


Weaving Together the Threads of Transportation Infrastructure

An Intermodal Transportation Station for the Proposed
MBTA Urban Ring, Sullivan Square Station, Boston

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
*Submitted to the Department of Architecture in partial fulfillment of the
requirements of the degree
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signature of the author 

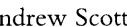
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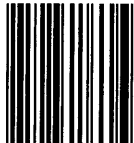
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In grateful appreciation to the sound and thoughtful
council of my readers

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Abstract

Transportation infrastructure in all its manifestations represents a huge capital investment expended during the evolution of a city and is perhaps the most visible character defining weave of any urban fabric. This weave, the interrelationship of circulation space with the spatial boundaries of lots, buildings, and various urban events, requires that one conceive transportation infrastructure as more than mere independent structures with a singular circulatory function.

Boston's Sullivan Square marks an urban condition which currently suffers from a singularity of function assigned to automotive circulation largely to the exclusion of the pedestrian. At this historic juncture between Somerville and Charlestown the elevated freeway, Interstate 93, cuts north-south. Directly beneath these three and five story structures are the train lines for the Orange Line Sullivan Square Station, and the through lines for the Commuter Rail and Boston & Maine Railroad. Together these systems promulgate the radial alignment of urban scaled circulation in Boston, a condition which continues to physically divide communities rather than knit them together. Cambridge Street, the original historical thoroughfare, runs east-west beneath the freeway and over the tracks and serves as one of few accessible links between the two sides of the freeway.

The contention of this thesis is that existing monumental infrastructures, specifically transportation infrastructure, are presently under utilized and contain within them the potential for civic spaces. The process here explored is to architecturally enhance the existing infrastructures, freeway, rail lines and roads, with the addition of a new Urban Ring circumferential subway line. This tying together of systems into an intermodal transportation center expands the present limited purposefulness and programmatic independence of the existing systems and can be directed to enhance urban conditions at Sullivan Square. I propose a schematic urban development template which utilizes more densely the surrounding properties in a multi-use manner reinforcing the Cambridge Street link between Somerville and Charlestown. Sullivan Square has the potential to become a destination rather than simply a transfer point between automobile and train, moreover, there exists the potential to create a meaningful, multi-dimensional northern threshold for the city of Boston.

Contents

2	Abstract	68	Appendix A Design Development
9	Introduction	72	Appendix B The Acoustics of Underground Stations
16	The Urban Ring	76	Appendix C The Promiscuity of Helvetica
27	Site Analysis	82	Bibliography
44	Description of Project	89	Acknowledgements

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Introduction

The nature of my research this semester has largely been an investigation of infrastructure at a multiplicity of scales and specifically, transportation infrastructure's capacity to give fuller definition to urban identity. The architect is charged with the design of habitable places, a scale experienced by the human person in space. This characterization suggests that the domain of our profession is limited to buildings and rooms within. And yet, our experiences in the city are modulated by many aspects of design which enter the "habitable realm" and yet are not attributed to architects. Infrastructure is not end in itself but rather the frame within which and around which meaning is later constructed. When designing infrastructure within the scales traditionally attributed to architecture there is need to respond to those scales adjacent to architecture as this framework will be both the context for future changes and itself must integrate into the larger site context. This contention is perhaps most

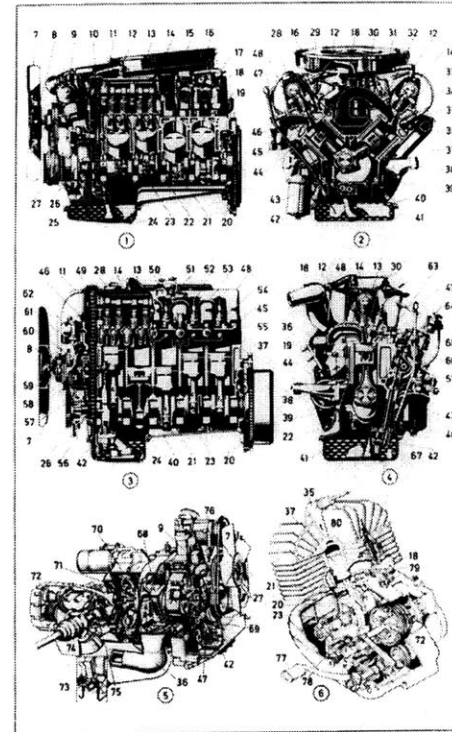
clear in the context of an urban transportation network. A system composed of numerous discrete stations all function together to create an experiential frame of the city for the commuter. The facility can read as a continuum within the city and as a portal to a specific locality: the architectural scale has much to do with maintaining such a balance. For a structure to contribute to the identity of a civic whole there must be a clear sense that it is truly linked to the multiple scales of the city.

At left is a found object, one of many which is truly an artifact belonging to the later part of the twentieth century. Despite its discarded form, the contour of its edges and placement of its folds reveals the nature of its three dimensional configuration. The product name, multiple identifiers and the image of the product itself describe clearly the purpose and nature of this object. The space of this box is by no means "architectural", yet the

190 Verbrennungsmotoren

- | | |
|--|--|
| 1 der Acht-Zylinder-V-Ottomotor mit Benzineinspritzung <i>f</i> im Längsschnitt <i>m</i> | 43 das (der) Ölfilter |
| 2 der Ottomotor im Querschnitt <i>m</i> | 44 der Anlasser |
| 3 der Fünf-Zylinder-Reihen-Dieselmotor im Längsschnitt <i>m</i> | 45 der Zylinderkopf |
| 4 der Dieselmotor im Querschnitt <i>m</i> | 46 das Auslassventil |
| 5 der Zwei-Scheiben-Wankelmotor (Rotationskolbenmotor) | 47 der Ölneßstab (Ölpeilstab) |
| 6 der Ein-Zylinder-Zweitakt-Ottomotor | 48 die Zylinderkopphaube |
| 7 der Lüfter | 49 die Zweifach-Hülse |
| 8 die Viskose-Lüfterkupplung | 50 der Temperaturgeber |
| 9 der Zündverteiler mit Unterdruckdose <i>f</i> für die Zündverstellung | 51 der Drahtzug der Leerlaufverstellung |
| 10 die Zweifach-Rollenkette | 52 die Kraftstoffdruckleitung |
| 11 das Nockenwellenlager | 53 die Kraftstoffleckleitung |
| 12 die Einlaßluftleitung | 54 die Einspritzdüse |
| 13 das Ölrohr zur Nockenwellenschmierung <i>f</i> | 55 der Heizungsanschluß |
| 14 die Nockenwelle, eine obenliegende Nockenwelle | 56 die Auswuchscheibe |
| 15 der Klappenstützen | 57 die Zwischenradwelle für den Einspritzpumpenantrieb |
| 16 der Sauggeräuschdämpfer (Ansauggeräuschdämpfer) | 58 der Spitzversteller (Einspritzversteller) |
| 17 der Kraftstoffdruckregler | 59 die Unterdruckpumpe |
| 18 das Saugrohr (Ansaugrohr) | 60 die Kurvenscheibe für die Unterdruckpumpe |
| 19 das Zylinderkurbelgehäuse | 61 die Wasserpumpe (Kühlwasserpumpe) |
| 20 das Schwungrad | 62 der Kühlwasserthermostat |
| 21 die Pleuelstange | 63 der Thermoventil |
| 22 der Kurbelwellenlagerdeckel | 64 die Kraftstoff-Handpumpe |
| 23 die Pleuelstange | 65 die Einspritzpumpe |
| 24 die Ölablaßschraube | 66 die Glühkerze |
| 25 die Rollenkette des Ölpumpenantriebs <i>m</i> | 67 das Ölüberdruckventil |
| 26 der Schwingungsdämpfer | 68 die Wankelscheibe (der Rotationskolben) |
| 27 die Antriebswelle für den Zündverteiler | 69 die Dichtleiste |
| 28 der Ölwanneflansch | 70 der Drehmomentwandler (Föltlinger-Wandler) |
| 29 der Filtereinsatz | 71 die Einscheibenkupplung |
| 30 das Reguliergestänge | 72 das Mehrganggetriebe (Mehrstufengetriebe) |
| 31 die Kraftstoffringleitung | 73 die Porlliner <i>m</i> im Auspuffkrümmer <i>m</i> zur Verbesserung der Abgasreinigung |
| 32 das Einspritzventil | 74 die Scheibenbremse |
| 33 der Schwinghebel | 75 das Achsdifferentialgetriebe |
| 34 die Schwinghebellagerung | 76 die Lichtmaschine |
| 35 die Zündkerze mit Einstecker <i>m</i> | 77 die Fußschaltung |
| 36 der Auspuffkrümmer | 78 die Mehrscheiben-Trockenkupplung |
| 37 der Kolben mit Pleuelstange <i>m</i> und Ölbleifring <i>m</i> | 79 der Flachstromvergaser |
| 38 der Motorträger | 80 die Kühlrippen <i>f</i> |
| 39 der Zwischenflansch | |
| 40 das Ölwanneoberteil | |
| 41 das Ölwanneunterteil | |
| 42 die Ölpumpe | |

