ANALYSIS AND DESIGN
OF THE PATH SYSTEM AT MIT

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SUBMITTED IN PARTIAL FULFILLMENT
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ABSTRACT

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SUBMITTED TO THE DEPARTMENT OF CITY AND REGIONAL PLANNING
ON SEPTEMBER 26, 1966 IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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This thesis suggests a methodology which can be followed
for the future planning of MIT's physical environment. The
process describes an integrated relationship between physical
planning and architectural design, and is illustrated through
a detailed evaluation of the Institute's path system.

The study is divided into three basic sections:

1. Derivation of Design Criteria. Valid design criteria
for the path system are extracted from environmental
objectives. The formulation of these objectives is
in turn based on the Institute's educational philoso-
phy and goals pertaining to its physical development.
Particular criteria and objectives are grouped under
five main categories: Identity and Legibility, Comfort
and Protection, Accessibility, Flexibility and Adapta-
bility, and Economy.

2. Analysis of the Path System. The total circulation
system is examined for its ability to satisfy these
design criteria, and a summary of MIT's visual struc-
ture as perceived from this system is presented.

3. Design of the Path System. Using the first three of
the criteria towards design and accepting the latter
two as constraints, a proposal for the total form of the
campus for 1980 is suggested. The existing main pedestrian
sequence is evaluated and redesigned as a prototype
example for the rest of the system.

The thesis concludes that the existing path system fails
to satisfy most of the design criteria. That its visual and
physical properties can be improved and enriched by design
application of these criteria. Finally, that a planning
thesis concerned with the aspect of design can profitably
present prescriptions, in a graphic form, for better under-
standing and more effective use as guidelines for detailed design
and implementation in the future.

Thesis Advisor: Donald Appleyard
Professor of City Planning
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INTRODUCTION
This thesis stems from my concern about the aspect of design. Architects are accused of being purely aesthetic and intuitive, while planners, on the other hand, are chastised for stopping just short of grappling with the creative process. Both are justified to stay strictly within their respective fields, but this begs the question of how one can plan for logical design. Neither in the education nor the professional practice of architecture or planning is there sufficient rapport established for a workable meeting of minds. As the fields mature and urban problems get more complex, instead of better interdisciplinary and inter-professional cooperation, the gap seems to widen. The master builder responsible for the satisfying examples of cities and buildings in the past has disappeared and has been replaced by specialists in all conceivable endeavors. This high degree of specialization is necessary in technology, but within our field, which deals directly with people and their environment, we need greater cooperation and overlap of knowledge. This would enable society to benefit from better and more meaningful plans and designs. Fortunately, a start has been made in this direction by some enlightened teachers and practicing professionals, and it is hoped that this thinking will continue and be refined.

This thought process then directly concerns a planning thesis dealing with visual design. Many of the past theses
have dealt extensively with the analytical aspects of design but have stopped short of actual creative design. Through analysis of existing and projected data, a statement of goals and objectives is evolved. Detailed policies are stated as guidelines within which design solutions can occur, and sometimes directions for visual and physical solutions are suggested. But usually, such work neglects design solutions to particular aspects of the subject. The end result, then, is a statement of policies and guidelines, a conceptual framework within which particular design solutions can occur. The planner stops where he feels the realm of the architect begins. Unfortunately the architect usually neglects the guidelines set forth by the planner or misinterprets them. I feel, on projects of moderate scale, for a planning study concerned with perceptual and design aspects, what is needed is that the study itself set forth as guidelines, prototype design solutions. These prototype designs should be recognized as possible alternates and not as absolute demonstrations.

This is by no means an attempt to impose specific solutions by the planner on the architect or designer, but to bridge the void which seems prevalent between the two, by attempting to use the graphic language as a common denominator. Visual and physical prescriptions graphically stated as part of a planning report would tend to strengthen the
realistic feasibility of the design component of such a study. It is only through such an investigation that many times the true implicit constraints are revealed. This thesis then is a search for a procedure which might be followed by both the disciplines, to diminish the barrier between them and make for a more logical transition from planning to architecture in the realization of a project.

This thesis will follow a series of logical steps which will analyze, through applying valid criteria, MIT's total path system and its environment as perceived from this system. Then by applying the same criteria towards design, it will determine visual and physical prescriptions for its improvement, presented mostly in graphic form. The path system's lack of visual qualities presents a challenging though real problem and so the design will strive for exciting but implementable solutions.
MIT IN METRO SETTING

fig 1
DERIVATION OF DESIGN CRITERIA
The circulation or path system of a university is an integral part of its physical environment. In fact, it is one of the more important design components of the total environment. Certainly for the physical planner or designer it is a powerful tool with which he can manipulate the character of the physical form. As Professor Lynch has rightly pointed out:

"The designer can give an area a positive visual character....His strongest resource is the street and path system, since it is while moving along these ways that his development will be seen. Thus the sequence and dynamic shape of the roads, the way they point, lead to their more intensive uses, and their relation to the building lines along their course, can have a visual impact on the observer." 1

Nevertheless, the designer or planner must base his decisions on certain valid criteria, and it is the validity of these criteria that concern us here.

The application of criteria to the design of MIT's path system can only be considered valid if these criteria can satisfy the major environmental objectives of the Institute. Also, these objectives must stem from the general policy established for its physical environment as guided by the Institute's educational goals and philosophy. Therefore the character of a university's movement system thus conceived should be a reflection of its educational goals.

MIT GOALS AND EDUCATIONAL POLICY

Let us deliberate then on some statements of Institute goals and policies which might be pertinent to the formulation of environmental objectives. Dr. Vannevar Bush, reflecting on educational objectives in his MIT Centennial essay, remarked:

"The training which equipped men for the world of a generation ago will not suffice today. Yet how can we train for the world of tomorrow if we cannot know what sort of world it will be? It will still be inhabited by men who will struggle with their environment and with their fellows. We cannot go far wrong if we do our best to impart a deep understanding of both..." 2

Dr. James R. Killian, Jr., recognizing MIT's responsibilities beyond that of providing an academic education, remarked at the dedication of Baker House.

"....We want to develop an environment at MIT which performs in the broadest sense and educational function itself, not in a passive way, but in a dynamic way. The whole complex of living conditions, activities and atmosphere must be skillfully arranged to provide the kind of environment that contributes to the development of leadership, breadth and standards of taste and judgement among our students." 3

More recently, Dr. Julius A. Stratton, in the President's Report of July 1964, recognizing the diverse needs of the undergraduate student commented:

"All the trends of recent years have placed a premium on qualities of mind that excel on the side of the mathematical, the analytical or the abstract. It is imperative that by some manner of means we also encourage undergraduates whose talents weigh more heavily toward the experimental and a sense of design." 4

2. Bush, Dr. V. A Program for Undergraduate Men's Housing MIT Planning Office 1965, pg. 11
4. Stratton, Dr. J. A., President's Report Issue '63-'64 MIT Bulletin 1964, pg. 30
Germane to this study and especially to the form of the existing path system, is the opinion President K. T. Compton expressed on engineering education at MIT:

"Of very great advantage, in my judgement, is a physical layout whereby the buildings which house the various specialized department are all interconnected under one roof." 5.

