TRANSFORMATION OF A BUILDING TYPE:
A Study of Back Bay Houses in Boston

by

Ricky Pei-Shen Liu

Diplome Par Le Gouvernement
Ecole Nationale Superieure Des Beaux-Arts
Paris, France
1984

SUBMITTED TO THE DEPARTMENT OF ARCHITECTURE
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE
DEGREE
MASTER OF SCIENCE IN ARCHITECTURE STUDIES AT THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

JUNE, 1986

© Ricky Pei-Shen Liu 1986

The Author hereby grants to M.I.T. permission to reproduce and to distribute publicly copies of this thesis document in whole or in part.

Signature of the author ____________________________
Ricky Pei-Shen Liu
Department of Architecture
May 9, 1986

Certified by ____________________________
N. John Habraken
Professor of Architecture
Thesis Supervisor

Accepted by ____________________________
Julian Beinart
Chairman
Departmental Committee for Graduate Students

MASSACHUSETTS INSTITUTE
OF TECHNOLOGY

JUN 04 1986
Transformation of a Building Type:
A Study of Back Bay Houses in Boston

by

Ricky Pei-Shen Liu

Submitted to the Department of Architecture on May 9, 1986 in partial fulfillment of the requirements for the Degree of Master of Science in Architecture Studies.

Abstract

The objective of this thesis is to explore the transformation of an existing building type and the application of the support/infill concept in a new context. For this purpose, a traditional Back Bay residential form in Boston has been selected.

The study has been carried out in two parts:
(I) Part One consists of an observational study of the existing context. This involved an analysis on the levels of urban structure, urban tissue and lot unit. The rules of the original Back Bay house type are identified in the last section.

(II) The second part comprises a design study based on the observed context by inserting new constraints. To discover possible floor-plan variations within the type, the support/infill distinction has been applied. Furthermore, the application of the modified type to irregular lot forms is studied.

At the end of the thesis unresolved issues are discussed.

Thesis Supervisor: N. John Habraken
Title: Professor of Architecture
Acknowledgements

I gratefully acknowledge the guidance and advice of professor John Habraken, whose experience has been invaluable in the preparation of this study.

I would also like to thank Vivian Fu for her great assistance during the process of production.

Finally, my sincere gratitude to my parents and sister, for their encouragement and the sacrifices made in order to make my study here possible.
Table of Contents

Abstract ........................................ 2
Acknowledgements ............................. 3
Part One
Introduction .................................... 7
Context
  Historical Background ....................... 10
  Architectural Character .................... 15
  Urban Structure ............................. 18
  District Boundaries ......................... 19
  Regional Transportation Networks ....... 21
Tissue Level
  Block Form .................................... 23
  Streets ....................................... 24
Lot Level
  Lot Organization ............................ 25
  Internal Organization ....................... 27
  Plan of the Back Bay House ............. 28
  Envelop ...................................... 35
  Street Facade ............................... 35
  Bay Window .................................. 37
  Entrances .................................... 38
  Front Steps .................................. 39
  Garden Fences ............................... 41
  Front Yards .................................. 42
Identification of the
  Original Rules ............................... 43
Tissue Level
  Thematic and Non-Thematic Elements .... 44
  Corner Lots .................................. 45
  Lot Level
  Interior Organization ....................... 47
Part Two

Issues Analysis ..................... 49
Changes in Function .................. 49
New Technical Possibility .......... 52
New Constraints .................... 53
Design Study for Alternative Solutions .......... 55
Design Study for Support Structure .......... 70
Zone Distribution .................... 85
Space and Function Analysis .......... 71
Modular Coordination ................ 83
Wall Positioning ..................... 84

Alternative Position of Staircase and Elevator ........ 87
Diagram of Basic Variations .......... 88
Sector Analysis ..................... 91
Sub-Variations ...................... 92
Parking Alternatives ............... 93
Block Type .......................... 99
Irregular Lot Forms ................ 104
Final Remarks ....................... 106
Bibliography ........................ 107
Part One
Introduction

The Back Bay is one of the most distinguished areas of urban architecture in the United States. Its survival as a handsome Victorian neighborhood provides its residents with a unique opportunity for quality living.

The changes made for modern residential use have led me to ask myself how these originally designed town houses could be further transformed in order to adapt to current needs. What appropriate approach should we use to generate alternative design solutions without violating the original building type? I am also concerned about the importance of designing plans that are easily adaptable to changing needs.
The structure of the study has been organized in the following manner:

To begin with, I give the reader a broad overview of the Back Bay residential district. This first part is organized into three levels: urban structure, tissue and lot level. This observational study allows me to determine the original rules. Thus, the existing dwelling type can be identified.

Over time the Back Bay residential area has been undergoing a lot of change due to various forces. The original rules must inevitably be modified to take into consideration the new constraints. With a discussion of these new constraints as a starting point, Part Two gives a design exploration of the Support System based on the modified rules.

The study gives attention to a number of issues that I feel are important:

(i) Transformation of a building type.

(ii) Adaptability of a dwelling within the type.