Verbrennungsmotoren 190



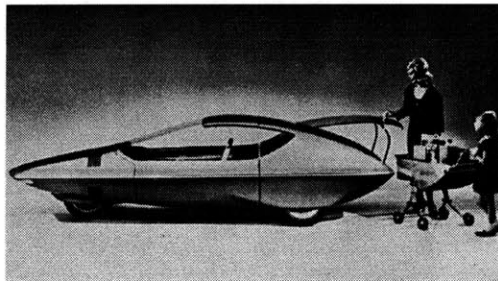
vocabulary of images and conventions brought together into the space of this spark plug box points to the existence of numerous administrating agencies, conventions and to an audience which presumably understands this assemblage. Numerous larger organizations (a type of infrastructure) are implied while never fully revealed: the bar code, the registration logo, the printer's marks, etc. These clues to rules and systems of logic (many of which are typically unnoticed) have pressed themselves visibly into the form of the found piece. The object is therefore the synthesis of numerous concerns which stretch well beyond the purely physical constraints of the box itself. It is a space which plugs into the conventions surrounding its unfolding life cycle: production, commodity exchange, information exchange, use and ultimate consumption.

The choice of this found object was quite arbitrary. Any number of examples could be used. What is fundamental to this example is the integration of infrastructural relationships, the results of design at a multiplicity of scales. While the scale of this discarded box is within the realm of graphic design, packaging and product design, the spark plug contained within the box is a component piece belonging to the larger assemblage of a car's combustion engine, a component of a car's infrastructure. This permits a transition to an examination of the automobile.

Few inventions of the twentieth century have so dramatically altered the shape of the urban condition as the automobile. The car is the context for the web of paved roads overlaid and cut into the landscape providing the driver behind the wheel the capacity for spontaneous



11.01. Image of a man dining while trapped in a traffic jam. Scale of the automobile enters into the realm of inhabited space.
Frankfurter Allgemeine, November 14, 1992, p. 37



11.02. Future Auto: Prototype of an energy efficient automobile designed for short trips. The shopping cart is an integrated part of the design. The nature of the design reveals an implicit acceptance of the middle class suburban utopia.
(image source unknown)

12.01. The Inner Loop around the Kansas City downtown area. The interchange in the lower right-hand corner occupies more than 50 acres. A considerable portion of the rest of downtown is occupied by parking lots. Here is an extreme example of the urban dilemma generated by the incursion of the automobile into the urban fabric. *Halprin, p. 25*

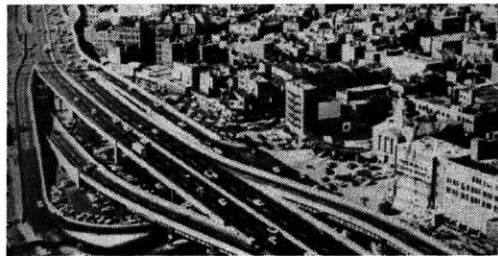


mobility. The moduli of the car, turning radii, parking dimensions and access standards for fire emergency vehicles among others, increasingly dictate the landscape of both city and suburbs. Sometimes these dimensions determine the structural grids of buildings (shape the architectural infrastructure) which build over parking facilities. To take full advantage of the "freedom" of the automobile requires the creation of an exorbitantly expensive regional infrastructure. America's freeways, highways and roads come with a considerable price tag - not merely for their construction and maintenance, but also the dramatic alteration to the fabric and culture of our cities. To the far left is an aerial image of Kansas City in the mid-1960's showing the dramatic belt of freeways which effectively restricted traditional pedestrian access to downtown from the adjacent neighborhoods. Similar dramatic effects have been witnessed in Boston: the Central Artery effectively wiped away a considerable portion of the city center and walled off the North End. Equally dramatic are the efforts presently underway to bury the Central Artery.

The effects of the automobile and the cultural changes it has affected do not stop at the urban scale but breach to the regional scale. After World War II Americans moved outside the traditional borders of the city and initiated the suburbanization of America. In the 1960s and 1970s, Americans grew tired of going downtown to get the necessities of life, so marketplaces and shopping centers were moved to the periphery and beyond in a process referred to as the *mall*ing of America. The third wave away from the city is the advent of what Joel Garreau has termed *Edge City*. The means of creating wealth is now

located primarily away from the central business districts of the traditional downtown and now resides in the ambiguous strips of speculative real-estate which often have no names. The pseudo-architectural space of the automobile has had far reaching consequences in architectural, urban and even regional evolution.

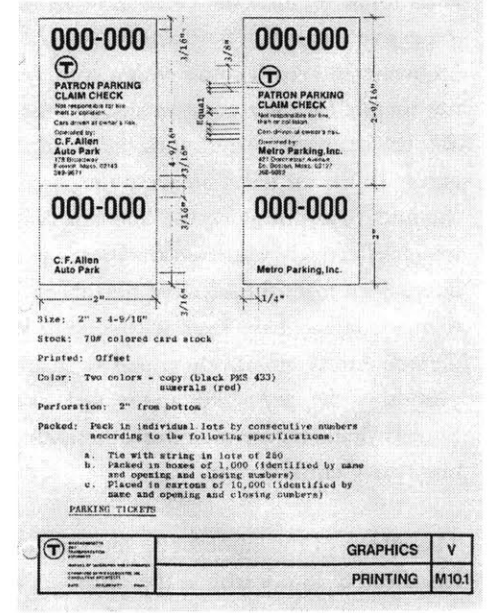
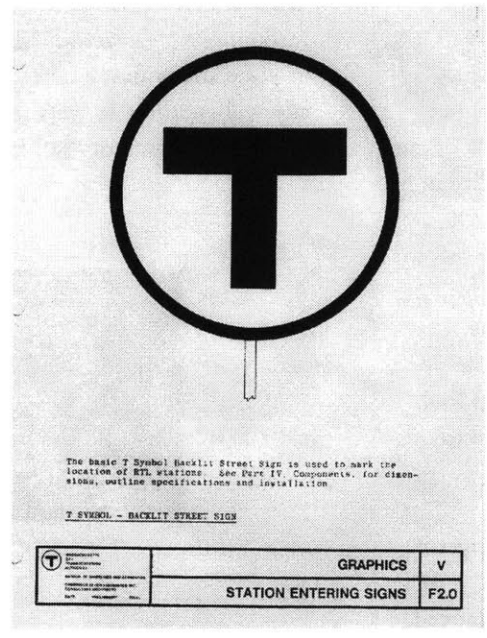
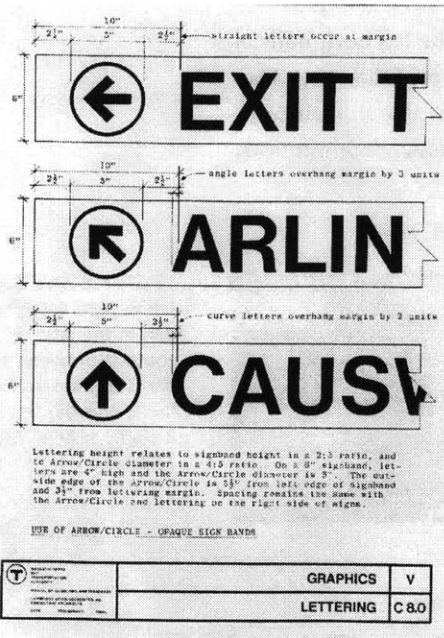
While much old fabric in our cities has been erased to accommodate the automobile, a new one has been built in its place and with it a new sense of the city's identity. The city will continue to exist so long as it is able to maintain an identity. Much of this identity rests on civic institutions



