the area of the city within which the proposed development would occur: outer city, central city, or urban core. These individual thresholds are described in Table 2 taken from the plan (p. 3-8).

A legitimate concern arises from this well-intentioned policy which relates to the cost of available land within Durham. In an attempt to find developable parcels, this policy can prevent developers from access to vacant and affordable land for the construction of subsidized units. Higher land costs are often found in portions of the city where this threshold is not yet realized which increases the cost of affordable housing construction. In addition, there may be instances in which the dispersal policy is at odds with the desire for access to employment opportunities, service centers, and transit corridors. There is an allowance in the subsidized housing location policy for individual review of project factors that may override the deconcentration goal in some cases. The following types of projects are exempt from the dispersal policy and deal with some of the aforementioned critical issues:

- Rental housing proposals with four (4) or fewer units;
- Home-ownership proposals of fewer than 100 single family detached housing units;
- Home-ownership proposals with 12 or fewer condominiums or other attached dwelling units;
- Group homes, shelters, and homes for persons with special needs that have an occupant capacity of no more than 24 individuals;
- Elderly housing with 60 or fewer dwelling units;
- Renovation, rehabilitation and/or replacement of existing dwellings. The total number of units in a replacement housing development shall not exceed the total number of units in the development prior to the replacement program. When replacement housing is being located on a different site the total number of subsidized units shall not exceed 50 units;
- Housing assistance provided directly to owner occupants or tenants, and is not reflected in rent, income or purchase price limits that are attached to the home or land, such as down payment assistance, second mortgages, mortgage tax credits, Section 8 or other rental assistance, or Temporary Assistance to Needy Families (TANF);
- Dwellings to be built in compliance with a City approved plan for a “Redevelopment Area” consistent with the provisions of the North Carolina Redevelopment Law (Article 22), a “Neighborhood Revitalization Area,” or a City-approved application for the HOPE VI program. Development proposals in these Focus Areas must be implemented in accordance with the plan approved by the City Council for these areas (See Map 3-3, Focus Areas); and
- Housing in mixed-income projects, where no more than 20 percent of the housing is subsidized. (Durham Comprehensive Plan, 2005, p. 3-8, 3-9)

These exceptions to the policy implicitly emphasize the types of subsidized housing that the city and county would like to encourage, by allowing them even in areas where overconcentrations of poverty or subsidized units exist. These include small-scale rental, renovation or rehabilitation, homeownership, mixed-income and targeted “redevelopment areas.” Note that these types of housing work well within existing infrastructure and therefore help encourage developers to simultaneously consider location efficiency in affordable housing placement. By focusing development efforts in these areas, deconcentration efforts and “location efficiency” concerns can both be emphasized without interference. Home renovation/rehabilitation, as one of the above exceptions and an important strategy for location within existing infrastructure of affordable housing will be the focus of the following section.

Rehabilitation for Affordable Housing
With a shortage of available land for development within the existing infrastructure of the city, it is important to consider the rehabilitation of existing structures for creation of affordable housing units. There are many reasons to consider rehabilitation in dealing with a stock of vacant and abandoned houses and/or historic structures. Carefully considered rehabilitation can be a very effective mode of creating affordable housing that seamlessly fits into the fabric of the surrounding neighborhood by utilizing the existing built form. Therefore, this section discusses the importance of rehabilitation of non-historic and historic structures for the provision of affordable housing.

Abandoned Houses
Vacant and abandoned homes can be problematic to a neighborhood. Community disinvestment and a corresponding drop in property values is more likely to occur when houses within are abandoned. Some research has shown that while demolition of these properties results in an average property value drop of $1300, rehabilitation of property has demonstrated stabilization
of surrounding values (Goetz et al, 1998). Abandoned houses also increase costs for the city through snow removal, garbage collection, or other maintenance requirements. Health and safety liabilities may also be of concern for the municipality. These burdens to the city often correspond with property tax delinquency, which results in further costs for the city to bear (Goetz et al, 1998).

As a remedy, rehabilitation can not only put an end to these growing municipal burdens, it can also boost the local economy through creation of jobs and increased property taxes for the city. Jobs are created because the rehabilitation of houses is more labor-intensive than materials-intensive. While new construction costs involve approximately half materials and half labor, the cost of rehabilitation includes 60-70% labor costs and the remainder is costs for materials. Because of this, rehabilitation creates more local jobs and therefore, the local economy retains each dollar longer than new construction allows (Rypkema, 1998). Furthermore, rehabilitation projects provide the option of reusing and recycling existing resources. In a period where sustainability is emphasized more and more, this aspect can be a selling point for municipalities, non-profits, and developers. While many in the green building industry claim “the greenest building is the one that isn’t built,” more people are beginning to recognize that since it is unlikely the development will be curbed in the future “the greenest building is the one that’s already built” (Roberts, 2007, p. 2). These factors are also true of historic rehabilitation. However, it can be argued that with the quality of historic materials and the amount of energy it would take to replicate these materials, it is even more essential to rehabilitate rather than build new when possible.

Historic Houses

Rehabilitation of historic resources for affordable housing provision involves slightly different concerns and goals than that of vacant or abandoned home rehabilitation. Throughout the United States there are many historic resources located in very low income areas. In fact, almost sixty percent of homes eligible for historic tax credits are located in low income areas with a concentration of poverty (Andrews, 1999). Historic district designation and rehabilitation of these homes dependably promotes reinvestment and, therefore, provides an important tool for the revitalization of such areas (Rypkema, 1998). Since only those structures located within National Historic districts are eligible for tax credits, application for the National Register should be considered for any historic neighborhood before beginning rehabilitation efforts. If granted, this designation can be a great source of additional funding to help keep housing affordable after rehabilitation. However, with reinvestment in historic districts often come rising property values. This can be a good thing for low income homeowners in the community, but must be carefully dealt with through rent restrictions or community land trusts to ensure that these households continue to be served in the long run (Mowry, 2007).

