The Inter-Relationship of Nature and Built Form in an Urban Context

by

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abstract

How does one mediate between nature and the city as development continues to arise out of necessity? What is the significance of the connection between nature and city and how can they be articulated? What is the relationship between architecture and nature in the context of densely settled area?

This thesis attempts to address these questions through the application of environmental consciousness with three different scales: urban, community and individual. The site is known as Boston State Hospital Site in Mattapan where existing dense neighborhoods and abundant natural environments meet. Moreover, Boston Nature Center of Audubon Society is a major component of the site. Given the mixture of dichotomous settings, this thesis attempts to show how interpenetration between built environment and natural setting can proceed to bring urban living quality through Eco-housing development.
dedication

To my wife, Haesoo and my Family
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dimensions of environmentally conscious design

The environmentally conscious design concept is not a new idea of making built form. It has been located in all the places where people live and work. Only a few generations ago, it would have been absurd to suggest that one should design and build in such ways that did not reflect local climate, materials, landforms, and customs. The human habitat design was limited to local resources, abilities, and ways of doing things. The built form tended to follow patterns that were well adapted to local conditions (especially environmental conditions). The environmentally conscious design concept was the rule and not the exception.

During the rapid modernization period of the last century, we have seen a dramatic change
from buildings which have thick and solid walls with small openable windows to buildings with thin and transparent skins which have a completely sealed separation between the inside of the building and the outside. People believed that the modern buildings can control internal environment entirely by using mechanical system. The relationship between built form and natural environment was reduced and the environmental consciousness was not an important consideration of design process any more.

Since the global awareness of an environmental crisis has came out over the past 25 years, there have been many attempts to retrieve the importance of the natural environment and it's interrelationship to built form. Since the
true nature has been far away from the city and the cities are filled with artificial built forms, it is hard to find relationship directly between built form and the natural environment such as in a traditional manner. However, in contemporary situations, I suggest that the urban environment should be considered as a second nature and be defined in terms of: what are the constituents of the contemporary urban environment, and what are the constraints of making relationship between built form and the urban environment.

In the past, there was no separation between nature and built form. There were substantial interrelationships between nature and built form, which are missing now. In seeking the missing part of this relationship, it is imperative
to demonstrate the importance of an environmentally conscious design concept which only be a tool to reestablish the interrelationships of nature and built form in an urban context.

"The city is part of nature... The realization that nature is ubiquitous, a whole that embraces the city, has powerful implications for how the city is built and maintained and for the health, safety, and welfare of every resident. Unfortunately, tradition has set the city against nature and nature against the city. The belief that the city is an entity apart from nature and even antithetical to it has dominated the way in which the city is perceived and continues to affect how it is built. This attitude has aggravated and even created many of the city's environmental problems... The city must be recognized as a part of nature and designed accordingly... Nature in the city must be cultivated, like a garden, rather than ignored or subdued."

Many concrete examples and literature have recently been published around the subjects of environmentally conscious design and the wisdom of forms and knowledge that belong to old-traditions have been rediscovered. However, it should be filtered though today's technology and translated to meet present needs.

The analysis of case studies includes careful consideration of objectives, criteria, process, and technique. In the analysis of housing case studies, density and its relation to three dimensional patterns of spatial organization might be the core elements of research. In order to extract relevant ideas and techniques from case studies, it is required to perform a comparative analysis of the studies associated with diagrammatic techniques.
Once a theoretical basis for the thesis are formulated, it is possible to start a design proposal. With a new set of principles and objectivity, program of housing development and strategies of environmentally conscious design will emerge.

It is my intention to seek dimensions in each environmental consciousness and their relationship throughout thesis process. With this idea, design process is constantly changed and developed.

It seems impossible to combine every elements for one idea of environmental consciousness, but I believe that it is possible to do that when I establish a clear relationship between each scale of environment; area, community, individual.

