

Between Campus and City: The Transformation of MIT's Campus

By

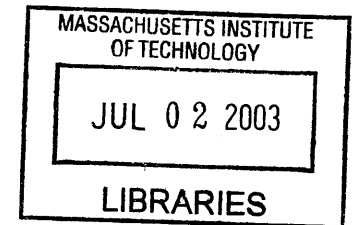
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Submitted to the Department of Architecture
in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Architecture Studies

at the
Massachusetts Institute of Technology
June 2003

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Abstract

The urban campus will not be an isolated enclave in the future. The quality and vitality of the campus will affect and be influenced by the character of the surrounding neighborhoods. Therefore, it is significant to enhance the relationship of the campus with the surrounding community to create a vital, diverse, and attractive environment.

This thesis proposes transitional urban campus boundaries as a future form of the educational environment that contributes to shaping an attractive physical setting for the university, fostering neighborhood amenities and enhancing the relationship between them. The interpretation of this concept is explored through the design exercise in transforming MIT's campus boundaries into transitional boundaries. It addresses the potentials for future redevelopment and transit development as a revitalization mechanism. A series of relevant planning strategies and urban design guidelines will be set up to achieve the design goal. This study is a qualitative evaluation of the urban form that is best suited for a successful transitional boundary between city and campus.

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Acknowledgements

I would like to thank :

Michael Dennis, my advisor, for his insightful direction, guidance and generosity. Hubert Murray and Paul Lukez, my thesis readers, for their constructive criticisms and value supports. Julian Beinart, for facilitating the opportunity to work in MIT/Cambridge University Urban Design Studio.

Work on this project would not have been possible without the support of various individuals and groups. I am grateful for the help from the colleagues in the urban design studio, Deborah Poodry and Kelley Brown in MIT Planning office.

I thank my close friend Jing Su for her wise suggestions and time. I thank my dear bear for his love and sharing this time period with me. I thank my family for their endless support and love.

Finally, I want to express special gratitude to all the people who have given me help and support.

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Chapter 1: Introduction

This thesis first summarizes categories of urban universities and introduces the basic concept of "transitional boundaries." Secondly, it provides an outline of the development of the city of Cambridge as an essential part of any understanding of the urban context as well as a brief history and description of MIT's campus development. A discussion of development missions for both Cambridge and MIT follows with consideration of some implications of current development projects. Moreover, the methodology of transforming the existing boundaries into new transitional boundaries is interpreted through the design exploration, including a series of analyses and the design project. This design work can be characterized as the physical organization of linking and transitional elements. Finally, conclusions drawn from this study in the form of transitional boundaries are summarized briefly.

1.1 Types of Urban Campuses

The quality and vitality of a campus will affect and be influenced by the character of its surrounding neighborhoods. The university itself should be an integral part of the larger community to fulfill its mission in a congenial environment. Given that premise, it is important for the university in a competitive environment to sustain the "collegial" qualities of the university's academic core in a diverse urban setting, as well as to foster informal exchange and enliven the experience of the university. Moreover, a university can be an economic engine that can deliver significant economic benefits for the city. These qualities can be enhanced by a rich mix of activities within the boundaries area.

The ways in which urban universities are located in the urban setting determine the character of campus boundaries, which become a symbol of the relationship between the campus and city. Therefore, it is essential to study the varieties of existing university-city links in terms of the character of the campus boundaries. Three basic types of urban campuses are summarized as follows, based on the manner of the campus locations and the nature of the boundaries.

Embedded

One type of urban university can be characterized by the campus embedded in the urban setting without distinct boundaries between the campus and city. Harvard University, Yale University, and Columbia University are good examples of this type.

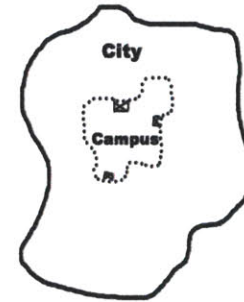


Fig 1-1 Diagram of the embedded urban university

Fig 1-2 Diagram of Harvard University's Campus



Fig 1-3 Diagram of Yale University's Campus



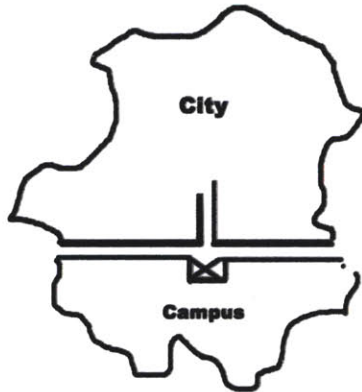


Fig 1-4 Diagram of the differentiated urban university

Differentiated

Another type of urban university features the campus located on the edge of the city with distinct boundaries between the campus and city, such that the boundary facing the city serves as a frontage. Princeton University is of this type.

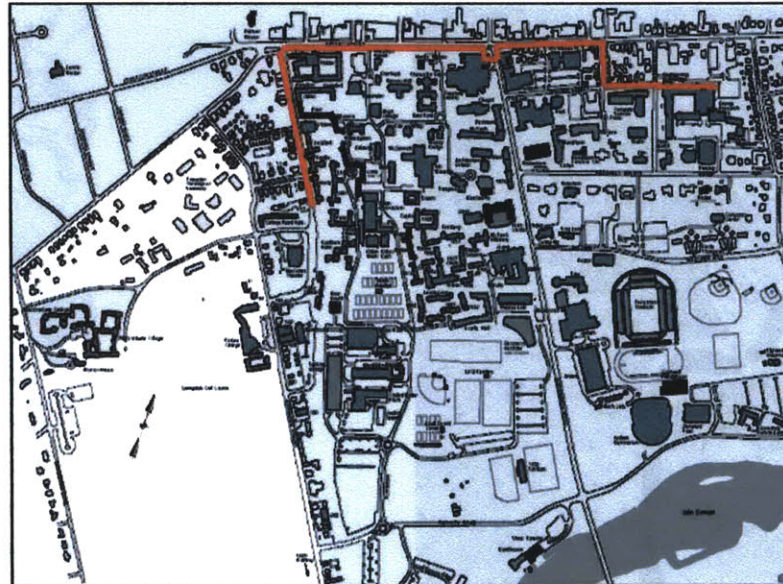


Fig 1-5 Diagram of Princeton University's Campus

Interrupted

The third type of urban university places the campus between two adjacent cities, with frontage of the campus facing one city and the back facing the other. MIT belongs to this type because the campus lies on the fringe region between Boston and Cambridge, with the frontage facing Boston and the back facing Cambridge.

Fig 1-7 Diagram of MIT's Campus

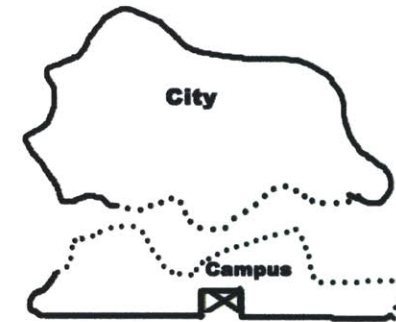


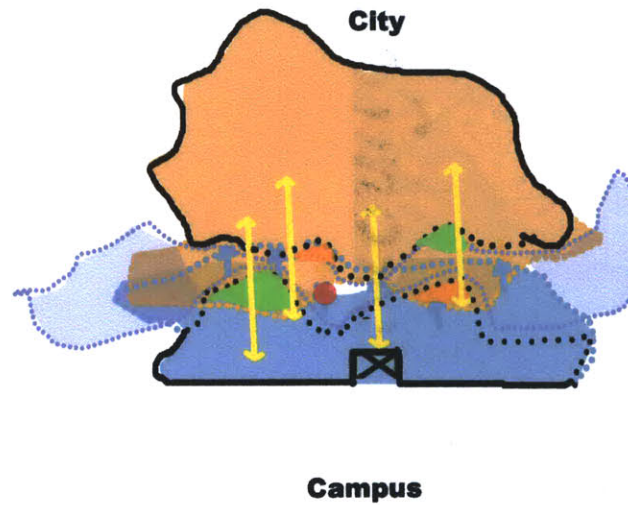
Fig 1-6 Diagram of the interrupted urban university

Compared with the other two types of campus boundaries, the back edge of MIT's campus embodies a barrier that has negative effects on the relationship between the campus and city.

1.2 Concept of "Transitional Boundaries"

Transitional boundaries refer to a condition in which there is no absolute edge between the campus and the city, but a blurred edge, which embodies a mid-belt and serves as a transition between the campus and city. This type of boundary helps to enhance the relationship between the university and its surroundings because of the following characteristics that contribute to shaping a continuous physical setting between them.

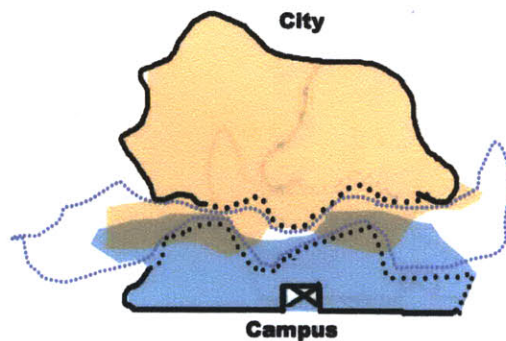
Fig 1-7 Diagram of "transitional boundaries"



Dual

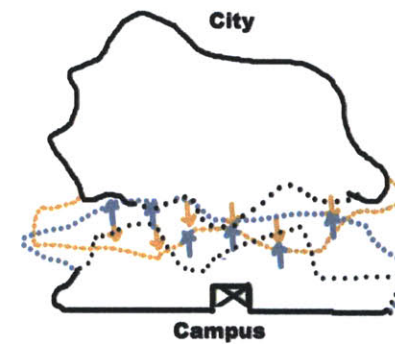
This kind of boundary is characterized by the overlapping of the campus and its adjacent neighborhood. It allows sharing of resources and possesses dual characteristics for both the universities and the surrounding communities.

Fig 1-8 Diagram illustrates the dual characteristic of "transitional boundaries"

**Neutral**

This boundary possesses the ability to reconcile the conflicts between the campus expansion driven by its missions and many other stakeholders (public sector, private developers and users) participating in this area with different interests and objectives .

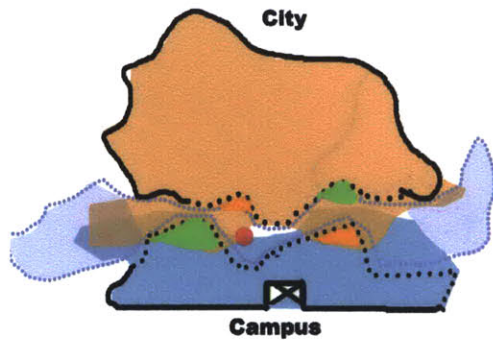
Fig 1-9 Diagram illustrates the neutral characteristic of "transitional boundaries"



Mixed

This transitional boundary can accommodate diverse elements in terms of population, land use, and land ownership.

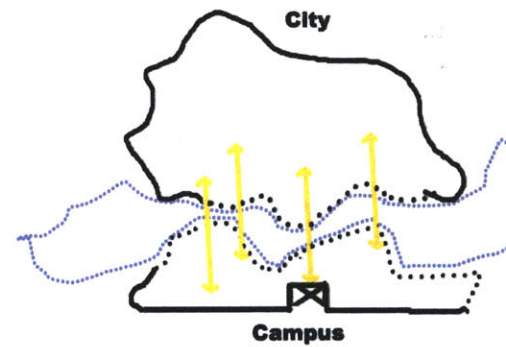
Fig 1-10 Diagram illustrates the mixed characteristic of "transitional boundaries"



Penetrable

This area is permeable such that it allows free and flexible movements of people between the campus and its surroundings.

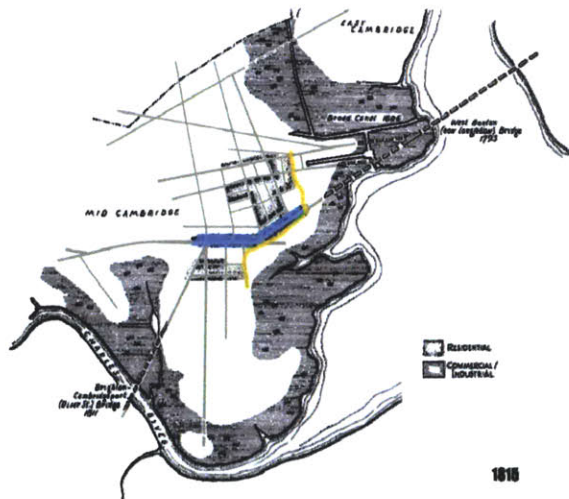
Fig 1-11 Diagram illustrates the penetrable characteristic of "transitional boundaries"



Chapter 2: Background

This chapter first outlines the urban history of the City of Cambridge as an essential part of an understanding of the urban context. In addition, a brief history and description of MIT's campus planning development are shown. The current development missions for both Cambridge and MIT are discussed.

Fig 2-1 Diagram illustrates urban development in Cambridge in 1815



2.1 Historical Trends

2.1.1 Urban History of Cambridge

Pre-1973: Pre-development

"Old Cambridge" grew in the area immediately around what is currently Harvard Square where the first urban settlements in Cambridge occurred in 1630. The rest of the land in Cambridge was still agricultural lands. Until the late 1790s, the south and east of Old Cambridge were developed where the current Cambridgeport and East Cambridge are located. During the Revolutionary War, some military installations were stationed in these areas; Fort Washington Park was the site of a three-cannon battery and has been preserved through the present.

1793-1850: The Road and Bridge, Commerce, and Suburban Development

The construction of West Boston Bridge, which linked Cambridge directly to Boston via Main Street, led the urban development of the area in 1793. This connection was also the catalyst for large-scale land development for residential and commercial purposes along the route to the bridge. During this time, major roads and intersections were laid out. In 1809, Cambridge Street and Canal Bridge were constructed to connect East Cambridge to Boston.

Commercial development started to occur in Central Square and Lafayette Square, followed by business development in the marshes around the present Kendall Square area. The original residential development took place around Central

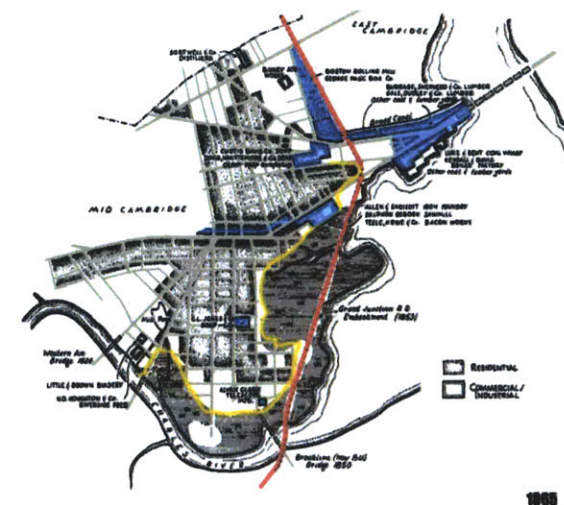
Square. It was occupied by the middle-class businessmen who worked in Boston, so that it started to develop slowly as a suburb of Boston causing the city fabric to have a suburban nature. East Cambridge was developed as the first industrial center in Cambridge. All streets on the solid land had been established by 1850.

1850-1900: Railway and Industrialization

The 19th century was the greatest period of topographical expansion, as well as population growth in Cambridgeport. Increases in population naturally put pressures on the supply of housing, but Cambridgeport was equal to the task. Cambridgeport's accidental pattern of development differed from the more systematic growth in East Cambridge. In Cambridgeport, the centrally located neighborhoods were intensively built up close to Main Street and Massachusetts Avenue. Nevertheless, the meaning of centrality changed considerably during the third quarter of the 19th century as transportation became more rapid and more sufficient.

The multiplication of street-horse railway services had a significant influence on the Cambridgeport development because the rail lines stimulated commercial and residential activities along the streets. As a result, Cambridgeport did not form a single center or even single spine, but rather stretched along a grid of crossing lines. Centrality came to mean proximity to the major street railway routes; thus the whole group of streets became "central" locations.

Fig 2-2 Diagram illustrates urban development in Cambridge in 1865



The establishment of the Grand Junction Railroad led a new phase of urban development in the 1850s. It was constructed on a bank over marshland in the east and south of Cambridge. After it opened in 1866, it became an influential factor bringing the growth of large-scale industrial development to the surrounding area, which soon became known as a major soap manufacturing center. Heavy industrial development soon expanded into the commercial wharf district where the present Kendall Square area is now located. From the 1870s to the 1910s industrial development continued to extend on marshland along the railroad to the south of Kendall Square, filling the Osborn Triangle area, the land between the railroad and existing residential district in Cambridgeport, and the area between East Cambridge and Cambridgeport. An industrial belt was formed along the entire length of the railroad through Cambridge by 1916. In short, the railroad's arrival stimulated an industrial reaction. Inexpensive soft land adjacent to the railroad was another factor encouraging industrial development. The strips of industrial land along the present Albany Street effectively prevented residential expansion to the east and south of Cambridgeport.

During this time residential development accelerated. Immigration brought with it major changes in the composition of the population. By the early 20th century the homogeneous Yankee population of the 1840s became much more cosmopolitan.

1900-1920: MIT's Campus and the Subway

By 1880, a local industrialist who owned a large amount of the mud flats to the south and east of the railroad embankment proceeded to construct an embankment and sea wall with other developers. Their intention was to create an upper-class neighborhood with boulevards and an esplanade along the Charles River, however they never succeeded in creating a neighborhood, except for a few residential buildings.

MIT moved its campus from Boston to the newly filled embankment in Cambridge in 1916. The initial part of MIT was constructed on a site to the east of Massachusetts Avenue and eventually extended to cover almost all land along the river. The coming of MIT introduced a new kind of urban-suburban consolidation and also provided Cambridge with its scientific and technical focus in development.

During this time, the West Boston Bridge was replaced by the present Longfellow Bridge designed for carrying not only trolleys but also the rapid transit subway which connected Harvard Square to Boston. The subway from Park Street to Harvard Square opened in 1912. Its route followed the old horse-car and trolley line which is across the Longfellow Bridge and under Main Street and Massachusetts Avenue. This subway provided the suburbs very convenient access to the Boston business center, which caused Central Square to be less important as a commercial district.