13.01. Boston's Central Artery a few years after its construction in the late 1950's. The contrast between the remnants of the remaining urban fabric and the single purposed freeway system. *Mumford, p. 158*



13.02. Popular support for the highway system began to wane after the dramatic effects on the city began to be felt. San Franciscan opponents to a proposed freeway through the community, February 1966, *Halprin, p. 155*



and this thesis examines specifically the Massachusetts Bay Transportation Authority (MBTA) and the public face which it presents through multiple media. On an urban scale, the network of busses, train lines and stations is dispersed throughout the city both statically and dynamically. Stations, bus stops become the static points of reference for a system which is unique to Boston and ideally should convey a clearly recognizable identity both on pragmatic communication grounds and as a civic institution. This language needs to run through all design decisions, from the graphic interface of tickets, tokens, transfers, passes, schedule information to the signage conventions throughout the system. Architecture must be the bridge between the scale of information exchange in an environment designed for transitions and the fixed urban development in which it proposes to place itself.

As a civic function the same care and attention which went into the design of the packaging for the spark plug should be applied to the information aspects of the system. The city will begin to read as a whole when threads are created which read throughout the city: civic transportation infrastructure has this capacity and responsibility.

The capacity for any one person to design all these scales in absurd - however, this thesis has been in many ways about just that - dabbling in all these fields - not penetrating very far in any direction, rather getting a sense of the complexities and necessity of integration on a multiplicity of scales. The attempt to create an intermodal transportation site in Boston requires a design attack from several fronts. In addition to solving the architectural issues of circulation and structure given the program and the existing conditions, one must also be able to integrate the new program into the urban situation, both on the scale of the immediate context and in the larger city wide network of which this station proposes to be part.

14.01. Pages from the 1966 *Manual of Guidelines and Graphic Standards for the Massachusetts Bay Transportation Authority* as assembled by Cambridge Seven Associates. Unfortunately, the MBTA of the mid-1990s has opted to no longer restrain themselves to a consistent graphic language.

The Urban Ring

The Issue of Urban Sprawl in Boston

The city of Boston is one of the most mature metropolitan areas in the country and during its 350 year evolution remains one of America's most diagrammatic. During Boston's often aggressive and influential history of urban expansion, the center has (until recently) remained the principle focus. The downtown core is the site of the civic centers of state and city government and a thriving downtown central business district. These foci connect to the ever expanding periphery through numerous radially directed spokes of transportation (train, subway and vehicular).

As Boston expands and the population moves away from the city center, these spokes have a proportionally increased influence on the speculative development which ensues beyond Boston. In the late 1950s Boston was one of the first cities to receive federal grants from President

Eisenhower's Interstate Highway Program for the creation of Route 128 located about ten miles out from the city center. Roughly twenty miles further a second beltway, I-495, has since been constructed making Boston one of the few cities in the country to have achieved two vehicular rings roads. With the development of this infrastructure and the already discussed trends toward suburbanization in the 1960s and 1970s, Boston was ripe for the generation of some of the first *Edge City* developments in the 1980s. Indeed, Route 128 has since been re-named "America's Technology Road" precisely because of the birth of numerous computer industry campuses which in the booming 1980's fueled the Massachusetts Miracle.

Joel Garreau has defined and identified five 'edge city' conditions in Boston, four of which have grown around the intersection of Route 128 with four of the ten major roadways which cross it. These include Quincy/Braintree

"I love the Moscow Metro, to me there is nothing better in the entire world. Some people say there is nothing better than the Taj mahal, but I know they're wrong. In the Moscow Metro there's a Taj Mahal at each station...the word Metro is something else. It has a special ring to it. It speaks of beauty, harmony and hidden strength – especially the Circle Line. The line embraces the center of Moscow, drawing its one hour underground circle which rings the heart of the city and connects all its nerves and arteries. There is no better place to feel the city's pulse"

Kaletski, p.1

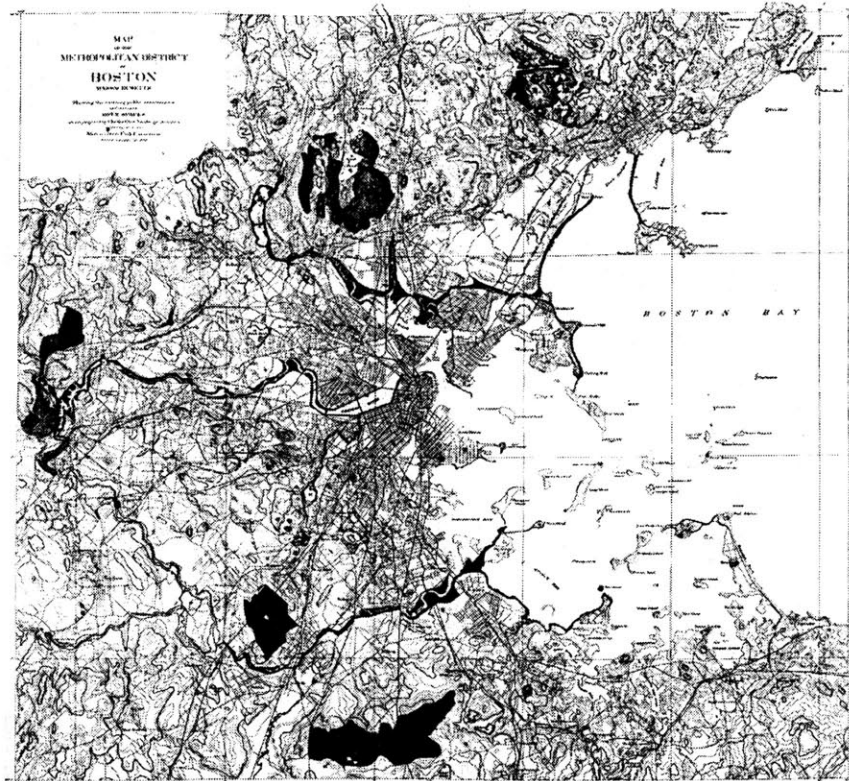
in the south, the intersection of Route 128 and the Massachusetts Turnpike, the Burlington Mall area and Peabody/Danvers to the northeast. Inside the beltway are two other examples which are unique in that they are still within the orbit of the old Boston downtown. These are the Alewife T area in west Cambridge and the Kendall Square area near MIT¹. Combined, these developments mark the shift felt throughout the country in which the engines of capital and its job markets, are shifting to the periphery of the traditional city to the ambiguously defined highway interchanges where suburban America has lived and shopped for the past three decades. It is telling (and not uncommon) that the four edge cities identified along Route 128 are not true 'cities' despite Garreau's increasingly accepted label. They do not have a mayor or a city council, they neither match boundaries on a map nor do they have proper names.