Figure 8. Conceptual diagram of design principles. Circle of environmental consciousness.
The project is proposed on a potential site where urban housing redevelopment projects occur. The intention of choosing a potential site of real development processes is to suggest alternative of housing design approaches, and to introduce an idea of adaptation of environmental consciousness into urban housing development.

The site is located in the very heart of the most populated part of Boston- in Mattapan, to be exact, -on the abandoned grounds of the old Boston State Hospital.(figure 9) The site is a part of the unique 'Nature System in the City' of Boston.(figure 10) Nature system in the city starts from the center of
the Boston Common through the linear park of the Commonwealth Avenue, Back Bay Fens park, Olmsted park, Jamaica pond, Arnold Arboretum, and ends at Franklin park. (figure 10)

Public transportation and transit system around the site is shown above. Each dot labeled “T” represents the closest MBTA rail access to the site, “C” represents Commuter rail station, and “B” represents the MBTA bus access to the site. The two black concentric rings are drawn one mile and two miles from the site.

The site is bounded by three existing roads and one upcoming Boston Nature Center Massachusetts Audubon Society. The northwest boundary of the site is defined by Boston Nature
Center. The southwest boundary of the site is defined by Walk Hill Street. The northeast boundary is defined by Morton Street. Finally, the southeast boundary is defined by Harvard Street.

There are several characteristics of the site. First, the site is surrounded by abundant natural environmental settings, including Boston Nature Center, Mt. Hope cemetery, and Franklin park. Second, there are two large vegetated fresh water wetland areas which are also located near the site, Boston Nature Center, and 50 feet difference of slope within site from lowest point of northern part of site to top of southern part of the site. Finally, the site is facing one of the most dense residential areas in the State, Mattapan.
figure 13. Morton Street.


figure 15. Walk Hill Street.

figure 16. Inside views of the site.

figure 17. Inside views of the site.
The thesis site is affected by several important forces which range from urban micro climate to existing neighborhood; they are prevailing wind flow, existing vegetation pattern, rain water run off pattern, topography, possible link to existing neighborhood and entrance to the site.

It is very useful to sort each forces individually before starting to design a siteplan. These forces are further discussed and illustrated in the following sections (strategies for urban micro climate, natural environments, public transportation, and urban density) of this paper.
figure 19. Local Traffic system. Building Uses. Topography/ Vegetation. Micro Climate(from above left)
program

: existing plans

Before establishing specific program for the project, there are two existing master plan to be considered for this site. One is The Boston Nature Center, and another is Boston State Hospital Development Study by Boston Redevelopment Authority. These two plans should be carefully looked at and referred as precedents for the project. Therefore, it is important to introduce two program of plans briefly.

The Boston Nature Center

The nature center will consist of an assembly room, classroom and other program space, exhibits, meeting space, a reception and gift-shop area, and office for staff. In addition to the nature center, Massachusetts Audubon Society
will retain and renovate the easternmost of the three cottages at the northern entrance off Walk Hill Street. This building will serve as a residence for caretaker of the MAS site.

The nature center and wildlife sanctuary offer natural history related activities for adults, children and youth. The nature center and sanctuary will also serve as a community resource offering year-round programming about nature and the environment for neighborhood residents and the general public.

To characterize the relationship between the site and Boston Nature Center, it is important to consider a natural connection using the existing topography and proposed community planning program.
Boston State Hospital Development Study

This study recommends such uses for this site, light industrial and manufacturing, office, retail, housing research and development, and educational. The goals of this development are i) creation of a complementary mixture of land uses consistent with market demand, community aspirations, ii) creation of settings that are attractive, safe and promote enjoyment, iii) job creation compliant with the State and City construction and contract goals, iv) provision of literacy, job training, apprenticeship placement and day care programs for neighborhood residents.
The major component of the program is housing. In addition to the housing program, there are current need of community, educational, commercial, and cultural uses, such as common rooms, child care and elderly center, community specialized retail, health care, etc.