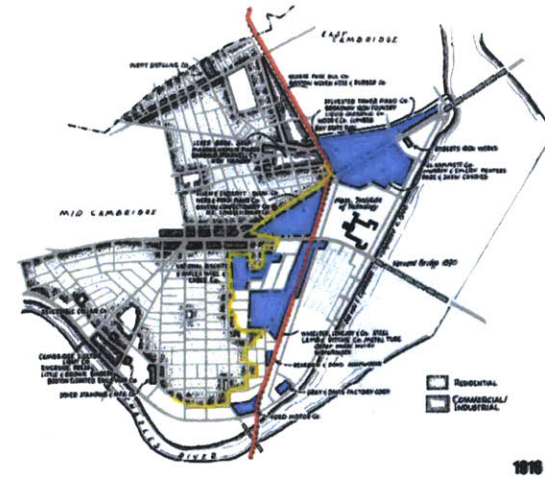


Fig 2-3 Diagram illustrates urban development in Cambridge in 1916

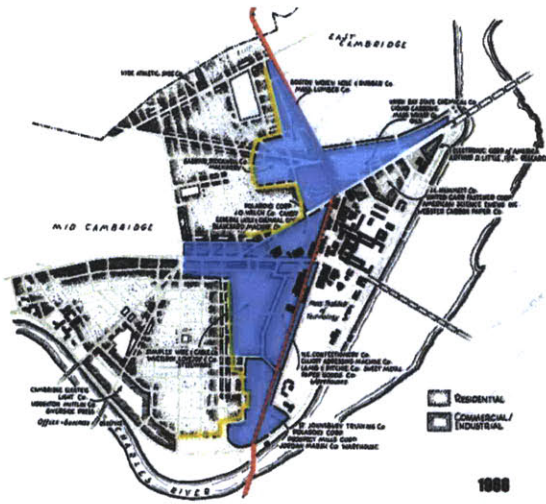


Fig 2-4 Diagram illustrates zzzurban development in Cambridge in 1966

1920-1990: Industrial decline, Urban Renewal

The growth of population and industry was stable during this phase. The basic urban fabric of residential, commercial and industrial uses did not change much from the 1920s to the 1970s. Some public housing projects were built during that time. The automobile started to have a significant impact on Cambridge, as residents began to move to the suburbs.

The railroad system was also gradually being replaced by trucks as a major means of shipping, so that large manufacturers began to move their factories from the city to the suburbs. A declining population, shrinking industrial economy and increasing stock of vacant land occurred in Cambridge during the 1950s and 1960s.

Cambridge began to undertake urban renewal in the late 1950s like other cities in the US at that time. The first project was the development of Technology Square after the clearance of Rogers Block, a mainly residential parcel on Main Street, by MIT and other real estate developers. A large-scale urban renewal project intended to be a research center in the area around Kendall Square was occupied by a smaller office complex in the middle of the 1960s and the mixed-use Cambridge Center in the 1980s. The real estate developers, with MIT, then replaced one of the dominant industrial districts with the mixed-use University Park. The MIT-sponsored renewal of old industrial areas has continued into the present.

2.1.2 Evolving History of MIT's Campus

MIT was founded in 1860 and constructed its first buildings in the vicinity of Copley Square in Boston. The institute had to move out of Boston, since it was short of space in its original location. It purchased 43 acres of land east of Massachusetts Avenue in Cambridge that extended from the railroad right-of-way behind Vassar Street to the Charles River Basin. To acquire the land, MIT had to negotiate with thirty-five different owners and also with the City of Cambridge. In the early 20th century MIT moved to Cambridge from Boston.

William Welles Bosworth, an alumnus of 1889, received the design commission by MIT. He had already set up a successful New York practice when he was commissioned by MIT. It was in part because of his reputation for developing projects that were designed in attractive landscape settings that Bosworth was chosen as the new campus architect.

Bosworth designed the main building with symmetrical wings flanking major and minor courtyards. Bosworth put the academic buildings in the eastern section because of its proximity to the transit routes and the Kendall Square subway station that would provide convenient access for the students and faculty members. The campus plan included a Great Court of more than five acres facing outward to the embankment parkway. Side courts and interior courtyards enclosed by the academic buildings, in combination with park-like squares in surrounding

residential areas. The Court was designed to be the front entrance to the Institute, but it never became the main entrance because of the trolley car stops at the corner of Memorial Drive and Massachusetts Avenue. In his plan, the river bank was designed as part of the main court with a platform at water level. In 1916 this might have been a feasible idea for direct pedestrian access from the Court to water, but now it's difficult without tunneling vehicular traffic under the road level.

MIT's campus evolved following Bosworth's master plan until the early years of World War II. Some athletic buildings were placed in West Campus, while some buildings were not placed on the axes he had suggested. Other buildings were built into the crowded back yard for wartime research, which did not adhere to the original concept of the main complex. Considering campus expansion in the future, Bosworth also designed corridors leading north from the back of the main complex to a corridor parallel to Vassar Street. By 1919, a corridor was added to the wing parallel to Massachusetts Avenue.

In 1924, MIT purchased the land west of Massachusetts Avenue and gradually acquired the existing buildings. With some apartment houses being converted to student dormitories and athletic facilities being built, the campus development center began to move west of Massachusetts Avenue. West Campus gradually became the center for student amenities, eventually including a chapel, an auditorium, and a student center. This differs remarkably from the original

concept of Bosworth's master plan of occupying some lots in East Campus with student service and dorms.

In 1937, MIT finally built a major entrance on Massachusetts Avenue, on an axis aligned with the major dome. This entrance became the principle public ingress to the Institute because it is close to the major road edge.

In 1949, MIT leased land adjacent to the President's House to the New England Mutual Life Insurance Company for construction of a large apartment building, 100 Memorial Drive, which was intended for faculty housing. Later on, West Gate and East Gate residential towers for married-student housing were built on the two ends of the campus. By 1956, approximately forty percent of MIT's employees arrived in automobiles, which reflected the changes in commuter and residential patterns in the Boston area. Most campus parking was on paved surface lots located in the North, East, and West Campuses. Many students and staff relied on public transportation to commute to MIT.

In order to rapidly acquire available space, MIT was involved in purchasing and converting buildings in its immediate surroundings. Three major buildings along Massachusetts Avenue were MIT acquisitions: Riverbank Court, the Armory, and the Metropolitan Storage Warehouse. Additionally, other converted buildings in the vicinity include a series of buildings along Albany Street.

From the 1960s to 1990s, MIT's campus has doubled in size. Along the south side of Vassar Street, new buildings, mainly for laboratory uses, and parking garages replaced temporary buildings. A row of dormitories was built along Memorial Drive in West Campus. Later on, parts of East Campus were developed with Sloan School Campus, some family housing, a medical center and a fine arts center.

MIT has become involved in a building campaign, employing famous contemporary architects, as a new focus for campus development. In 1999 a team of world-renowned designers convened in Cambridge to generate ideas for a more visually valuable campus environment in the future.

2.1.3 MIT's Campus Plans

Campus Master Plan

1960 Campus Master Plan

In the early 1960s, the campus known as the East Campus consisted of the area bordered by Ames Street. This area had been designated for residential use in the original plan; however, much of the space had been converted into a large parking area, remaining available for the future campus expansion.

The 1960 Campus Master Plan, which the Planning Office prepared for the Long-Range Planning Committee, intended to establish ground rules for the future development of the MIT campus. The Plan set up five general criteria for future development:

- “(1)MIT’s growth would be careful and selective;
- (2) MIT would continue its major activities on the Cambridge Campus and not relocate them to other municipalities;
- (3) MIT would develop a complete campus community that includes academic, research, residential, and recreational areas;
- (4) MIT would use its existing land intensively, redeveloping some areas and making limited land acquisitions;
- (5) MIT would develop an attractive, well-designed campus.”

The 1960 Campus Master Plan identified major issues that would influence future MIT development, including: land-use principles; population expectations for the MIT community, design guidelines for MIT property in academic and non-academic uses, the location of a major interstate expressway, the Inner Belt Highway, and new amendments to the Cambridge Zoning Ordinance.

The broad planning document served as the basis for the coordinated development of the campus. The document also stressed that MIT should interact with the City of Cambridge in complementary ways that benefited both the City and Institute. In contrast to the earlier master architect philosophy, MIT preferred to engage a variety of distinguished architects and assigned parts of the campus to each one. While the 1960 Campus Master Plan has been reviewed, amended and improved every five years, its basic goals have served as the standard for physical decisions regarding the development of the MIT campus.

Campus Master Plan Review and Update 1975

The Campus Master Plan of 1975 recommended new student housing development along Memorial Drive and an upgrading of existing dormitories, but it made little progress in accommodating more faculty and staff. The major objectives were to replace and expand the existing athletic facilities and improve teaching facilities. Additionally, the plan's initiatives for the mixed-use redevelopment reflected the new responsibilities of contribution to the city.

Campus Master Plan Review and Update 1980

This plan reflected policies that aimed at stabilizing and possibly reducing the size of the faculty and called for more efficient use of existing space. However, the plan neglected the urgent needs for more department spaces and graduate housing. The transportation component developed new parking plans and proposals for shuttle buses and better bicycle facilities.

MIT Development Plan

The MIT Development Plan provided a list of outstanding needs for the next round of planning. The plan assumed that the undergraduate community would not grow, or would grow in very small numbers, and that most of the growth would occur at the graduate level. The conclusion was that the campus should remain in Cambridge and grow naturally within the context of the Cambridge Planning Board's 1965 long-range land use plan for the city. The plan recommended that MIT study patterns of communication within the Institute, with the goal of designing a campus to provide opportunities for interaction among faculty and students within the buildings. Moreover, the plan suggested that MIT strongly emphasize the architectural design of its buildings and facilities in order to create a visually appealing campus.

MIT Housing Plan

The Planning Office prepared this Housing Plan designed to provide for all of

the parts of the community in proportion to their need. It provided the basis to build or redevelop housing on the campus. The plan recommended that land at the east and west ends of the campus be acquired for the development of faculty and staff housing. It urged participation in cooperative housing development and encouraged private developers to increase the housing within walking distance of MIT.

Transportation Planning

The transportation component of the 1960 Campus Master Plan called for the construction of garages for automobile commuters. Car pools, parking fees, remote parking areas and a campus shuttle were all proposed for consideration. In 1974, the Planning Office prepared and presented a comprehensive Transportation, Circulation and Parking Plan to the Parking committee. The plan contained new incentives for better transportation planning for MIT. In the fall of 1980, the Planning Office began updating the Transportation Plan beginning with a new survey of the Institute's housing and transportation needs. Then the plan assessed and made recommendations for six key transportation areas: parking, mass transit, shuttle service, ride sharing, bicycle use and street improvement. By the 1990s, MIT had installed more bicycle parking facilities and introduced shuttle vans. In the later 1990s, MIT became involved in the Commonwealth's long-range public transportation plan called the "Urban Ring". One long-range goal, underground parking, has made progress, with the Maria Strata Center project constructed. It is anticipated by the Planning Office that all parking will be located below grade in the future.

East Campus Plan

From 1958 to 1959, the planning office developed a preliminary program of needs and development capabilities for the East campus. It included possibilities for building new courtyards and expanding of the academic building fabric. It also directed connection of this area with future expansion to the east. The new development kept with MIT's principle of an interlinked building system, designed to facilitate circulation from building to building in order to foster interdepartmental interaction and exchange of ideas.

The new East Campus Plan in 1975 explored the opportunities for future links between the Main and Sloan Campuses. It focused on the northern campus boundary on Main Street which was established by emerging Technology and Kendall Squares. Acquisition of neighboring buildings was proposed in the plan. Some building commissions started before the plan was sufficiently developed. That caused the landscape strategy and design guidelines to never be fully developed.

North Campus Plan

The 1960 Campus Master Plan identified the area north of the Main Buildings, bordered by Vassar Street, Massachusetts Avenue and Building 20, as the location of development for a number of projects listed in the Second Century Fund campaign. The preliminary studies explored ways to satisfy academic expansion needs in this area known as the "backyard." The plan proposed the replacement

of several wooden buildings. Guided by the original plan, which had anticipated northward extension from the Main buildings creating courtyards and a possible new northern campus entrance, the North Campus Plan established a perimeter of buildings around the new central courtyard. A new group of laboratories along Vassar Street would form the courtyard's northern edge. Replacing the vehicle entrance at Massachusetts Avenue, a new Vassar Street entrance would provide access to campus for both vehicles and pedestrians coming from the proposed parking garages on Albany Street. The North Campus Plan can be seen as an extension of the simple ideas initiated by the original plan as well as reiterated and expanded upon by Skimore, Owings & Merrill (SOM) in 1961. The North Campus Plan attempted to use contemporary design principles to bring order to the North Campus, which is one of the most visually disordered sectors. In 1972, I.M. Pei & Partners were asked to conduct site studies for the North East Sector. They established the visual design guidelines and recommended design vocabularies. The construction of Maria Stata Center indicates a major deflection from the guidelines of the North East Sector Plan.

Sloan Campus Plan

The Sloan Campus Plan was quite compatible with MIT's Campus Master Plan. The housing community would offer attractive and easy access to all academic centers of the Institute, as well as a visual frontage of the campus along the Charles River Basin to mark Institute borders.

West Campus Plan

After World War II, the need for the West Campus Development Plan emerged. With East Campus becoming the center of future MIT intellectual activity, the relocation of residential and recreational uses to West Campus became necessary.

MIT Landscape Master Plan

The campus landscape development principles were integrated with the 1960 Campus Master Plan for new campus and city projects. The Landscape Master Plan called for tree-lined, landscaped streets and pathways in addition to well-defined open spaces. During the 1960s, great progress was made in the greening of MIT. Briggs Field's temporary WWII housing was removed for athletic field expansion.

Progress on implementing the Landscape Master Plan continued through the 1970s, but not always as intended and sometimes not with the most satisfying results. The appearance of Amherst Alley was improved according to the plan.

Landscape improvements in the 1980s included new courtyards and modest additions to existing landscapes. The planning office thought that MIT needed more stable landscape planners that could help develop the vision and maintain a green campus. Landscape changes were important to the improvement of the quality of life at MIT.

Fig 2-5 MIT's Campus Landscape Plan prepared by Olin Partnership in 2001



2.1.4 Lessons from History

Historical Barrier

The Grand Junction Railroad is the major factor that brought the growth of industrial development to Cambridgeport and resulted in the industrial character of the mid-belt between the campus and city. Due to its history of industrial use and subsequent abandonment, the industrial belt is largely isolated from residential Cambridgeport, nearby Central Square, and MIT's campus, although there are ample opportunities for pedestrian and vehicular connections along existing streets.

Because of the industrial belt to the north of MIT's campus, the campus has primarily expanded to the east and west. The northern edge of the campus facing the industrial belt naturally became the back of the campus. The industrial belt has produced the serious problem of disconnection between the campus and Cambridge. Revitalization of this area is crucial for future academic expansion and the relationship between the Institute and the City. As the campus has evolved, it has not only created a grand frontage facing Boston across the newly-formed Charles River Basin, but has also turned its back to industrial Cambridgeport with little immediate effect the industrial belt embedded between the campus and the City of Cambridge.

“Efficiency and Economy”

The campus has evolved by following the fundamental design principles: efficiency and economy. Reviewing MIT’s campus expansion, I found that the main academic expansion in East Campus simply reiterated the principle of the interlinked building system initiated in the original master plan while actually neglecting external spatial connections. MIT has been mostly involved in campus physical design for partial area rather than in overall physical development plan. An integrated master campus plan for the future physical development is urgently needed.

Factory Campus Character

With an urban campus lying in heart of Cambridge/Boston area, one of the most diverse and rich cultural urban environments, MIT places a high value on its role within that community. However, since beginning as a commuter campus, MIT’s campus has been relatively weak on residential community and the major utilitarian laboratory buildings, with little social space resulting in the "factory on the Charles" campus character. A welcoming social environment for students to gather, as well as places to relax and study in comfort, is lacking.

2.2 Current Development Trends

2.2.1 Major Current Regional Trends

Biotechnology in Massachusetts

The biotechnology industry has been growing in Massachusetts in recent years. It has focused principally on research and development activities; therefore, laboratory facilities are much more common than manufacturing facilities. Currently, the urban development in Cambridge intends to convert and rehabilitate buildings, which previously were intended for telecommunication purposes, into biotechnology research uses.

The City of Cambridge is the center of biotechnology research in Massachusetts. However, recently the ratio of biotechnology companies in Cambridge to those in the state have been dropping. Moreover, there are at least twenty-one biotechnology companies, including both larger and smaller firms, in Cambridge associated with MIT by various means. According to a year 2000 survey¹, many smaller biotechnology firms would like to be located in Cambridge because of the proximity to a talented labor pool and research institution. Furthermore, the vacancy rate for laboratory space in parts of Cambridge near MIT has gone down from 5% in 1996 to only 1% at the end of 1999 according to Mitchell's survey. In addition, many firms are willing to invest in leasehold improvements to existing space or conversion of former industrial buildings to laboratory space aiming at desirable locations.

¹ This survey was made by Brandon Mitchell, an MIT urban planning student.

² The 1948 Massachusetts Highway Master Plan included a belt highway that would connect all the radial roads linking Boston to suburban communities and beyond. Originally it was to be a four-lane road. By 1952, Massachusetts had included an Inner Belt Highway in the Interstate and National Defense Highway Plan. In 1955, the Massachusetts Highway Department proposed that the highway's Cambridge section be located along River and Lee Streets, west of Central Square. In response, the Cambridge Planning Board examined other alternative routes through Cambridge, including the Craned Junction Railroad. MIT was opposed to the Grand Junction alternative because of the devastating impact that a 300-foot-wide superhighway would have on the Institute's research facilities along Vassar Street, Albany Street, and surrounding areas. Through the effort from the City of Cambridge, other city officials, Cambridge residents, and MIT, the highway threat finally diminished and was abandoned in 1971.

"Urban Ring"

Starting with the 1972 Boston Transportation Planning Review, and with subsequent studies in 1976, 1989, 1993 and 1994, the Massachusetts Department of Transportation and the MBTA have articulated goals for a new circumferential system around the "spoke" of the present radial transit system. This new transitway has become known as the Urban Ring. It would go through southern Cambridge, southern Boston, East Boston, Chelsea, Everett, and Somerville. This project will supply significant links to the major centers of residence and employment that are outside of downtown and help reduce the transit congestion in Boston Downtown, which is covered by all the current transit lines. In these studies, the corridor envisioned for this system generally follows the alignment of what was to have been the Inner Belt Highway² planned in the 1960s. The Urban Ring is intended to connect Lechmere station to Kendall Square, proceed through MIT's campus and enter into Boston near Boston University Bridge. Even now, the exact alignment is still uncertain.

The preliminary draft of the Major Investment Study (MIS) Progress Report Executive Summary discusses a fifteen year, three-phase strategy for the implementation of the Urban Ring. It also discusses alternative alignment for the rail transit corridor planned for Phase 2 and Phase 3. The phases and alternatives are discussed below, especially the segment related closely to MIT's campus.

Phase 1: 2001-2006

Improvements recommended in Phase 1 include increased service frequency on the existing limited-stop CT1, CT2, and CT3 routes during peak hours, and new limited-stop CT routes connecting activity centers and regional transportation nodes. The CT2 bus currently runs through MIT's campus.

Phase 2: 2006-2011

During Phase 2, Urban Ring Bus Rapid Transit (BRT) routes and other transportation related supporting elements will be designed and constructed. Urban Ring BRT service will increase transit convenience, comfort, and reliability in the corridor with easily identifiable stations, frequent service, and multiple routes. Passengers will travel comfortably on roomy, quiet and easy-to-board vehicles. Use of exclusive busways and bus lanes will provide faster and more reliable trip times.