Turning back to the President's Report of 1964, Dr. Stratton, refering to the policy desired on general education and to interrelationships between departments within its academic community said:

"Every department of the Institute participates in the general education of students and therefore, to a greater or lesser degree, fulfills in a sense a 'service function'. But every member of the faculty, in whatever field, is an equal partner in the whole community of scholars." 6.

Further on commenting more directly on the physical environment he stated:

"In each of my recent annual reports to the corporation and alumni I have emphasized strongly at one point or another, the part played in the total process of education by the physical environment and moral tone of a campus." 7.

To summarize MIT's central mission and its main goals we turn to the President's Report of 1962, in which Dr. Stratton said the intent was:

"To enhance the quality of education at MIT.

To create new facilities for research, to press forward in special fields of critical importance, and to relate research more closely to teaching.

5. Compton, Dr. K. T., A Scientist speaks, Undergraduate Assoc. MIT, Cambridge 1955, pg. 54
6. Stratton, Dr. J. A. President's Report Issue '63-'64 MIT Bulletin 1964, pg. 14
7. Stratton, Dr. J. A. President's Report Issue '63-'64 MIT Bulletin 1964, pg. 31
To develop further the physical environment of our campus so that it may contribute more effectively to the life of each student."  8

Based on the preceding educational policies and goals, we can now derive meaningful objectives, which, when applied to the physical environment would enhance the quality of the total atmosphere at MIT.

PRINCIPAL ENVIRONMENTAL OBJECTIVES

The following objectives derived for MIT reflect my interpretation of qualities needed to better its physical environment and are not to be considered as extracted from any official Institute document or policy. Major environmental objectives which influence the physical form may be summarized under the following main categories.

1. Identity and Legibility
2. Comfort and Protection
3. Accessibility
4. Flexibility and Adaptibility
5. Economy

Identity and Legibility

The total environment should have a vivid and legibly powerful form, so as to evoke within an individual a sense of relationship with something significant. To achieve this would necessitate the following:

Main physical elements to be well structured, both statically and sequentially, having visual coherence and continuity. Also that these elements convey meaningful relationships between its visual form and the function or activity performed therein.

Reveal and clarify repeatedly the environment's interesting and unusual activities and characteristics.
Establish a sense of connection between the Institute form and the adjoining city environment. Presently this tenuous relationship is expressed only by a few parts of the total form, such as the Main Dome, the Great Court, the Earth Sciences Building and mainly only experienced along the Charles River boundary.

Comfort and Protection

A rather crucial objective for the physical environment, since its components are most lacking at MIT. Enhancing the environment through this objective would entail:

Generally the creation of a stimulating and at the same time a humane atmosphere within the environment.

Providing more areas for informal social participation and interaction. Some of these areas to imbue a warm and friendly feeling to the user, others to be more seclusive and quiet ones conducive to introspection and meditation. Both types preferably integrated with major internal pedestrian paths.

Improving the micro-climatic conditions, both outdoors and indoors.

Providing protection against irritants such as noise, noxious fumes, perceptual overload and traffic hazards.
Making safe and comfortable points of danger and transition within the whole environment, such as road crossings and changing modes of travel.

Accessibility

This objective can facilitate the environment both physically and socially. The following steps would be required:

The Institute as a whole should be more easily accessible from the outside urban areas, and vice versa.

There should be easy access within the campus to communal facilities and other amenities.

Good and workable conditions provided for regular service facilities and also for emergency services.

The environment should ease and encourage communication between professionals within its own precinct, and also with those from outside its community. This would require provision of and easier access to more meeting areas, formal and informal.

Flexibility and Adaptibility

Dynamic growth and constant change have subjected MIT to internal and external pressures. To satisfy such demands, the Institute, confined within its present urban setting would require the following:

Adequate space for multi-directional growth and expansion.
More structures with spaces which could be easily subdivided and re-used. Physical connections between these structures to be improved and well defined.

The circulation system of the whole environment must be just as flexible, and be able to absorb and adjust to changes in direction and volume of activity.

Economy

Economy is an ever present objective in any institution's growth and development and in the continued maintenance of its facilities. Expenditure of resources should be reflective of MIT's overall educational policy and long range physical development plan. Economies of design such as simple new structures, the reconversion of older ones, well-planned service and utility access, and a dense configuration of interconnected buildings with well-utilized open spaces in between, would justifiably off-set the high cost of land acquisition for future growth.

Thus we might assume that the path system, considered as a major component of the physical environment, and designed to support the preceding goals and objectives, can be a positive instrument with which the Institute may pursue the task of improving the perceptive phase of its students' general education. We can now derive pertinent and valid design criteria for the MIT path system based on these environmental objectives. But
before we investigate and form these criteria, a statement of MIT's long range development plan for its physical growth is in order. This will give us a better understanding of the Institute's thinking regarding its physical layout and thus should make our criteria more realistic and meaningful.
LONG RANGE DEVELOPMENT PLAN

The Institute's long range plan for its physical development as stated in "A Program for Undergraduate Men's Housing" prepared by the MIT Planning Office, suggests the following:

In general, Institute policy will be to contain the east-west growth on the campus between the two residential complexes of Eastgate and Westgate, a distance of 1 1/8 miles or a brisk 20-25 minute walk along Memorial Drive. Future east-west growth will be allowed to occur only by filling in the interstices along the axis. The total form will be allowed to grow in depth northwards, not in length. A guess at the ultimate physical form might be a triangle whose apexes would be Westgate, Eastgate and the intersection at Massachusetts Avenue and Main Street. (Figs. 2 & 3).

Concentration of the main academic activities will be on the Main and East campus. The Alumni Swimming Pool and Walker Memorial might be refurbished so as to provide a mixing of recreation and social with primarily academic activities.

Major community facilities including Kresge Auditorium, the Chapel and the Student Center, located just west of Massachusetts Avenue to act as a lively and stimulating area through which the student often travels when going
to and from the academic and residential cum recreational areas.

The West campus will be reserved for residential and recreational use. Undergraduate housing will relate to the river and playing fields. The new Graduate Center will be located just west of Kresge defining the eastern boundary of the playing fields. Future housing along with the existing Westgate complex will define the western-most terminal of the campus. Approximately 25 acres of playing fields will be permanently reserved for outdoor athletics with a new indoor athletic building located to the north of the new Graduate Center.

The eastern terminal of the campus will be defined by the new Eastgate residential complex for married students and faculty. This complex will also house the main buildings for the School of Business Administration and Political Science.

Along the northern periphery of the campus will be research and development facilities which do not lend themselves to easy integration with permanent academic buildings. Also in this area will be the special service facilities such as central utility plants and surface parking garages. No effort will be made to hold a permanent northern boundary since research and development facilities will necessarily grow and change with the national economy. However, a concerted effort should
be made throughout the entire planned development to make recognizable the Institute's precinct, not as a barrier between town and gown, but so as to help identify for the viewer its true extent and size, especially in the north-south direction, at any particular development phase.