Project consists of affordable housing of multifamily housing type: 730sq.ft. of 1 bedroom unit, 950sq.ft. of 2 bedrooms unit, 1180sq.ft. of 3 bedrooms unit, single family row house type: 1200sq.ft. of 3 bedrooms unit, and single family house type: 1820sq.ft of 4 bedrooms unit, for total 57.5 acre area.
strategies for
: urban micro climate -

The urban geometry and profile—shape, height, and size of the buildings, orientation of streets and of buildings, and nature of the surfaces of the urban open spaces—all these factors have an impact on the urban climate. -Giovoni, Baruch. *Climate Considerations in Building and Urban Design*. Van Nostrand Reinhold, New York, 1998. p12

This site is located on the climatic region of cold winters, hot-humid summer and moderate shoulder seasons. The areas in this region are found mainly between the latitudes of approximately 30° and 45° N such as the metropolitan area of Boston.

Wind velocities in cities are generally lower than that of open countryside. However, this site

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**figure 24. micro climatic analysis sketch of site, air flow and section, summer prevailing wind flow sketches(from above)**
is located at the edge of the city where densely built urban environment meets natural open space. Therefore, enough wind velocity can affect heat diffusion and the urban cooling rate. On the other hand, there are needs for testing the wind velocity for using natural ventilation in the summer time. Important variations of velocity occur both seasonal and within the daily cycle. At this point, the built form is an important consideration again.(figure 25. wind flow test)

Compared to open countryside, this urban site will have a larger area of exposed surfaces. Potentially more solar radiation could be
collected on a built urban site than on a flat open area, especially in winter. However, in addition to reductions in incoming radiation due to pollution, view of the sun is also a variable on urban sites.

In the city, a surface's view of the sun at any given time is largely determined by the built form and street widths and orientations. In midwinter overshadowing is often considerable in high density sites. Thus built density and built form become critical considerations.

In summing up, there are several key considerations for thesis project about urban micro
figure 28. Shadow changes through season:
June 21, 12:00pm. September 21, 12:00pm. December 21, 12:00pm. - early scheme (above)
Final scheme (right) - December 21, 12:00pm.

climatic condition

- Built form density and type, to influence airflow, view of sun and sky, and exposed surface area.
- Building design to influence building heat gains and losses, thermal capacity of external surfaces.
- Urban materials and surface finishes to influence absorption, heat storage, and emissivity.
- Vegetation and bodies of water to influence evaporative cooling process on building surfaces and/or on open space.
- Traffic reduction, diversion, rerouting to reduce air and noise pollution, and heat discharges.

These are considered as important parameters to develop this site through entire thesis design process.
natural environments

Topography/ Orientation of housing block

The highest point of the site is on southern part along the Harvard Street and lowest point of the site is northern part right next to the wetland area. Thus, the slope runs down from south to north and southeast neighborhood is located at the highest point of this area. The overall slope of the site is very moderate except the area along the Harvard Street.

The orientation of the existing neighborhood blocks are determined by contour of the area. In addition, climatic conditions another important aspect. These two factors also influence new housing block orientation on the proposed site.
Water management system

The storm water management system is developed for the site specifically. The main system for the water management is open swale. Open swale runs through the site along the road, passage, and linear park from higher point of the site to lower point of the site. Open swale system naturally filters the storm water and provides unique place for rest. Also the under ground water way connects the open swale system.

The retention ponds are located at the end of each open swale system and connected to the next system again. Within the community blocks, recycled gray water can be used for orchard irrigation, gardening and bathroom use.
Existing vegetation

Trees on the site were surveyed by Bill Nichols, Gil George, and Andy Kendall on December 2, 1995. This survey provides precious information for project's concerns about preserving the existing landscape and site planning.