Three alternatives for the Phase 2 BRT route alignments through MIT's campus are presently being evaluated. The BRT corridor planned through MIT would run one way, rather than two ways, in three alignment alternatives: the combination of former Grand Junction right of way and Vassar Street, or the combination of former Grand Junction right of way and Albany Street, or the combination of Vassar Street and Albany Street. The Grand Junction alignment would consist of a 24' wide paved road to the south of the freight rails, which would be relocated

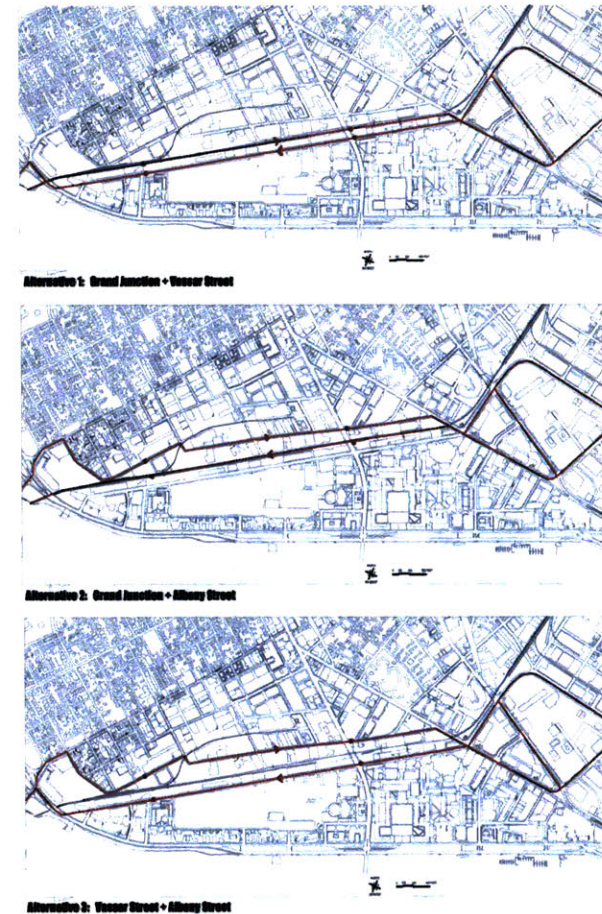
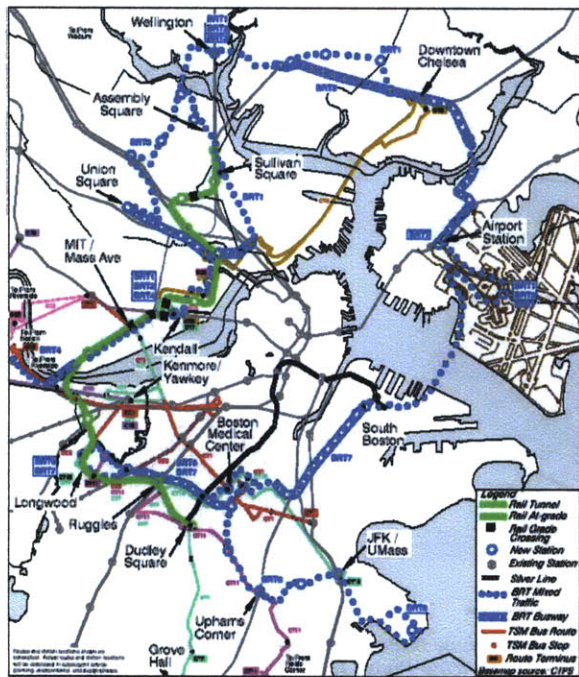


Fig 2-6 Diagrams show three alternatives for the BRT alignment in Urban Ring Phase II

Fig 2-7 Diagram shows one alternative for light rail alignment in Urban Ring Phase III. This alternative put the light rail at-grade in the Grand Junction Rail Corridor



approximately 10 feet to the north. The City of Cambridge has been working with the MBTA to also include a 12' wide "multi-use path" centered in an 18' wide easement, also in the Grand Junction corridor. The alignments on Vassar Street and Albany Street would run together with other traffic on the streets.

Phase 3: 2011-2016

The Urban Ring rail alignment and stations will be designed and constructed during this phase. The MIS process developed two rail transit alternatives to provide additional service on the segment of the Urban Ring through MIT campus.

According to the completed MIS there are two alternatives for the Phase 3 rail alignments through the MIT campus. Alternative A places the rail transit totally within a tunnel. Alternative B would be surface light rail in the vicinity of MIT. It would run in the Grand Junction right of way. Both alternatives call for an MIT Station at Mass Ave. There has been discussion of a large joint development project at this station, which would reduce the MBTA's cost of constructing it.

Current planning for the corridor includes the present CSX railroad right-of-way through MIT's campus. The CSX right-of-way is too narrow to accommodate the plans currently included in the MIS; it is the Capital Planning Development Group's assumption that the state will have to acquire land from the Institute to implement their plans.

The Urban Ring project will potentially have both beneficial and adverse impacts for MIT. Transportation will create a more accessible and therefore attractive environment. MIT's campus is currently poorly served by transit. While the East Campus benefits from proximity to the Red Line stop at Kendall Square, the center of the campus has only MBTA buses and the West Campus has almost no access to public transportation. The proposed Urban Ring would dramatically change this situation, essentially connecting the entire campus to all of the main subway lines of Boston. A crucial livability benefit is that people like living close to transit for the convenience. Both internal and external integration of MIT would create a significantly more attractive and dynamic environment.

³ Deborah Proody is the Director for Capital Project Development.

However, according to interviews with Deborah Proody³, MIT has difficulty with the alternative of alignment in Grand Junction. Albany Street is full of MIT laboratories equipped with highly sensitive magnets which cannot tolerate a lot of vibration or electromagnetic interference. The existing freight trains run through MIT's campus in the evening only for ten minutes which does not significantly affect the sensitive machines. MIT would not be able to conduct research near the light rail. The original MIS report was written with the assumption that mitigation could be done for the people that were affected. However, to protect the magnets from the traffic, it would cost MIT one million dollars per machine to move lots of machines. Currently MIT Capital Project Development has been invited to attend working groups and leading committee meetings for the study.

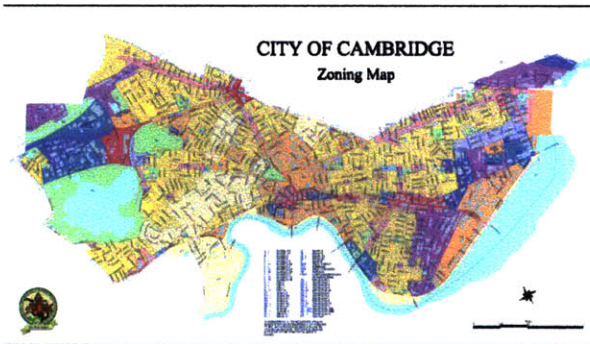
2.2.2 Major Current Trends in the City of Cambridge

An increased amount of development has been undertaken in the past few years in the old industrial belt that surrounds the MIT campus. In south and east Cambridge the current urban development trend is to replace former industrial sites with office or laboratory space usually a part of biotechnology or pharmaceutical industries or mixed use spaces. There has been a number of adaptive reuse conversions to biotech buildings in and around Kendall Square, along Albany Street and in the area between MIT and University Park.

Zoning in Cambridge

The City of Cambridge is divided into a number of districts, each of which is assigned a specific designation including a variety of residential, office, business, and industrial zones with several special districts. The divisions of these zones throughout the city are shown below. The Cambridge Zoning ordinance also sets regulations for development in each zoning district. The regulations include land use, physical dimensions, required parking areas, and other special considerations. Zoning overlays are additions or modifications to the Zoning Ordinance applying to specific areas of the city. Zoning overlays are used to control new development in some areas. One of the important overlay districts in southeastern Cambridge is the MIT Institutional Overlay District.

Fig 2-8 City of Cambridge Zoning Map



The Cambridge Citywide Growth Management Advisory Committee was formed in 1997 in response to growing community concerns for the future development of Cambridge. This organization has the right to revise the majority of the zoning code to accommodate appropriate quality and density of new development, traffic growth, and affordable housing. The issues that need to be addressed in the rezoning are: an emphasis on transit-oriented development, housing as a type of development promoted anywhere in the city, non-residential density limitation to reduce traffic impacts, and adjustment of parking requirements for new projects.

There are special zoning ordinances in the original industrial belt. The areas to the north of Main Street are the districts with overlay zones called "Planned Unit Districts" (PUDs) intending to have multiple use zones with office, retail, hotel and residential uses. Additionally, there are areas to the north of Vassar Street called Special Districts with special zoning ordinances, which promote more residential uses. Both of these special regulations intend to integrate existing business and office uses with the Cambridgeport residential fabric.

Transportation in Cambridge

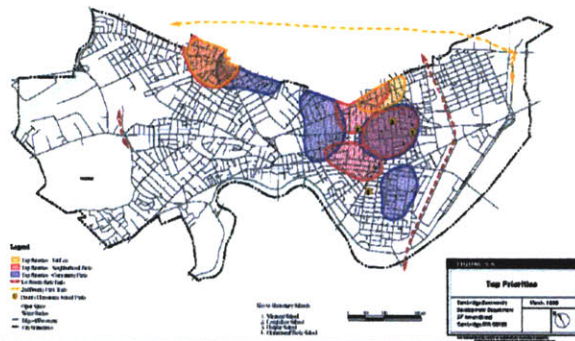
Traffic and transit congestion, parking, and pedestrian safety continue to be significant issues that need to be addressed in Cambridge. Therefore, several projects are being undertaken for improvement of the transportation system.

The City of Cambridge has set a goal of reducing single-occupant vehicle trips within and around the city. The Parking and Transportation Demand Management Plan has been developed to achieve this goal. The objective of this plan is to "minimize the amount of parking demand associated with the project." Developers are encouraged to make use of effective measures to reduce the number of single-occupant vehicle trips, so that they can get special consideration during the appeals for the approval of the projects.

Recent Planning in Cambridge

Although there is no overall master plan for the City of Cambridge, the Community Development Department serves planning functions. In fact, it has proposed several documents showing plans for the future of Cambridge. Two of the recent plans important to this study are the Green Ribbon Open Space Committee Report and the Cambridgeport Neighborhood Study.

Fig 2-9 Green Ribbon Report: Top Priorities for Open Space Acquisition



Green Ribbon Open Space Committee Report

This report intends to develop criteria for expanding and improving the city's open space system. It observes that the larger Central Square area has the least open space per 1000 residents, including Cambridgeport, Area Four, Mid Cambridge and Eastern Riverside. A dilemma facing the city of Cambridge currently is the simultaneously increased demand for open space and decreased availability of land for creating open space. In order to ensure the development of open space, the

committee has recommended to the city the following measures: focus funding on priority areas, maintain current open space, improve access to open space, and the like.

Cambridgeport Neighborhood Study

The principal goals identified in this study for the future of Cambridgeport include: maintaining diversity, encouraging interaction between residents in order to enhance the community, promoting safety, and increasing neighborhood involvement in the process of city decisions. One of the important issues addressed in the study is to increase housing for all income levels, especially for middle-income people.

2.2.3 Major Current Trends in MIT's Campus Development

"The goal behind the Institute's construction initiative is to create an infrastructure for invention that fosters the unfettered cross-fertilized of ideas. New facilities will bring together colleagues in related fields, strengthening existing synergies and sparking new ideas for research and teaching."⁴

⁴ This paragraph is extracted from the essay on <http://web.mit.edu/evolving>.

*Campus Expansion*⁵

MIT's Campus continues to expand. Science and Technology Research and Teaching have the main priority; therefore, everything else is secondary. That is the development mission MIT follows.

⁵ This section is written based on the interview with Deborah Poodry and MIT Reports to the President 1997-98.

MIT currently faces a variety of pressures to increase the supply and quality of on-campus and off-campus housing for students, both undergraduate and graduate, faculty, and staff, and these pressures are expected to increase in future. The Institute's need for additional housing resources has been affected by demographic factors such as increased numbers of women students, increased competition for faculty and students, and general changes in the composition of the faculty, staff, and affiliate populations. In short, the Institute is striving to build a campus that will be a source of inspiration and support for the 17,000 members of the MIT community for generations to come.

The need for providing new and upgraded athletic and recreational facilities continued in an environment of changing expectations and increased competition for faculty, students, and research funding. More recreational space is required for students. Another phase of the sports centre is replacing Rockwell Cage and moving the tennis space. The planning office is at the feasibility stage for a Music/Theatre labs stage.

MIT needs more space for department use. In addition, MIT administrative staff needs to be located on campus with their own space rather than being located off-campus leased space. Furthermore, there is an infinite demand for research space. Likewise, libraries need investment, because presently too much of the collection is currently located off-campus.

MIT remains focused on the importance of appearance and the quality of MIT's physical environment. With several landscaping projects of Walkways and common spaces planned, the evolving MIT's campus will be redesigned to be unified physically, aesthetically, and socially. Moreover, significant works of art are being commissioned for many of the new buildings. However, these ongoing projects only intensify interconnection within the campus, but do not really connect MIT with its surroundings successfully.

MIT's Involvement in Public and Private Development

"The Cambridge/Boston area is one of the most diverse and culturally rich urban environments in the world, and MIT places a high value on its role within that community. The Institute works in partnership with city officials to ensure that the relationship between town and gown is mutually enriching."

MIT's present efforts are directed, in part, toward enhancing the metropolitan experience for those on and off campus. The Institute has been participating in funding public improvement projects to manage traffic congestion, upgrade the infrastructure, and improve the social and aesthetic qualities of the urban landscape. These projects include the work on Vassar Street, overhauling the underground utilities and constructing new landscaping and pedestrian promenades to unify the campus.

Chapter 3: Design Synthesis

The methodology of transforming the existing boundaries into new transitional boundaries is interpreted through design exploration, including a series of analyses of the design project.

Design Synthesis

3.1 Design Intention

The north boundary of the campus has a serious problem of disconnection between the Institute and the City of Cambridge. The formation of the back of MIT's campus facing north results from the industrial belt adjacent to the Grand Junction Railroad. For that reason, revitalization of this area is crucial for future academic expansion and the relationship between the Institute and the City.

3.1.1 Site Location

Based on the design intention, the area around the historical industrial belt between MIT's campus and Cambridgeport is selected as the site to be investigated.

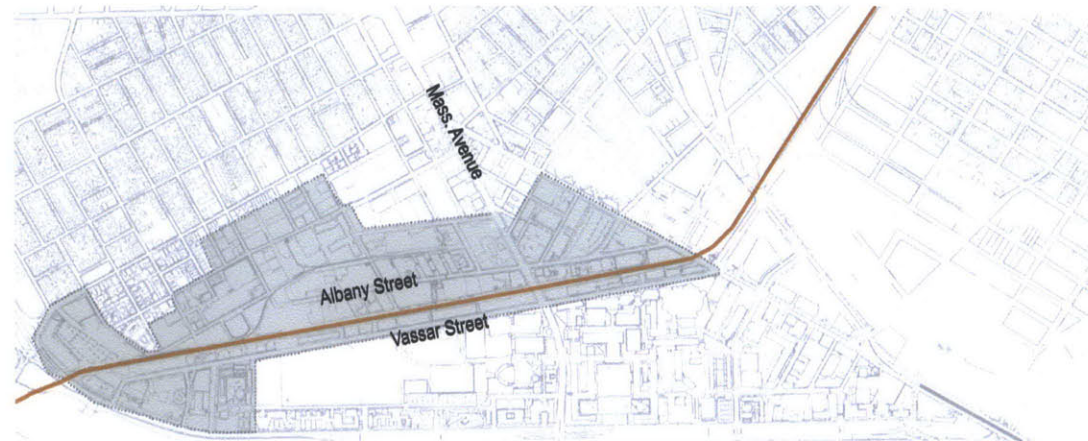


Fig 3-1 Map of site location. The red line shows the Grand Junction Rail Corridor. The blue area is the site to be investigated.

3.1.2 Site Implications

To understand the implication of the site, analyses of the overlapping of the site boundary with neighborhood boundaries, the zoning map, and the land properties map are given as explanations.



Overlapping with Neighborhood Boundaries

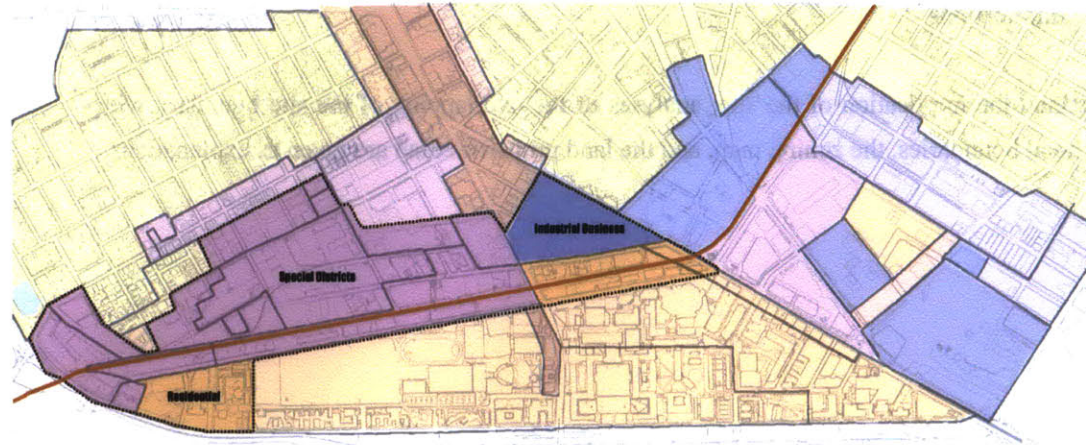
Fig 3-2 Diagram shows the site overlapped with neighborhood boundaries: Cambridgeport, Area IV, and MIT.

This diagram indicates that the site can be considered as the overlapping of MIT, Cambridgeport and Area IV.

Overlapping with Zoning Map

Fig 3-3 Diagram shows the site overlapped with the zoning map: Special Districts, Industrial District, Residential District.

This diagram implies that the site belongs to diverse zoning categories.



Overlapping with Land Properties Map

Fig 3-4 Diagram shows the site overlapped with the land properties map: MIT's Academic Plant, MIT's Investment Property, and other non-MIT Properties

This diagram indicates that the site accommodates mixed land ownerships.



3.2 Methodology Manifestation

Stratification

Stratified urban elements will be analyzed first. Equally important, the site potentials will be investigated based on the information imported by external forces in order to prepare sufficient information for the next step.

Existing Built-Form

The analysis of existing built-form is a departure point that takes into account the traces of the existing situation of the site for urban reconstitution. The tasks include identification of the existing urban elements: urban fabric, street pattern, open space, circulation, land use, and density.

Site Potentials

Potential built-form implied by external forces is explored in relation to the elements of continuity and integration with the context and the possible structure. The tasks involve determination of the projected development, including urban fabric, street pattern, open space, circulation, land use, and density.

Superimposition

First of all, we obtain all relevant information to determine the design goal and then filter out the information that helps to achieve the invention. In succession, we select the crucial factors determining the invention via overlapping information of site potentials with the crucial external force influence. In addition, we will modify the preconditions that are not in favor of the goal to some degree.