Although National Historic district designation provides the means for obtaining historic tax credits, a Local Historic district application should also be considered as a potential asset. With local district designation, comes the added protection of design review for any building modification or new construction. While this may not always be in the best interest of low income households, it does provide another manner in which to regulate compatible infill development, and not only for affordable development.
Regardless of historic district designation, flexibility is essential in attempting to marry historic preservation and affordable housing development in order to make this partnership work for both parties (Mowry, 2007). In affordable housing development the bottom line is “affordability” - keeping costs as low as possible. In preservation, the bottom line is “historic integrity” - keeping as close to the original house design as possible. These two goals may often be at odds, but employing flexibility can balance these interests and create an affordable historic asset for low income households. One of the benefits of rehabilitation are the superior materials often used in historic homes, therefore in making compromises it is important to preserve elements such as wood floors, original wood windows, and exterior character and details (Mowry, 2007). Items such as wood floors are much too expensive to install new in affordable homes, and historic windows may be more expensive to repair than replace, but the homeowner will have a product that is more durable and can be repaired again rather than replaced in the future (Rubman, 1999).

In some areas of the country, Habitat for Humanity and various historic preservation organizations have partnered to undertake historic rehabilitation for affordable housing. Habitat brings to the project their financing of a no-interest mortgage supplemented by hours of “sweat equity” on the homeowner’s part. This requires the future homeowner to take part in the construction (or rehabilitation) of their home. Because of the more skilled nature of historic rehabilitation work, homeowners can gain valuable construction skills through this process which could lead to future job possibilities. Preservation and Habitat are more likely to partner in urban areas where undeveloped land is in short supply, which is the case in Durham (Goetz et al, 1998). Habitat for Humanity in Durham has undertaken historic rehabilitation through the HOPE VI project currently under way. There are several mill houses along Franklin and Worth Streets, east of downtown Durham past the Golden Belt mill, that are now being rehabilitated (see Figure 5). According to Habitat, in many instances rehabilitation is cost prohibitive, mainly because the more skilled level of work cannot be completed with volunteer labor (Rubiera, 2006). However, programs such as HOPE VI allow greater flexibility for the organization by providing a single, significant subsidy source.
CHAPTER 5: AFFORDABLE HOUSING ADAPTABILITY AND DESIGN

Once an appropriate site for an affordable housing development is chosen, the small-scale patterns of site-level dwelling design must be considered. The first concern addressed is creating homes to adapt with households’ life stages, allowing families to remain in their communities as they change. The second, in the vein of working within existing infrastructure, is promoting accessory dwelling units as affordable housing options. The final consideration for this section is the design of small, efficient homes that are affordable, yet livable.

Adaptability for Affordability

The adaptability of a home to transform with the occupants’ life changes is an important concept for households of all income levels. However, this concept can be especially important for lower income households when purchasing a home. Since housing needs change through the lifecycle of a household, it is necessary for a home to be adaptable in order for families to remain in their home and neighborhood for longer periods of time. The benefit of this is the stabilization of social networks within a neighborhood over time and the creation of social capital. In addition, sometimes households incur a loss when selling a home, but when planning for adaptability, it is possible to reduce some of this risk by allowing a family to adjust their home to suit their needs, both spatially and financially. Furthermore, an adaptable home can allow a family to afford their home in stages as it grows and changes over time. For example, in Figure 6, illustrates adaptability in a house plan that allows a young couple to close off and rent out a portion of the dwelling, or allowing a growing family to accommodate children in changing from a one- to four-bedroom unit through changing partitions. Friedman (2002) puts forth one definition of adaptability as “providing occupants with forms and means that facilitate a fit between their space needs and the constraints of their homes either before or after occupancy” (p. 1). The rise of non-traditional households, the desire to age comfortably in one’s own home with longer life expectancies, and changing household finances are all important justifications for creating homes that can grow, shrink, or subdivide as needs dictate.

There are a few basic areas of adaptability to consider in the design of a home. These include the “manipulation of volumes, spatial arrangement, growth and division and manipulation of subcomponents” (Friedman, 2002, p. 67). The manipulation of volumes refers to the rearrangement of space allocated to a particular unit within the structure. This includes combining floors or units to allow for expansion as well as dividing large units into smaller ones. Spatial arrangement refers to the design of specific spaces within a unit that allows for change over time. One example is to create room dimensions that allow for a variety of uses as needs change. Another example is planning for wheelchair accessibility for later life stages. A final aspect of spatial arrangement is the use of flexible furnishings that can act as room divisions or create extra space or storage. Growth and division refers to the increase or decrease of spaces or volumes in the dwelling. This aspect can include small actions such as making use of under-utilized space or large steps like dividing a large home into two separate units. Consideration of this aspect must allow units to function effectively both jointly and individually. Manipulation of subcomponents refers to the building mechanics or the creation of adaptable space. This can include the placement of building systems, fixtures, and wiring within the several potential unit plans (Friedman, 2002). These elements of adaptability may require the flexibility of regulations on the part of local government to allow the types of changes discussed here.
Adaptable House Design
Several designers have taken on the task of creating homes that adapt with their inhabitants through life changes. A few of these adaptable house plans are shown and discussed in this section to exemplify the consideration of this aspect for affordable housing. The strategies taken on by these plans can include the options for inhabiting unfinished basement or attic spaces, creating modular forms that can be added to a property and integrated into the existing dwelling, the option of growing upwards in additional floors for the house, and planning for potential subdivision as family sizes shrink or income limitations necessitate.

As mentioned above, unfinished basement space can be finished as the family’s needs change. *Figure 7* shows an example of the transformation an unfinished basement can undergo over the length of occupation. However, basement constructions are more expensive than slab on grade, crawl space, or pier foundation construction types. As an alternative, attic space that is adequately designed can serve as growing space for the household (Friedman, 2005). Built unfinished at first to keep the purchase price down, attic spaces can be renovated later to add to the finished square footage and livable space in the house. Certain roof types and construction techniques lend themselves to habitation more easily and should be considered during the design phase. Some of these efficiently habitable attic spaces are shown in *Figure 8*.

One interesting design for adaptable and affordable housing is Donald MacDonald’s (1996) San Francisco cottage prototype which utilizes both interior and exterior expansion options to create “the house as an armature” (p. 44). This model, shown in *Figure 9* accommodates either horizontal or vertical extension, depending upon the context of the structure and lot sizes available. By considering a plethora of growth options for the dwelling, the unit can be designed to anticipate these changes and increase the ease with which they can be executed. For example, the additional loads involved in building vertically have been dealt with in the original model, thereby removing any need for increased structural capacity. Furthermore, using a plywood-skin wood frame structure with bolts instead of nails increases the simplicity of labor in remodeling the structure. Much consideration of materials and construction methods was made by the designers, as well as cost considerations, thus increasing the affordability of the unit.