(iii) Users participation in designing their own living space.
Historical Background

The Back Bay, Boston's elegant residential district, was originally a broad shallow body of water located beyond the southwestern shoreline of the old Boston peninsula. The bay separated Boston from Brookline and bordered the narrow neck of land access to Roxbury in the vicinity of the present South End. Until the creation of the Public Garden, the marshes of the Back Bay reached Boston Common, and Charles Street served as a thoroughfare at the water's edge.

Development of the Back Bay was initiated in 1814 when the Boston and Roxbury Mill Corporation proposed a scheme to harness its tidal flow for commercial purposes. A granite-faced mill dam completed in 1821 stretched
across the bay from Charles Street to Sewall's Point (now Kenmore Square) along a route corresponding to the present Beacon Street. A shorter cross-dam projecting from Roxbury intersected the mill dam and divided the Back Bay into full and receiving basins. The mill dam project however, was soon forced to compete with steam powered manufacturing and never became the financial success envisioned by its promoters. Railroad lines built on trestles across the dammed basins in the 1830's further frustrated industrial development by impeding the flow of water in the bay. By 1849, stagnating Back Bay waters produced such an unhealthy and offensive sewerage problem that city health officials demanded that the area be filled in the interests of the public welfare.

In 1852, a special commission was appointed by the state legislature to prepare a plan for the development of the Back Bay. Because of difficulties in resolving conflicting claims to ownership, a delay of several years blocked the immediate filling of the area. Prolonged negotiations resulted in the Tripartite Agreement of 1856 which divided the proposed lands among the Boston and Roxbury Mill Corporation, the Boston Water Power Company (a subsidiary of the Mill Corporation), and the Commonwealth. To satisfy Boston's claims, two and a half acres were donated to the City from the Commonwealth's share for an addition to the existing Public Garden.
The filling of the Back Bay began in September 1857. Since the hills of the city, earlier a frequent source of land fill, had been completely developed by the 1850's, gravel had to be brought into the area from the town of Needham by a specially constructed railroad line. By 1860, the Back Bay had been filled as far west as Clarendon Street; by 1870, the fill had reached Exeter Street; by 1880, the entire area now known as the Back Bay District was solid ground; and by 1890, the fill extended beyond Kenmore Square and was continuing along Bay State Road. At its completion, the monumental Back Bay project had added 450 acres of new land to the City of Boston.

The plan for the Back Bay District, attributed to the Boston architect Arthur Gilman, was very much influenced in its street forms by the impressive Parisian boulevards of Second Empire France. Unlike earlier residential plans for Beacon Hill or the South End, the Back Bay was not divided into tree-lined squares inspired by Georgian London, but was conceived as a grand
scheme of generously landscaped parallel avenues. Commonwealth Avenue, designed as the dominant boulevard of the area, provided the district with a central linear park and served to connect the green open spaces of the Common and Public Garden with those of the Fenway system.

From its inception, the development of the Back Bay was planned both as a major civic improvement and as a substantial residential district. Its impressive plan of spacious streets and appealing location soon attracted many of the city's leading families. The handsome town houses and splendid mansions that began to line the streets of the district were designed by prominent local architects and reflected the tastes of a fashionable and affluent clientele.

Despite many variations in architectural style, the Back Bay developed as an area distinguished by a general consistency of character, form, and scale. This architectural unity, determined for the most part by the linear boulevard plan which subordinated individual town houses to the design of the street, was strongly encouraged by
the original and far-sighted deed restrictions imposed upon Back Bay construction. These restrictions specified minimum building heights, established a system of generous setbacks on all major streets, and called for masonry construction. The mandatory building setbacks coupled with later limitations on mass assured the development of a continuous street facade, regular cornice and mansard roof lines, and a repetitive pattern of projecting oriel and bay windows.
Architectural Character

The architectural character of the Back Bay Residential District is determined by an extensive complex of masonry buildings of similar form, scale, proportion, color, and texture. Although variations do exist, the traditional Back Bay town house is:

* Constructed of red brick or brownstone
* Three to five stories high
* Placed perpendicularly to the street
* Attached on both sides
* Set back 20-22 feet from the front property line
* Often crowned with a mansard roof

The Back Bay town house is generally designed as a narrow (16-25 feet wide) rectangular form with flat facades enlivened by projecting elements including bay windows, oriells, porches, stairways, balconies, cornices, and door and window enframements. The main elevation of the Back Bay residence is divided into well defined levels of basement, upper floors, cornice and/or
roof, and long narrow facade openings are typically arranged within strict grid-like rows. Entrances and accompanying porches are set above a low basement or placed at grade level. Ornament and architectural detailing emphasize the structural organization of the facade.

In the Back Bay, individual structures are subordinated to the avenue plan of the district. The continuity of this plan is dominant design factor of the area, and unbroken walls of masonry construction are formed from the constant alignment of the separate residences and their repetitive landscaping, regular cornice lines, building heights, and window and floor levels. Interruptions in street corridor walls occur only at cross street intersections and are not generally apparent along avenue frontages. The architecture of the Residential District is restrained and dignified, and few buildings are visually prominent either through flamboyance of style, irregularity of form, or marked differentiation of materials.