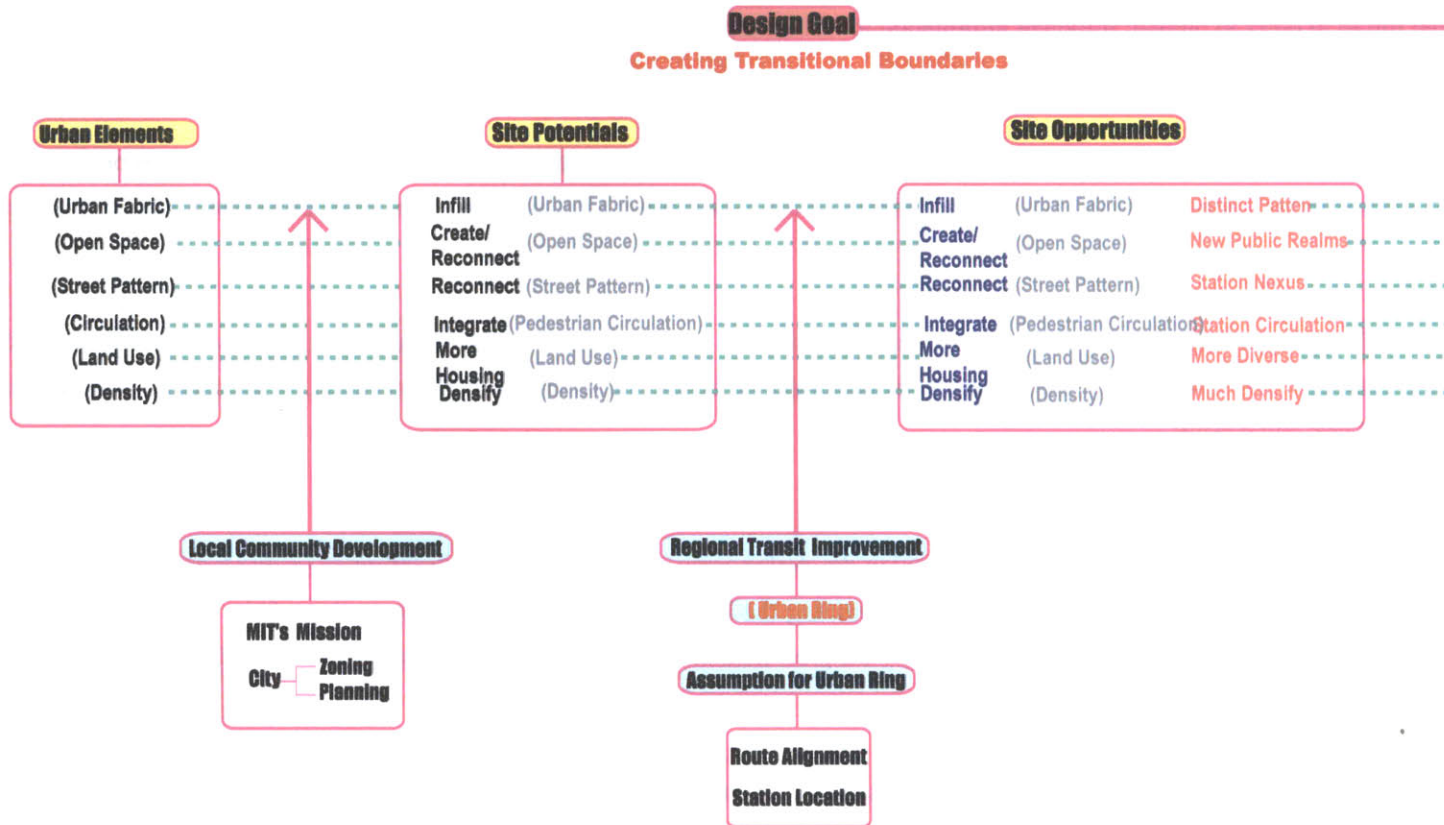
Elaboration of Process

The design process involves the integration of multilayered system of urban form, programming, policy control, human events, and emerging needs as well as their gradual concretization in urban bodies with the aid of guidelines.

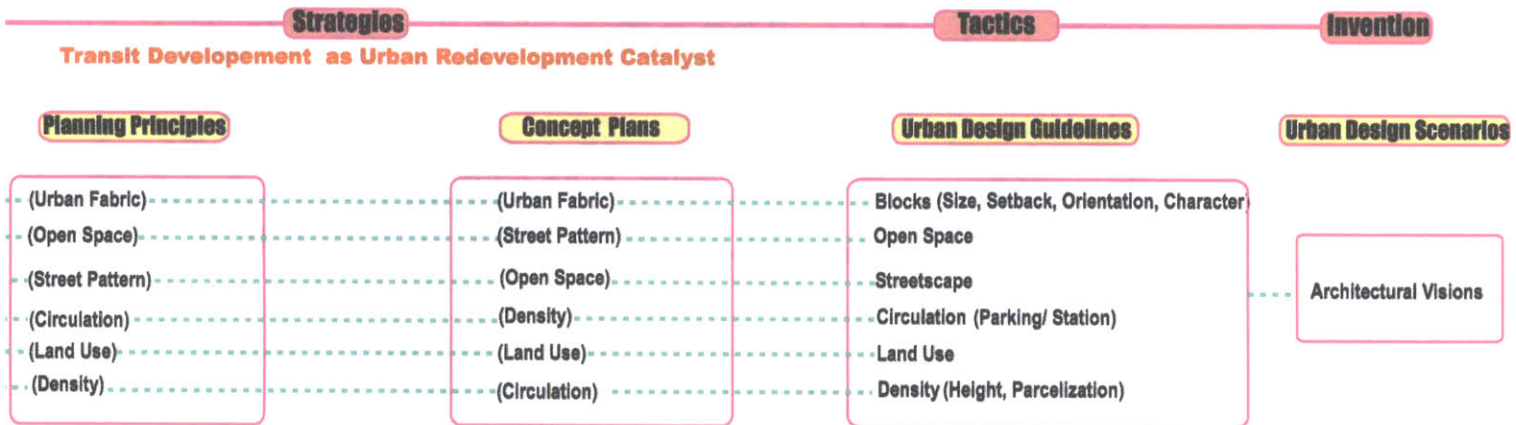
Design exploration will follow the steps explained in the following chart.

Stratification

Superimposition



Elaboration of Process



Design Synthesis

3.3 Design Exploration

3.3.1 Stratification

3.3.1.1 Urban Elements

Urban Fabric:

A lot of vacant land

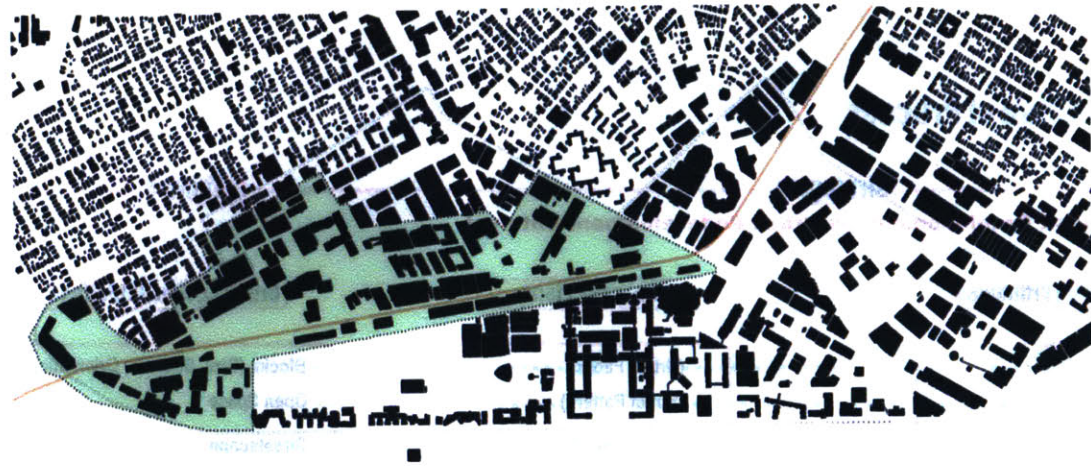


Fig 3-5 Diagram of Urban Fabric

Open Space:

Open space scattered

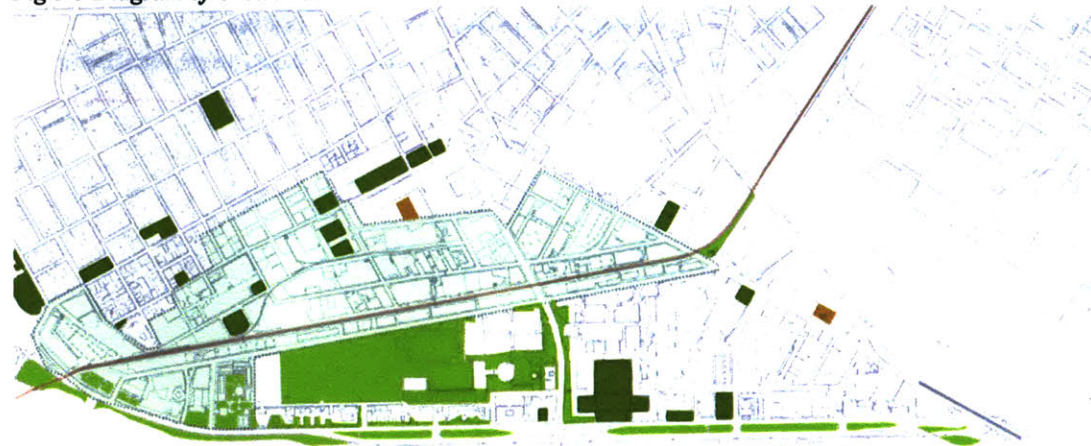
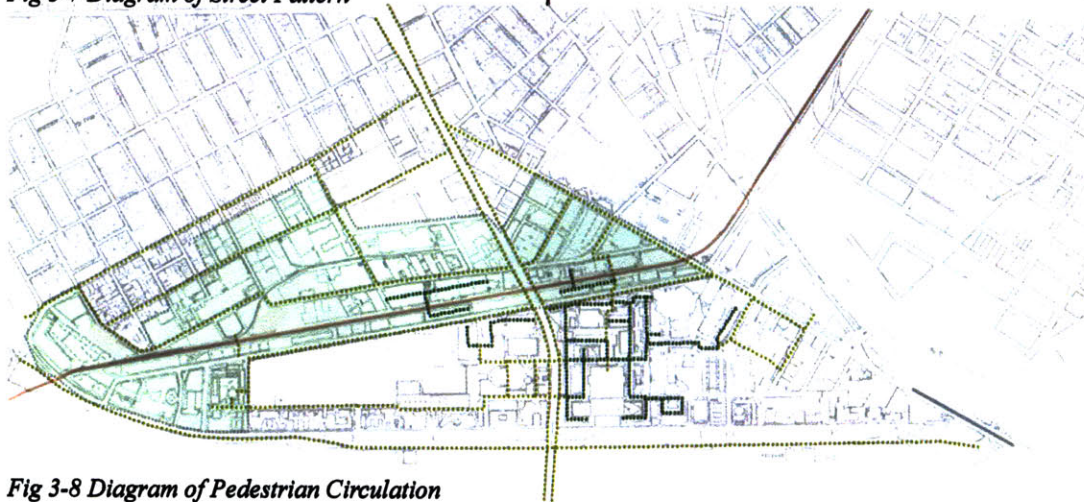


Fig 3-6 Diagram of Open Space



Street Pattern:
Streets disconnected

Fig 3-7 Diagram of Street Pattern



Pedestrian Circulation:
Pedestrian circulation interrupted

Fig 3-8 Diagram of Pedestrian Circulation

Land Use:
Academic use less distributed

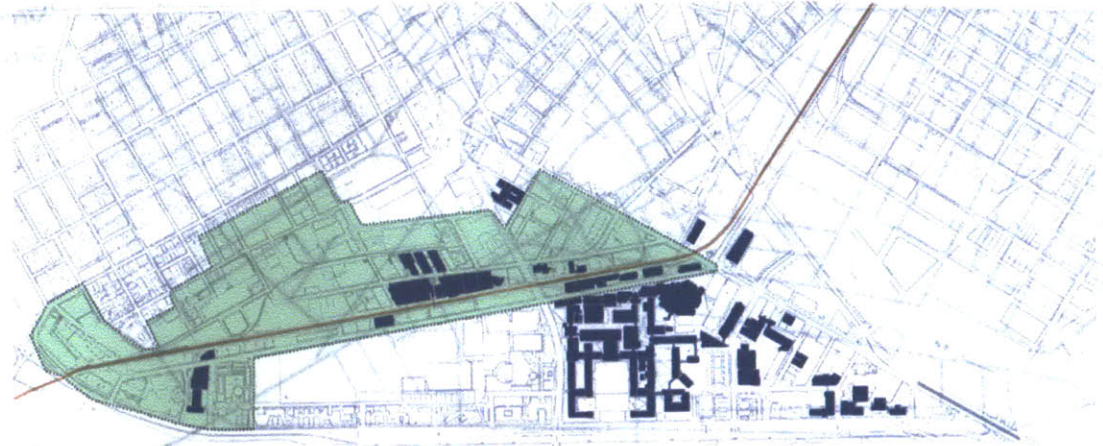


Fig 3-9 Diagram of Academic Land Use

Land Use:
Lack of residential use

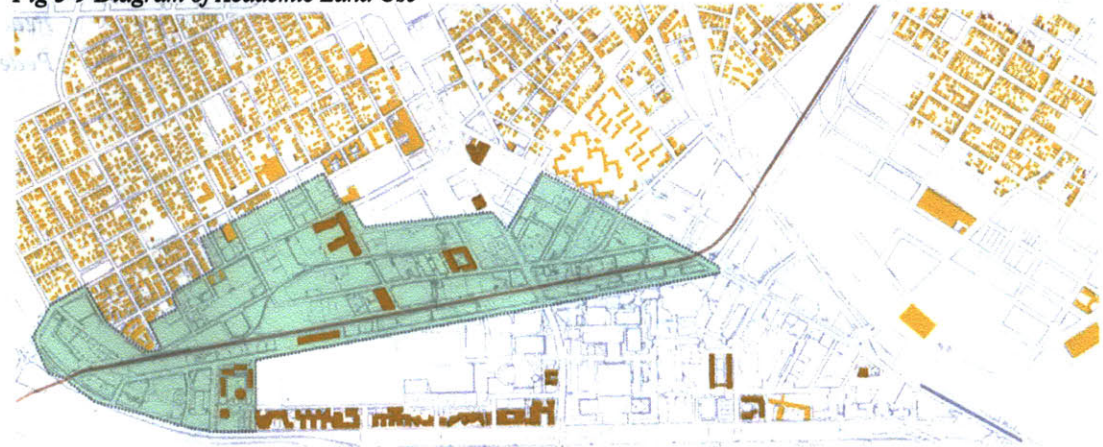
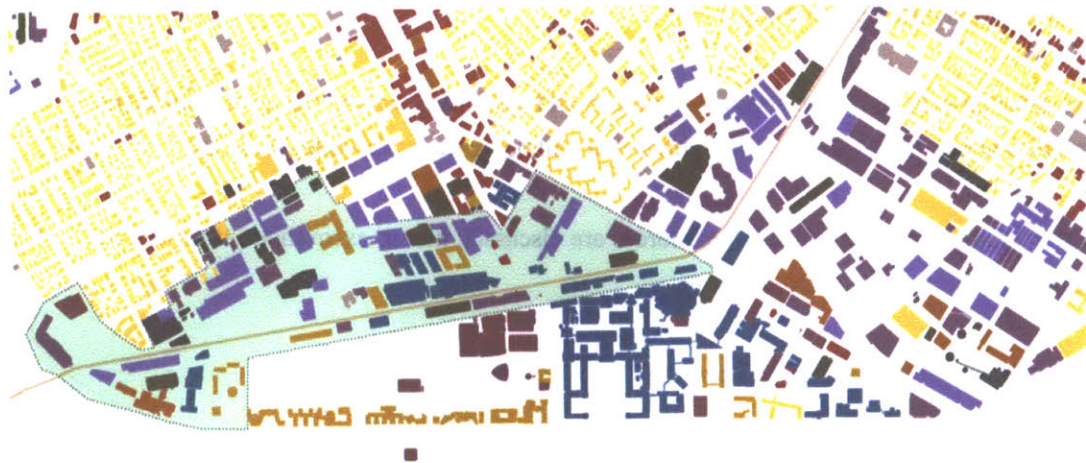
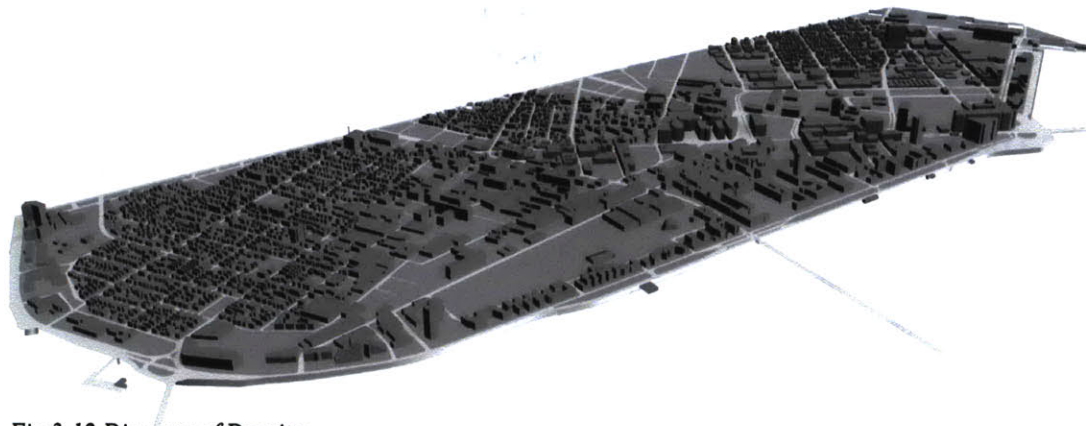


Fig 3-10 Diagram of Residential Land Use



Land Use:
Industrial character

Fig 3-11 Diagram of Land Use



Density:
Low density

Fig 3-12 Diagram of Density

3.3.1.2 Current Influential Local Forces

The design must have flexibility to accommodate current trends and foreseen circumstances in the future, and also to modify the exterior limitations that will be obstacles for redevelopment.

In the section of stratification, relevant local forces are discussed first to exam their influences on the transformation of existing urban elements.

3.3.1.2.1 Cambridge Community Development

Review of Existing Zoning in the Industrial Belt

Special Zoning Ordinances

A large amount of the land in the industrial belt belongs to unique zoning categories. The areas to the north of Vassar Street are zoned as Special Districts, with the goal of integrating existing office and business uses with residential Cambridgeport. Parts of the area fall into the categories of Residence C-3 District, Residence C-3B District, and Industrial B District.

Review of Recent City Planning

Green Ribbon Open Space Committee Report

Based on the analyses from this report, part of Cambridgeport is recommended as a top priority for Community Parks.

Cambridgeport Neighborhood Study

This study made a series of recommendations for the future of Cambridgeport. The recommendations related to this site are summarized below:

- In terms of housing, large scale and mixed-use developments are required in the study area; new developments should complement the existing neighborhoods' characters;
- In terms of land use and zoning, the area of Putnam Avenue is recommended to be rezoned to support neighborhood business clusters;
- In terms of urban design, transition between land uses will be emphasized; physical and visual links between important nodes (such as Fort Washington Park) will be strengthened.