One must also question to what degree these speculative real estate sub-divisions are *edges*. Garreau points out that their existence relies in part on their proximity to a major center and its amenities, for example, Boston and Boston's Logan Airport. Yet, as traditional centers for shopping and within the critical maximum 45 minute commute time for many workers, they have become independent consumer and employment destinations. The ambiguity between the symbiotic relation which they have to Boston only illustrates the degree to which the traditional boundaries of the city have been subverted. The advent of widespread peripheral development in the late twentieth century has created a crisis of urban identity which requires re-thinking and new solutions.

1. Garreau characterizes Edge Cities based on the following five criterion:

1. Has five million sq. ft. or more of leasable office space - the workplace of the Information Age.
 2. Has 600,000 sq. ft. or more of leasable retail space.
 3. Has more jobs than bedrooms.
 4. Is perceived by the population as one place.
 5. Was nothing like a "city" as recently as thirty years ago
- Garraeu, p. 6-7

2. Payton, p.3.



Metropolitan Boston in 1893, showing the reservations and other new open spaces (dark areas on map) proposed by Charles Eliot to the Metropolitan Park Commission. Zaitzevsky, p. 64

1. Payton, p. 3

Formal Delineations of the City's Edge

What criterion are we to use today to define the edges of our cities? The textbook examples of early Roman encampments and fortified cities with their formal delineation of boundaries no longer apply to the modern American condition. Payton observes that *"historically, the definition and authority of the civic realm was assured by the myths, traditions and conventions that bound the citizens to a place and to each other"*¹. The physical character of the city

has increasingly been abandoned to undifferentiated conditions of low density sprawl. Even traditional legal lines on a map no longer correspond to one's intuitive experience of a city and its boundaries. If, moreover, the civic institutions which traditionally contribute definition to the city are neglected by a public which is increasingly 'hyperindividualistic' where is one to define the "civic realm"?

As suburban development is allowed to spread unchecked, Boston's area of influence increases yet its characteristic identity is diluted, particularly since the type of growth in these outlying areas is so homogeneous throughout the country. Some have suggested new criterion altogether for defining our cities, for example, the range of influence of local media: the circulation area of the Boston Globe, the transmission radii of Boston radio and television stations. While media and communications technologies contribute to the weave, so too are civic, community, and cultural infrastructures necessary for a meaningful definition. Any meaningful boundary must somehow combine all of these aspects.

Historical Proposals for a Circumferential Edge

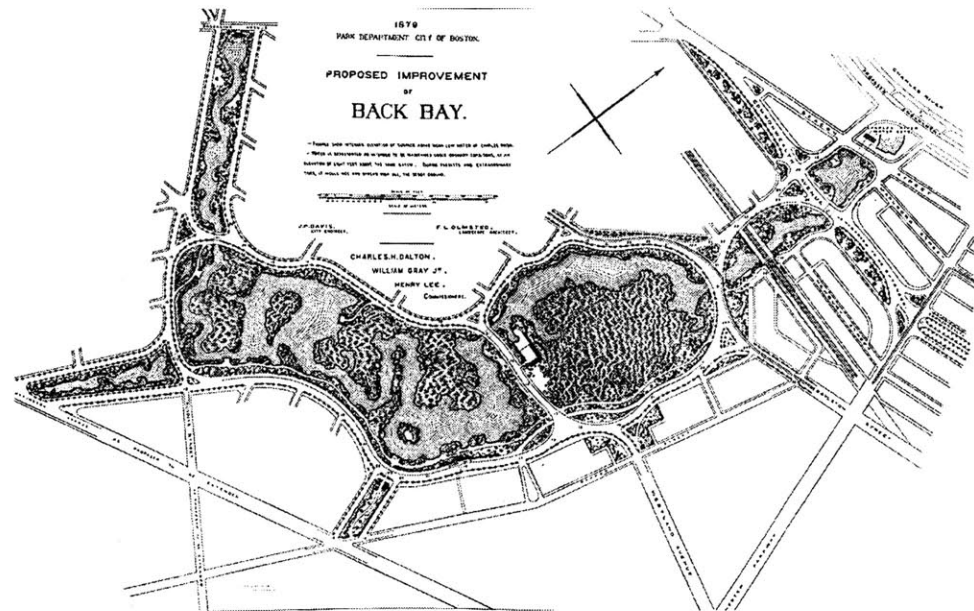
As a reaction to Boston's development along radial thoroughfares, numerous urbanists and designers have made proposals for circumferential borders which connect the disparate radial threads and delineate edges: physical thresholds providing common points of reference to where the city begins and ends.

Perhaps the earliest 'ring' to be designed and implemented for Boston was Fredrick Law Olmsted's *Emerald Necklace*. Here the primary objective was neither transportation nor economic development, rather to create *lungs* for the city. By threading a strip of nature through the bustling nineteenth century city, the restive common spaces were to build community and improve the quality of life. The plan was largely realized in the 1880s and the ring of parks including the Back Bay Fens (illustrated here) still perform this vital service.

Shortly after the Emerald Necklace's construction the future founders of the Metropolitan District Commission, Charles Elliot and Sylvester Baxter, began plans for a much more ambitious "comprehensive regional open space network" which extended well beyond the Emerald Necklace. By the turn of the century as much as 15,000 acres had been dedicated to public parks, including thirty miles of river frontage, ten miles of ocean shoreline and twenty-two miles of right-of-way for parkways. The regional interests of Elliot and Baxter extended to larger political unification among Boston and the surrounding communities for the purpose of creating collaboration for decisions concerning large scale infrastructure development for the region: "open space preservation, arterial roads, transportation, waste disposal, public works and even social services". Unfortunately, these goals were largely unrealized illustrating a historically intractable characteristic of politics in this area - interests and influence tend to remain close to the communities who have them. Cooperation among metropolitan districts is limited and considered suspect.

At the beginning of this century (1907-09) Arthur A. Shurtleff submitted a plan which addressed specifically the issue of circumferential circulation through the city. His proposal submitted to the Joint Board on Metropolitan Improvements had it been implemented would have superimposed a web-like network of connecting roads bridging the gaps between the existing primarily radial thoroughfares. His projected series of radiating concentric rings built from existing, yet unconnected roads, would have spawned the development of considerable tracts of under developed land within the city. This plan was not approved in part perhaps because of its narrow transportation focus.

19.01. Fredrick Law Olmsted's first published plan for the back Bay Fens, 1879. One component of the Emerald Necklace, an urban scaled landscape project which found realization in the late nineteenth century. *Zaitzevsky, p. 125*



Several years past before any concrete regional efforts were made to address the issue of circumferential transportation. In 1948 Route 128 was built becoming "America's Technological Highway" and with it came economic growth and suburban expansion. In the mid-fifties one of the priorities of the Eisenhower administration was the creation of an efficient national highway system. The Interstate Highway act provided funds for grand schemes designed on an automotive scale. In addition to Route 128, Interstate 495 and the Inner Belt were drawn up by State and Federal transportation bureaucracies the former being realized making Boston fairly unique among American cities in having two vehicular rings.