The survey revealed many tree and shrub species typical of an urban setting such as cottonwood, swamp white oak, majestic rows of mature red oak, and two red oak wolf trees. Healthy and mature coniferous trees planted near many of the buildings and roads include Colorado blue spruce, Norway spruce, Scotch pine, and Arbor Vitae. These trees have a DBH between 2.5'-5' and a height of around 60'.
Soil properties

The site consists of two kinds of soils, Ue and WrB. The properties of soil are important factors for understanding the site condition such as water table, porosity, and hardness.

**Ue- Udorthrnt:** Previously tidal marshes, river flood plains, bays, and swamps. Areas of these soils are most extensive along Boston, Dorchester, and Quincy Bays. Runoff is slow, and water tends to pond on the surface after intensive rain. Pilings are typically used in preparing foundations.

**WrB- Woodbridge:** This is a very deep, moderately well drained gently sloping soil on tops of hills. Moderate water capacity, 1.5 to 2.5 feet seasonal high water table. Constructing buildings without basements, above the seasonal high water table, helps to protect the interior from damage by the seasonal high water table.
To provide a certain level of sustainability to the project, it is required to consider a transit oriented development idea. Depending on walking distances to the public transportation-light rail and bus, the shape and organization of community will be developed. Public transportation is one of the most important issues in defining a pattern of urban developments and their use of energy.

A traditional master plan would have given primary importance to the private car as a means of transport. But in this project, entire site is within walking distance of 5 minutes, 300m to the shuttle stop and MBTA bus stop. Therefore potential energy savings for transportation will be made in this project.
Existing neighborhood

It is critical to study a necessary density for urban community housing and other related programs, which are needed to support this community based analysis of existing conditions and future needs.

Mattapan area, one of the most dense area of the state, was studied in terms of density, socio-cultural, and economic environments. The housing pattern and open space organization is determined based upon the density.

The existing neighborhood density analysis
- Block 1 (residential)
  area: 39,896 sq. ft. = 0.92 acre
  number of buildings/dwelling units: 9/28
  density of block: 30 units/acre

figure 36. Children from the neighborhood

figure 37. Study of existing neighborhood density - sample modeling
- Block 2 (residential)
  area: 88,360 sq.ft. = 2.03 acre
  number of buildings/dwelling units: 14/44
  density of block: 28 units/acre

- Block 3 (residential)
  area: 121,742 sq.ft. = 2.79 acre
  number of buildings/dwelling units: 22/54
  density of block: 19 units/acre

- Block 4 (residential)
  area: 139,986 sq.ft. = 3.2 acre
  number of buildings/dwelling units: 23/60
  density of block: 19 units/acre

- Block 5 (residential)
  area: 281,243 sq.ft. = 6.45 acre
  building coverage area/ratio: 96,335 sq.ft./34.3%
  number of buildings/dwelling units: 58/106
  density of block: 16 units/acre

- Block 6 (residential)
  area: 221,000 sq.ft. = 5.07 acre
  building coverage area/ratio: 65,090 sq.ft./29.5%
  number of buildings/dwelling units: 67/67
  density of block: 13 units/acre

- Block 7 (residential)
  area: 58,445 sq.ft. = 1.34 acre
  number of buildings/dwelling units: 11/24
  density of block: 18 units/acre

- Block 8 (residential+commercial)
  area: 118,153 sq.ft. = 2.7 acre
  number of buildings/dwelling units: 16/30
  density of block: 11 units/acre

- Block 9 (residential+commercial)
  area: 175,435 sq.ft. = 4.03 acre
  number of buildings/dwelling units: 30/83
  density of block: 21 units/acre

Average density of the study area is 20 units/acre.

- According to the source of "Friend of the Earth", it suggested the sustainable urban density as 28 units/acre and source of "URBED" suggest maximum density as 50 units/acre.......Building the 21st Century Home David Rudin & Nicholas Falk, Architectural Press, 1999
From the study of existing neighborhood density, large areas of unused land are discovered. Most of dwelling types in this area are freestanding building type such as single family house, two, three, multiple family dwellings in large house. These type of houses make neighborhood look denser than what research data provides, 20 units per acre and generate inefficiency in using land, especially in dense urban environments.