Accessory Dwellings
Greater affordability can also be achieved by introducing accessory dwellings to a site. The affordability results from supplemental income provided to the main residents through the rent of the additional unit. Increasing the diversity of housing types, sizes, and costs within a neighborhood can also produce more affordable units. If accessory dwellings can provide affordable housing for individuals, they are an excellent example of scattered site infill development. In areas of high demand, accessory units are highly encouraged to intensify the density with a given municipality. For the City and County of Durham, this type of structure can work towards smart growth development and decreased sprawl while providing a range of housing types within existing infrastructure. The *Unified Development Ordinance* (2006) in Durham allows one accessory unit on a single family parcel. In older neighborhoods where the block structure includes alleyway access to the lot, accessory units are ideal to increase safety along these corridors and to provide ample access and parking for the additional unit.

---

7 See Section 5.4.2 of Durham’s Unified Development Ordinance.
The need for accessory units to fit with the character of the main residence may be apparent, but must not be overlooked. When the possibility of increased density confronts a neighborhood, quality design of proposed units can help to placate any opposition. Many of the same considerations of infill development apply to accessory units. Predominant heights, front and rear setbacks, roof forms, materials, spacing, and landscaping of the surrounding existing development all influence the design of an appropriate accessory dwelling unit. These units can take on many forms and can be planned with a range of connectivity between the main and accessory units, shown in Figures 10 and 11. This aspect of development should be carefully considered as it can dictate the amount of flexibility and adaptability of use of the two parts of the residence. One of the most important and potentially offensive design considerations is the location of parking. Parking for an additional unit must be designed carefully so that it does not become a dominant feature of a neighbor’s view.

The first step for many municipalities is to allow accessory units on single family residential zoned properties. For those localities in which accessory units are already allowed, much can be done to induce local residents to develop their own accessory structure. For example, the City of Santa Cruz has established an Accessory Dwelling Unit (ADU) program to encourage single family homeowners to develop ADUs that are compatible with the larger neighborhood (Santa Cruz Planning and Community Development Department, 2003). The program offers loans and grants to incentivize this type of development and has created an extensive guide for the creation of such units. Further financial incentives are available for those willing to place their units in the City’s Affordable Housing Program. This incentive amounts to partial or complete waiver of planning and building fees, depending upon the income group you agree to serve (60% or less or 50% or less of area median income). The Santa Cruz program provides homeowners with the design and development tools to make ADU building a straightforward process. First, the department determined the types of neighborhood contexts that exist in the city. Figure 12, taken from the City’s ADU manual shows the typical form of traditional, transitional, and post war neighborhoods in Santa Cruz. Then the manual details the types of lot configurations and possibilities for ADU development on each lot type. For example, Figure 13 shows potential ADU placement for lots on corners or with alley access. Finally, details of the design of different ADU dwelling types are illustrated. Figure 14 illustrates the possible design of an ADU over an existing detached garage in three architectural styles with features commonly used in Santa Cruz architecture. Each of these type sheets also provide ‘Green’ features ideas for the dwellings (Santa Cruz Planning and Community Development Department, 2003). Through these details, the ADU manual works towards educating the public on the process of determining the existing patterns in their own home and surrounding properties to inform appropriate ADU design.

Small, efficient house plans
With rising land and material costs, new affordable housing construction has become increasingly difficult in recent years. One way to increase affordability is to build smaller homes. In order to make smaller spaces livable, interior space efficiency is crucial. Over the last fifteen years, many designers have explored ways in which one can create efficient, but livable home spaces. An article in Atlantic Monthly many years ago discussed this concept of “Living Smaller.” This article attributes the desire for efficient house designs to shrinking family size and changing characteristics, house prices that are rising faster than family incomes, and the energy crisis of the 1970s (Rybczynski, 1991). Therefore, societal and economic changes necessitated a
change from a “bigger is better” attitude to turn towards a more efficient use of available or affordable space. Although this is a slow moving trend, it is important to address for affordability and sustainability reasons.

Tightlines Design, a Raleigh North Carolina based firm, specializes in delivering “curb appeal, environmental sensitivity and livability in an efficient and affordable footprint.” The designs this firm produces borrow elements from historic architectural styles to create superior indoor and outdoor spaces within a small building footprint. Many of the firm’s designs utilize architectural styles commonly found in Durham. If an infill site is chosen for affordable housing development in one of Durham’s historic neighborhoods, an assessment of prevalent surrounding architectural styles could easily correspond with one of these house plans. For example, Figure 15, shows a one-story Folk Victorian home. This architectural style can often be found within historic mill house districts in Durham, such as the West End or Old West Durham. A simple Four Square style home is shown in Figure 16, which can be seen in many historic neighborhoods in Durham, such as Trinity Park, in a Colonial Revival style. Finally, Figure 17 illustrates a one-and-a-half story bungalow style home. Many of these Arts and Crafts influences can be found in historic areas, such as Trinity Park or Old North Durham. As can be seen from the dimensioned plans in Figure 15, 16, and 17, some of these plans are suitable for especially narrow lots, and the range of designs developed by this firm could potentially fit into a number of existing neighborhood architectural styles, historic or not. If obtaining individualized architectural expertise is not an option for an infill development, a context-sensitive plan can be purchased from a firm such as Tightlines Design as an alternative.

Another example of an intentionally small house design that also addresses planning for adaptability is the Grow Home. The Grow Home was developed as a prototype through the architecture school at McGill University and was built in 1990. Designed by Avi Friedman and Witold Rybzynski, the Grow Home attempts to marry efficiency, livability and affordability through a multitude of design considerations. The designers claimed that “a smaller home does not need to mean a reduction in comfort…a large portion of the savings in area can be achieve by eliminating waste space and by rethinking conventional standards” (Friedman, 2001, p. 13). Besides allowing for adaptability in the design, a large number of options were provided to homeowner’s to individualize the unit to their specific needs and desires. Figure 18 shows the model built on McGill’s campus in 1990 and the corresponding two-level floor plan. The unit is just 14 feet wide, but was expected to serve a small family. This model was taken and built by several developers in the Montreal area in the years following its’ introduction on McGill’s campus. A great range of styles was possible in the production of the model because the designers provided so many variations one could add to the base model (Friedman, 2001). Figures 19 and 20 illustrate a few examples of the individualization of the Grow Home model. As seen in these figures, this individualization acted to reduce redundancy in the placement of numerous units together in one development.
CHAPTER 6: PATTERN DETERMINATION

This section examines more closely the process necessary for determining the character of existing surrounding structures of affordable housing infill development and provides the tools for assessments of this nature. The following process for pattern determination is intended to be included in the Planning department’s final affordable housing pattern book. This section will work to inform affordable housing developers of how to determine existing development patterns and create compatible new construction. The second section provides an example infill site pattern determination process. The neighborhood fabric is assessed according to the below process and the necessary elements to introduce into the design of new construction are determined.