The automotive mind-set which generated these vehicular hubs similarly impacted the character of the radial roads emerging from the Shawmut peninsula. These too were built to handle increased volumes of traffic and in many instances reinforced already existing divisions between neighboring communities. I-93 has created a five-story wall between Somerville and Charlestown. The construction of the Central Artery ripped out considerable urban fabric in the central core and has walled off the North End from downtown and separated the Central Business District from the waterfront. Similarly, much of the slow evolutionary development of Charlestown's historic city center over the past 350 years has been erased in the last thirty years by the insensitive convergence over the site of I-93 (finished in 1973) and the Central Artery. The heavy volumes of traffic at this interchange resulted in long delays, congestion and hazardous driving conditions during peak hours which leaked into the local setting compounding traffic problems for local residents. The

overwhelming physical presence of the elevated highway further contributed to the economic decline of City Square.

Public transportation (the rail and T system) has also developed along these major thoroughfares further reinforcing a radial pattern making it artificially cumbersome to go from one segment of the city to another as it requires going all the way into the city center to transfer. To use one's commute time to construct a mental picture of the city results in a very skewed perspective of the real spatial relations defining Boston. Alex Krieger notes:

*"Efficient commuting time is not the only casualty of such an urban layout. A concomitant absence of orientation, along with social and economic dislocation are also characteristic"*¹

By artificially extending the distance between neighboring communities existing public transportation contributes to the perception that neighboring and distant communities are equally far apart. More efficient public transportation connections might bridge this disparity of spatial perception and spatial reality.

Since 1948 there had been plans for a third vehicular ring around Boston, the Inner Belt. Formally drafted in the late 1950's, this eight lane freeway was to be inserted into the city much closer to the central core. Its projected elevated trajectory was nearly identical to the 1907 Boulevard proposed by Shurtleff. The Inner Belt would have extended the Central Artery around the core through the South End and Roxbury, past Northeastern University and the Museum of Fine Arts, through the Fens, over the

1. Krieger, p. 13

Boston University Bridge, through Cambridge behind MIT and past Kendal Square and off to the section of I-93 abutting Sullivan Square in Charlestown. In the early 1970s popular opposition compelled Governor Sargent to make the landmark decision to halt plans although considerable energies to this end had already been pushed through by the Highway lobbies. At the time of Sargent's decision land-taking and clearance were already well underway (primarily in the low income neighborhoods of the South End and Roxbury). At Sullivan Square in Charlestown one can still see where the planned on- and off-ramp connections were to be made to I-93.

The decision after 20 years of battle between highway interests and local communities concerned about such a gigantic intrusion into their neighborhoods drew a line limiting the incursion of automobile traffic of this scale into the city. There were nevertheless then as today a number of compelling arguments which support the development of a corridor of development circumferentially around Boston which connects locally distinct and economically divided communities. Indeed, studies were initiated for the construction of a circumferential transit line in the late 1970s but were postponed while improvements were made on the Orange and Red Lines.

The Urban Ring

In the Fall of 1992 a new committee on infrastructure was created by the Boston Society of Architects from which grew the Infrastructure Forum, a group of architects,

interested persons and entities. The Forum, in coordination with Wentworth Institute of Technology and Northeastern University, sponsored two design charrettes with the expressed purpose "to explore the possibilities of an infrastructure initiative focussed on those areas originally targeted as the route for the inner-belt roadway".¹ What emerged is a recognition of the possibilities of repairing torn fabric of the city while improving transit connections between the existing radial pattern of transit resulting in new employment opportunities, increased development of a number of under utilized or abandoned sites in the city, as well as facilitate links between neighboring communities. The hopes for this new ring are multi-dimensional and it is the plurality of dreams which make the proposal so enticing.

Transportation Infrastructure

The fundamental component of the Urban Ring is a consistent pedestrian oriented transportation infrastructure. One of the New Urban Ring's major proponents, George Thrush, has described the Ring as a broad boulevard with dedicated lanes of circumferential rail or bus lanes, transit stations at the intersections of the ring with the arterial roads and high capacity parking structures. Moreover, he argues the language of the ring should be consistent throughout so as to be recognizable as a unifying 'Boston scaled' thread into which local communities can respond by choosing for themselves how best to integrate. The transportation aspect however is merely the skeleton of a larger urban agenda. The nature of how this infrastructure is synthetically integrated into the local and larger urban contexts requires design initiative.

1. Lee, M. David, "The Infrastructure Forum and the New Urban Ring", **The New Urban Ring**, © 1993 Boston, p. 6

Figure ground map of Boston and surrounding neighborhoods illustrating the clear patchwork texture of the city.

The expressed goal of the Urban Ring project is to begin to restitch these pieces together laterally, circumferentially. The alignment indicated is that proposed by George Thrush.

Map created by George Thrush, ©1993, Northeastern University



Community Building

If we are to use the analogy of "urban fabric" to describe the city, then clearly Boston is a patchwork of many textures which have developed at different rates and in different times: Beacon Hill and Charlestown have evolved very slowly from the very beginning while the Back Bay was a spontaneous product of land reclamation and speculative real-estate. An examination of a figure ground map of the city provides one level of information about how these neighborhoods relate to one another and a sense of the character of each.

The placement of a ring over the existing order tends to suggest a return to the utopian town planning of Ebenezer Howard's Garden Cities or even more clearly to the political hegemony of central monarchies as seen in Baroque centralized city planning. The original pattern of Boston's development tends to re-inforce this estimation given the centrality of the civic core and its traditional economic engine of the city, the downtown. To use the New Urban Ring to re-assert such a formalized authority of the center given the trends in development would be sheer folly. In the examples of the the Garden Cities and of the walled defensive cities, the edge, while clear, served a purpose which is no longer relevant to the modern American condition. There is nevertheless an argument to be made for the creation of a meaningful physical threshold to the city which establishes in the memory of the inhabitant a sense of orientation and identity which maps to one's experience. The nature of this threshold cannot be merely formal, as was earlier concluded, it must provide a plurality of characteristics as the identity of a city is itself a weave of multiple strands.

If current trends are allowed to continue, the relationship between the inner city and the suburbs will create their own dividing lines. The abandonment of the traditional inner city has created an economic condition between the the suburban periphery and the poorer urban center which is reflected in the tax base necessary to maintain schools and public infrastructure. As our inner city infrastructure decays and the balance between rich and poor increasingly polarizes between suburbia and the inner city there will be political consequences.

A more progressive threshold to the city would be the unification of Boston's peripheral neighborhoods together into a second urban zone around the traditional civic core. This band would be reinforced with civic institutions (schools, community centers, cultural centers and parks among others) in a manner reminiscent of Vienna's Ring Strasse. The New Urban Ring would then serve as a series of destination points encouraging community cross fertilization in addition to its function as a transportation thoroughfare.

Economic Aspects

Another very compelling argument for the Urban Ring is the potential for strong economic development. Garreau has identified two "edge city" conditions inside Route 128 which are clues as to the sort of economic potentials capable in this zone. If this sort of development could be spawned in the context of a civic infrastructure, then the ambiguity of anonymous sprawl could be channeled into an environment which grows to enhance the identity of a community and builds bridges between neighboring communities.