3.3.1.2.2 MIT's Campus Development Missions

The design should have flexibility to meet the mission of MIT's campus development.

Academic expansion

MIT needs more space for academic uses, such as administrative space, research space, department space, and libraries. In addition, new and upgraded athletic and recreational facilities are required, and some projects are at the feasibility stage.

*More Housing for students, faculty and staff*⁶

MIT has identified a clear need for significant expansion of the supply of new housing available to serve its graduate students, faculty and staff. The scope of this need suggests a long term program of housing development. Expanding the supply of good quality housing adjacent to MIT's campus will bring significant benefits to the Institute and to the larger Cambridge community with the

⁶This section is based on *Housing Site Inventory—A Physical Planning Context for Analysis of Housing Options* by David Dixon, January, 1987

emergence of a new off-campus residential environment in Industrial Cambridge.

Partnerships and collaborations

University collaboration with neighbors, local businesses and other institutions is a means for enriching academic and research resources. It allows the university to affect the quality of the greater environment. Joint public, private, and institutional initiatives can reverse the decline of surrounding neighborhoods and also enhance the friendly relationship between the university and its adjacent neighborhoods. The development of campus property for non-university research business can also benefit both of the university and other non-university communities.

3.3.1.3 Site Potentials

Problems with Existing Urban Elements

Vacant Land Unutilized or Underutilized with Industrial Character

The entire industrial belt has taken minimal advantage of its proximity to MIT in terms of its land resource utilization efficiency, mix of uses, urban form character, and amenities. Most of the vacant land is generally used for parking and other automobile-related uses, and older industrial buildings in poor condition. There is little open space with good quality and convenient accessibility.

Broken Environment

Clearly, the area lacks a center, and a set of well-organized open space networks. The extensive MIT landholdings are divided by the Grand Junction rail corridor. This has significantly split contiguous parcels, thereby reducing the land development potential and ability to generate

enhanced integrated environments.

Physical Barrier between the Campus and City

The Grand Junction Rail Corridor creates a continuous physical barrier that has seriously isolated the Institute from residential Cambridgeport. There are no pedestrian and vehicular connections across the rail corridor.

Prognosis:

● *Re-use the existing unutilized or underutilized vacant land for residential development*

The industrial belt already represents an excellent potential location for housing in terms of its proximity to a number of critical resources that are essential for a residential community formation, such as a variety of employment opportunities throughout Cambridge, employment and educational opportunities at MIT, public transportation via the Red Line, adequate open space and a great deal of vacant land.

● *Create a continuous urban setting to unify the broken environment*

The broken environment needs to be reorganized by a set of principal streets or a public place serving as the organizing center.

● *Establish an integrated pedestrian system*

The Grand Junction corridor which currently serves as a major barrier between the campus and Cambridgeport need to be passed by pedestrian connections.

Design Synthesis

Based on analyses of the local forces related to the site elements, a series of site prognosis are explained below:

Urban Fabric:
Infill the vacant land

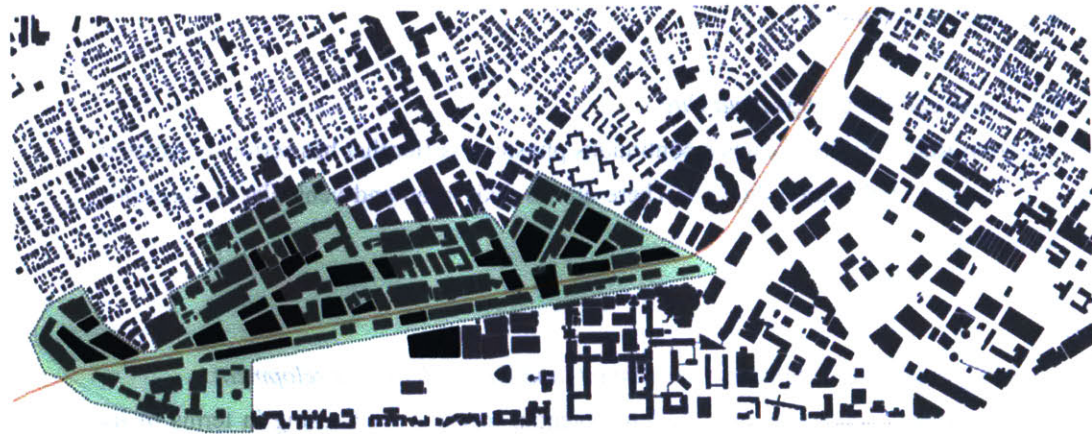


Fig 3-13 Analysis of Urban Fabric

Open Space:
Enhance open space connection

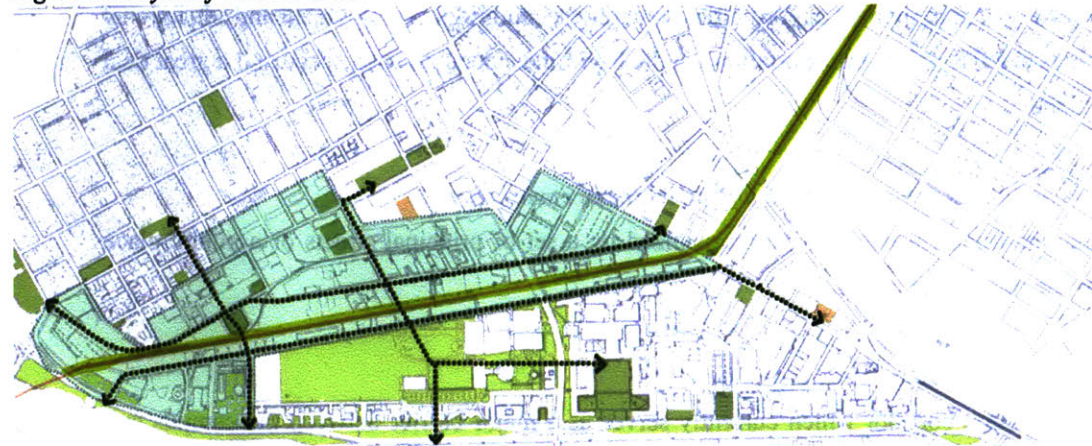
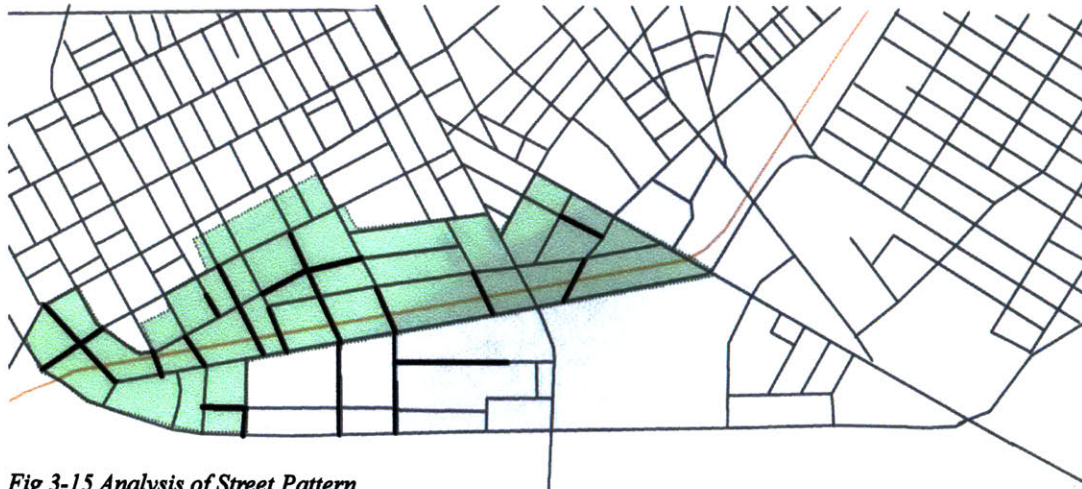
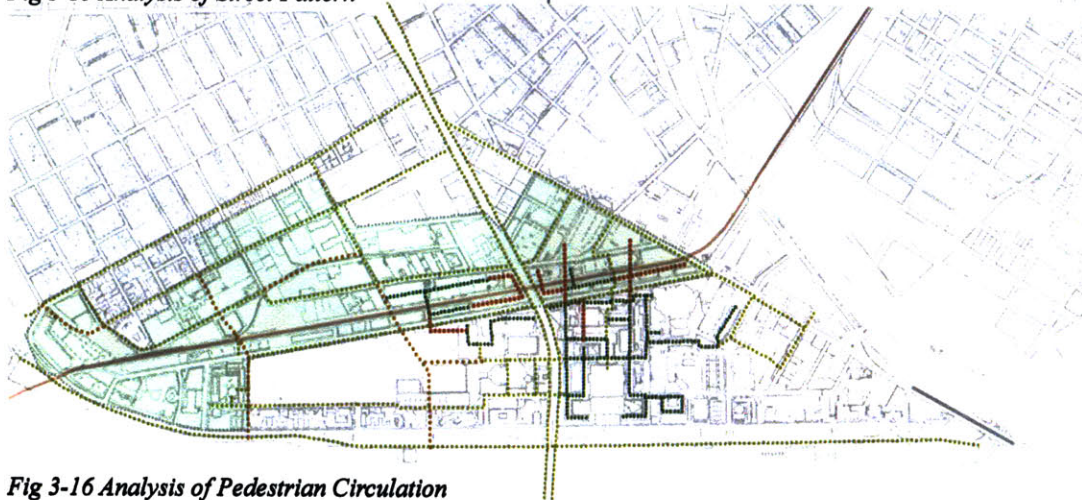


Fig 3-14 Analysis of Open Space



Street Pattern:
Reconnect streets

Fig 3-15 Analysis of Street Pattern



Pedestrian Circulation:
Integrate pedestrian circulation system

Fig 3-16 Analysis of Pedestrian Circulation

Land Use:

Accommodate academic use

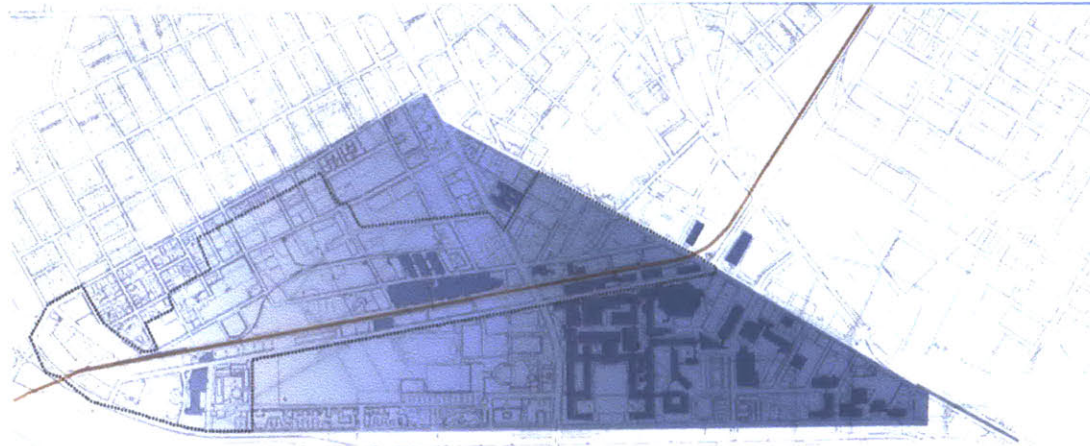


Fig 3-17 Analysis of Academic Land Use

Land Use:

Increase residential use



Fig 3-18 Analysis of Residential Land Use



Fig 3-19 Analysis of Land Use

Land Use:
*Increase residential use and consider
academic use*

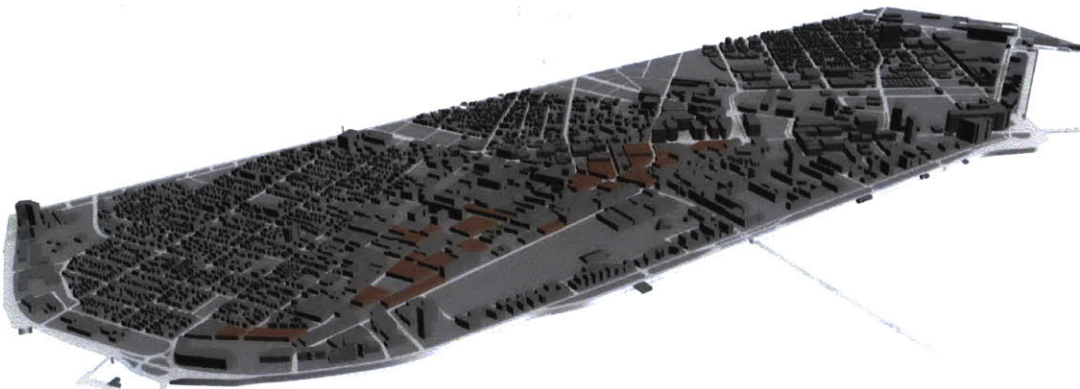


Fig 3-20 Analysis of Density

Density:
Densify the existing density

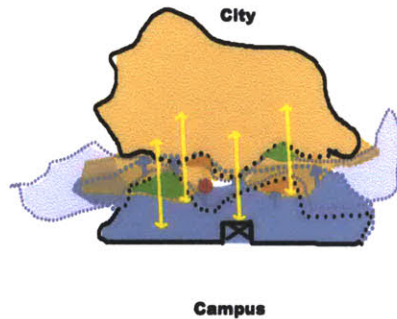


Fig 3-21 Diagram of transitional boundaries

3.3.2 Superimposition

3.3.2.1 Design Goals

The design intends to transform the industrial belt into transitional boundaries between the campus and city. It looks at the ways in which open space, land use, density, and circulation can be organized to enhance the relationship of the campus with the surrounding community to create a vital, diverse, attractive environment.

- Integration and unification of the campus development fabric with its surroundings by creation of a transition
- Improvement and enhancement of the links between the campus and adjacent neighborhoods
- Emphasis on higher density and integration of developed areas that can be accomplished to the benefit of campus quality, vitality, and diversity
- Utilization of mixed-use typologies that will encourage the creation of a lively sense of neighborhood and community both within the campus and the greater Cambridge community.

3.3.2.2 Regional Forces as Revitalization Catalyst

The proposed Urban Ring would dramatically change the site situation, and it is treated as an influential catalyst to transform the site into transitional boundaries. The construction of Urban Ring transit station will provide MIT with a New Western gateway. The light rail alignment with the Grand Junction Rail Corridor will offer a new opportunity for the infrequently used rail corridor space to be effectively used.

3.3.2.3 Modification of Preconditions

Urban Ring Assumption

Urban Ring Alignment and Urban Ring Stops Location

Urban Ring Alignment and Urban Ring stops location are determined based on the principle of enhancement of the relationship between the campus and city. Therefore, Urban Ring alignment and stops locations are planned to allow the new transit stops to attract the people from adjacent neighborhoods to MIT's territory. During Phase 2 Bus Rapid Transit route alignments is planned to run two-way on Vassar Street. During Phase 3 light rail alignment is planned to be a surface light rail running in the Grand Junction right-of-way.

CSX Railway Crossings

The existing CSX right-of-way does not allow many crossings across the CSX rail tracks because of fences laid out along the tracks. In addition, the railway is definitely there to stay for the foreseeable future. There is a dilemma that CSX will have to stop their trains at every grain crossing if more crossings are created. However, from a long-term perspective, the rail tracks are currently serving as a major barrier which can be overcome by necessary connections.

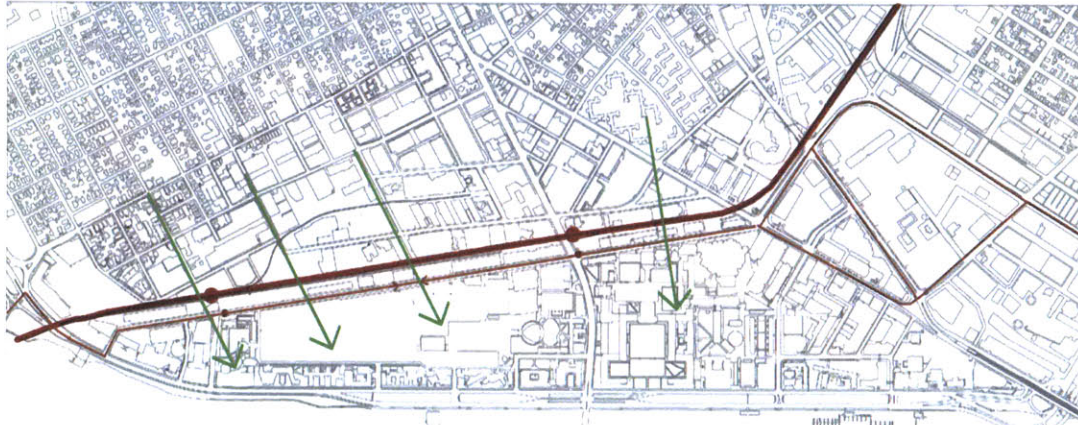
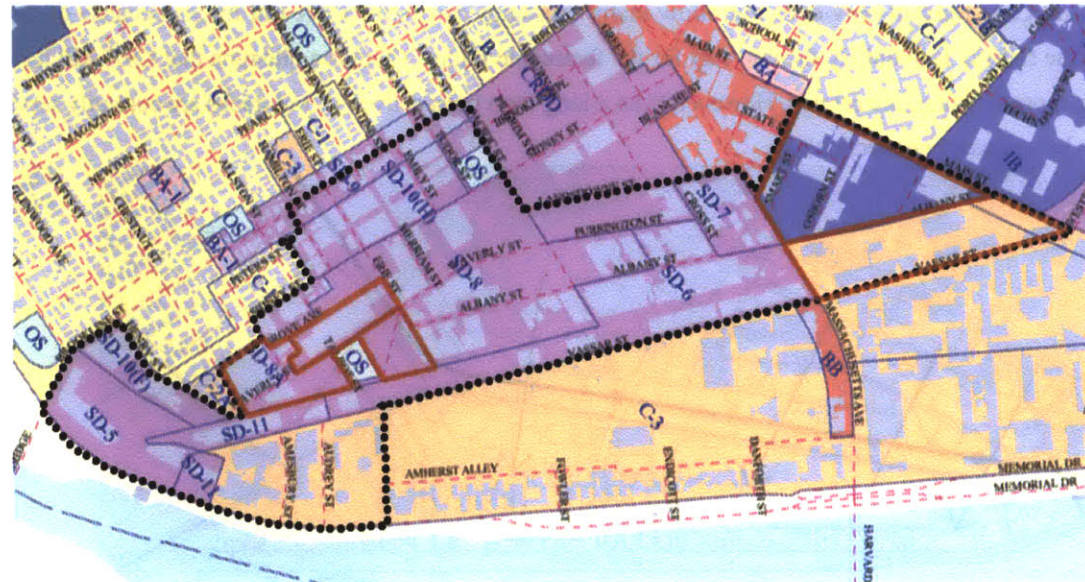


Fig 3-22 Diagram of Urban Ring Assumptions

Down-Zone

In order to emphasize transit-oriented development, Special District-8A and part of Special District-8 are recommended to be converted to a highly mixed use and density district. North of Vassar Street in the C-3B Residence District, commercial and office uses should be recommended rather than limited. In addition, housing should become an allowed type of development in the Industrial B District.