In addition to the above official policies on Institute distribution and location of buildings and activities, it is my contention that particular consideration be given to the planning and design of future open spaces. In general, there are two main types of exterior spaces which should concern MIT planners and designers:

Open spaces within the Institute precinct. Such spaces should be relevant in scale and importance to the activities and buildings surrounding and using them, and to the movement paths which traverse them.

Open spaces at the periphery, between the Institute and its neighboring community. These spaces are just as important and even harder to provide for and design. They require a mutual recognition of the need for social and physical interaction between the two neighbors. Such spaces need not be large in size, but should provide for easy visual and physical access between the two areas. For example, such a spatial or terminal focus should be created at Kendall Square between the future East Campus of the Institute and the Kendall Square Redevelopment Area.
DESIGN CRITERIA FOR THE MIT PATH SYSTEM

We have thus far investigated the Institute's educational goals and policies which are significant to its physical form. We have used these to guide the formulation of environmental objectives. Finally, we have looked into the official policy for the Institute's campus development. Now we can form relevant design criteria for the movement system.

Since these criteria are directly related to the environmental objectives, they necessarily reflect many of the elements stated within the five basic objective categories. Thus the design criteria are summarized as follows:

Identity and Legibility: Main paths should be well structured, as a whole and also each one sequentially, and they should be organized around the most usual journeys; the system should visually reveal and help to clarify the environment's different activities and characteristics, and also identify the location of different departments and facilities; the system should reinforce the sense of connection between the Institute and the neighboring City environs.

Comfort and Protection: Main paths, especially those used by the pedestrian, should have a stimulating and joyous atmosphere as contrasted to the existing drabness and should be comfortably scaled to the individual; integrated with them should be areas of formal and informal activities and open spaces also areas of seclusion and quiet; paths, especially the seemingly endless ones, should
provide some degree of protection and relief against the winter wind and cold, also heat and glare in the summer; points of danger along the system should be minimized and transitions from one mode of travel to another made easier.

Accessibility: The system should provide ease of access, both pedestrian and vehicular, between the Institute as a whole and its adjoining city environment; also within the campus precinct there should be a choice of variable routes and easy access to and from its different parts; the system should also provide for ease of service and emergency facilities.

Flexibility and Adaptability: The system's overall form should be adaptable to change and growth; also its internal fabric should be flexible enough to accommodate the rearrangement of activities and open spaces.

Economy: The path system should be highly usable in all directions; within the academic precinct itself, outdoor pedestrian channels should, if possible, be used also as emergency accessways; choice of materials and embellishments should conform to high standards of durability, ease of maintenance and aesthetics.

The criteria of flexibility and adaptability and of economy can only be fully realized when applied to each particular and real problem of the path system on the
Institute campus. Therefore in the design proposals of this thesis, the first three criteria constructively guide the design solutions, while the last two criteria are accepted more as constraints to be recognized during the design process.

When these criteria are met, the resulting environment should be capable of heightening the individual's level of experience in the following ways: provide a richer, more acute sense of visual and physical satisfaction obtained from the environment; increase and strengthen one's confidence and sense of position while moving through and exploring the environment; enhance the range and quality of meaning attained by the user from a well-structured and distinctive setting.
ANALYSIS OF THE MIT PATH SYSTEM
ANALYSIS OF THE MIT PATH SYSTEM

MIT's total movement system is composed of the following:
1. Pedestrian circulation
2. Vehicular circulation
3. Internal vehicular service and emergency circulation

Bicycles, motor cycles, and scooters are sparsely used, and they travel mostly on the vehicular paths around the campus, and on the internal service paths within the campus. Thus the above three circulation paths cover the entire spectrum of travel within and around the Institute campus. All three types are essential for the proper functioning of the Institute, but its visual image is derived essentially from the pedestrian and vehicular systems since the service and emergency circulation is piecemeal and not a complete network. Thus, if the pedestrian and vehicular paths have the ability to satisfy the previously mentioned environmental objectives and visual design criteria, then the resulting image will be a strong and memorable one. If not, the user will experience disorientation and a lack of cohesion between elements of the campus.

The following analysis will first examine each existing circulation system separately for its ability to satisfy the visual design criteria. Finally it will summarize MIT's visual structure as perceived from the entire circulatory system.
Pedestrian Circulation

MIT's pedestrian circulation can be viewed as composed of two groups. First, the movement within the different campus precincts and second, the peripheral movement occurring around the campus boundaries. The latter mainly uses the existing sidewalks running along the streets. This circulation at present is not well integrated with the pedestrian network, since except for a few instances, these paths have no sense of purpose, nor do they provide any connection between significant campus activities or structures. They exist, in fact, only because of the roads they run alongside. These pedestrian paths hardly satisfy any of the design criteria and are uncomfortable to use.

There are, however, a few exceptions, the main one being the pedestrian sidewalk along Memorial Drive. Although, when walking along this path it is difficult to grasp MIT's river facade in its entirety, the user is made aware of many of the environment's different activities and characteristics (e.g. the residential brick dormitories; the limestone-clad main buildings with its big dome and the Great Court; Hayden Library; the tennis courts, etc.). What this path achieves most is to reinforce, for the user, the sense of visual connection between the Institute's formal facade, the Charles River, and the neighboring Boston profile. This path is shaded
by trees during the summer and protected from the freezing north winds by the almost continuous wall of Institute structures. Accessibility to various parts of the campus from this path is good, and it does possess the formal entrance to the Institute through the Great Court; yet, the path's actual use is rather sparse since activities located along this path are usually approached from the interior network. Access from this path to the river bank is poor and dangerous due to the heavy vehicular traffic along Memorial Drive.

The other paths of this group which do connect campus activities and structures are along Massachusetts Avenue, Ames and Amherst Streets. The walk along Massachusetts Avenue does become important since it leads to the physical entrance at 77 Massachusetts Avenue, and also to the Kresge and Student Center Quadrangle. Unfortunately access both towards Boston and Cambridge along this path is made difficult and uncomfortable by the lack of proper protection against traffic and the natural elements. Sidewalks along Ames and Amherst Streets are used by pedestrians to go from one activity to another, but give no sense of sequence, are unsightly and afford no protection.

Pedestrian movement within the campus precinct, on the other hand, is the primary system of circulation of the Institute. As seen from Fig. 4, it is composed of a series of parallel paths interconnected at right angles, running both indoors and outdoors. Paths running east-
west dominate those in the north-south direction for two reasons. First, because of the existing physical layout of the campus activities and structures, which are elongated in a linear form from Westgate to the Sloan Building. Secondly, when moving east-west one has a strong association of travelling parallel to the Charles River and its Boston skyline. There exists a hierarchy among these paths, the major pedestrian spine runs from Westgate through the entrance at Building 7, along the corridors of the Bosworth buildings, and onto the Sloan and Hermann Building complex. This main path will be further analyzed in detail under the design sample section of this thesis. For the present we will examine the existing pedestrian paths on the whole to determine their ability to satisfy the stated categories of design criteria.