Despite the dominance of the long avenues, notable buildings were constructed on all four sides of the
typical Back Bay street block. Elegant
town houses and mansions frequently face
the shorter east-west streets, and side
street elevations of corner buildings
are often elaborately designed.
Monumental structures, including most of
the churches of the district, occupy
corner lots and, with few exceptions,
are carefully aligned with cross street
as well as avenue frontages.
Urban Structure

The Back Bay area was developed in the second half of the 19th century, when the area now called metropolitan Boston was composed of small towns with few connecting roads facilitating horse-drawn traffic.

Nevertheless, the urban structure in the vicinity of Back Bay continues to be governed primarily by the location of Downtown Boston and the course of the Charles River. For both historic and functional reasons, all the major arteries that either bound or penetrate Back Bay lead to Downtown Boston; their specific direction in the area is determined by the River and by the historic courses of the Boston Worcester railroad and the Muddy River. The river also restricts the number of north-south arteries, here represented by Massachusetts Avenue.

Although the expansion of metropolitan Boston has totally altered the relationship between the Back Bay and its regional context, it has not affected its basic organization. In fact, the district's presence was a determinant for the evolving urban structure rather than a response to it.
District Boundaries

The boundaries of the Back Bay have been always clear, although they have transformed in character.

To the north, the Charles River provides visual relief and effective termination of the area. The construction of Storrow Drive in 1938 created, however, a visual and functional barrier between the District and the River. Restricting access to the river bank, it has strengthened the identity of the Charles River park as a city-wide civic amenity.

To the east, the interface of the District and the City is more organic, both functionally and visually. Together with the Boston Common, the Public Garden acts simultaneously as a central space organizer for a number of districts, as a regional recreational resource, and as a visual separation between the Back Bay and its other surrounding neighborhoods. The north side of Beacon Street and the south side of Boylston Street provide continuity of the city fabric across Arlington Street, the Back Bay's easternmost street.

To the south, the boundary of the District is more complex and ambiguous. Copley Square acts as a central organizer for the buildings around it; therefore, it extends the perceptual space of Boylston - the Back Bay's southernmost street - beyond the District's boundary. East of Copley Square, the interface with the Park Square area is unnoticed due to the continuity of the street system. West of the Square, the sharp disruption of
the urban fabric around the Prudential Center marks the district's boundary. Past Massachusetts Avenue, the sunken course of the Massachusetts Turnpike tears the District off from Boylston Street. Despite the inconsistency of the southern edge, the perception of the District's southern boundary is clear: the "ridge" of high rises south of Boylston Street stands in sharp contrast with the district's typical morphology.

To the west, the boundary of the Back Bay is unfocused. Visual separation is obtained by the Park Drive overpass above the Muddy River, interrupting the otherwise continuous character of Commonwealth Avenue. The street pattern changes at Massachusetts Avenue, where Commonwealth Avenue bends and Newbury Street becomes a back alley.

West of the overpass, Commonwealth Avenue and Beacon Street converge at Kenmore Square, and the morphology of both changes.
Regional Transportation Networks

The interface of the Back Bay with regional transportation networks occurs in a number of modes. Limited access to and from Massachusetts Turnpike and Storrow Drive are marked. Regional traffic in the north-south direction is facilitated primarily through Massachusetts Avenue. East-west traffic utilizes all five through-streets, although Commonwealth Avenue, Beacon Street and Boylston Street receive most of it. Public transportation routes are interfaced through the three Back Bay subway stations and a number of bus-stops along Boylston Street and Massachusetts Avenue.
STUART LIMITED ACCESS FACILITIES

MAJOR ARTERIALS

SECONDARY ARTERIALS

COLLECTOR STREETS

LIMITED ACCESS FACILITIES

MAJOR ARTERIALS

SECONDARY ARTERIALS

COLLECTOR STREETS
As observed from the illustration, between 12 and 35 lots form a row along a public street. Typically, two rows are positioned back to back, separated by a narrow alley.

The aggregate form of two such rows and the building on them forms a "block".

Because it measures only two lots in width, the typical Back Bay block is decisively elongated in the direction of this back alley.

All buildings in the row, except occasionally those on the corner lot, front on one street, with the set back zone separating their front doors from the public sidewalk.
Streets

There are two typical street forms in Back Bay.

Primary street: the space created in between the fronts of two adjacent rows of buildings. Primary streets run in the east-west direction each acting as a collective space for the majority of front entrances in adjacent blocks.

Secondary street: the space created in between the short sides of two adjacent blocks. Secondary streets run orthogonally to primary streets, each providing access through alleys to backyards in their adjacent blocks.

This spatial difference reinforces the directional bias of the street system:

(i) The wider streets run east-west, facilitating public distribution to and within the area and provide access to the majority of the private destinations.

(ii) The narrower streets facilitate secondary movements between the major east-west streets, and provide access to only a few private destinations.
Lot Level

Lot Organization

The rectangular lot measures 110 to 125 feet in length, and 16 to 36 feet in width, with long sides perpendicular to the street.