1. These benefits were analyzed by Cambridge Systematics under contract to TAMS Consultants, Inc. in 1989 and revised in 1994 (Circumferential Transit and Regional Development, an MBTA Circumferential Transit Mid-Term Improvement Study). Conclusions were reported in Oliver, p. 109

2. Clusters are geographic groupings of companies and institutions in related business sectors which compete with each other (including drawing employees from the same labor pool), provide a market for specialized suppliers of materials and services, and produce a matrix of interrelationships which facilitate the rapid exchange and development of ideas.

Oliver, p.

Tess Oliver concludes in her analysis of the feasibility of the Urban Ring that the project must be strongly promoted for the direct economic returns that can be expected from such a major capital investment. The audience which needs to give its support for its successes are those communities in the outlying suburbs who frankly resent potentially another "Boston Project". Her 1995 thesis describes the dangers of the traditional local politics of Boston and its surrounding communities. Regional thinking is going to be very important for Boston's future, what is good for Boston is also good for its surrounding communities as cities world wide are forced through globalization to compete in a broader world market. Clearly Boston has a number of strong resources which it must build up in order to compete in the coming century. A number of these resources have been identified along the proposed corridor of the Urban Ring. The following is a list of conclusions of a 1989 draft MBTA report and summarized in Oliver's Thesis:

1. *Many sectors which are currently major employers within the Urban Core and Primary Impact area are those which have been identified as the future "economic engines" for the Commonwealth's economy. They are vectors which are forecast to have continued strong rates of growth within the economy, and sectors in which the Commonwealth has a strong competitive position. This position could be further enhanced by appropriate public actions such as improved transit service.*

2. *Substantially improved transit service would help strengthen the economies of the City of Boston and the Primary Impact area communities by enabling them to accommodate new employment growth with less demand for parking.*

3. *The proposed circumferential service would improve economic opportunities for presently disadvantaged populations by improving access to employment locations within the Core and the Primary Impact area communities.*

4. *Improved and expanded circumferential transit service would contribute to improved regional mobility and improved overall MBTA system efficiency.¹*

Four industry clusters² have been identified which are part of the state's strategy for competitiveness. These key industries dominate the proposed circumferential transit corridor and are as follows:

Knowledge Creation Cluster: higher education institutions, research and development facilities and firms with practices in management, public relations, law, architecture and engineering. Eighty percent of the state's concentration of this cluster is in Boston and nearby communities.

Health Care Cluster: this is the state's single largest industrial sector accounting for 12.8% of all employment in the state in 1991 with Boston accounting for 58% of this total. There are 31 hospitals within the city concentrated in five areas: the Longwood Medical Area, the West-End/Charlestown area, the South Boston/South Bay area, Jamaica Plain and Brighton.

Information Technology Cluster: includes computers, software, peripherals, professional services for information technology, information retrieval, telecommunications and hardware components. This cluster accounted for 7% of

the state's employment, 65% of this total in the greater metropolitan Boston area.

Financial Services Cluster: banks, credit and mortgage agencies, insurance carriers and brokers, real estate developers and managers. In 1991 approx. 6% of the state's private employment were in this cluster, 72% of which is located in the greater Boston region.

The consolidation of these industries around the New Urban Ring would simultaneously improve the local economy and provide a strengthened job base within reach of an inner city population stemming the tide to the contrary.

Conclusions

In order to control the sea of undifferentiated sprawl spreading out from America's traditional urban cores dramatic actions on a regional scale are required. A critical re-examination of the nature of our existing transportation infrastructures is essential as these structures have facilitated the trends away from the city. Boston's historic evolution has left traces of previous attempts to create circumferential connections between the numerous radiating roads and modes of public transportation. These fits and starts have nevertheless left Boston a legacy and trace for a much needed new means of self definition. Between Boston's traditional head on the Shawmut peninsula and its ever expanding apron of influence in the region a threshold must be created. The New Urban Ring provides a number of enlightened benefits which would further such an ambitious goal. Here is the possibility to create a border

condition between the center and the margins, an urban response linking surrounding communities and reinforcing a strong economic zone within reach of both the suburbs and the inner city all within the context of a civic space.

Somerville

The two levels of Interstate 93

Sullivan Square no longer exists as a specific site and now generally applies to the triangular site which is presently a 210 car surface parking facility and MBTA bus park and ride.

On- and off-ramps constructed for later connection to the cancelled Inner Belt freeway project. These become the context for tying the freeway to the site.



Elevated portion of Rutheford Avenue which forms a two story edge to this side of the site.

Cambridge Street

Charlestown

Site Analysis

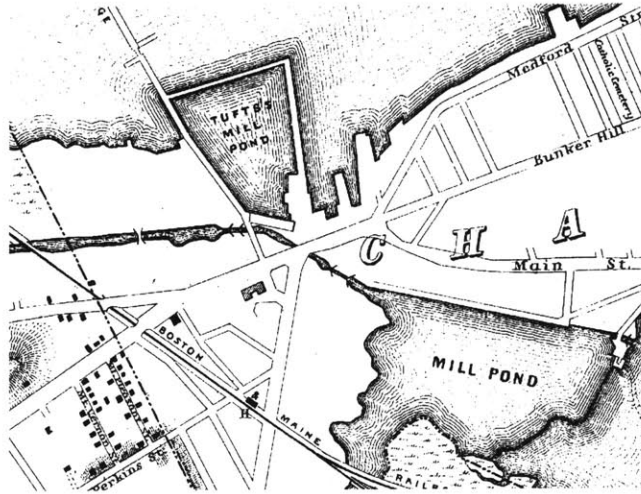
Historical Grounds for the Present Urban Configuration

The site which I have adopted for this thesis investigation occurs at the confluence of three transportation thoroughfares, each occurring at different elevations: two levels of freeway traffic elevated 25 feet and 45 feet from Cambridge Street, Cambridge Street itself, and four train lines 20 feet below. The node is peculiar as it is sited at the periphery of two neighborhoods, East Somerville and West Charlestown, serving neither very efficiently. There are a number of historical and topological grounds why development in this area appears so awkward and presently so under utilized.

Charlestown was originally a peninsula connected to the main land via a constricted bridge of land referred to as the *Neck*. The main arteries through Charlestown converged at this point into Main St. Upon entering the western most part of Charlestown Main St. branched into

Cambridge St. creating the two sides of a triangular plot of land the trace of which still exists and is presently designated 'Sullivan Square'. Residential and commercial real-estate developed on this triangular site throughout its recorded history: "*Charlestown Neck was something of a business place and many of the residents were among the most thrifty and enterprising citizens of the town*"¹. The earliest map of the site which my research could uncover is a site map from 1852 showing a street configuration which links it closely to the morphology of the neighboring Somerville residential neighborhood. Maps created a few years later show that much of the site was mixed use with large residences and some commercial buildings. A park at the tip of this triangular site (for which the whole has been now identified) was named after Governor James Sullivan (1744-1808), the fifth governor of the Commonwealth.

1. **Old Charlestown**, ©1870, Boston, p. 175



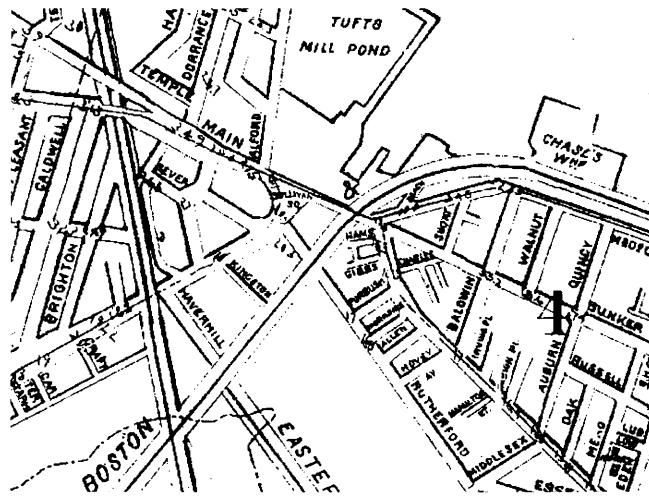
Detail from an 1852 Map of Somerville, Mass.
Survey by Martin Draper, Jr.