The pedestrian paths on the whole do not convey a well defined structure and thus cannot be recognized as a strong pattern. East-west paths intersect north-south ones at certain points, but these nodes lack spatial definition and clarity of function. An important node or junction should possess certain qualities to be meaningful and purposeful. The space it unfolds should be alive and proportioned in scale to the volume of activity it holds. Also activities within and around this space should be clearly exposed. Wherever possible, views to and from this space should be made available. The user must be well informed at all times as to the direction he wants
to travel and to any changes in orientation he might encounter, by the provision of legible signs and other visual devices identifying various departments and individual buildings. The space should provide for the change in pace required to acquire ones bearing, before making a decision.

When viewed from the outside the strongest node wants to be under the big dome of Building 10, but the space there is disappointing and also one rarely enters the system as this point. However, one does make a strong visual connection from this node, through the Great Court, with Boston. The node with the greatest clarity of function and meaning is the space under the dome of Building 7. Not only is this the main physical entrance to the academic building complex, but the interior space also reveals the multi-level relationship of the other corridors, and justly expresses the architectural form of the dome from the inside. Yet this lofty space seems empty and needs a strong activity or element placed within it to enliven and enhance its dimensions. From its outside steps one can view most of the west campus, with the Kresge dome and Westgate tower as its strongest landmarks.

The pedestrian paths reveal four distinct open spaces within the campus as being legible and purposeful. Other smaller courts are visible but have no significant purpose, for example, the small garden court behind Building 3 is
meaningful but is hard to see and approach. The Great Court establishes a strong visual connection between the Institute and Boston, even though the use of its space is more formal than informal. Its identity could be further improved by providing more and better visual connections to it from the interior corridors. The Eastman/McDermott Court is more visible from the paths running through and around it. It holds a major and minor landmark, the Earth Sciences tower and Calder's "La Grande Voile". A confined visual connection is attained between the axis leading from the tower, across the river to Boston. Physical entrances to and from the court are weak but the space does reveal the environment's different activities such as the Hayden Library books and the classrooms of the main buildings. The most legible and identifiable court on the West campus is the Kresge Quadrangle. This is a space which is well scaled for human beings and through which passes the main pedestrian spine, revealing various activities such as Kresge Auditorium, the Student Center, and the Chapel. These distinctive architectural forms make the journey very memorable. It also acts as a meaningful transitional space between the academic and the residential and recreational activities. During the summer its tree-shaded lawns are well used by students, but the provision of benches and intimate sitting areas would enhance its use during some of those clear and sunny New England winter days. The fourth space is Briggs Field revealing its special
activities which in the future should become a well-defined and significant open space within a dense urban campus.

The pedestrian path from Westgate along Amherst Alley does reveal a spectacular view of the three domes, of Kresge, Building 7 and Building 10, juxtaposed against the towering vertical shaft of the Green Building topped with its radar equipment. This certainly helps to orient oneself within the campus and also sets up a meaningful relationship between elements of the Institute and those of Boston, like the State House Dome and the Prudential Tower. Unfortunately from this path the potential view of the river is lost behind the dormitory structures.

In general, the paths do not make clearly visible the Institute's many varied activities and characteristics, such as swimming, interesting laboratory equipment, crucial vertical circulation points and connection links between buildings. The only imageable connection link joins Building 16 and 26 (The Dorrance Laboratories and Compton Laboratories), where the activity and purpose is clearly identified, and from where one can also make visual connections to the outside.

The comfort and protection criterion is the most neglected of all when applied to the path system. One advantage provided by the interconnected corridor system of the main academic building complex, is that of interdepartmental access without having to step outside, but unfortunately this is not a complete system of connections.
Most of the indoor corridor paths are drab and lacking in stimulation, are painted and lighted without imagination, and provide no areas for informal social interaction. Outside pedestrian paths are mostly unprotected against the winter winds and the summer heat, and there are many dangerous pedestrian crossings across roads along the entire system, the prime example being the pedestrian crossing at Massachusetts Avenue. Changes from the pedestrian system to the vehicular system are very abrupt and lack provision of areas for an easier and smoother transition. Such an area of transition might provide protection against the weather, adequate seating accommodation while waiting for a vehicle and might also enjoy a pleasant view. The pleasant landscaped court behind Building 3 is a start towards enriching the open spaces of the environment, but is not fully used and appreciated at the present due to a lack of connection with any main pedestrian path.

Pedestrian accessibility from the outside to the campus is available, but is neither visually identified nor physically comfortable. Entrances and exits are confusing and conflict with the vehicular system at these points, thus making for dangerous crossings and congestion. The stepped entrance to Building 7 is certainly the most accessible pedestrian node. The Boston-Cambridge bus stops right in front making this a strong and logical point to enter, but this transition should be made much easier. There are no real pedestrian entrances to the campus from Kendall Square or
the northern boundary, if one arrives by the subway. In
general, pedestrian accessibility between the campus and
its city environs must be classified as weak and indistin-
guishable. Within the campus pedestrian accessibility is
more purposeful. There is a choice of variable routes to
and from its different parts, although the interconnections
between these routes are fussy and torturous. A prime ex-
ample of such an illogical connection is the lobby of
Material Sciences-Building 13, (completed in 1965). Here
the pedestrian has to perform a series of meaningless
motions, climbing up and down steps and turning around
blind corners, simply to get from one path to another.
Access to dormitories along Amherst Alley is available but
confusing to the newcomer since one cannot equate which
is the front or back. The pedestrian system also fails
to provide easy access and movement for the physically
handicapped. There is an increasing need to provide posi-
tive solutions for accommodating these people within the
MIT system. On the whole the interior network needs more
horizontal connections at different levels and also many
more efficient elevators at strategic points.

Flexibility and adaptability is a criterion which is
well satisfied by the MIT pedestrian system. The gridiron
layout of the paths, although not adequate enough, does
lend itself to expansion and change in many directions.
The rectangular relationships established by the Institute
structures gives the interior corridor system much lati-
tude for growth and rearrangement, however, many of these
connections are badly designed and changes in direction
are hard to execute. There are many buildings that break
the interior corridor system, the notable examples being the Earth Sciences tower and the Student Union Building. A connection to the latter can be solved, but one ponders how to approach with a covered connection to the tower.

To strictly satisfy the criteria of economy while achieving flexibility is a very difficult undertaking. At present the MIT pedestrian system cannot rightly be called an economical network. While the original Bosworth building complex enjoyed economy of travel and stayed flexible and adaptable to growth and change, the post-World War II development of structures and spaces allowed for a rather wasteful and weak plan. For example, north of the main complex there are too many disjointed buildings, a lack of organization along a secondary central path, and the distribution and layout of exterior paths are excessive and underused. Thus economy can be achieved not only through use of the right materials and embellishments but primarily from simple design and logical programming.