In plan, the lot is divided to three major sectors along its longitudinal axis.

(i) A mandatory set back zone measuring 20 to 22 feet from the public sidewalk controls the position of the primary plane of the built zone.

(ii) The built zone extends from the set-back zone into the lot, accommodating either three or four sectors in between the front and the rear walls.

(iii) The back yard, which functions primarily as a service access and parking area, extends between the varying position of the back wall and the service alley.

Section

* The set-back is elevated three feet above the back alley.

* The basement level lies five feet below the street elevation.
Internal Organization

Front and back entries allow access via exterior stair to a double-stair vertical core, located around the middle of the "built zone". Only the service stairs connect to the basement.

Transversely the built zone occupies the entire width of the lot. The structural system consists typically of transverse wood joists supported by two longitudinal fire walls positioned along the lot lines; one intermediate line of support, typically wood stud wall at 2/3 of the span, divides the "built" zone into two longitudinal parts.

On the first floor, this line defines a narrow service sector and a wider living sector.

This division pertains uniformly to the middle part throughout the house, facilitating access via the vertical cores to upper floors, but does not control the distribution of spaces along the exterior walls on those floors.

Typically, ceiling heights vary among floors, depending on the location of the living room in the original house.

Variation in this basic organizational scheme of the lot often result from:

(i) Different positioning of the staircases
(ii) Removal of front stoops to allow direct access to basement floors
(iii) Different attitudes toward natural lighting from the back wall
Plan of the Back Bay House

Generally speaking, every dwelling, in addition to sleeping and service quarters, has four main rooms for daytime activity.

(i) Parlor:
Parlor served as a place for entertaining and as a music room.

(ii) Library:
Library was important not only because the prominent Bostonian was expected to be well read but because the man of the family need a study.

(iii) Reception Room:
Reception room, always adjacent to the main entrance, was required in those days of rigid social decorum as a place to receive persons on less intimate terms with the family.

(iv) Dining Room:
The dining room was as larger and formal as the meals served in it, and no informal eating room were provided.
Basic Form:

The row house is represented by a long, narrow structure three to five stories high, squeezed between party walls, and open for windows at its narrow front and rear ends.

Depending upon the lot width, three basic plans for the row house can be distinguished:

(i) Type I for the narrow house
(ii) Type II for a lot of medium width
(iii) Type III for a wide lot
Type I

* It allows for two rooms on each floor, one front and one back, and it is usually arranged on six levels.

* Library and parlor are placed on the second floor. These two large rooms connected by the stair hall open up to form a larger space for entertaining.

* This model has always two bedroom floors:
  (i) The lower contains two large bedrooms, one front and one back.
  (ii) The upper level may or may not be subdivided to form two small bedrooms across the front or back.

* The main staircase frequently does not carry above the second level and hardly ever above the third.

* Only service stairs run through from basement to attic.

* The main stair is always placed fairly back in the house.
This allows for a room of generous depth on the second floor at the front of the house.
* It provides also for a deep entrance hall on the first floor containing two sets of double doors connected by a vestibule as well as an outside porch.
* The ceiling height for the two main floors vary between 12 feet and 14 feet.
* A rear ell is never included, as that would eliminate outside light from the back rooms.
* If the house is too narrow to admit both reception room and entrance hall, the former is omitted and entry opens directly into a spacious reception hall.
Type II

* Type II houses are usually three stories in height plus basement and attic.
* Each lot is wide enough to permit one room plus a side hall.
* In both Type I and Type II, the middle of the house is given over to stairs, closets, toilets, and a light well.

This category can be subdivided into three groups.

Type IIa is two rooms deep.
* Library and parlor on the second floor.

Type IIb is three rooms deep.
* This second classification has the great disadvantage of a middle room without outside windows.
* The library is placed on the second floor.
* An ell is never added to houses three rooms deep.

Type IIc is two rooms in depth but has a rear ell.
* The library is placed on the second floor.
Type III

* Type III permits greater variation in plan.
* It has a center hall with rooms place in the four corners.
* All principal rooms are on the first floor, bedrooms on the second floor.
* Disposition of the second floor is determined by the number of main rooms that could be placed on the first floor.
* Because a greater number of rooms are located on each floor, there is no need for rear ell. Type III houses are usually no more than three stories plus basement and attic.
Service Spaces

In the large majority of Back Bay houses, the kitchen is placed in the rear of the basement where it opens onto the back yard.

The middle portion of the basement is devoted to stairs, pantries, storage closets, a water closet for servants, and a furnace room.

At the front of the house is a laundry with appended drying room and a large coal bin. Often this bin extends out under the front steps and occasionally a small outside door under the front steps open into the coal bin for coal deliveries. The window of these front basement rooms are always small and covered by some kind of metal grill.

The attic is divided into small servants' bedrooms of which there are never less than three. Sometimes one attic room is fitted as a sewing room with wardrokes and shelves.