Pattern Determination Process

The process for determining the characteristics of neighborhood fabric begins with field work that surveys the existing structures. Then, existing resources on housing types should be consulted. Finally, prevalent or distinctive elements should be documented and incorporated into the design of the new development. The steps below describe this process in greater detail:

1. Survey the existing built form within approximately a two square block area of the site under consideration. Take photographs and measurements of structures, sites, landscaping, and streetscapes. Also gather aerial photography and maps to determine plan view character.

2. Classify the surveyed structures into categories with the aid of housing style reference books. Guides such as Guide to American Homes by McAlester and McAlester (1984) can be used to determine historic architectural styles based on roof forms, windows, massing, and detailing. Once categories are created the various photographs of existing structures can be sorted by style.

3. Assess the stock of structures surveyed to determine neighborhood patterns. Once the architectural styles have been classified and sorted, compare and contrast the existing structures and determine whether there are any unique or prevalent styles, types, materials, or other elements. The elements to assess can include:
   - Building height, scale, and orientation
   - Spacing and building site coverage - setback or build-to lines
   - Façade proportions and window patterns
   - Size, shape and proportion of entrances and porches
   - Projections, materials, textures and color
   - Roof forms - pitches and overhangs
   - Horizontal, vertical or non-directional emphasis and
   - Landscaping, walls and fences (Rubman, 1999; UDA, 2004)

4. Create an inventory of the most visually present elements from the assessment of the surrounding structures and sites. Use this inventory to consider which elements should be included in the design of the new development. Determine whether the different housing styles have any characteristics in common. Include any special details in particular housing styles to consider repeating or reinterpreting.
5. Rank these elements by visual weight within the surrounding built environment and give those elements in structures directly adjacent to the site greater priority in the ranking. Although there are many elements in architectural styles, pay particular attention to those that attract attention from the street. Utilization of these characteristics will go a long way towards fitting into the neighborhood.

6. Introduce these highest ranked elements from the above step into the design exercises for the development, taking into account the logistics of the project, such as financial constraints, number and size of units, etc. Develop schematics to compare with photographs of the surroundings to determine the appropriateness of the design.

**Example Pattern Determination Process**

Since analyzing, interpreting, and incorporating design elements into a development is not a process that is entirely tangible or defined, this section takes the above process steps and applies them to an existing site. This site was chosen for its location within established neighborhood patterns and its location within existing infrastructure.

**610 Watts Street, Durham NC**

The site at 610 Watts Street is approximately 1/3 acre comprised of two parcels currently zoned Residential Urban - Multifamily (RU-M). This site is part of the Trinity Park neighborhood, a National Historic district, where surrounding structures are mainly single family residential and exemplify a variety of historic architectural styles. In addition, several brick multi-family structures are scattered within the neighborhood. Currently, there are 12 apartment units on this site that do not particularly fit within the existing neighborhood fabric.

In the suitability analysis undertaken in Chapter Four for location efficient placement of affordable housing, this site scored 12 points of a possible 28. The points for the site came from its close proximity to an employment center, a medical center (Duke Diet and Fitness Center), a school (Durham School of the Arts), and it is within walking distance of eleven different bus stops.

The context of the site can be seen on the map in Figure 21. This map shows the building footprints in black and other impervious surfaces in grey within the survey area. The area is just five blocks from West Main Street and is adjacent to Duke’s East Campus to the west. Downtown Durham is less than a mile to the east of the site. The patterns of placement begin to stand out with the building footprints mapped. The aerial photograph in Figure 22 shows in more detail the siting and landscaping of surrounding lots within the survey area shown in Figure 21.

While photographing the surrounding structures, measurements of the street, verge, and sidewalk widths were taken, in addition to general setbacks of structures from the sidewalk. Watts Street, Dacian Avenue and Monmouth are all two-way streets along the portions in question and allow intermittent parking along both sides. All the streets are very similar in width, but Watts Street is three to four feet wider than the other streets. Also, most of the blocks in the study area contain alleys cutting through in the east-west direction and are about one third the width of the street. While all of the structures have a significant setback from the sidewalk location, almost all
properties use landscaping, fencing or low walls to pull the presence of the house up to the sidewalk’s edge and define the boundaries of the lot. The houses along Watts Street are generally two or three stories. Mid-block structures tend to be taller than they are wide and therefore have a vertical emphasis. To contrast, corner sites are usually cubic in massing, possibly due to lot configuration and therefore do not generally have either a vertical or horizontal emphasis. Houses on Dacian and Monmouth Avenues range from one to three stories and are a mix of horizontal and vertical emphasis in massing, depending upon the architectural style utilized. Nearly all of these residential structures are raised up approximately thirty inches from the ground and have large front porches at this raised level.

The site plan and street section in Figures 23 and 24 detail the characteristics just described and their dimensions. The area shown in these figures is just south of the infill site where a three-story, brick apartment building exists across from a three-story, colonial revival house. Figure 23 shows in plan view the landscaping patterns, street widths, setbacks, and building massing. The dimensions of these characteristics are shown in Figure 24, the street section. Setbacks are predominantly 30 feet, but front porches often encroach 8 to 10 feet into this space. Most properties include landscaping in this setback area and a fence or low wall at the edge of the lot. The right of way includes a 30 foot wide street, and an 8 foot verge and 5 foot sidewalk on either side of the street. Buildings are generally three stories along Watts Street and heights range from 30 to 40 feet. Figure 24 also shows the raised level of the first floor (approximately 30 inches) that is typical in the neighborhood.

The main architectural types represented nearby this site are colonial revival and craftsman houses. Photographs of nearby homes can be seen in Figure 25 arranged by location to reflect the actual streetscape formed by these structures. The main styles identified take on many vernacular forms and variations in the surrounding built form. In addition, there are a few unique forms near the site, including one International style home and one Neo-classical style home that can be seen in Figure 25. Further observations of the surrounding context, from step 3 of the above pattern determination process, are listed in Table 3.