Fig 3-23 Diagram shows the zoning districts that need to down-zone.



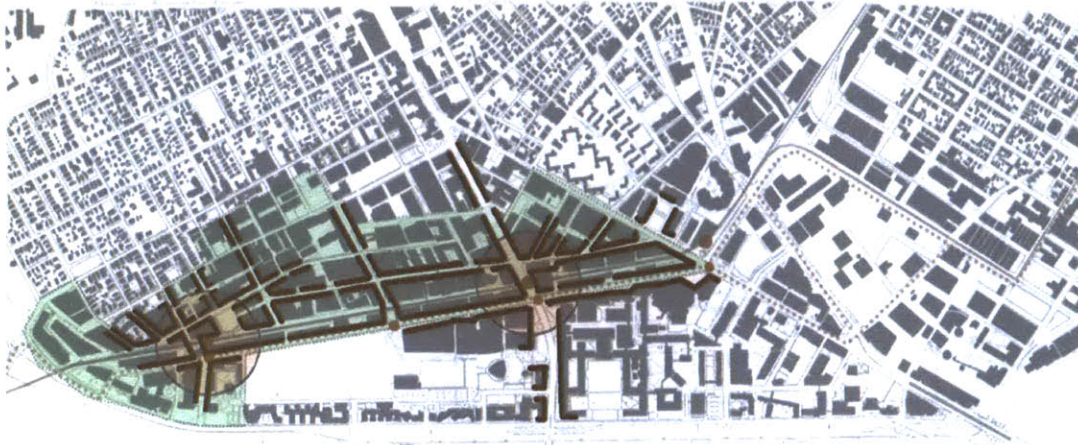


Fig 3-24 Analysis of Urban Fabric

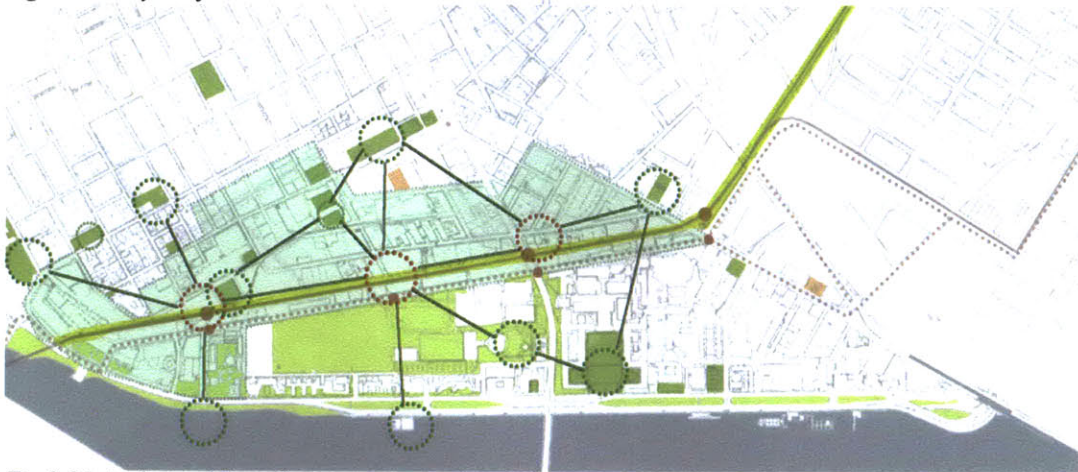


Fig 3-25 Analysis of Open Space

3.3.2.4 Site Opportunities

Referred to as transit-oriented development, new site opportunities are discussed below:

Urban Fabric:

Station Area should be filled with a distinct urban pattern

Open Space:

The transit station will be an open space center to enhance open space connection

Street Pattern :

Streets adjacent to the station should have the top priority to be connected

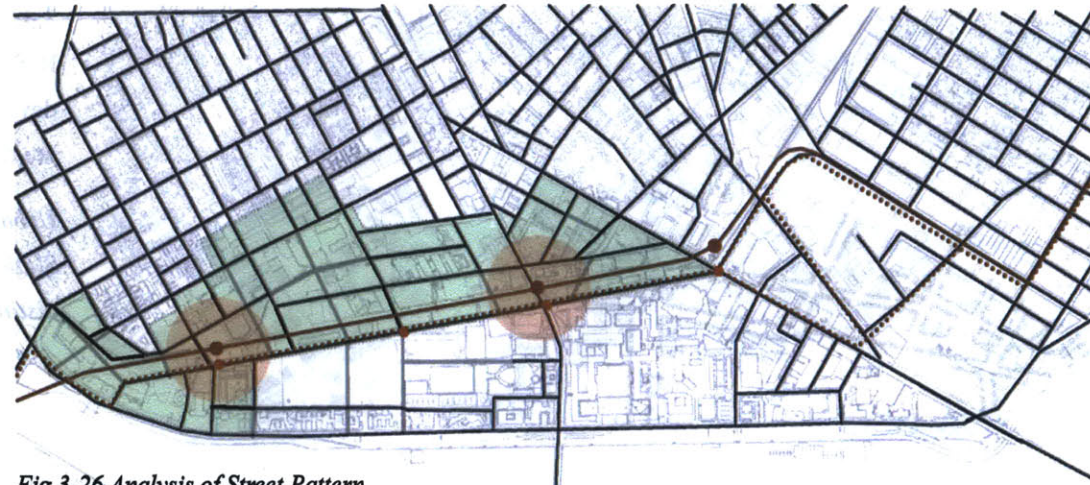


Fig 3-26 Analysis of Street Pattern

Pedestrian Circulation:

The transit station will be a pedestrian nexus to integrate the pedestrian circulation system

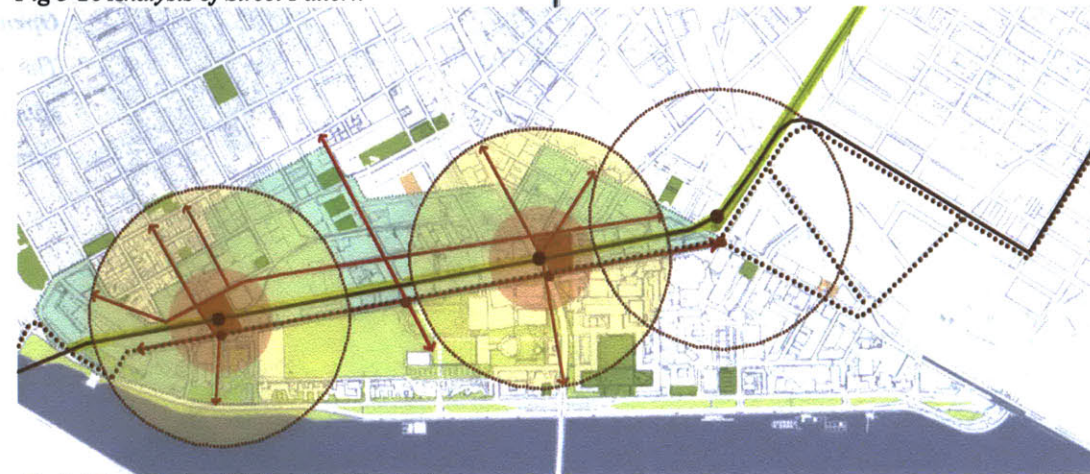


Fig 3-27 Analysis of Pedestrian Circulation

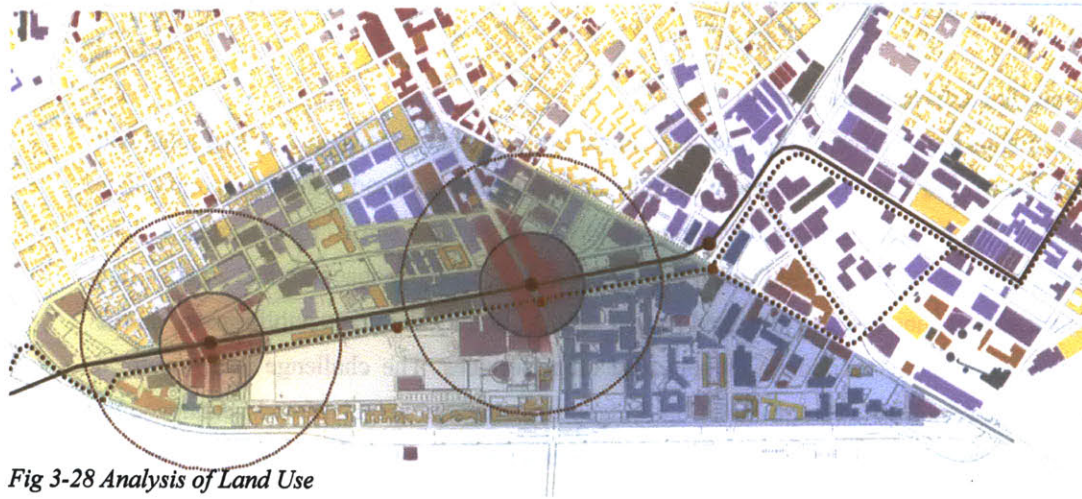


Fig 3-28 Analysis of Land Use

Land Use:

The transit station area should have highly mixed land use distribution

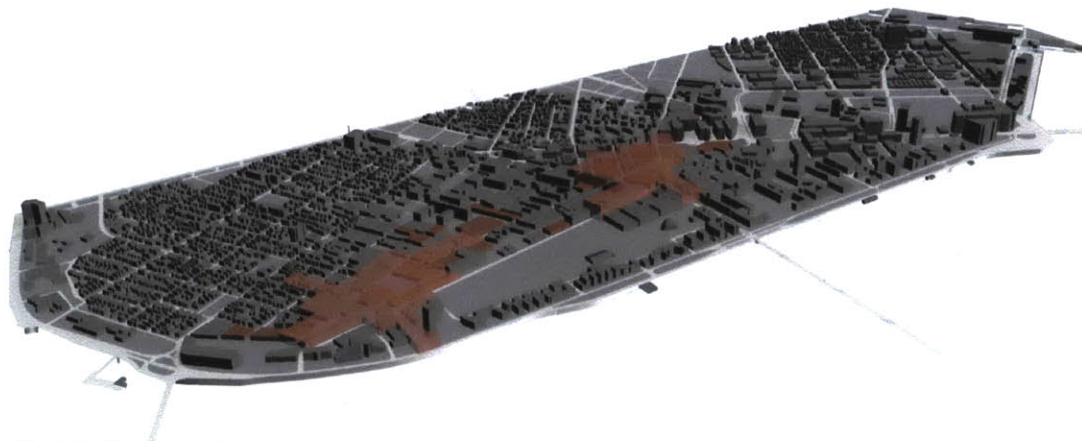


Fig 3-29 Analysis of Density

Density:

The transit station area should be much more densified than other surrounding areas

3.3.3 Elaboration of Process

3.3.3.1 Strategies to Achieve the Design Goal

The design intends to use Urban Ring transit development as a catalyst to create a transitional belt that contributes to weaving MIT's campus with its adjacent neighborhoods, and to accommodate MIT and the City of Cambridge's development missions. In that sense, the campus and its surroundings will form a transitional urban setting connected by open spaces, streets, pedestrian routes, transit stations and a series of shared resources: community facilities, public space, public transportation, elementary-secondary schools, and other services. The challenge is to ensure a transition belt between MIT's campus and Cambridgeport residential neighborhoods, catalyzed by the development associated with the Urban Ring aiming to achieve a new mixed urban environment. The strategies to achieve such urban character are addressed as follows.

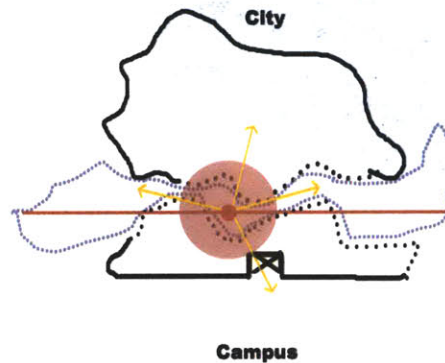


Fig 3-30 Diagram of transit catalyst

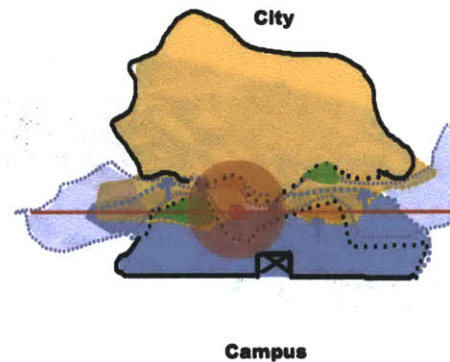


Fig 3-31 Diagram of planning strategy

Utilize Transit-Oriented Development⁷ as a Catalyst to Urbanize Mixed Fabrics

Transit is always treated as a revitalization mechanism that attracts new development to neighborhoods. This is based on the premise that transit can consistently bring people to a concentrated area. Therefore, the construction of the Urban Ring will offer a significant opportunity to reshape land-use and built-form patterns, particularly the areas close to the transit stations.

Adaptive Re-use

Obstacles to urban redevelopment must be reintegrated into the urban context by finding new uses for the buildings that are currently vacant and in need of rehabilitation. Numerous abandoned sites, previously in industrial use, can be converted into mixed-use. The promotion of the articulation role between different fragments of urban fabric will help in the rehabilitation or reconstruction of existing underutilized manufactories. The city is considering re-zoning and ordinances to encourage this type of conversion as well.

3.3.3.2. Planning Principles and Concept Plans

Planning principles set forth the fundamental design concepts of the long-term concept plan. The concept plans establish the civic structure that is the underpinning of all future development on the site and provide the primary land use and density recommendations. Connections between major existing open spaces and new public realms are explored. The street patterns are re-organized as well. The total developable area has been broadly distributed to accommodate four types of land uses: residential, retail, office and academic. The density in the area adjacent to the transit station has been greatly increased and some buildings need special zoning permission.

⁷ A Transit-Oriented Development (TOD) is a mixed-use community within an average 2,000-foot walking distance of a transit stop and core commercial area. A TOD mixes residential, retail, office, open space, and public uses in a walkable environment, making it convenient for residents and employees to travel by transit, bicycle, foot, or car.

An Urban TOD is located directly on the truck line transit network: at light rail, heavy rail, or express bus stops. It should be developed with high commercial densities, job clusters, and moderate to high residential densities. (Ibid, P.56-57)

Character of Urban Fabric

- Create urban forms with mixed scale to serve as transition from the small residential scale to larger complex scale
- Establish the scale, configuration, and character of new built-forms to encourage a sense of identity among the new residents
- Construct gateway towers in conjunction with middle-rise buildings (The towers should relate in scale, massing and geometry to the family of towers which already clusters at the eastern and western limits of the campus.)

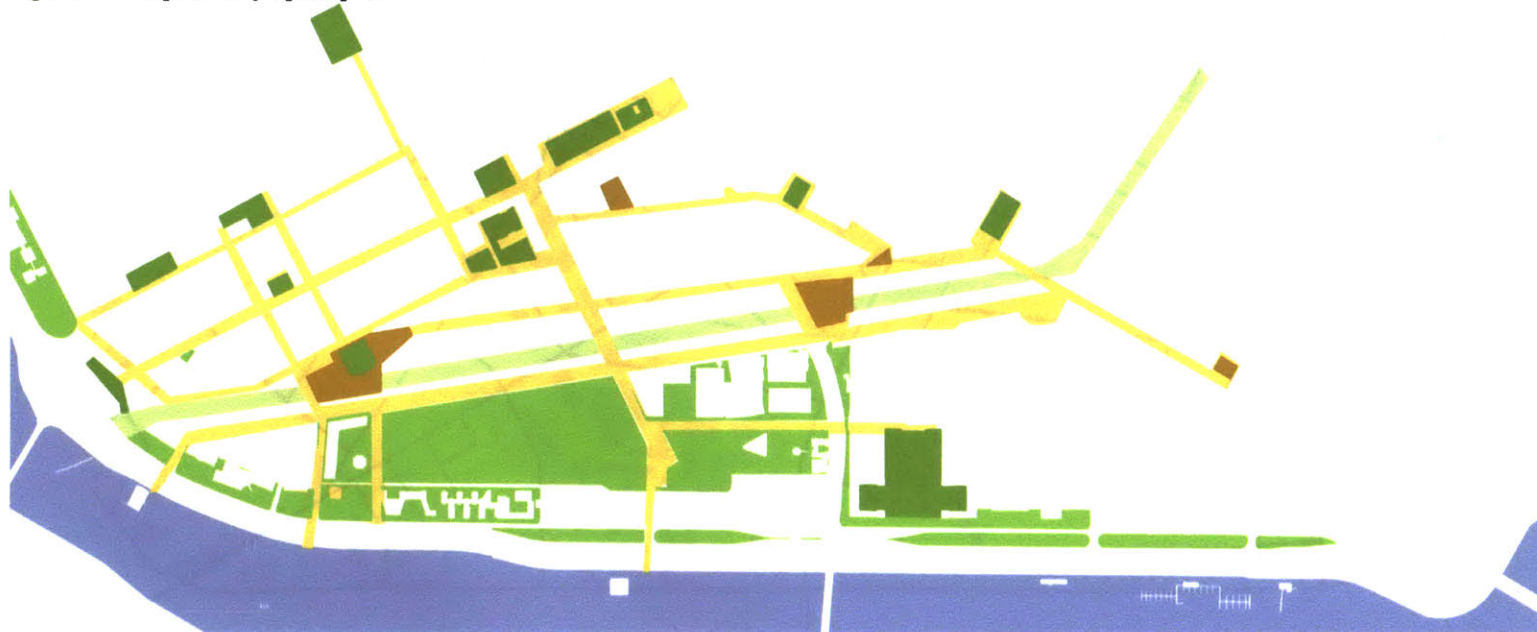
Fig 3-32 Concept Plan of Urban Fabric



Open Space

- Focus on providing open space in priority areas and maintain current open spaces
- Create a hierarchy of open spaces to serve as a series of centers in the new environment and amenities to be enjoyed by people
- Improve pedestrian access to open space
- Ensure that visual corridors enhance access between the campus and Cambridgeport
- Develop transit stop areas with major public places as new neighborhood hubs

Fig 3-33 Concept Plan of Open Space



Street Pattern

- Use principal streets to form an underlying civic structure enhanced by streetscape improvement and marked by public spaces at crucial points
- Lay out street pattern that encourages stronger ties to residential Cambridgeport by creating continuous pedestrian and vehicular routes

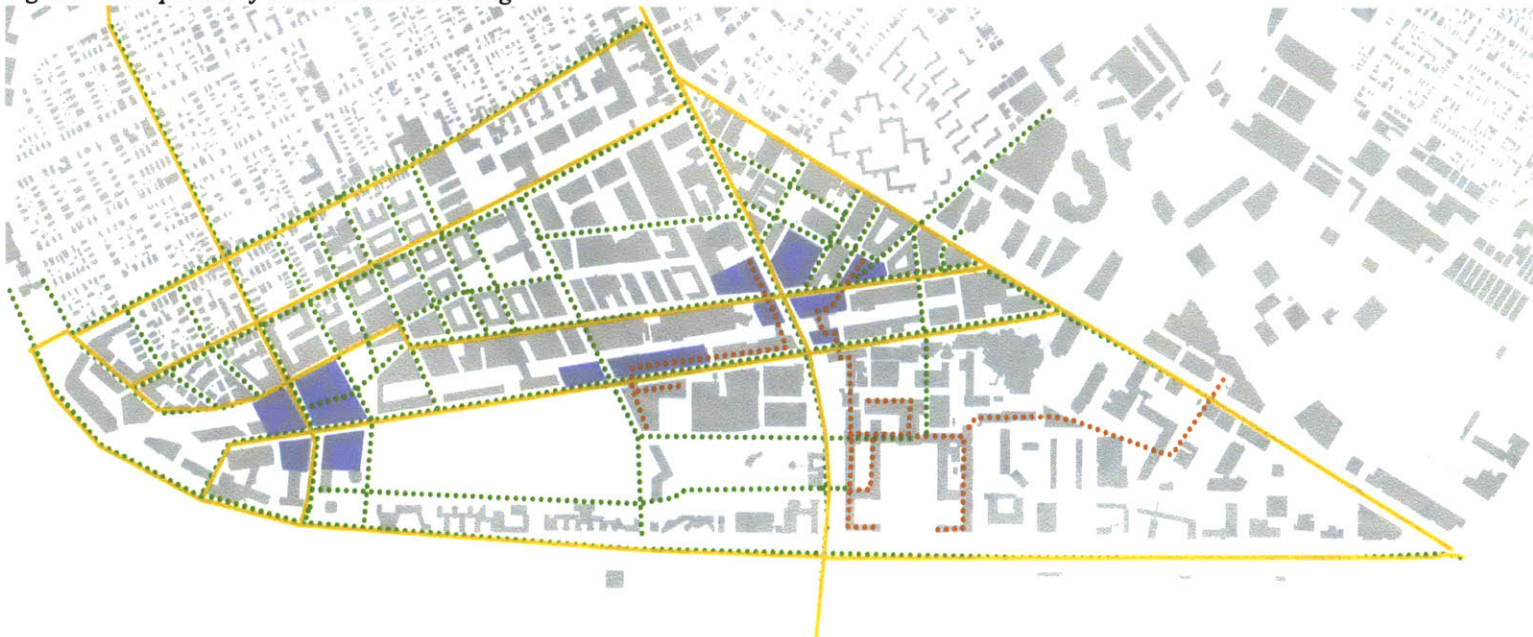
Fig 3-34 Concept Plan of Street Pattern



Circulation and Parking

- Reduce parking area and construct underground parking structures
- Make necessary vehicular/pedestrian connections from existing streets across the rail track to MIT's campus (such as pedestrian connections at Pacific Street, Erie Street, and Fort Washington Park, and vehicular/pedestrian connections at Putnam Street.)