The peculiar drainage condition which prevailed in the Back Bay, affected the arrangement of rooms.

The lowest basement level allowed by law was Grade 12, which is:

* Five feet below the street level.
* Three feet above the average level of high tide.

There are records of tides as high as 15 feet above low tide, so it was impossible to place the dining room or any main room in the basement.

This problem also explains why the main entrance in the early day was never situated in the basement.
Envelop

Similar to variable depth of the built zone, its height is not regulated dimensionally, except for the height range allowed by zoning, this is three to five floors above basement.

Most Back Bay houses, however, contain no more than five floors, for both technical and comfort reasons. These result in height between 48 to 75 feet.

Street Facade

The basic facade configuration of the Back Bay house is composed as a traditional tripartite system with regular distribution of openings.

A bay window is frequently added as an appendage. Similar appendages, such as dormers and balconies also affect the facade configuration.
Tripartite System:

The organization of the typical facade is obtained by subdividing its primary plane into three parts:

* A rusticated "base", extending up to the first floor line.
* A "body" extending from the base up to the cornice line.
* A "cap" extending from the cornice line at least a few feet up; in many cases it is formed by a lived-in Mansard roof.
Bay Window

The figuration of the bay window is governed by the original deed restrictions, as well as by functional reasons.

The main objective for projecting out of the primary surface of the facade is twofold:

(i) First, allowing more varied and even light penetration into the house;
(ii) Second, multiplying the angles of view into the street.

There are three generic geometries of these concave shaped windows:

(i) Sem-Circular shape;
(ii) Tripartite shape with middle section wider than two ends;
(iii) Triangular shape, which is encountered less frequently in Back Bay area;
Entrances

The entrance to the Back Bay townhouse customarily includes the following architectural features:

* Front steps
* A projecting porch or recessed vestibule
* The doorway
* An accompanying complex of masonry ornament, ironwork, and wood panelling.

Because of the diversity of architectural styles in the district, Back Bay entrances occur in various forms. Although they are generally designed as graceful arched openings set above a low basement, entrances may be placed at street level, and may include a monumental porch of freestanding columns or a massive portal with ornately carved door jambs.
Front Steps

The front steps of the Back Bay town house are constructed of brownstone, sandstone, limestone, or granite.

The front steps were low, often not more than six risers. This was possible because the basement level could be as much as five feet below the street and there were no major basement rooms which demanded excessively high ceilings.

Occasionally the outside staircase approaching the porch is recessed, especially in the small dwelling facing the cross streets where the house is place next to the sidewalk.
Garden Fences

The front gardens of the Back Bay Residential District are enclosed by the following different arrangement:

(i) Simple six inches curbs
(ii) Study brownstone fences
(iii) Masonry curbs ornamented with an iron work fence of two to three feet in height
(iv) Iron fences erected in the early twentieth century with the height varying between five and seven feet.

In the last case, a front gate is always added in order to separate the doorway from the sidewalk.
Front Yards

The small gardens that line the long streets and avenues of the Residential District are an integral part of the Back Bay landscaping scheme. The condition and design of these gardens have a significant effect on the appearance of the area as a whole, and property owners who plant and maintain them contribute substantially to the general enhancement of the District. Although Back Bay gardens are fairly uniform in design and dimension, many different kinds of landscape treatment are suitable.
Identification of the Original rules
Tissue Level

01 Primary St
02 Secondary St
03 Alley

B Built Zone
Min Built
Max Built
Larger Structure
Parking Lot
access for indirect light

Thematic and Non-Thematic Elements
Corner Lots

The corner lot, by virtue of its location at the end of a row, has two sides of its perimeter exposed to the street, compared with only one such side in the case of the mid-block lot. This exposure provides ample opportunity for:

(i) Natural lighting and increases the flexibility of internal organization.
(ii) Visibility of the corner building from the street.

Thus, although some non-typical buildings occur in mid-blocks, the great majority of "non-thematic" morphologies occur at the corners of blocks.
Lot Level
Lot Height
Most Back Bay houses contain no more than five floors which result in height between 48 to 75 feet.

Bay Window

No Projection Other Than Cornice Allowed in Front of This Line

Total Width of Lot or a Maximum of 18 Feet

Property Lines
Interior Organization

* Four main rooms such as parlor, library, reception room and dining room are needed for daytime activity.
* Main rooms are situated on the first or second floor and never in the basement.
* Reception room is always adjacent to the main entrance.
* Living room ceiling height is greater than that of other floors.
* Bedrooms are always on the upper floor of the main rooms.
* Dining room is usually adjacent to kitchen.
* Kitchen is often placed in the rear of the basement.
* The functions of the dining room and kitchen are well distinguished. No informal eating is provided in the kitchen.
* Principal staircase is located in the middle of the house.
* Only service stairs run through from basement to attic.
* Basement is devoted to service spaces.
* Attic is divided into servants' bedrooms or service rooms.
Issues Analysis

The Back Bay residential area has been undergoing a lot of change due to various forces like conversion of original dwelling to different functions, changes in life style, and new technical possibility.