The study in Figure 26 is a compilation of photographs and sketches of prevalent elements from the context around the site. Based on observations of the area directly adjacent to the site, the most visually prominent elements of the site and architecture are a hipped roof with dormers, 30 foot setback from the street, encroaching front porch raised 30 inches or more from ground level, lot line definition with landscape features, and window proportions. Many of these features can be seen in the photographs or sketches in Figure 26. The one unique feature to consider incorporating into the infill design is the arched window that occurs in a few of the surrounding structures which can also be seen in the photographs in the figure.

The last step of the pattern determination process is to introduce the above site and architectural features into the design process for the new development. Figures 27 and 28, respectively, show plan and elevation views of a schematic design incorporating the elements listed above. The impact of this example site can be seen in the side-by-side comparison of the proposed design in Figures 27 and 28 with the existing multi-family buildings on the site shown in Figure 29. The most striking elements affecting the way the development fits within the neighborhood are the raised level of the porch, the landscape features defining the property lines, and the compatible
window proportions. Completing a design exercise like the one detailed above can clarify which elements of the surrounding built form are the most important to incorporate into the infill development.

Resources
CHAPTER 7: DURHAM'S PATTERN BOOK
This chapter of the project is a discussion of the process for creating Durham’s patterns book in addition to detailing the input that has been gathered thus far in this research. The first portion discusses the advice obtained from individual interviews and a focus group discussion. The next section discusses the role that the pattern book should take - whether regulatory, incentive-based, or voluntary. Following that is a table of contents for the final product that the planning department creates.

Input Gathered
Input was solicited on the logistics of the pattern book in the form of interviews in the fall of 2006 and a focus group in February of 2007. Interviews were conducted with several affordable housing stakeholders to begin to understand how these individuals and organizations could use a pattern book in their work. Later, a focus group setting allowed further exploration of the issues surrounding the development of a pattern book for affordable housing with various stakeholders. The information gathered through these discussions provides important guidance for the successful development of the Planning department’s pattern book.

The first point brought up in the focus group is the broad range of households that fall within the general area median income requirements (80% of AMI and below) to qualify for affordable housing (Gaddis et al, 2007). Therefore, it is important to consider in the development of the pattern book, to who the units are affordable. Careful consideration of income levels served in mixed-income housing is also very important to the success of the project. Furthermore, layering of subsidies is often necessary in order to meet the needs of the lowest income groups.

A second issue raised in the focus group discussion addresses the role of land availability and economics in the placement of affordable housing in Durham. The city has a short supply of vacant land which can present a problem for developers. When land is available, economics can determine where you can afford to build and still produce something affordable. The combination of these two factors does not necessarily produce affordable housing in desirable locations. It may be necessary to tie subsidies to the land through land trust models or other means in order to overcome this issue. A further economic consideration is that in dealing with rehabilitation and new construction one must understand the realistic cap on sales prices for given types and locations of housing so that unnecessary losses are not realized (Gaddis et al, 2007).

Several programs were brought up by stakeholders that currently exist in Durham that could encourage or discourage the production of affordable housing. For example, concern was raised regarding the Neighborhood Protection Overlay option recently adopted. It is possible that this overlay, although intended to protect neighborhood character, could zone-out affordable units if preventative steps are not taken (Blum, 2006). Other programs were mentioned that are intended to encourage affordable units. The suggestion was made that the pattern book should make attempts to coordinate with programs in existence already such as the density bonus or side-by-side programs. It is possible that refinement of these policies through the pattern book process could encourage more developers to take advantage of the incentives offered (Gaddis et al, 2007). Furthermore, in many instances, the Community Development department has design review authority. The pattern book could serve as a resource for those developers working to
meet design expectations for this department that could remove some of the subjective nature of design review (Jarvis, 2006).

Many suggestions were given regarding the characteristics of the housing units, including a mix of housing types and sizes, mixed-use development, green building features, and low maintenance construction and materials. A variety of housing types and sizes were encouraged to provide for a range of income levels. In addition, mixed-use development was suggested because this option encourages more scattered subsidized housing and could also help keep the downtown revitalization from excluding lower income groups. Green building technologies were discussed as an essential aspect of affordable housing, and deemed especially important where homeowners can reap the benefits of lower monthly utility bills. Some research on which green technologies would be most cost efficient in not adding too much to the upfront costs but creating significant savings in energy or maintenance costs over time could be conducted. Furthermore, if green building incentives are created in Durham, they could be coordinated with any affordable housing incentives adopted with the pattern book. Finally, the costs of home maintenance were raised as an important topic. Where possible, the production of low maintenance homes should be encouraged. However, in all developments, education of homeowners on how to maintain homes to avoid major costs of repair or replacement is essential to ensuring affordability (Gaddis et al, 2007).

Several ideas were given regarding the design of affordable units. One suggestion was made that in infill development to disguise greater density, affordable housing requires skillful design. For instance, in a neighborhood with large houses, affordable housing could create a similar built form on the exterior, but provide four dwelling units within that structure with disguised entrances (Blum, 2006). Another issue was raised, that many neighborhoods do not have existing patterns that are desirable or do not establish clear patterns. In these situations, it may be useful to reference a larger context to tie into to avoid repeating objectionable development precedents. This issue should be accounted for in the pattern book development (Gaddis et al, 2007). Another idea on the design of compatible affordable housing is to look at infill development standards in historic districts. The Raleigh Community Development department partnered with Wake County Habitat for Humanity on a project in the Oakwood historic neighborhood in Raleigh. In this example, design review is required for the historic district, and Habitat worked towards meeting these standards while remaining within their financial constraints. The process used in historic districts could inform the development of infill housing through the pattern book (Bethune, 2006).

The most significant concern from stakeholders was that whatever role that pattern book takes, it should not make affordable housing more difficult to produce (Rubiera, 2006). Affordable housing development should not be held to a higher design standard than other developments and any policy put in place needs to encourage more affordable housing production not less (Blum, 2006). Therefore, the focus group encouraged the Planning department to create an incentive-based program with the pattern book and a variety of incentive options were suggested (Gaddis et al, 2007).

The general consensus of the focus group was that the possibility of creating new incentives for affordable housing development that is accepted as context-sensitive design should be explored.
Any incentives created should be coordinated with the use of tax credits, both Low Income Housing and Historic Preservation, in order to assist with the increasingly difficult task of financially supporting subsidized housing. One incentive suggested for encouraging affordable housing development is to offer an expedited review of any subsidized units through Planning and Inspections. In addition, any flexibility on the requirements for affordable housing from Planning and Inspections could increase affordability. Furthermore, the current downtown redevelopment in Durham was discussed as a great opportunity to encourage and develop urban affordable housing. Therefore, the suggestion of creating incentives specific to downtown and the need for patterns of urban affordable housing in the pattern book were raised (Gaddis et al).