Therefore, in searching for efficient way of land use and managing private and public open space, attached building type are considered as one of solutions. Attached buildings have outside entrance to each unit from the street or courtyard. Multiple unit buildings with entries to each dwelling from common stair or interior hall, can be considered.
The criteria for developing housing prototypes should be formed to meet the social, economic, and environmental concerns for whom will occupy the units. The residential buildings should include:

- Visible entry space from the street and inside unit so that porch space becomes a social place for gathering.
- Clear separation of private and public open space.
- Secure space for children playing.
- Natural light and natural cross ventilation for public corridors.
- Exposure to direct sunlight at some part of the day, especially in winter.
- Shading to reduce hot summer sunlight.
- Privacy between parents and children.

The circular diagram on next page shows categorized considerations for designing dwelling units and community blocks.
DEFINING UNIT
# of dweller
age of dweller
usage: time, function - living, working

MASTER BEDROOM
privacy from child
watch out child near bath

LIVING ROOM
relative public space
quiet space
good view, orientation
day-use/multiusage

LINKAGE SYSTEM
artificial - street, road, alley, natural - landscape,

THRESHOLDS TO
the community
the building
the unit
the private/public space
the nature

PUBLIC SPACE
playground for public
good visibility
safe area for child
easy access

PRIVATE SPACE
internal space
protected space
playground for privacy

MEETING COMMUNITY
on street
on public space
on private space
on unit
on parking lot

WINTER SUN
direct heat gain
associate with protected winter wind

SUMMER SUN
enough shades on communal space, street
sharing shade on porches
prohibit heat island associate

FRONT/BACKYARD
privacy with limited public exposure
transition space from hard edge to soft edge

figure 45. Housing design considerations.

figure 44. Unit study sketches.
**design explorations**

: siteplan diagrams

First diagram (figure 46) shows possible connection between Wellington Hill neighborhood and project site. There are one main threshold on Harvard Street and another possible sub-threshold. The main threshold is located on the extension line of Deering Street which run toward Blue Hill avenue where major commercial activities occur in this area. The idea of connecting two ends crossing of Harvard and Morton Street, and Harvard and Walk Hill Street is show in the second diagram.

Finally the idea of linkage park system and creation of community hub is expressed on third diagram. The basic strategy for site is established and ready to launch detailed siteplan sooner or later.
figure 47. Diagram 2: creation of inner connecting road from the south entrance on the crossing of Harvard and Walk Hill Street to the east entrance on the crossing of Harvard and Morton Street.

figure 48. Diagram 3: emphasizing the hub of the site and connecting three nodes, main entrance on the Harvard Street, south entrance, and east entrance. Considering future expansion of the development to cross the Morton Street, eastern side.
**Scheme 1**

The major features of the siteplan scheme-1 are the creation of the connection between the two existing landscape and orientation of the linear buildings which follow the topography of the site.

The existing landscape on southern part of the site and Nature Center site are connected by stepped garden. The idea of creation of linear housing block helps to define natural formation of building at sloped site.

However, the slope in the site is not too steep so, it is not necessary to align buildings linearly; because the linearity of block pattern doesn’t fit of the existing neighborhood.
figure 50. Stepped garden from the top of the site to the lowest point of the site, wet land area (above). View from south to north, stepped garden and housing blocks (below left). Looking neighborhood. 8 stories tower apartments define edges between stepped garden and row house blocks (below right).
Scheme 2

The subdivision of the site and pattern of housing buildings are defined by existing neighborhood pattern and topography. Rough idea of land use is developed as public use and commercial mixed use area at the center of the site, light industry use at northeast part of the site along the Morton Street, and major residential area.