It would thus seem necessary for a designer to take into account these changes during the design process. These issues are described in the following analysis. Finally, new constraints are formulated as principles for design guidelines.

Changes in Function

It is evident that these Victorian houses were built for a way of life very different from that of the present day.

The large, single-family town houses, were gradually converted into apartments or rooming houses, or divided into offices for professional people.

This conversion resulted in two basic modes of ownership:

(i) Condominium Type
* A single existing structure is subdivided into apartments, each belonging to one household.
* The open space and common circulation sectors are shared by all its residents.

(ii) Public Type
* A number of individual houses are combined under one owner -- eg. schools, dormitories...etc.
* This pattern has been discouraged in recent years.
Conversion

(i) Conversion of secondary residences to regular apartment buildings.

Since the town house was originally used only during the winter, no special accommodations were needed for the hot months.

* No porches or balconies for outdoor living on the lower levels.

* No loggias at the top of the house to take advantage of summer breezes across the Back Bay.

* Neither was any effort made to utilize the backyard as a garden or open living quarter. Instead, this rear area was paved with bricks, and it functioned only as a service yard through which tradesmen entered the kitchen from the back alley; seldom was this area planted with even a tree.

Although, these houses are now occupied during the whole year, it is difficult to modify the original design. Especially in the case of the backyard, with all the later physical extension, environmental upgrading become almost impossible.

An improved pattern will be suggested in Part Two.

(ii) Conversion of dwelling to commercial uses.

Generally, when the lower levels are converted into shops, only first floor and basement are affected. Open space such as entrance and front yard will also be modified in order to
accommodate the new function. We can see many this kind of examples in Newbury street.
New Technical Possibility

(i) Elevator

Originally there were no elevators in the houses of Back Bay. Only costly houses built after 1895 have elevators regardless of its height.

With the demise of the large family residences, the single existing structure was subdivided into apartments, each belonging to one household.

If the building contains more than three stories, a common elevator will become very convenient for its residents.

Fortunately, for later owners desirous of installing an elevator, the light wells and banks of interior closet so common in the earlier houses often provided accessible elevator shafts.

(ii) New Drainage System

The main entrance and living spaces can be placed in the basement since the improvement of the sewer system in late nineteenth century.
New Constraints
Common Sector:

Open space and common circulation sectors are shared by the residents of the building.

Open Space:
* The entrance can be situated at basement level.
* The Backyard functions as parking space.
* Each house has its own parking space adjacent to the dwelling.
* Sufficient parking space should be provided for each lot.

Built:
* Common vertical circulation should be located in the middle part of the house.
* Every apartment house should possess an elevator which is located as close as possible to the staircase.
* Common passage between frontyard and backyard is necessary.
Private Sector:

The single structure is subdivided into different private units.

* Equal spatial quality for each unit.
* Surface per unit is more critical than in the original design.
* Buildings are occupied during the whole year.
* Each house should provide possible variations in plan in order to accommodate different family sizes and life-style.
* Living space can be placed in the basement.
* Living space has priority of southern exposure.
* The dining room can be either independent or incorporated in the living room.
* The kitchen can also be located in the middle of the floor plan.
* An informal eating space can be situated in the kitchen.
* Each floor should provide at least one bathroom when possible.
Design Study for Alternative Solutions
Space and Function Analysis

3' 4' 5' 6' 7' 8'

3' 32" 32" 32" 32" 32" 32"

4' 44" 44" 44" 44" 44" 44"

5' 56" 56" 56" 56" 56" 56"

6' 68" 68" 68" 68" 68" 68"

7' 80" 80" 80" 80" 80" 80"

8' 92" 92" 92" 92" 92" 92"
Modular Coordination
Wall Positioning

|----|-----|----|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
Zone Distribution
Position of Spaces in the Zone Distribution

(i) General purpose spaces:
   Living room

(ii) Special purpose spaces:
   Bedrooms, kitchens, dining rooms, and studies.

(iii) Service spaces:
   Bathrooms, storage rooms, staircases, and elevator.
Alternative Position
of Staircase and Elevator

\[ Ia \quad Ib \quad Ic \quad Id \]

\[ IIa \quad IIb \quad Ic \quad III \]
Diagram of Basic Variations

L - LIVING ROOM  
D - DINING ROOM  
K - KITCHEN  
B_1 - SINGLE BEDROOM  
B_2 - DOUBLE BEDROOM  
B_3 - MASTER BEDROOM  
E - ENTRANCE  
P_1 - PUBLIC PASSAGE  
P_2 - PRIVATE PASSAGE  
S_1 - PUBLIC STAIRCASE  
S_2 - PRIVATE STAIRCASE  
E - ELEVATOR  
B - BATHROOM  
b_1 - HALF BATHROOM  
b_2 - FULL BATHROOM  
ST - STORAGE
<table>
<thead>
<tr>
<th>BASEMENT</th>
<th>FIRST</th>
<th>SECOND</th>
<th>THIRD</th>
<th>FOURTH</th>
<th>FIFTH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ia</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( P_1 )</td>
<td>( B_2 )</td>
<td>( B_2 )</td>
<td>( K )</td>
<td>( B_1 + B_2 / B_3 )</td>
<td>( B_2 )</td>
</tr>
<tr>
<td>( 3_1 )</td>
<td>( E )</td>
<td>( 3_1 )</td>
<td>( E )</td>
<td>( P_2 )</td>
<td>( 3_1 )</td>
</tr>
<tr>
<td>( L )</td>
<td>( K )</td>
<td>( P_2 )</td>
<td>( L )</td>
<td>( K )</td>
<td>( L )</td>
</tr>
</tbody>
</table>