Vehicular Circulation

MIT's incremental growth has resulted in a physical plan which has had to conform to the pattern of the existing streets around it. Thus, at the present, we have the Institute plan divided into four campuses; the main, the west, the east and the north campus. These four are not necessarily well distinguished from each other nor are they, physically or visually, well interconnected. Fig. 5 shows the existing vehicular circulation consisting of roads
around the periphery of each of these four parts. One could generalize that it is composed of a ring road around the west, main and east campuses, with Massachusetts Avenue besecting the entire plan in half.

The two main vehicular spines are Memorial Drive and Massachusetts Avenue. On Massachusetts Avenue, as one crosses the river from the south, the MIT river facade is vividly legible. The Great Court and the Great Dome are clearly identified, but one is disappointed at being denied an entrance here. However, one soon realizes that the main physical entrance to the complex is at 77 Massachusetts Avenue. Approaching from the north on Massachusetts Avenue, the image of the Institute is not as strong and the small dome of Building 7 is the only really identifiable element for the motorist. However, the subtle curve of the road does focus one's attention on the pillared entrance at the steps to the main building. Memorial Drive, on the other hand, gives a distinctly different experience to the motorist. One can traverse the entire length of the campus driving at 40 mph within 1 1/2 minutes and this journey reveals sequentially the environment's different activities and characteristics. The time scale also helps the individual to retain this sequential image as a whole picture. On Memorial Drive, the journey is more meaningful when travelling from west to east since the Westgate high-rise tower signals the physical beginning of the campus. In the future, the Eastgate towers will visually reinforce the eastern terminal. Both Memorial Drive and Massachusetts
Avenue tend to reinforce a sense of connection between the Institute and Boston physically as well as visually. The rest of the vehicular circulation paths are not well structured, and they neither reveal the environment's activities and characteristics nor give a sense of connection to its neighboring city environs. However, from Broadway one can view the Great Dome and some of the new structures such as the Earth Sciences tower and the Material Science Building, as one passes open parking lots and openings between buildings which allow for a long view. Thus the criteria of identity and legibility is only partially satisfied by a few paths of the present vehicular system.

The comfort and protection criterion are once again the most neglected of all, as was the case in the pedestrian system. Traffic on all channels is extremely heavy and most of the intersections are extremely torturous to negotiate. This condition makes for an uncomfortable and nerve-racking experience. Travelling other than rush hours on Memorial Drive is the only time the motorist derives any enjoyment while using this system. Points of transition from the vehicular to the pedestrian system are uncomfortable and confusing.

Accessibility from Memorial Drive is fair and visually quite clear. On the other hand, approaches from the north are poor, hardly visible and quite confusing. At present, the vehicular system lacks any really strong entrance points.
This should be remedied by the future development plan as proposed by the official MIT plan document, and also by the proposal as set forth in this thesis.

The criteria of flexibility and economy are fairly well met by the present system, but have room for improvement within detailed parts of the network. For example, the nature of traffic circulation along Vassar Street could easily change from the present heavy trucking to light inter-campus movement, with well planted sidewalks, when the campus expands in this direction and when the railroad is eliminated. The present road layout seems adaptable to the future master plan circulation system.

Entry to the parking lots and garages are scattered all over the campus at the present time, and the approaches to these facilities are not as direct as one might prefer. However, the erection of new centralized parking structures between Vassar and Albany Streets will firstly, eliminate many of the small tucked-away lots and secondly, will make for an easier identification of such a facility. The transition after parking is important, and should be made easier by proper and pleasant pedestrian connections from these facilities to the major paths of the Institute system.

**Internal vehicular service and emergency circulation**

As stated previously, the prime purpose of this particular segment of the total movement system is to make the environment workable and accessible to the necessary routine and emergency services. Meaningful criteria applicable to this system would then be those of accessibility, flexibility
The present system is segmented and lacks interconnection between different parts. Vehicular access to each of these parts is physically inconvenient to attain and visually hard to distinguish. Access along Amherst Alley is the easiest and most direct part of this system, but even this needs improvement.

The system's overall form is flexible to growth and change since there is no one overall form, rather a number of separate individual circulation loops. (Fig. 6).

The present system is rather wasteful in its physical proportions of individual paths and also in its total quantity coverage. The present service paths are highly underused, and do not lend themselves to be used by the pedestrian. The future development of this system should strive for the supplemental use of its paths as pedestrian channels, and choice of materials should conform to both utilitarian and aesthetic standards.

**Visual structure of MIT**

The preceding analysis has examined each of the three circulatory systems as to their ability to satisfy the basic design criteria stated for MIT's total path system. The following summarizes the environment's visual structure as perceived from the total movement structure.

The MIT environment does not convey, at present, a well-defined and true total-visual image. While certain parts of its visual structure are clear and meaningful, other parts of the campus are incoherent and weak. The more
imageable aspects of the physical environment being:

1. The Main Campus complex with its two domes and the Earth Sciences tower and Kresge Auditorium across the Avenue as landmarks.

2. The image of the Institute's linear growth parallel to the Charles River.

3. Certain open spaces as exterior nodes.

4. Interior nodes as points of visual connections with the outside and circulation junctions.

These aspects of the campus are relatively more perceivable than other parts, but in themselves need greater coherence and visual clarification when considered within the total context.

The Main Campus does possess a common character as an area and can thus be considered a visual district. This quality is stronger from Memorial Drive, Massachusetts Avenue and the main pedestrian spine than along the other edges of the campus. One recognizes the characteristic grey color of the buildings, the standard four-story height and the neo-classic architecture of the Bosworth complex. The columned entrances of Buildings 10 and 7 topped with their respective domes, even though the former is a formal entry, are clearly perceivable and convey a strong image. Viewed from across the river the Great Dome juxtaposed alongside the Earth Sciences tower has become a symbolic image of the Institute. This symbolic image makes a strong connection with its neighboring-Boston skyline for
any one who has once experienced this view. Looking east from the pedestrian walk along Amherst Alley, this grouping of the domes and tower, with Kresge's domed form in the foreground, makes for a spectacular and meaningful view, which should be preserved in the future.

The Institute's linear growth parallel to the river is evident since two important paths of the movement structure travel along this axis. Vehicular circulation along Memorial Drive enables one to grasp a sequential image of the whole facade along the river while the main pedestrian spine with its path traversing varied spaces, connecting many activities and exposing meaningful views of the campus, reinforces, for the user, the Institute's strong linear quality.

Four open spaces are apparent from the movement system and can be defined as exterior nodes. The Great Court is formal in character, symbolic in its meaning and visible both from the pedestrian and vehicular paths. This node, above all other spaces, makes a strong visual and meaningful connection with Boston. The Eastman/McDermott Court is recognized as a space more enclosed by the environmental fabric; it is visually better integrated with the path system and reveals meaningful activities surrounding its periphery. At present, its spatial qualities are not fully defined, while the unsightly parking activities make for congestion and the use of harsh paving surfaces. On the West campus the Kresge Quadrangle is very visible from the path system. It is scaled for humans, possesses significant common facilities housed in distinctive architectural
forms and acts as a meaningful communal focus between the academic campus and the residential/recreational campus. The athletic field is very visible from both path systems but its spatial boundaries are ill-defined at the present. Nevertheless, the sheer size of its green surface and clarity of activity make it very imageable.