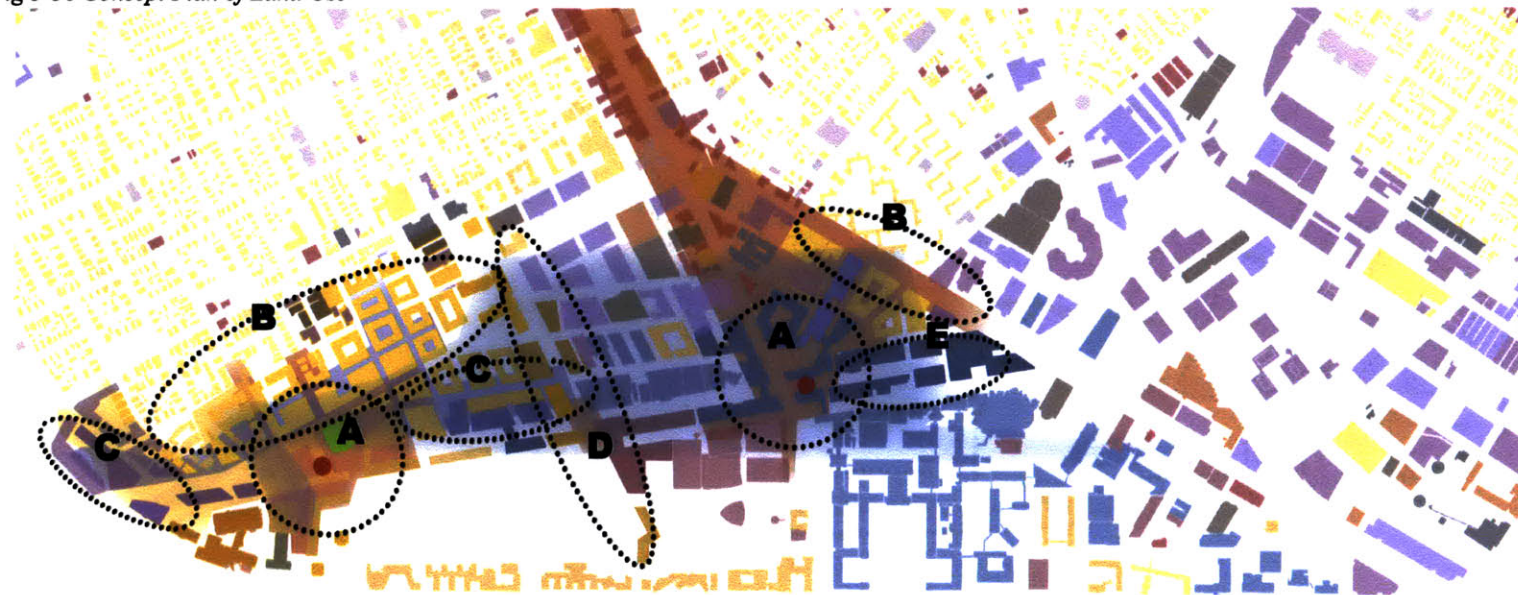
Fig 3-35 Concept Plan of Circulation and Parking



Land Use

- Consider academic expansion, residential need, and new mixed-use development in order to enhance a diverse mixed-use environment
- Gradually replace buildings previously consisting of industrial and bio-technological laboratory uses with residential, business and office spaces and related services
- Provide five zones with different methods of land use distribution:
 - A: Highly mixed-use
 - B: Major residential use mixed with retail
 - C: Major office use mixed with residential use
 - D: Major residential use mixed with academic use
 - E: Major academic use

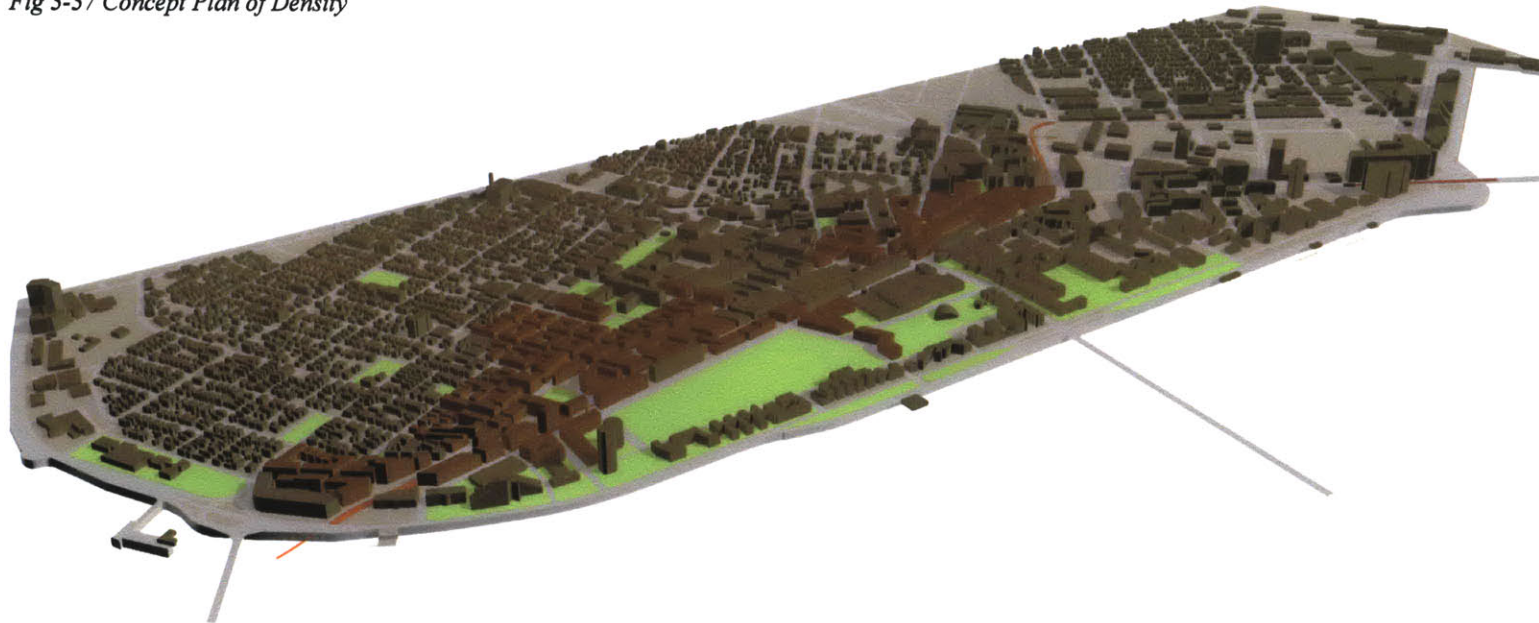
Fig 3-36 Concept Plan of Land Use



Density

- Develop the station with concentration of built density
- Develop densities that are compatible with adjacent urban neighborhoods.

Fig 3-37 Concept Plan of Density



3.3.3.3 Phase Planning

The rationales for determining the phasing are clarified below:

- Built-out relevant to transit development should correspond to the Urban Ring construction phases.
- Rehabilitation should be conducted simultaneously with the new construction.
- The area adjacent to the transit station should have top priority for development.
- The area around the major street connected to the transit station should have secondary

In order to correspond to the Urban Ring construction phases, the long-term plan would have to be implemented in four phases:

Phase 1: Integrated with Urban Ring Bus Rapid Transit Phase II (2006-2011)

Phase 2: Integrated with Urban Ring Light Rail Transit Phase III (2011-2016)

Phase 3: Development after Urban Ring Construction (2016-2021)

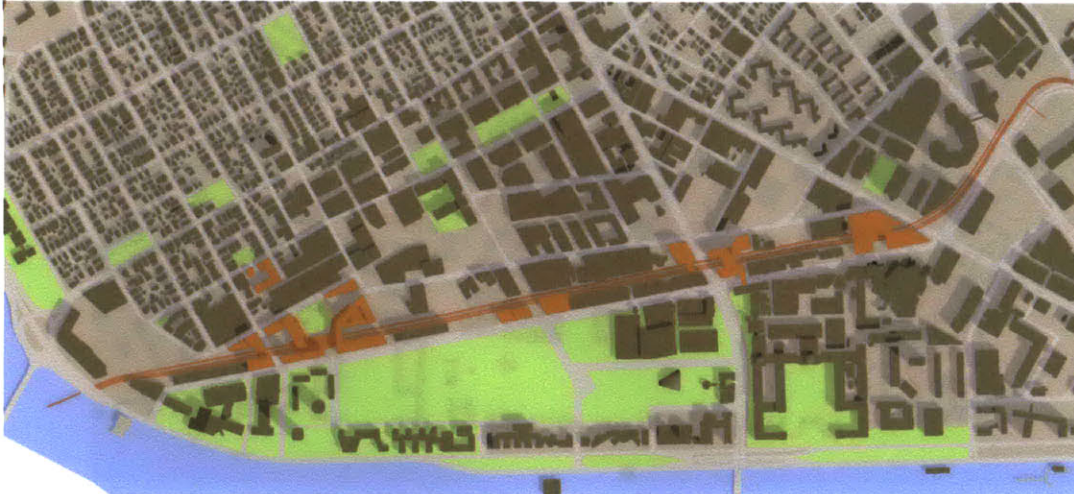
Phase 4: Development after Urban Ring Construction (2021-2026)

Phase 1: Integrated with Urban Ring Bus Rapid Transit Phase II (2006-2011)



Fig 3-38 Density Plan in Phase 1

Fig 3-39 Master Plan in Phase 1



In Phase 1, the areas adjacent to BRT stops should be developed first: the Fort Washington Park stop area, the crossing of Massachusetts Avenue and Grand Junction Rail Corridor, and the crossing of Pacific Street and Vassar Street.

Phase 2: Integrated with Urban Ring Light Rail Transit Phase III (2011-2016)

In Phase 2, the larger areas adjacent to transit stops should continue to be developed: the Fort Washington Park stop area, the crossing of Massachusetts Avenue and Grand Junction Rail Corridor, and the crossing of Pacific Street and Vassar Street.

Areas around major streets, such as Vassar Street and Albany Street starts to be constructed to achieve an appealing streetscape.



Fig 3-40 Density Plan in Phase 2



Fig 3-41 Master Plan in Phase 2

Phase 3: Development after Urban Ring Construction (2016-2021)

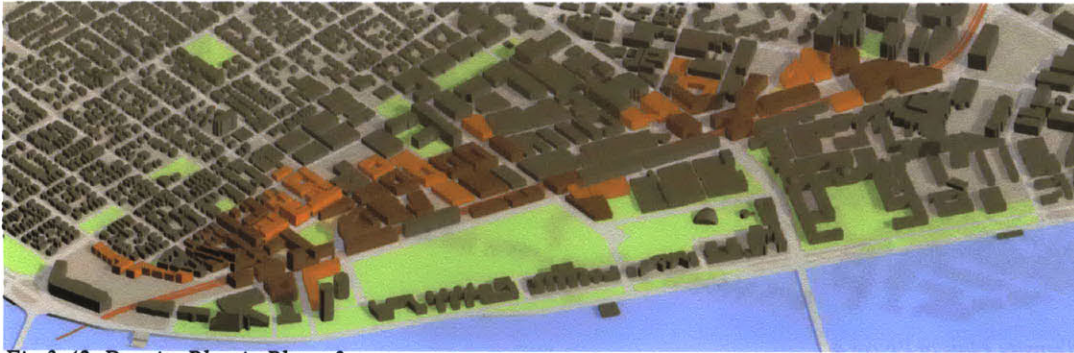


Fig 3-42 Density Plan in Phase 3

Fig 3-43 Master Plan in Phase 3



In Phase 3, areas around major streets, such as Vassar Street and Albany Street, continue to be constructed to achieve an appealing streetscape.

Development along secondary streets start to strengthen the connections to the transit stations.

Rehabilitation of industrial buildings should be considered in this phase.

Phase 4: Development after Urban Ring Construction (2021-2026)

In Phase 4, major streetscapes should be constructed completely in phase 4.

Development along secondary streets is strengthened.

Rehabilitation of industrial buildings is the major development in this phase.

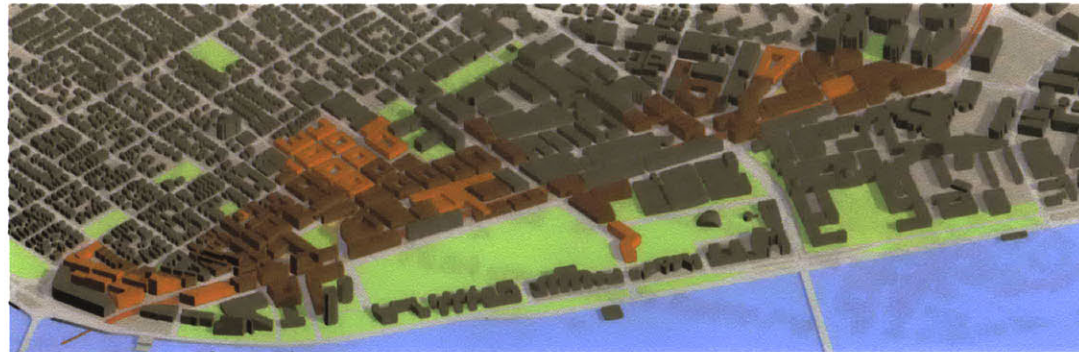


Fig 3-44 Density Plan in Phase 4



Fig 3-45 Master Plan in Phase 4



Fig 3-46 Long-Term Development Master Plan

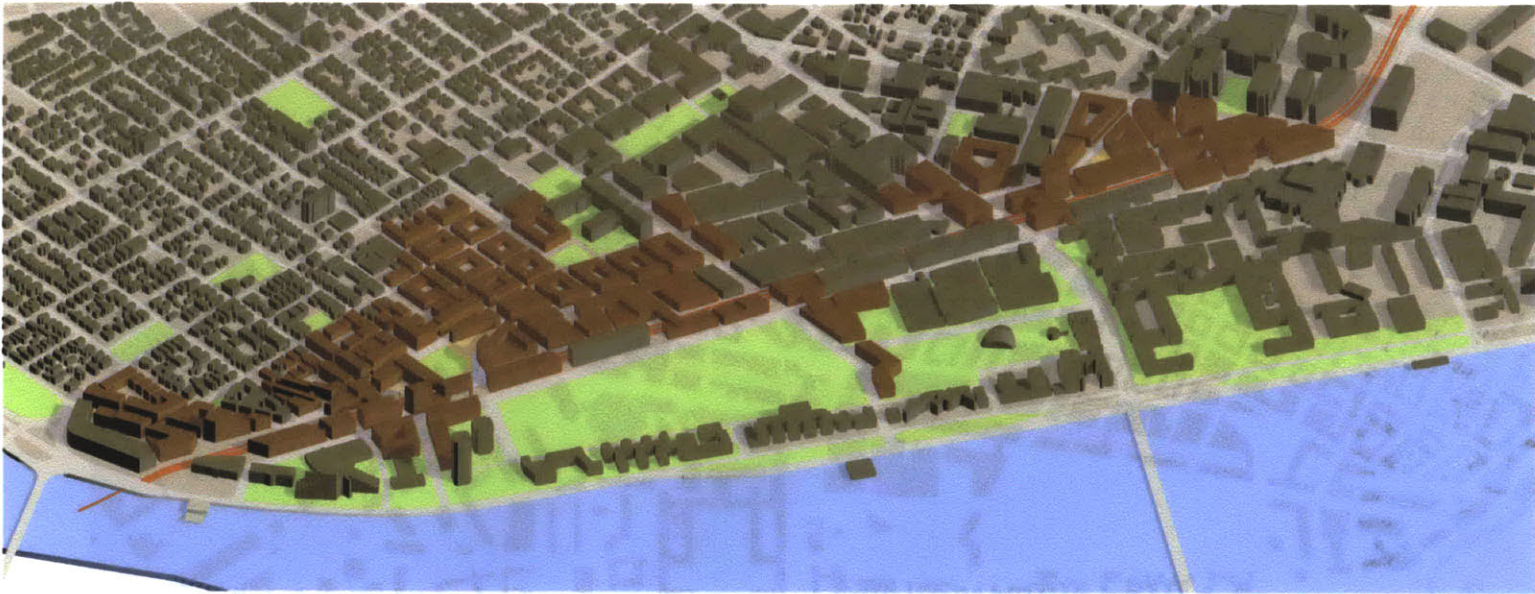


Fig 3-47 Long-Term Development Density Plan

3.3.3.5 Urban Design Case Study: Fort Washington Park Area

Fort Washington Park Area is a specific case for exploring the guidelines of urban design in order to reinforce its contribution to and affirmation of the design goals.