| **Ib**   |       |        |       |        |       |
| \( B_1 + B_2 / B_3 \) |       |        |       |        |       |
| \( 3_2 \) | \( E \) | \( P_2 \) | \( K + D \) | \( D \) | \( K \) | \( B \) | \( K \) | \( D \) | \( B_1 + B_2 / B_3 \) |
| \( L \) | \( B \) | \( L \) | \( D \) | \( L \) | \( B_1 + B_2 / B_3 \) |

| **Ic**   |       |        |       |        |       |
| \( B_1 + B_2 / B_3 \) |       |        |       |        |       |
| \( b \) | \( 3_2 \) | \( P_2 \) | \( D + K \) | \( B_2 \) | \( b \) | \( B_3 \) | \( K \) | \( D \) | \( B_1 + B_2 / B_3 \) |
| \( b \) | \( E \) | \( P_2 \) | \( 3_2 \) | \( E + P_2 \) | \( 3_2 \) | \( E + P_2 \) | \( 3_2 \) | \( E + P_2 \) | \( 3_2 \) | \( P_2 \) |
| \( L \) | \( D \) | \( K \) | \( L \) | \( L \) | \( B_1 + B_2 / B_3 \) |

<p>| <strong>Id</strong>   |       |        |       |        |       |
| ( B_1 + B_2 / B_3 ) |       |        |       |        |       |
| ( b ) | ( 3_2 ) | ( P_2 ) | ( P_1 ) | ( K ) | ( K ) | ( D ) | ( K ) | ( D ) | ( B_1 + B_2 / B_3 ) |
| ( b ) | ( 3_2 ) | ( P_2 ) | ( S_1 ) | ( S_1 ) | ( B_1 + B_2 / B_3 ) | ( B_1 + B_2 / B_3 ) |
| ( L ) | ( K ) | ( K ) | ( L ) | ( L ) | ( B_1 + B_2 / B_3 ) | ( B_1 + B_2 / B_3 ) |</p>
<table>
<thead>
<tr>
<th></th>
<th>BASEMENT</th>
<th>FIRST</th>
<th>SECOND</th>
<th>THIRD</th>
<th>FOURTH</th>
<th>FIFTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ia</td>
<td>P₁</td>
<td>K₁</td>
<td>D₁</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P₂</td>
<td>b₂</td>
<td></td>
<td>D₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>s₂</td>
<td>s₂ + b₂</td>
<td></td>
<td>s₃</td>
<td>b₂ + s₂</td>
<td>b₂</td>
</tr>
<tr>
<td></td>
<td>b₂ + s₂ / b₂</td>
<td>E₁</td>
<td></td>
<td>D₂</td>
<td></td>
<td>b₂</td>
</tr>
<tr>
<td></td>
<td>EL + P₁</td>
<td>L₁</td>
<td>L₁</td>
<td>D₂</td>
<td></td>
<td>b₂</td>
</tr>
<tr>
<td>Ib</td>
<td>P₁</td>
<td>b₁ + b₂ / b₂</td>
<td></td>
<td>D₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b₁ + b₂ / b₂</td>
<td>EL</td>
<td></td>
<td>s₁</td>
<td>b₁</td>
<td>b₂</td>
</tr>
<tr>
<td></td>
<td>s₁</td>
<td>s₂ + b₂</td>
<td>E₁</td>
<td>s₂</td>
<td>b₁ + b₂</td>
<td>E₂</td>
</tr>
<tr>
<td></td>
<td>s₁</td>
<td>s₂ + b₂</td>
<td>E₁</td>
<td>s₂</td>
<td>b₁ + b₂</td>
<td>E₂</td>
</tr>
<tr>
<td></td>
<td>b₂</td>
<td>P₁</td>
<td>L₁</td>
<td>D₂</td>
<td></td>
<td>b₂</td>
</tr>
<tr>
<td>Ic</td>
<td>P₁</td>
<td>b₁ + b₂ / b₂</td>
<td></td>
<td>D₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>s₁</td>
<td>s₂ + b₂</td>
<td>E₁</td>
<td>s₂</td>
<td>b₁ + b₂</td>
<td>E₂</td>
</tr>
<tr>
<td></td>
<td>s₁</td>
<td>s₂ + b₂</td>
<td>E₁</td>
<td>s₂</td>
<td>b₁ + b₂</td>
<td>E₂</td>
</tr>
<tr>
<td></td>
<td>b₂</td>
<td>P₁</td>
<td>L₁</td>
<td>D₂</td>
<td></td>
<td>b₂</td>
</tr>
<tr>
<td>III</td>
<td>b₃</td>
<td>s₁</td>
<td>b₃</td>
<td>D₁</td>
<td>s₁</td>
<td>b₃</td>
</tr>
<tr>
<td></td>
<td>s₃</td>
<td>b₁ + b₂</td>
<td>E₁</td>
<td>b₂</td>
<td>b₁ + b₂</td>
<td>E₂</td>
</tr>
<tr>
<td></td>
<td>b₁ + b₂ / b₂</td>
<td>EL</td>
<td></td>
<td>s₁</td>
<td>b₁</td>
<td>b₂</td>
</tr>
<tr>
<td></td>
<td>b₂ + s₂ / b₂</td>
<td>EL</td>
<td></td>
<td>s₁</td>
<td>b₁ + b₂</td>
<td>E₂</td>
</tr>
<tr>
<td></td>
<td>b₂</td>
<td>P₁</td>
<td>L₁</td>
<td>L₁</td>
<td></td>
<td>b₁</td>
</tr>
</tbody>
</table>