The above map shows the convergence of the main arteries of Charlestown at the Neck giving definition to the triangular site which is currently referred to as Sullivan Square. The constriction of land at this point has naturally made this site a circulation thoroughfare, and as is often the case with infrastructure, once it has been built future development tends to adapt to the existing condition rather than erase it and begin again.



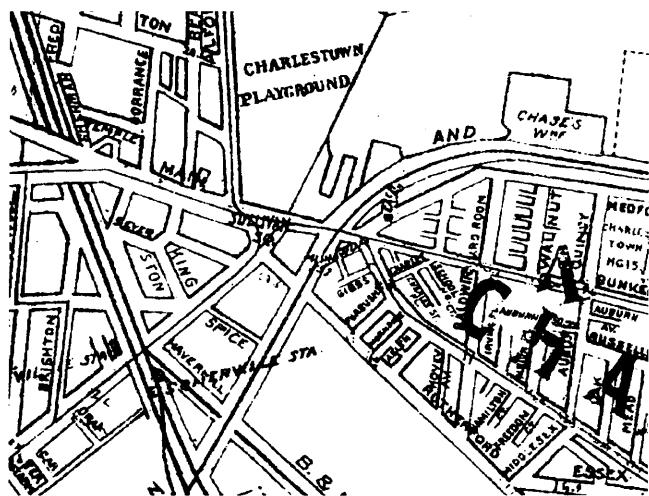
Detail from an 1874 Street Map of Boston

The above detail does not show much of the site however street car service is indicated along Cambridge Street (Washington Street in Somerville maps). The tip of the triangle marks the site of Sullivan Square proper, a small park with a central fountain surrounded by large homes.



Detail from an 1891 Map of City Streets, Boston

Larger tracts of land both north and south of the site have been filled-in establishing the context for light industrial developments and vast train yards. The map also shows the existence of intersecting street car lines at Sullivan Square connecting service along Cambridge Street and Broadway with the main center of Charlestown.



Detail from the 1904 Massachusetts Atlas, Geo. H. Walker & Co.

An additional street car line has been introduced which intersects Sullivan Square and travels along the Malden Bridge to the north. To date the fabric on the triangular site remains stable and suggests a bridging between Somerville and Charlestown.



30.01. Image of the park in Sullivan Square at about 1898. *Bergen, p. 114*

The third leg of the site's defining triangle is supplied by the Boston & Maine Railroad, a major line which continues to connect Boston via rail to all parts North. The introduction of the railroad created a physical barrier running north-south between Charlestown and Somerville bridged at the time along Cambridge St. and Broadway. The marshy wetlands west of Charlestown began to be reclaimed during the nineteenth century and the land utilized for light industry and manufacturing as well as large tracks claimed for the railroads for maintenance and storage of trains. The nature of the site today continues to be primarily very low density light industry and the MBTA continues to own much of the surrounding under developed property.

Sullivan Square had an entirely different character a century ago in stark contrast to today's parking surface. The inclusion of the Boston & Maine Railroad did not detract from the pleasant Sullivan Square park with its central fountain and shade trees, surrounded by Victorian homes. This restive residential nature, however, changed in 1905 as development made way for the terminus of Boston's Elevated Rail Line, Boston's first rapid transit line. Sullivan Square became known thereafter for its vast mass of tracks and interchanges of ramps, platforms and commuters.

Sullivan Square as a Transportation Node

Street cars had converged at Sullivan Square for several years before a dedicated building was created to consolidate all traffic in the area. As the maps on the previous pages show, Cambridge Street and Main Street were serviced by street cars since the mid-nineteenth century. As Boston's transit system matured it relied heavily on feeder lines connecting with major routes to downtown, which eliminated as many trolleys in the central area as possible. Sullivan Square became in 1905 the transfer facility for lines from the immediate northern suburbs. The main station for the Sullivan Square Terminus building was located across Main Street from the present triangular parking lot.

Originally a terminal station, Sullivan Square Station took the form of a steam railroad terminal. At street level in this octagonal, irregular, open ended structure was contained a large waiting room, spaces for billiards and retail sales, and access to surface lines. Here then are lessons to be learned from the past concerning sustainable design. Integration of

a multiplicity of programs housed within a over arching civic complex enhanced both the immediate urban community as well as those using the station merely as a transfer facility. On the second (main) level which was an open, unobstructed space 62 feet high with eleven arches spanning 175 feet, were the northbound elevated tracks and tracks for surface cars linking to the surrounding local neighborhoods (including a line which formerly ran along Washington Street and onto Cambridge Street - a passage I would like to re-establish). The mezzanine level contained office suites for the Boston Elevated Railway Co.. On March 10, 1919 service was extended beyond to Everett Station making Sullivan Square a through station which remained in operation until the early 1970s. The appropriately scaled civic structure has unfortunately since been demolished (the steel structure weakened by pollution from nearby factories).

In the mid 1950's work on the Central Artery began and with it air rites above the Boston & Maine Railroad were secured. Construction began on the elevated two deck Interstate 93 in the late 1960s and completed in 1973. Thereafter, in addition to the railroad line as a barrier between the communities of Somerville and Charlestown, a monumental five story wall of speeding vehicles was constructed. Moreover, Rutheford Avenue was developed along the northern edge of the site into an elevated highway (Maffa Way) forming a two story edge. On April 4, 1975 service ended on the old Charlestown Elevated Railway structure from Haymarket station to Everett Station and shortly thereafter the elevated system was dismantled. Three days later the first leg of new transit service of the new Haymarket/North Station rapid transit

extension from Haymarket Station to the new Sullivan Square station and Bunker Hill Community College Station was initiated. The new and currently used Sullivan Square Station stands under the freeway and integrates into a MBTA Park & Ride. Details from the construction drawings can be found on pages 38 and 39.

Conditions Today

The hegemony of the automobile has completely erased the fabric which once gave a sustainable character to this site. All construction on this site has been erased (except for a few remaining buildings at the east most tip) leaving instead a 210 stall parking lot and bus turn around. No longer an amicable pedestrian destination, Sullivan Square has been reduced to a transfer point between personal automobile, local bus service and the Orange Line.