Of all the interior nodes along the pedestrian network, there are three spaces that are significant to the visual structure. The space under the dome of Building 7, as analyzed before, has the greatest clarity and meaning for the user. The space at the entrance to Building 10, also described previously, lacks meaningful relationship with the Great Dome, but possesses visual connection with the outside court and the Boston skyline. The third node has a purely functional purpose at the junction of Building 8, the Life Science Building (16) and the Compton Laboratories (26). Though this node needs improvement in many ways, it does attain clear visual connections from inside and outside, is a focus for vertical distribution and allows a choice of movement in either the north-south or east-west directions. The glass and steel cage joining Building 16 with 26, which is part of this node, is the best and only successful example of how Institute structures staged at different time intervals should be linked together. It satisfies the function of floor connections at all levels and visually exposes the activity of people crossing over from one building to the other. Also from within this glassed link the user can make visual connection with other parts of the campus environment.
While the above were the stronger points of the physical environment, major faults which weaken the visual structure may be summarized as the following:

1. The total form fails to evoke within an individual a sense of relationship with something significant.

2. The campus lacks a coherent mesh with its neighboring City of Cambridge.

3. The lack of cognizance as to the true dimension and size of the campus.

4. When approaching the Institute from outside, the lack of visible elements which might act as entrances to the campus.

5. MIT's innumerable buildings do not adequately reveal, visually or symbolically, the varied functions performed within.

6. MIT's movement system lacks a sense of total structure, and is uncomfortable, monotonous, dangerous and aesthetically unsatisfying.

The word MIT connotes, nationally and internationally, a mystique in educational circles. The Institution is envisaged as a place of great erudition and scientific development. It would be justifiable for people to expect its physical environment to embrace this iconic embodiment. Unfortu-
nately, for the observer who is not involved with its scholarly endeavors, MIT's physical image is disappointing. The physical environment should measure up to this mystique both for people familiar with the Institute and for strangers experiencing MIT's physical form for the first time.

Its physical form lacks any visual or other meaningful connection along its boundary with Cambridge. There should be social and physical ties between the two communities. The Cambridge housing stock could be better integrated with MIT's housing and yet maintain their own identities. Commercial facilities at Kendall Square and towards Central Square could be made visually and physically more accessible to the Institute community. The future redevelopment in Kendall Square offers a great challenge towards a vital move in this direction. Such opportunities for reinforcing the City-Institute fabric should not be lost.

The true size of the campus is not clearly evident because of the scattered location of many of its buildings. Many of its special facilities are housed in older reconverted buildings which do not maintain the continuity of appearance of the Main Campus buildings. Thus, one fails to associate oneself with the MIT environment, especially along the northern paths.

At present, except for the Westgate Tower, paths leading to the campus lack any type of definition which might stimulate the senses and act as a gate or beacon
demarcating the Institute campus. Future development programs might help this situation.

The popular maxim of "form follows function" practiced by architects nowadays was well understood by Bosworth when he designed the original complex of buildings. He created distinct forms and put meaningful activities within them. The Building 10 dome housed the main library of that time. He gave the dome of Building 7 architectural and functional meaning. He created an envelope around the interconnected buildings to impart a conformity of appearance which justly de-emphasized the ever-changing spatial requirements needed for its facilities. The architects of buildings after the Bosworth era did not respect nor understand his concept, thus, the enlarged MIT campus today has lost many of its early attributes. To help clarify its internal visual structure, the Institute needs to expose its varied academic activities from the internal paths. These activities should be housed in simply designed, highly interconnected buildings of neutral character, which would allow great flexibility and economy of function. Other particular functions might be expressed symbolically by giving the architectural envelope a distinctive form and articulating these structures along the pedestrian paths. Another very important component of the internal visual structure is the internal courtyard. A series of courtyards, well connected to the movement system, each with its own special attribute, would help to strengthen and clarify the campus environment.
The movement system has already been examined and was found basically lacking in form, sequence, comfort, interconnection, accessibility and aesthetic stimuli. In MIT's urban situation, it would be impractical to try to attain an ideal solution. Yet, a short and long range approach towards rectifying its deficiencies, by the satisfactory application of objectives and criteria, could result in a stronger, better structured and legible system which would reinforce the visual structure of the total environment.
LEGEND

VEHICULAR CIRCULATION

- VERY HEAVY
- HEAVY
- MODERATE
- LIGHT

CONGESTION

RAILROAD

BUS OR SUBWAY STOP

VEHICULAR SYSTEM

1" = 400'

fig 5
INTERNAL VEHICULAR SERVICE AND EMERGENCY SYSTEM

LEGEND

- PRIMARY
- SECONDARY

SERVICE ENTRANCE TO BUILDING

SCALE 1" = 400'
DESIGN OF THE MIT PATH SYSTEM
Proposal for the Total Form

The 1980 envisionment as illustrated in Figs. 11 and 12 is not a figment of a designer's imagination but the visual embodiment of the relevant and practical issues to be faced by the Institute for its future need.

Practical considerations such as maintaining a FAR of 2.0, the staging of new construction, and the funding for structural volumes with a maximum of 100,000 s.f. of gross floor area for each such increment, have been carefully considered and worked into the planned form.

Physical and visual considerations deemed beneficial to the Institute are:

1. A network of indoor-outdoor paths affording a greater choice of travel and experience (e.g. the main pedestrian sequence as compared with a green belt established along the existing railroad alignment).

2. A possibility of better covered connection links between academic buildings.

3. The choice of materials used within a design vocabulary to enable the dual use of service paths as pedestrian ones.

4. The height of the new East Campus academic buildings to conform with the old Bosworth complex.

5. The preservation of important potential views like the ones shown in Figs. 20 and 21, and the creation of meaningful new ones.
6. The reserving of approximately 25 acres of land as permanent playing fields and the identification of this requirement by grouping the graduate and undergraduate residences around them.

7. The creation of housing tower complexes at the east and west ends of the campus to act as terminal foci and entrance gates for the movement system.

8. The use of planting along paths and in open spaces to create a more identifiable and relaxed atmosphere.

9. The creation of transitional and intimate areas and providing them with benches and protection from the elements.

Among the social aspects considered important to planned form are:

1. The creation of physical and visual access from the campus to the residential community located to its north.

2. To make a concerted effort not to disrupt these homes by gradual acquisition of residential property.

3. To reinforce the ties between the Institute and the commercial and business communities at Kendall and Technology Squares, by creating spatial foci along the boundary and providing strong physical and visual access to them.
Evaluation of the Main Pedestrian Sequence

The existing main pedestrian sequence runs from the Herman and Sloan Buildings to the Westgate tower complex. On the whole it fails to satisfy most of the five design criteria. Within the main building complex the path does possess the quality of being flexible and adaptable but this quality is hardly noticeable at the present and should be brought out by design treatment of the corridor.