90
Sector Analysis
Sub-Variations
Parking Alternatives

The present parking situation of Back Bay:

Private parking is located in the backyard with access from the alley.
Parking in the set back zone

Advantages:
* Backyard can be fully used for playing area or private green.
* Public space between backyards can also be arranged as children's playing area or pedestrian promenade.

Disadvantages:
* Entire building frontage at the street becomes parking spaces.
* Inflexibility of land use for basement and first floor.
* Insufficient number of parking spaces per lot.
* Interruption of parking lane on the street.
Parking under the building with access from the street

Advantages:
* Individual parking spaces.
* Direct access to the building.

Disadvantages:
* Garage entrance takes the major part of the building frontage.

In this situation, which is prevalent throughout the city, garages become the sum total of the urban pedestrian experience.
* Insufficient number of parking spaces per lot.
* Difficult to convert basement and first floor for commercial use.
* Interruption of parking lane on the street.
Parking under the buildings concentrated in lots

Advantages:
* Garage entrance occupies a small part of the building frontage.
* Backyards can be fully used.

Disadvantages:
* Indirect access to the building units.
* Continuity of the street parking lane will be partially interrupted
* Inflexibility of land use for the basement.
Parking under the building with access from the backyard

Advantages:
* Building frontyard will not be disturbed by garage entrance.

Disadvantages:
* Individual parking spaces in each lot.
* Garage entrance occupies major part of the backyard.
Parking under the buildings with access from alley

Advantages:
* Flexibility of land use in frontage.
* Continuity of street parking lane.
* Indoor garage is provided.

Disadvantages:
* Direct access to each residential unit.
* Sufficient number of parking spaces per lot.
* Backyard can be fully used.

* A small part of backyard will be used as common garage entrance.
Block Type

This function model represents Back Bay's tissue type in the middle of the nineteenth century.

Several main characteristics can be identified:

(i) Primary streets run in the east-west direction, each acting as a collective space for the majority of front entrances in adjacent blocks. The spatial enclosure of the primary street is defined by the combined width of the public distribution zone and its two flanking set-back zones, and by the height of the street wall. The distribution zone contains a 40-foot wide street for horse cars and two 12 feet sidewalks.
(ii) Secondary streets run orthogonally to primary streets, each providing access through alleys to backyards in their adjacent blocks. The spatial enclosure of the secondary street is significantly different from that of the primary street. Because setback zones exist only along primary streets, the width of the secondary street-space is much smaller.

The distribution zone contains a 36-foot wide street and two flanking sidewalks.
In this function model most of the residential parking is situated in the rear of the building and between the backyards.

* Public parking and part of the residential parking and located along the main streets.
In this function model, part of the pedestrian street is used as a parking area.

* The pedestrian street therefore have a greater width.
* The middle section of the street remains free from cars and is a pedestrian area.
* This pedestrian area can be arranged as:
  (i) Playing area
  (ii) Public green
* The south-north street can be fully used for car circulation since there are no parking lanes.
This function model provides building blocks in combination with the separated circulation for cars and pedestrians.

* Public parking is located along side the vehicular streets.
* Secondary streets should be enlarged in order to provide sufficient space for public parking.
Irregular Lot Forms

\( \omega : \text{Facade Width} \)

\( R : \text{Radius} \)
Final Remarks

Having gone through the process of working with the SAR Methodology, I have begun to fully realize the importance of such a system and its implications in design. Besides allowing for a certain range of variation of built form, it is capable of being applied in different contexts.

In this present research, technical and architectural details have not yet been addressed. I intend to elaborate upon issues of the actual construction in the future.

Following the work presented here, the Back Bay tripartite facade system could be studied with the same approach. It can be organized into two district levels: the framework which establishes a structure at the level of collective control, and the infill which allows for variations at the level of individual control.

I hope this thesis will contribute some ideas to any designer who needs to intervene in the context of the Back Bay.
Bibliography