The residential area is divided into three part; high density areas on the east side of the site align the Harvard Street, medium density area on the center and near linkage park, and low density area on existing landscaped area for preserving natural resources. At the same time, the building pattern and orientation of the blocks are developed.
figure 52. Siteplan sketch showing land uses and building pattern (above). Building orientation study models (below)
Scheme 3

The siteplan scheme—3 shows evolution of linkage system and an idea of clustering community blocks. There are certain logic in building patterns that run from southeast to northwest, facing southwest, gesture of fingering into the nature and neighborhood, and pattern of expansion of urban fabric into the nature.

Clustered community blocks create edges between built form and natural environments. It is intended to generate such a transitional space where people can meet natural environments with certain limits. The idea of “built form making edges, nature blurring the edges” is one of the key concepts to the design of this community.
figure 54. Pattern of buildings (above). Study model pictures (below).
Scheme 4

The block model is developed into the specific site condition. The block consists of two row houses and one walk-up apartment with covered parking lot. One community block has 62 dwelling units. This block is an option model for the development and several different type of houses are developed. (figure 55)

The subdivision pattern is followed by existing neighborhood, but the entrances from the Harvard Street are too close to generate traffic problems.

The densities of overall area are 24 units/acre, 27 units/acre, and 10.3 units/acre. The scheme-4 doesn’t seem to use land efficiently.
figure 57. Midterm siteplan sketch shows linkage park system and open swale (above). Block and setting of building on sloped site computational model study (below).
Scheme 5

Still, there is a hard time for refining residential blocks. This scheme attempts to bring a complexity into building orientation and pattern. Creation of cul-de-sac at the end of internal circulation road and courtyard house type are explored.

Mixed-use commercial areas are aligned along the main internal spine road and bring activities to the community hub, central plaza.
Scheme 6

The final scheme explains several strategies and design idea. Main linkage system consists of linear park, pedestrian passage, open swale system, and bike path.

Each district has its own characteristics. East district of multiple family house type, southwest district of row house type, and single family attached house type at near the existing forestry are one of the suggestions for development option.
strategic plan for Audubon Hills community- the final project

: dimension 01- neighborhood area

Audubon Hills Development Summary

- Total development area: 2,034,000sq.ft.(46.7 acre)
- Public area (including parks, passages, etc): 659,100sq.ft.(15.1 acre)
- Residential area (excluding road): 531,000sq.ft.(12.2 acre)
- Commercial/mixed-use building area(footprint): 132,000sq.ft.
- Public building area (footprint): 39,300sq.ft.
- Total 494 units on residential area(excluding mixed-use building residential units): average 40 units/acre

*compare to 20 units/acre(existing neighborhood),
24 units/acre(BRA study plan)
Figure 62. Building Uses
1. residential (yellow). 2. mixed use - commercial (red). 3. public (blue)
figure 63. Circulation System
1. vehicle road(grey). 2. off street parking. 3. pedestrian way
figure 64. Open Space System
1. private green space. 2. public green space. 3. pedestrian/easement
figure 65. Urban Linear park-Linkage System
1. passage from existing neighbor to Audubon Nature Center. 2. site linkage system. 3. vehicle free pedestrian path/bicycle throughway. 4. water management system. 5. play ground
Figure 66. Water Management System
1. surface water run off system. 2. open swale system. 3. local rain water retention for filtration in the place.
figure 67. Existing Vegetation/Proposed Landscape
1. Nature Center. 2. linear park system.
figure 68. Nature Center/ Audubon Hills Development
The urban community block consists of housing, public buildings - day-care center, library, etc., and commercial mixed use buildings - small retail, light industry, and offices. Each blocks are interconnected by linkage system - linear park, pedestrian alley, bicycle road and landscape. Furthermore, the passages to the Nature Center provide important connection between existing neighborhood (Wellington Hills) and new neighborhood (Audubon Hills).
Linear park and central plaza surrounded by mixed-use buildings and public library.

Multiple family housing block on Harvard Street.

Pedestrian and bike passages run through the linkage park. Open swale system for reuse of water.