The path connecting the Herman Building to the main campus is the weakest link of this sequence. There is no sense of arrival to the campus along this path from the east. This link is exposed to the extremes of summer and winter, and the general visual atmosphere is depressing. One feels as though one were walking along an ugly back alley, with no sense of identity between the user and the campus. Upon crossing Ames Street there is a sense of being within the campus environment, but the path is ambiguous as to the direction one should follow. One continues walking along the asphalt path by default rather than being beckoned by an entrance or focus at the end of it.

The entrance to the main corridor from the east is visually weak and physically tight, and needs much improvement. This should be an entrance portal befitting the main building complex, not just an entrance door. The main
corridor suffers from a lack of all the various qualities listed to be satisfied under the five design criteria, except for adaptability.

The colour scheme, if one dare call it that, is drab and dull. The continuous and poor intensity of the lighting and the endless monotony of this corridor cast a hypnotic spell as one walks the path, and even though his destination is known, one tends to overshoot the mark. There are no directions to follow for finding various departments. Nor are there any clues identifying much sought-after facilities such as rest rooms. (See general notes on Fig. 15 for new treatment.) Once having entered the corridor, there is no view to the outside except when passing through the node at Building 10, and even this is obscured during the regular school term by the various banners and activities exhibited by student causes. The importance of the activity for the students is not questioned here, nor that this is an important location for the same. What is questioned is the amount of activity that should be allowed in a space, which, in all essence is the path, and which is already overcrowded. What is proposed is that only two current exhibits should be allowed at any one time and that their duration should be short, after which if the party needs an extended representation that they be allowed space in the new proposed Student Pavilion between Buildings 5 and 3. The pleasant garden court behind Building 10 is hardly noticeable and thus is
not appreciated by the corridor user. This corridor does possess stair nodes with exciting volumes and shapes but these attributes are visually wasted. The present structural ceiling is much too high and creates an awkward spatial proportion. The exposed piping and ducting can be stimulating to look at in a factory, but here look out of place.

The corridor floors of terazzo and marble are the right choices of materials for such a heavily used path, but need extensive refinishing. The floor colours are not objectionable but could be improved upon.

After the endless and boring walk one arrives under the domed lobby of Building 7. Here for the first time the path user experiences a visual and physical impact. If this sequence were reversed the impact would come first and the boredom later. This important node has been elaborated on elsewhere and we can dispense with it here. As one emerges from this node just before walking down the steps one is exposed to a panoramic view of the West Campus. This is quite satisfying and meaningful since most of the students who travel the path live there.

Next, the path makes a very dangerous crossing across Massachusetts Avenue. This danger should be eliminated and a proposal for it has been made in this thesis. The path then continues past the Student Center with its contorted grandiose
outside stair. This entrance has a duality which is quite disconcerting. Now the pedestrian wants to cut diagonally across the unexplainably shaped lawn, but his civic sense wants him to pass alongside Kresge. His conscience might be helped along by the right treatment given to the Kresge lobby. The lobby should always have some activity or exhibition scheduled within it. When there is some movement or display behind the glass facade the space comes alive and the path system user becomes aware of this experience, and visually and physically participates in it. On the other hand, when the lobby is empty, the eye is not drawn within and the glass takes on a reflective quality.

As the path leaves the Kresge Quadrangle the user is confronted with a confusing situation. The physical path is blocked by parked cars and there are no visual elements identifying which way is the main spine. One has to be a constant user, familiar with the environment, to know what to do at this point. From here to the point when one passes under the Burton diningroom building, there are no amenities. No rest benches, no points of transition, no views except for a hint of tennis behind the evergreens; in fact, the path itself is so narrow that during the winter months, one is forced to walk on the road and dodge service and other vehicles. What is perceptible are the various rubbish bins, usually open and overflowing. Students living at Baker House do get a strong sense of entry which is commendable for the architect. After crossing Fowler Street, the existing path
does take on quite a pleasant and relaxed atmosphere. Views towards Boston and the playing fields are available and one's attention is immediately directed to them. This stretch could use more sitting amenities and protection against the cold North wind. During the summer with the sun streaming through the green foliage, the pedestrian is subjected to a gorgeous experience. Another important attribute of this segment of the sequence is the very meaningful view exposed when looking East. (See Fig. 20) Extra effort and research should be expended by planner and architect to try to preserve this view. The Westgate tower does create a visual focus and has contributed towards giving this stretch a strong direction.

When travelling the sequence from West to East, one would encounter most of the same reactions as described above; and a photographic documentation of the sequence in both directions is presented in Fig. 13.
Design of the Main Pedestrian Sequence

The 1980 main pedestrian sequence uses the same alignment as the existing main path within the west and main parts of the campus, except for minor variations in design. The alignment is significantly changed when traversing the East Campus. This has been deliberately designed and can be justified on four counts. First, the new physical, visual and social connection made between Kendall Square and NASA, and MIT, through the new East Campus, is considered more important and meaningful for the main path than just a connection between the School of Political Science, the Business School, and the Eastgate housing, and the Main Campus buildings. Second, the Earth Sciences tower and the Eastgate towers act as significant foci when walking along this path. The existing sequence from the Herman Building to Walker Memorial has no such focus at either end. Third, this existing walk parallel to Amherst Street views the back elevation of 100 Memorial Drive, which certainly cannot be improved. On the other hand, the new sequence will traverse a series of different spatial and textural experiences with transitional areas and courts along it and also offers the possibility to enter indoors and then continue along the corridors connecting the new complex of academic buildings. This walk will heighten one’s experience and will give a greater sense of being within the main body of the campus. Finally, the alignment makes for a direct and easy access for the pedestrian who
arrives by public transit or bus and enters the campus at the northern gate.

Another significant point to mention here is the change made in vertical alignment when crossing Massachusetts Avenue. Under the dome of the most important node of the campus and following the axis of the main corridor the path flows down an escalator, passes through a basement lounge activity, crosses Massachusetts Avenue and emerges onto the West Campus. The easy ramp and the Continental Cafe provided as one emerges from the 60 ft. passage make for a very pleasant and easy transition. Also the natural light pouring in from the glass walls of this passage will make up for the normal aversion to underground tunnels. Unless a better demonstration has been provided, this seems to be the most satisfying solution to a safe crossing of Massachusetts Avenue.

Much more has been accomplished with the main sequence but this should all be evident by studying the various drawings. For readers of this work who might not be conversant with the graphic notations the following list summarizes the design treatment.

1. New spatial experiences are provided.
2. Transitional areas are designed; these areas are provided with furniture, are protected against the elements, are given varied and different ground surface treatments, and finally, where possible, views from these areas are
3. Exposure of significant views, activities, spaces, and landmarks are provided along the sequence.

4. The placement of trees and vegetation suggests the visual experience planned for. (e.g., along the length of a path, a shady vista might be desired, while within a court a roof of foliage might be envisaged.)

5. The path along Amherst Alley is protected from bitter cold winter winds by the planting of a hedge alongside the metal fence. This will allow for visibility of field activities and yet give adequate protection.