The final point of concern raised in the focus group is the need for community involvement in the process of affordable housing design and the creation of the pattern book. The surrounding community should have an opportunity to give input into affordable housing development, but some energy should be spent determining ways to encourage this input without overburdening the Planning department or affordable housing developers with a lengthy process (Gaddis et al, 2007).

**Role of the Pattern Book**

Since this is a pattern book that only addresses the design of affordable housing, it is important to consider the role of the pattern book in the development process. One caution heard numerous times and mentioned above was that affordable housing should by no means be held to a higher standard than market rate housing. Giving this pattern book a regulatory or mandatory role would unequitably require affordable housing developments to meet more stringent design guidelines than any other type of development. Since this would severely impact the already tenuous process of balancing costs and available subsidies within affordable housing construction, the pattern book should not take on this type of role. Instead, an incentivizing role for the pattern book was encouraged by the stakeholders consulted in this work. Based on the concerns and ideas raised in interviews and the focus group, the following is a list of incentives and process considerations for developers willing to subject themselves to design review for affordable housing:

- Full or partial waiver of planning and development fees
- Expedited permitting process
- Require design review in those developments utilizing affordable housing density bonus currently in place
- Expand existing density bonus program for developments where 100 percent of units are affordable where appropriate
- Reduce parking or setback requirements where appropriate
- Donate publicly owned land for affordable housing
- Encourage higher density infill development at strategic locations to be identified in coordination with staff
- Create incentive for “location efficiency” in housing placement and work with local lending institutions to create a type of Location Efficient Mortgage for Durham
- Dedicate planning staff time to aid in development of patterns
- Utilize the Durham Appearance Commission or other design review body to approve designs and/or assist with pattern development
• Determine a process for public input on the design that allows concerns to be dealt with while not impeding the development process unnecessarily

**Durham Pattern Book Contents**

Based on the input from stakeholders and the work of this Masters project, the following is a suggested table of contents for the final pattern book to be produced by the Planning department.

1. **Introduction:** This section would discuss the issue of reasons that context sensitive development of affordable housing is highly desirable.
   a. **Purpose:** This would discuss the desire to encourage developers to create affordable housing developments that fit into their surroundings through use of incentives. This desire to encourage is partnered with a desire to guide designers in the process of creating sensitive designs.
   b. **Use:** This section will describe the process that one must go through in order to receive the incentives offered by the municipality. This will include the steps to gain insight and/or approval from Durham’s Appearance Commission and available assistance from planning staff.

2. **Guide to developing patterns:** This section will be similar to Chapter Six of this project. In addition to detailing the process for creating patterns from observing the surrounding context, it may be desirable to have several examples of this process worked out in a variety of contexts. In addition to the process detailed earlier in this work, it may be appropriate to include any steps with which planning support can be provided (i.e. access to maps, aerial photographs, or reference books).

3. **Patterns:** This section would aim to look generically at residential architectural forms and elements to provide some general patterns of successful, or generally acceptable, designs that exist in Durham.

4. **Incentives:** This section would discuss the possible incentives that the municipality can offer in exchange for specific actions on the part of the designer/developer. This may offer options based on the level of affordability provided for by the project (similar to Santa Cruz’s affordable accessory dwelling unit options).

5. **Appendix:**
   a. **Resources -** This section will list both print resources and point people for assistance in the assessment of neighborhood patterns. Books like McAlester and McAlester’s (1984) *Field Guide to American Houses* would be included. This list would also attempt to locate these resources in a manner in which individuals could have access them (either through the public library, a planning library for public use, or some other avenue). The list of resource people could include local individuals with design expertise with whom individuals or organizations could consult in this process.
   b. **Images:** This section will include images of successful and unsuccessful affordable housing designs to refer to in the process of understanding what makes compatible infill development.
REFERENCES


Rubiera, Miguel. (2006, October 17). Personal communication.


Santa Cruz Planning and Community Development Department. (2003). *Accessory Dwelling Unit Manual.* Santa Cruz, California.


APPENDIX A: Context-Insensitive Examples

Above are a couple of examples of subsidized housing found in Durham. The one on the left is infill housing and the one on the right is part of a large subsidized housing development.

Above left is an infill subsidized house in a historic neighborhood. Above right shows this new construction with the historic mill housing as a backdrop. From these photos a few major items stand out that would lead one to determine that the new construction is not compatible with the surroundings. The new unit is pulled back much further from the street, the roof pitches are noticeably different, and although the windows themselves match fairly well, the pattern of window placement does not. Furthermore, the emphasis of the new house is very horizontal, while the existing development tends to be vertical or neutral in this aspect. This structure does create the essential front porch, but minimizes it from the usual length of the façade, and also keeps the cross-gabled roof form of the surroundings.
APPENDIX B: Context-Sensitive Examples

HOPE VI development, Durham North Carolina
The HOPE VI project in Durham that redeveloped the Few Gardens public housing project is a local example of context-sensitive subsidized housing new construction. This development serves a mix of income levels and provides rental and homeownership options. Several elements of the surrounding built form have been brought into the design of the various buildings in this development.

The hosiery mill and Golden Belt mill are adjacent to the site. Aspects of these historic buildings are brought into the new construction by using brick exteriors, and mimicking visually important elements such as the rounded corner of the hosiery mill and the stair towers at both mills.

Other surrounding structures include a few parapet commercial buildings and many historic mill houses. These forms can be seen in the varied façade of the townhomes on site. Although, these structures generally take on higher density than the traditional mill house, the roof pitch and form, the plethora of front porches, roof overhangs and window proportions are taken from the
mill house tradition. In addition, many single family mill houses were created or renovated in this project, adding to the cohesion with the neighborhood. The below photos show the townhomes incorporating parapet and mill house style roof forms (left), a new mill house (top right) and mill house elements incorporated into multi-family housing (bottom right).
Richmond Square, San Francisco California

Donald MacDonald Architects designed the Richmond Square mixed-use development, another example of context-sensitive development. The work of the designers to respond to the surrounding context actually helped to overcome some of the NIMBY opposition that the project faced at one stage. The drawing below shows influences from the surrounding area that were drawn into the design for the project including roof and window forms and other architectural details. Also shown below is a detailed model of the proposed development that incorporates these design details into the form.
Figure 1. Map showing the results from the location efficiency calculations.
Figure 2. Screen shot of the attribute table showing the tally of parcel suitability.