Community Block Model

Audubon Society Nature Center

Existing neighborhood

figure 74. Plan view of community block model: from Nature Center to existing neighborhood
figure 75.
1. Ground floor plan
2. First floor plan
3. Second floor plan
4. Attic / Roof garden
5. Model picture
6. Row formation

Multiple Family Housing Type
1 Bedroom unit (yellow): 730 sq. ft.
2 Bedroom unit (blue): 950 sq. ft.
3 Bedroom unit (red): 1180 sq. ft.
figure 76.
1. Semi-public open space
2. Private garden
3. Threshold to the linear park
4. Play ground
5. Entrance to the housing block

District A: Multiple Family Housing
- Duplex and Triplex+ Walk-Up Apartment type
figure 77.
1. Ground floor plan
2. First floor plan
3. Model picture
4. L-shape formation

Single Family House Type
4 Bedroom unit: 1,820 sq.ft.
District B: Single Family House

two houses share front entrance space and have separate private garden space

Figure 78
1. Courtyard
2. Playground
3. Common parking lot
4. Threshold to linear park
5. Existing vegetation
Figure 81. Open swale system
figure 80.
1. Roof garden (garage)
2. Private garden
3. Linear park passage
4. Surface water retention
5. Entrance to housing block
6. Existing vegetation

District C: Row House
figure 85. Overall view of block model. Looking from neighborhood (above). Looking from Nature Center (below). Master plan (right).
figure 83. Pedestrian and bike passages run through the linkage park. Open swale system for re-use of water.

figure 84.
1. Open swale system
2. Surface water retention
3. MBTA bus stop
4. Central public plaza
5. Entrance to the Nature Center
6. Play ground
7. Block connecting path
8. Public library
9. Small business/ Retail center

Linear Park/ Community Hub
figure 87.
1. Looking linear park
2. Looking walk-up apartments
3. Looking down hills
4. Looking row houses
5. Along the internal road
6. Single family houses
7. Along the Harvard Street
8. Overall view from North
9. Section through the community blocks

figure 88. Multiple family housing block on Harvard Street. View from Wellington Hill neighborhood.
Sinal
Family House
Daman
CAl-
nter
Semi-Public Space
Private Garden
distance between
cbuildings: 80ft.
Covered Parking
Open Swale
Mixed-use Building

Views through the site/
Section along the Harvard Street
The three prototypes are developed for this project. These prototypes can be used as options for this specific area and situation.
Dwelling Type A:  
Multiple Family Housing

figure 90. right page
1. Ground floor plan
2. First floor plan
3. Second floor plan
4. Attic / Roof garden
5. Section a
6. Section c
7. Section b
8. Section d
9. Unit addition
10. Section model
11. Ventilation core

1 Bedroom unit (yellow): 730sq.ft.
2 Bedroom unit (blue): 950sq.ft.
3 Bedroom unit (red): 1180sq.ft.

figure 91. dwelling prototype models (from above)  
front view, rear view, porch/ entrance/ covered parking lot
Dwelling Type B: Single Family House

figure 92.
1. Ground floor plan
2. First floor plan
3. Section d
4. Section c
5. Section a
6. Section b
7. Model picture

4 Bedroom unit: 1820 sq.ft.
Dwelling Type C: Row House
figure 93.
1. Ground floor plan
2. First floor plan
3. Second floor plan
4. Section a-alt1
5. Section a-alt2
6. Front view
7. Section model
8. Rear view

3 Bedroom unit: 1,200 sq.ft.
I am grateful to my advisor, Andrew Scott, for his contribution to this thesis. In his consistent engagement with this thesis process he has helped me to move through the range of issues this thesis set out to investigate, from the natural environments to urban and architectural considerations.

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figure 2, 8, 32, 33, 36. http://search.gallery.yahoo.com/search/corbis


figure 20. Massachusetts Audubon Society.

figure 21, 22. Boston Redevelopment Authority.