6. All along the entire sequence, benches and path furniture are envisioned but cannot be drawn at the small scale imposed on the drawings.

7. The use and placement of building surfaces give a varied sense of visual and spatial expression when moving along the path. Sometimes the building wall runs closely parallel to the path, giving a sense of scraping against it, then again the path travels away from it, sometimes goes through the buildings and then sometimes under them. The location and relationship of the path and building surfaces can contribute greatly toward protection from the sun and the cold winds and can also excite one's visual senses.

8. Finally, Figs. 15 and 16 suggest re-evaluation of activities along the main corridor and make detailed prescriptions for sharpening its legibility, improving its physical qualities, and establishing better visual connections to the outside.
SIGNIFICANT VIEW TO BE PRESERVED FROM WEST

fig 20
SIGNIFICANT VIEW TO BE
PRESERVED FROM NORTH
fig 21
CONCLUSION
The MIT environment has presented a real and fascinating opportunity for application of planning and design principles to its path system. The conclusions arrived at from the study are as follows.

That MIT's educational objectives do enable one to derive meaningful criteria for bettering its visual image.

That the need for improvement as brought out in the analysis was substantiated by a sample survey of user reaction to the MIT path system. (See Appendix for questionnaire results.) Also, that the path system was weakest in satisfying the criteria of identity and legibility, comfort and protection, and accessibility, and performed better when equated against those of flexibility and adaptability, and economy.

That the design criteria when applied to the circulation system can improve the existing conditions and that they can justifiably suggest guidelines for the physical planning and design program consistent with the overall philosophy of the Institute.

That during the process of implementation of any particular project within these guidelines, other more immediate factors such as funding and timing will have to be evaluated
within its context. However the matrix set up to guide its design can influence for the better its final embodiment.

Finally, this design oriented planning thesis does not pretend to have solved all of the path system problems and those of getting the planner and architect to work closer together. But it does provide an example of how logical planning objectives and criteria, graphically presented, can produce a design concept understandable and useable by both professions.
APPENDIX
A questionnaire was sent to 200 subjects, all members of the MIT community; 100 were students selected randomly, and 100 were faculty and staff members, 4 from each department and 1 of whom was female. A 40% response was received, with no striking differences among the subject groups.

There were three parts to the questionnaire: a campus plan on which respondents marked their paths, questions about reactions to the circulation system, and space for comments on the system.

Using the paths as they are indicated on the sample questionnaire, the results of the first part are as follows:

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<th>% TOTAL</th>
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</thead>
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<td>7.6</td>
</tr>
<tr>
<td>B</td>
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<td>25.6</td>
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<td>19</td>
<td>13.2</td>
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<tr>
<td>D</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>E</td>
<td>10</td>
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</tr>
<tr>
<td>F</td>
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</tr>
<tr>
<td>H</td>
<td>25</td>
<td>17.3</td>
</tr>
<tr>
<td>I</td>
<td>12</td>
<td>8.3</td>
</tr>
<tr>
<td>Total:</td>
<td>144</td>
<td>100</td>
</tr>
</tbody>
</table>

The corridor from Building 8 through 10 to Massachusetts Avenue is most frequently used (B); the paths next in importance connect the main buildings to the Student Center (H), and connect Hayden Library and the east campus to the main buildings (C).

Responses to the specific questions also fell into five areas on which there was general agreement:
There should be more exposure of activities, more expenditure to improve facilities, more social interaction, better views and better lighting.

There were also requests for better vertical circulation, and for quiet.

The physical appearance does satisfy the symbolic meaning of MIT for 34 out of 50 respondents.

The remaining answers bore out the comments and indicated the same difficulties in travelling around MIT.

There were five areas of comments on the system. The most frequent was a complaint about doors being locked after 6 pm and on weekends.

Second, and of more general importance, was the group of comments which indicated that the "system" is unclear, "a maze", and even after several years does not appear to the traveller as a whole navigable system. The building numbers apparently do little to lessen the confusion; there were several complaints about the lack of signs to indicate directions and buildings.

The third group of comments indicated that the corridors and the lack of open space between the buildings are oppressive; the corridors are disorienting, "hypnotizing", and reminded one respondent of "a jail", another of "herding cattle". The comments on outside space primarily ask for more pleasant paths, alternatives to the closed corridors, and more space between buildings; the new construction seems to one respondent to be creating a "closed system". To another, the connected buildings connote "simplicity, respect and mental dependence".
Fourth, MIT seems drab; there were requests for color in corridors, more textures, better outside lighting and more grass.

Fifth, the Massachusetts Avenue crossing, which is the second most frequently travelled path, is considered an obstacle; there were requests for either an underpass or overpass, although several respondents felt that a bridge would be inappropriate at the main entrance.

In summary, most respondents felt the system was unclear, uninteresting and at times harassing; there were very few positive responses to the system.
QUESTIONNAIRE: MIT PATH SYSTEM SURVEY

COURSE STATUS STUDENT 1 2 3 4 5 G Sp.
STAFF: Prof. (Full, Assoc., Asst., Lect.)
OTHER: specify
AGE YEARS AT MIT SEX M F MARRIED yes no

1. Do you live on campus? Yes No
2. Mode of travel to MIT Auto Bus Walk
3. Indicate on following diagram path travelled upon arrival at MIT campus. Please use following notations:
   pt. of origin X pt. of destination □ stops on way
   main path — alternate path — special path (summer)
   internal circ. path (interdepartmental-meal time)

4. Check the following:
   (a) Is the total circulation syst. clear in your mind? ___________
   (b) Do you feel a sense of arrival at MIT? ___________
   (c) Is the physical approach to MIT easy? ___________
   (d) Is origin to destination path excessively long? ___________

5. Comments:

Fold in thirds, Staple, Use Institute Mail
6. Relative to the circulation system, check your reaction to the following:

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does MIT convey a symbolic meaning for you?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the physical appearance satisfy this meaning?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clearer identification of vertical circulation areas?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Better system for identifying various bldgs. &amp; depts.?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ease of movement hindered by physical barriers?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Could you adapt your activity in another location?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greater use of diverse textural surfaces?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More exposure of activities in different depts.?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is expenditure justified to improve facilities?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are you able to always travel the shortest path?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are you well oriented at all times while travelling?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Better location &amp; arrangement of bulletin boards?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greater opportunity for casual social interaction?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greater opportunity for seclusion and quiet?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Better views to the outside?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greater protection against exterior elements?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improve interior &amp; exterior quality of lighting?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Comments:

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INTERDEPARTMENTAL

MIT PLANNING OFFICE
J. MUGASETH
BLDG.24-606


Housing for Undergraduate Men; A Program. MIT Planning Office, August 1965.

Lynch, Kevin A. "Quality in City Design". Unpublished.

Lynch, Kevin A. Site Planning. (Cambridge: Technology Press, 1962)


President's Report, 1962 to MIT.

President's Report, 1964 to MIT.


Thiel, Philip. "An Experiment in Space Notation".


Zion, "Design for the Pedestrian". Arts and Architecture, June 1964.