3.3.3.5.1 Urban Design Guidelines

The objective of establishing urban design guidelines is to postulate a development direction for Fort Washington Park Area that will possess "transitional boundaries" characteristics.

Neighborhood Blocks

- *Size*

In general, the block size is determined by the grid pattern of streets in order to allow multiple route choices and maintain convenient walking distance. In the case of larger blocks, public easements are provided to allow pedestrian circulation through longer blocks that link with the main streets connected to the station or park.

- *Setback*

Buildings should front directly from the lot lines in order to discourage inactive open spaces. Exceptions include spaces that accommodate public activities, like street-side cafes and open displays. The front walls of buildings should be parallel to the streets to emphasize the street edge.

- *Orientation*

Buildings should be visibly oriented toward adjacent streets (Waverly Street, Albany Street, Sidney Street, Putnam Street, and Erie Street) and Fort Washington Park rather than focus inward.

- *Height*

The building height is determined in accordance with the width of the adjacent open spaces to ensure the penetration of sunlight. The buildings located close to the station need at least to satisfy the high FAR.

- *Character*

The facades along Putnam Street and Erie Street should vary and have individually expressive characters in order to convey the impression of a composition or transition which strengthens connections between the campus and Cambridgeport. The facades along Waverly Street and Albany Street should be read as a unified design but should have more varied and individually expressive characters.

- *Parcel Division*

The method of parcel division will determine the pedestrian activity in the street. In the area adjacent to residential Cambridge, the blocks should be divided into smaller individual lots to maximize the number of front entries and openings. Blocks adjacent to the transit station should be divided to incorporate the optimum number of tenants.



The transit station area is recommended to be divided into one parcel in order to be constructed with a uniformed character.

Fig 3-48 Parcel Plan for Fort Washington Park Area

Open Space

- Support new housing with a system of private, semi-private, and public open spaces and recreation facilities for uses by residents and other members of the community.

Streetscape

- Putnam Street and Albany Street need to widen existing sidewalks to replace the existing off-street parking space.

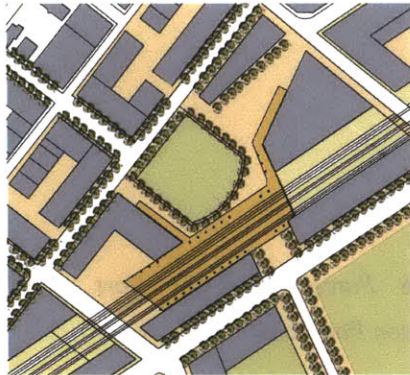
Parking

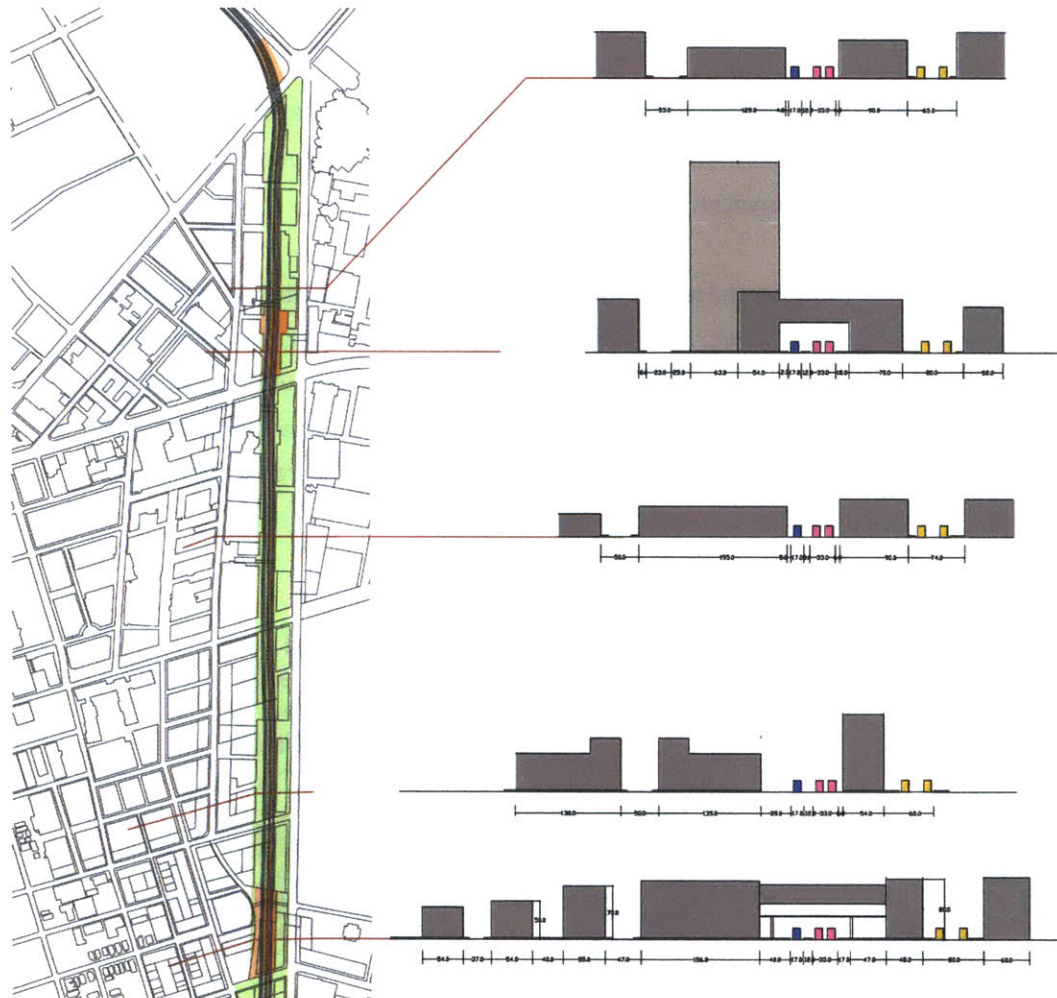
- Parking should not occupy excessive area and diminish the quality of open space.
- Parking structures are not acceptable because they would occupy excessive area and be visually unappealing.
- Parking should be minimally visible from parks and major streets.
- Below-grade parking should be located under the majority of buildings.

Transit Station

- The transit station should be an at-grade station developed near a street corner with entrances separate from the surrounding commercial uses. It should include multiple retail, office, business and institutional uses.
- Paving should be located along the train station segment of the rail tracks.
- Greenery should be located along the corridor segments of the rail tracks.

Fig 3-49 Landscape design for Fort Washington Station area





- The transit station should be developed upon the joint development prototype station. The at-grade station should include shops, seating areas (both inside and outside) on the ground floor. The upper floors could be developed for retail, office and entertainment uses.

In the early stage, the station development should strengthen the at-grade pedestrian connections. The pedestrian connections above ground should also be constructed by bridges or building connections in later stage.

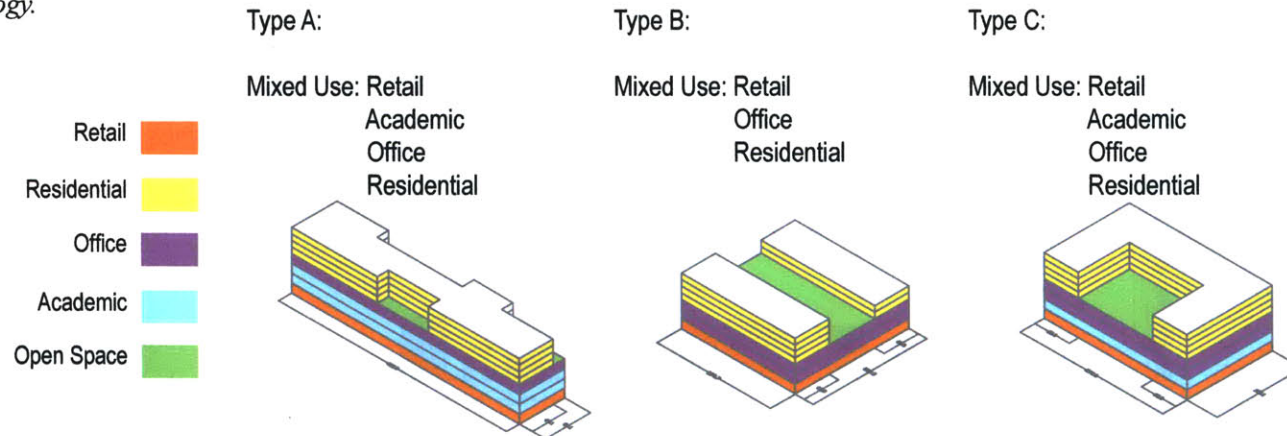
Fig 3-50 Plan of Station Locations and Sections along the Grand Junction Rail Corridor

3.3.3.5.2 Building Typology Exploration

The concept of mixed-use building typology, with shops at street level, and apartments above, can be found in cities throughout history. The rediscovery of this building type might be seen as a critical point in recent urban redevelopment.

The function of retail, office, academic, and residential spaces will be included in the exploration. To accommodate multiple uses in one block, the building configuration of upper floor should be different from the ground floor because the spatial requirements of diverse uses are distinct. Normally, the lower floors are retail, office and academic use; upper floors are residential use. For that reason, on the upper floor semi-open spaces are provided for residents. Three basic types of mixed-use building topologies are chosen based on typical block shapes.

Fig 3-51 Diagrams show the mixed-use building typology.



3.3.3.5.3 Scenarios

The following images show the vision for Fort Washington Park Station area based on the parcel division guideline that divides the station area into one parcel.

Fig 3-52 Photo shows the existing condition of Fort Washington Park.



Fig 3-53 Photo montage shows the vision of Fort Washington Park.



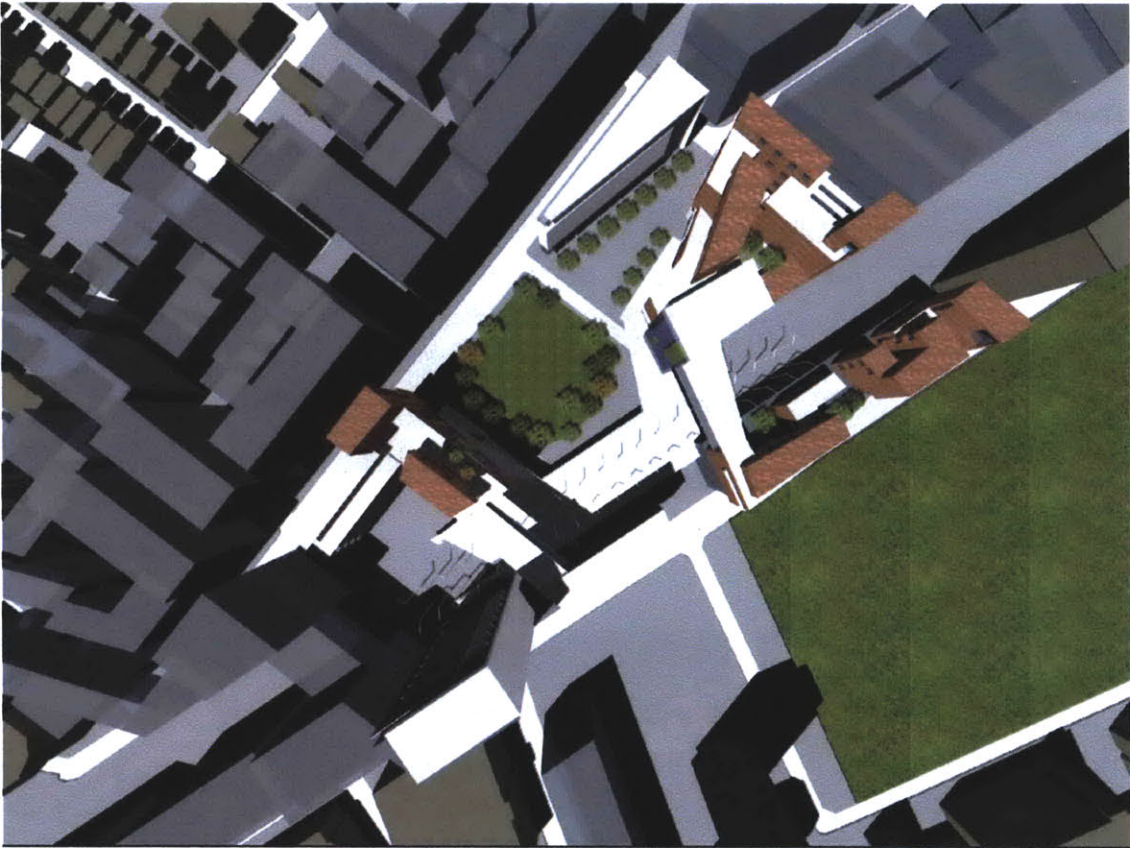


Fig 3-54 Rendering shows the top view of Fort Washington Park Station Area

Fig 3-55 Rendering shows the bird view of Fort Washington Park Station Area





Fig 3-56 Rendering shows the street view of Fort Washington Park Station Area from east

Fig 3-57 Rendering shows the street view of Fort Washington Park Station Area from north

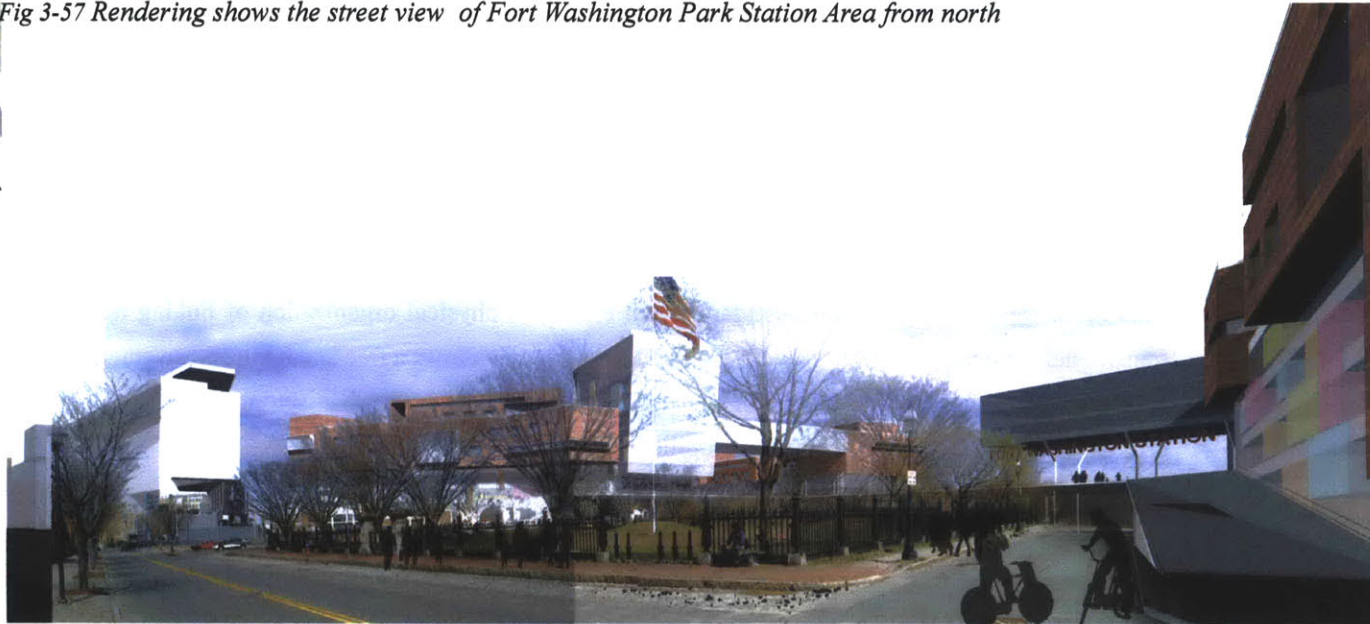
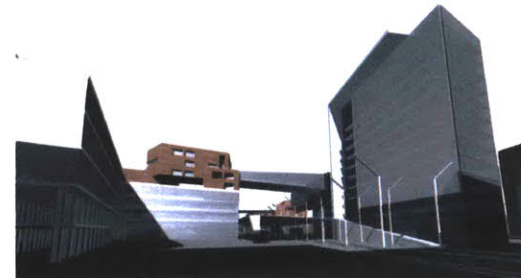


Fig 3-58 Rendering shows the view of Fort Washington Park Station from South



Fig 3-59 Rendering shows the view of Fort Washington Park Station from west



Chapter 4: Conclusions

Revitalization of the industrial belt is crucial for the future of MIT's academic expansion and Cambridge's urban development. Transitional boundaries are considered as a promising urban form to replace the industrial barrier, enhancing the relationship between the Institute and the City of Cambridge.

This thesis defines "transitional boundaries" not only as a physical organization of linking and transitional elements, but also as a well-integrated system that allows a free and flexible movement of people. This kind of integration can be achieved through design of urban settings that respect mixed-use environment and pedestrian mobility.

To summarize this thesis, the following principles define the characteristics of transitional boundaries:

- Emphasis on higher density and diversity that can be accomplished to the benefit of campus quality and vitality
- Enhancement of links between the campus and adjacent neighborhoods
- Promotion of joint public, private, and institutional initiatives that enhance the friendly relationship between the university and its adjacent neighborhoods

The design exercise of MIT's campus transformation shows one promising direction for future redevelopment: it considers the redevelopment referred to as transit-oriented development. It is

based on the assumption that the construction of the Urban Ring will offer a significant opportunity to reshape land-use and built-form patterns, particularly in the areas close to the transit stations. This new transit-oriented development will contribute to creating a transitional belt that weaves MIT's campus with its adjacent neighborhoods.

The future of MIT's campus depends on a variety of factors, including the completion of projects currently in progress, and the implementation of other efforts of MIT and the City of Cambridge. While it is difficult to predict whether or not the mechanism of using transit as a catalyst for revitalization will be effective, it addresses the potential for redevelopment and the elements that will foster the interest of both the Institute's and the City of Cambridge's interest in the area.

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Chapter 1:

Fig 2-1 Developed from Cambridge Historical Commissions, *Survey of Architectural History in Cambridge: Cambridgeport, Cambridge*, (MA: MIT Press, 1971.)

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Fig 2-3 Developed from Cambridge Historical Commissions, *Survey of Architectural History in Cambridge: Cambridgeport, Cambridge*, (MA: MIT Press, 1971.)

Fig 2-4 Developed from Cambridge Historical Commissions, *Survey of Architectural History in Cambridge: Cambridgeport, Cambridge*, (MA: MIT Press, 1971.)

Fig 2-5 http://www.olinptr.com/project_current_institut2.html

Fig 2-7 *Major Investment Study of Circumferential Transportation Improvements in the Urban Ring Corridor Final Report* (Massachusetts Bay Transportation Authority, July, 2001)

Fig 2-8 http://www.ci.cambridge.ma.us/~CDD/commplan/zoning/zngoverlaymap/zng_over_map.html

Fig 2-9 <http://www.ci.cambridge.ma.us/~CDD/commplan/greenribbon>

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