<table>
<thead>
<tr>
<th>suitability</th>
<th>schools</th>
<th>libraries</th>
<th>banks</th>
<th>post_offic</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Figure 3. Close-up of suitable parcels and subsidized housing concentrations.
Figure 4. Close-up of suitable parcels and vacant land locations.
Figure 5. Two houses part of Habitat for Humanity’s HOPE VI rehabilitations.
Figure 6. The Flexabilt Home built in San Antonio, Texas built in 1952 by Frank Robertson (Friedman, 2002, p. 29).

2. Young married owners could close off main part of house, rent it as a one- or two-bedroom unit, and live in a one- or two-room "efficiency" apartment.

3. With the arrival of children, entire house is occupied, arranged with one, two and then three bedrooms. One end of still-sizeable living room could be used for study, dining, or TV.

THEORETICAL FAMILY CYCLE
starts with 60'x 12' open living area (plan 1). Dotted black lines are tracks for partitions; arrows point to four possible locations for storage walls. Cycle can start with any of four plans shown (representative of the 72 variations possible), move in any direction.

1. When owners first move into adjustable house (plan above) they have a wide choice of room arrangement, depending on their requirements.

4. As family grows, a fourth bedroom is added. When children marry or move away, parents can reduce number of bedrooms (plan 3), finally return to a small apartment with rental unit (plan 2), completing cycle.
Figure 7. Transformations of the basement of a dwelling (Friedman, 2005, p. 80-81).

**Occupancy**

The family moved in.

**Five years after occupancy**

A closet was added on the upper floor. An opening direction of an existing closet was changed.

**One year after occupancy**

The powder room was converted into two closets. A newborn baby lived in his parent's bedroom and later the two sons shared one bedroom.

**Six years after occupancy**

The family room was converted into a bedroom; the basement was finished into a laundry room equipped with a shower and sink and a storage room.

**Two years after occupancy**

The front part of the basement was finished as a family room. A wall was added to separate the family room and the laundry area.

**Eleven years after occupancy**

The bedroom in the basement was converted into a family room.
Figure 8. Examples of habitable roof forms (Friedman, 2005, p. 56).

Basic Pitched Roof    Gambrel    Mansard

New England Saltbox    Pitched Roof Shed-Type Dormers    Double Hip
Figure 9. Axonometric drawings of MacDonald’s cottage prototype (1996, p. 47, 49, and 69).
Figure 10. Ground floor plan of a lot with a one story ADU (Friedman, 2005, p. 72).
Figure 11. Diagram of levels of connectivity between residence and ADU (Friedman, 2005, p. 71).
Figure 12. Plan view diagrams of three neighborhood contexts in Santa Cruz (Santa Cruz Planning and Community Development department, 2003, p. 12).
Figure 13. Examples of ADU placement for context-sensitivity (Santa Cruz Planning and Community Development department, 2003, p. 17).
Figure 14. Prototype of detached ADU over an existing garage (Santa Cruz Planning and Community Development department, 2003, p. 24-25).

**Prototype: Detached ADU over Existing Garage**

**Key Features:**
- Preserves and preserves existing garage and driveway.
- Private deck and yard for ADU.
- Dining and living room spaces have sliding windows that open to usually expand rooms into the outdoors.
- Provides architectural variations to match existing house or unique architectural expression.
- The plan can be rotated to accommodate utility connections or alley access.

**Site Plan**
This Prototype demonstrates how an ADU can be constructed over the top of an existing detached two-car garage located at the rear of the lot. Your existing garage may be built too close to the property line. Two-story ADUs have to be built at the minimum setback, which is 5’ in Santa Cruz. This plan offsets the ADU over the garage providing the necessary side yard setback. The ADU and owner share the same driveway and split the backyard. The ADU has a private deck and small yard at the back.

**Floor Plan**
The one bedroom plan orients the public spaces (living, dining and kitchen spaces) towards the front driveway and private spaces (bath and bedroom) towards the rear. Dining and living spaces have large operable windows that expand the visual space of these rooms to the outdoors. The plan includes tenant storage at the lower level adjacent to the deck.

**Context Issues**
The site illustrated is in an older neighborhood that has experienced higher density apartment infill. Many of the backyard spaces have already been developed with garages or apartments. The ADUs outdoor spaces and windows are oriented into the back yard of the house. This protects the privacy of neighbors and tenants.

**Potential Variations**
The plan is flexible and can be rotated and flipped to accommodate right, left or rear access to the garage. The alley access variation presents itself as though the alley is a traditional residential street with a porch and front yard. The porch can be deleted or expanded depending on the site. Architectural variations could include traditional styles or contemporary expressions. Key to either approach will be the consistency of the new ADU and the existing garage in terms of materials, windows, and proportions.

**“Green” Features**
The plan also demonstrates opportunities to include “green” features such as solar panels on the garage roof and rainwater collection and storage under the ADU deck.

**Massing**
Right: This drawing illustrates the shapes of the roof and orientation of the ADU. You can see how the garage roof steps down towards the property line and windows are facing towards the main house or interior of the lot, away from the neighbors.

Left: These sketches illustrate all four elevations of the ADU. Traditional Example, Window placement reflects the need for privacy, sun access and views.
Figure 15. The Winslow, a 1,128 square foot, one-story Folk Victorian style home (Tightlines Small House Design).
Figure 16. The Four Square, a 1,167 square foot, two-story Prairie style home (Tightlines Small House Design).
Figure 17. The Bailey, a 1,184 square foot, one-and-a-half-story bungalow style home (Tightlines Small House Design).
Figure 18. 1990 Grow home floor plan (left) and model (right) (Friedman 2001, p. 45).
Figure 19. Bois Franc development of Grow Home model in St Laurent, Quebec (Friedman 2001, p. 166).
Figure 20. Notre-Dame-de-Grace (left) and Longueil (right) developments of Grow Home model in Montreal, Quebec (Friedman 2001, p. 66).
Figure 21. Map of context of the infill site at 610 Watts Street.
Figure 22. Aerial photograph of infill site at 610 Watts Street.
Figure 23. Plan view sketch of neighborhood characteristics adjacent to site.
Figure 24. Sketch of neighborhood street section adjacent to site.
Figure 25. Photographs of the structures directly surrounding the site at 610 Watts Street.
Figure 26. Photographs and sketches of elements on structures surrounding 610 Watts Street.
Figure 27. Schematic plan incorporating setbacks, lot definition, and massing into design.
Figure 28. Schematic elevation incorporating window proportions, porch details, and roof forms into design.
Figure 29. Photograph of existing streetscape and multi-family building at 610 Watts Street.
Table 1. List of data inputs for “location efficiency” mapping.

<table>
<thead>
<tr>
<th>Type of Use</th>
<th>Type of Data</th>
<th>Buffer - walking distance</th>
<th>Importance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment centers</td>
<td>Point file</td>
<td>Not applicable</td>
<td>3</td>
</tr>
<tr>
<td>Grocery stores</td>
<td>Shape file</td>
<td>1/8 mile</td>
<td>3</td>
</tr>
<tr>
<td>Commercial centers</td>
<td>Shape file</td>
<td>1/8 mile</td>
<td>2</td>
</tr>
<tr>
<td>Basic health</td>
<td>Point file</td>
<td>1/2 mile</td>
<td>3</td>
</tr>
<tr>
<td>Day care facilities</td>
<td>Shape file</td>
<td>1/4 mile</td>
<td>3</td>
</tr>
<tr>
<td>Police Stations</td>
<td>Point file</td>
<td>1/2 mile</td>
<td>2</td>
</tr>
<tr>
<td>Fire stations</td>
<td>Point file</td>
<td>1/2 mile</td>
<td>2</td>
</tr>
<tr>
<td>DATA bus stops</td>
<td>Point file</td>
<td>1/4 mile</td>
<td>3</td>
</tr>
<tr>
<td>Public Schools</td>
<td>Point file</td>
<td>1/4 mile</td>
<td>2</td>
</tr>
<tr>
<td>Banks</td>
<td>Shape file</td>
<td>1/2 mile</td>
<td>1</td>
</tr>
<tr>
<td>Post offices</td>
<td>Shape file</td>
<td>1/4 mile</td>
<td>1</td>
</tr>
<tr>
<td>Senior centers/homes</td>
<td>Point file</td>
<td>1/2 mile</td>
<td>1</td>
</tr>
<tr>
<td>Public Libraries</td>
<td>Point file</td>
<td>1/2 mile</td>
<td>1</td>
</tr>
<tr>
<td>City Parks</td>
<td>Point file</td>
<td>1/4 mile</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 2. Table from the *Durham Comprehensive Plan* showing the allowable subsidized housing concentration areas and thresholds.

<table>
<thead>
<tr>
<th>Evaluation Area</th>
<th>Evaluation Radius</th>
<th>Maximum Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outer City</td>
<td>0.50 miles</td>
<td>25 percent</td>
</tr>
<tr>
<td>Central City</td>
<td>0.50 miles</td>
<td>20 percent</td>
</tr>
<tr>
<td>Urban Core</td>
<td>0.25 miles</td>
<td>20 percent</td>
</tr>
</tbody>
</table>
Table 3. Table of detailed observations from the pattern determination process.

<table>
<thead>
<tr>
<th>Observations on Neighborhood Patterns for 610 Watts Street</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Building height, scale, and orientation</strong></td>
</tr>
<tr>
<td>The buildings surrounding the site are predominantly two-story, some include a third story dormer, either hipped or gabled. The few multi-family residential buildings are a full three to four stories high. All of the structures are oriented to the cardinal directions within the grid of streets.</td>
</tr>
<tr>
<td><strong>2 Spacing and building site coverage</strong></td>
</tr>
<tr>
<td>Setbacks of houses from the sidewalk edge are generally about 30 feet. Sidewalks are typical 5 foot widths. A small landscaping area between the sidewalk and the street is approximately 8 feet and includes street trees where planted. Blocks to the west of the site are longer in the north-south direction, while blocks to the east of the site are east-west oriented. Both block orientations include mid-block east-west alleys, which is the main vehicular access for these residences. Garages are placed away from the public street space and pulled to the back of the property. Built areas typically comprise approximately 30% of the lot size.</td>
</tr>
<tr>
<td><strong>3 Façade proportions and window patterns</strong></td>
</tr>
<tr>
<td>Windows are for the most part similarly patterned and proportioned in terms of overall size and shape, but contain a variety of pane patterns (9 over 9, 9 over 1, 4 over 1, 6 over 1, etc.). Occasionally 6 over 6 or 6 over 1 window shapes are used in addition to the above proportions. In a few places, an arched window takes a special place on the building.</td>
</tr>
<tr>
<td><strong>4 Size, shape and proportion of entrances and porches</strong></td>
</tr>
<tr>
<td>Most of the surrounding structures include porches running the full-width of the front façade. Entrances are typically centered but occasionally are to one side of the porch or the other. In addition, entrances generally have a vertical-emphasis.</td>
</tr>
<tr>
<td><strong>5 Projections, materials, textures and color</strong></td>
</tr>
<tr>
<td>Any prevalent projections are associated with the porch. Materials seem to be either clapboard siding or brick cladding. Trim on porches and windows, on both siding types, are wood and painted white. A variety of red brick is used and colors widely range on structures with siding.</td>
</tr>
<tr>
<td><strong>6 Roof forms</strong></td>
</tr>
<tr>
<td>The roofs have wide eave overhangs which are commonly boxed. The roof shapes are a combination or hipped or gabled (side or front) often with dormers taking on shed, hip or gable forms.</td>
</tr>
<tr>
<td><strong>7 Horizontal, vertical or non-directional emphasis</strong></td>
</tr>
<tr>
<td>The structures nearest the site have a vertical emphasis. This emphasis is partially a result of narrow lots, but windows and entrance proportions also contribute. The surrounding area craftsman homes, further from the site, have a more horizontal emphasis. This results from 1 story eave lines with broad front porches and shallower roof pitches.</td>
</tr>
<tr>
<td><strong>8 Landscaping, walls and fences</strong></td>
</tr>
<tr>
<td>Some of the front yards have fences that are fairly transparent. Others have no fencing, but in these cases landscaping usually clearly defines the yard through hedges or low retaining walls surrounding vegetation. Large old street trees are common along surrounding north-south and east-west streets. Many properties have small yard trees in the front as well.</td>
</tr>
</tbody>
</table>