31.01. Aerial view of completed Sullivan Square terminus (ca. 1931) show the proximity of Sullivan Square to the south. *Co-operation, V. 10, p. 10*





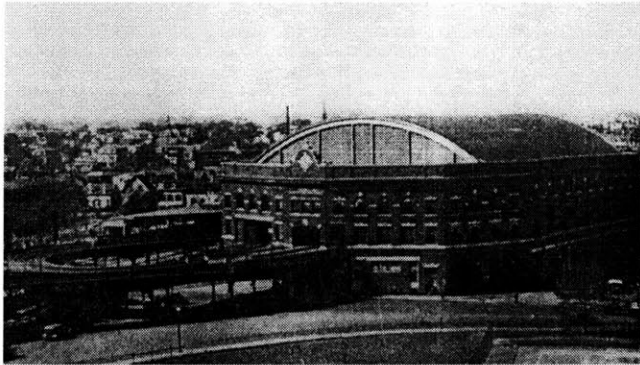
32

32.01. Rear of Sullivan Square Station, May 5, 1901, formerly the northern most terminal of Boston's first rapid-transit line. Sullivan Square station was the transfer facility for lines from the immediate northern suburbs, a far cry from the peaceful green park of a few years earlier. *Bergen, p. 117*

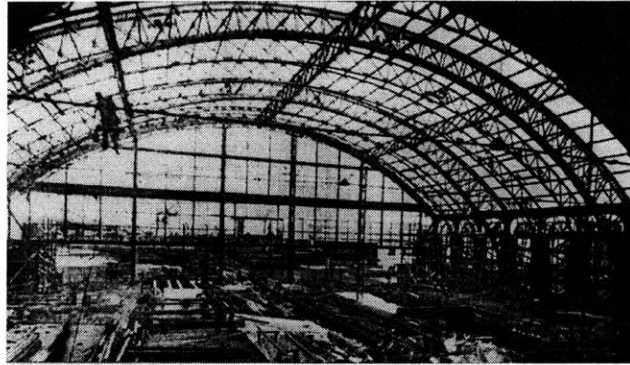
The confluence of different transportation media create several different venues for the experience of the site. In my research I have attempted to record the perception of these spaces by these different transportation media. The automobile along the freeway provides a brief glimpse of the site at 60 mph making Sullivan Square an experience which lasts perhaps 50 seconds. For the Orange Line commuter the passage along side and under the freeway offers views to the east and west primarily of undeveloped land and suffering light industrial infrastructure. In both of these means of transportation one is hermetically sealed from the actual site which offers few amenities to the pedestrian. Clearly the design development and construction of these spaces was

primarily for the automobile and as a response to the primarily light industrial infrastructure which was established to the south of the site and the continued ownership of large tracks of undeveloped land by the MBTA. The original bridges between the two communities of Somerville and Charlestown remain, yet are transversed primarily by car rather than foot. There is nothing along Cambridge street for 1000 feet under the freeway and beyond towards Charlestown which could be considered a destination proper (the Station itself is simply a transfer point demonstrating little attention to the task of integrating urbanistically into the suffering context) Indeed, this is the implied purpose of a pedestrian oriented subway system: to establish a city wide pedestrian access web independent of the automobile.

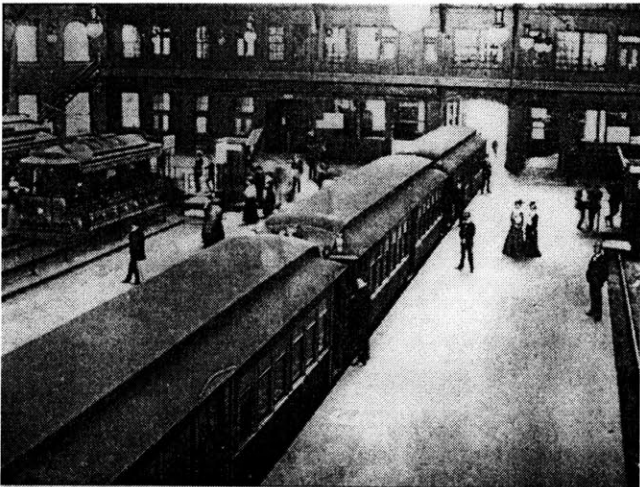
The conditions here reflect a malaise of sprawl in a setting which potentially is ripe for development. The primary difficulty for the site is the preponderance of traffic flow in a direction radial to the city center effectively separating neighborhoods from one another. The bridges between the two communities of Somerville and Charlestown have been under emphasized with recent development. I propose to reverse this trend and instead reinforced Cambridge Street as a bond which both defines a northern edge to Boston and connect more strongly access between adjacent neighborhoods.



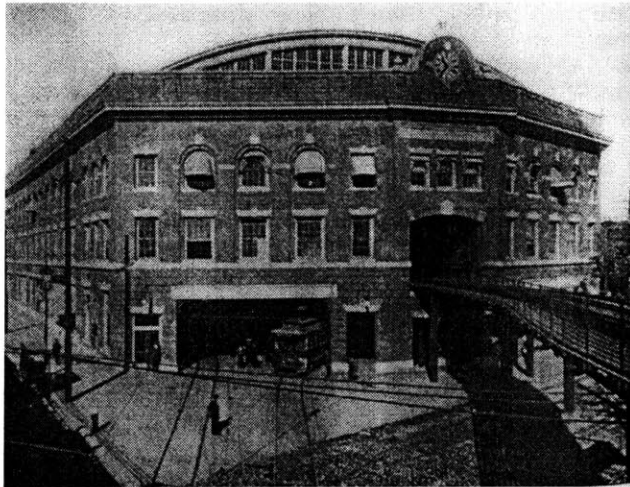
33.01. View of Sullivan Square Station from the northeast with Somerville in the background. *Bergen, p. 116*



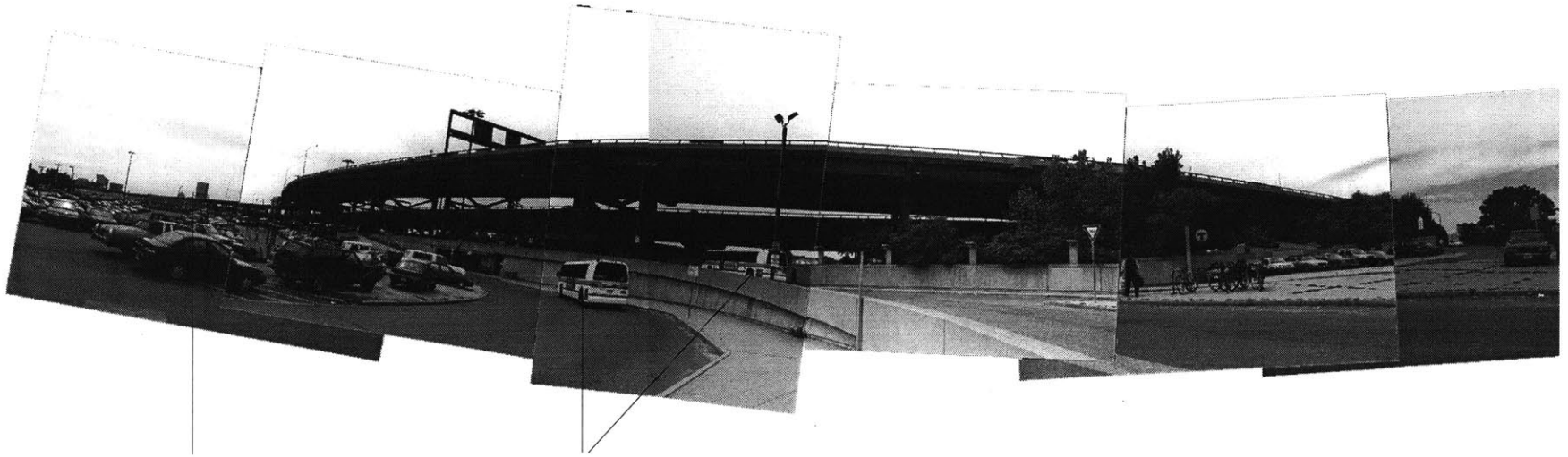
33.02. Interior of Sullivan Square Station under construction, ca. 1901. *Illustration courtesy of Charlestown Public Library*



33.03. The interior of the Sullivan Square Terminal had a platform on the right where passengers coming from Boston would exit the cars. On the far left are the streetcars that would pick up and discharge passengers arriving at the station. *Bergen, p. 117*



33.04. The front of the Sullivan Square Terminal was an impressive red brick structure that commanded attention from all vantage points. *Bergen, p. 116*



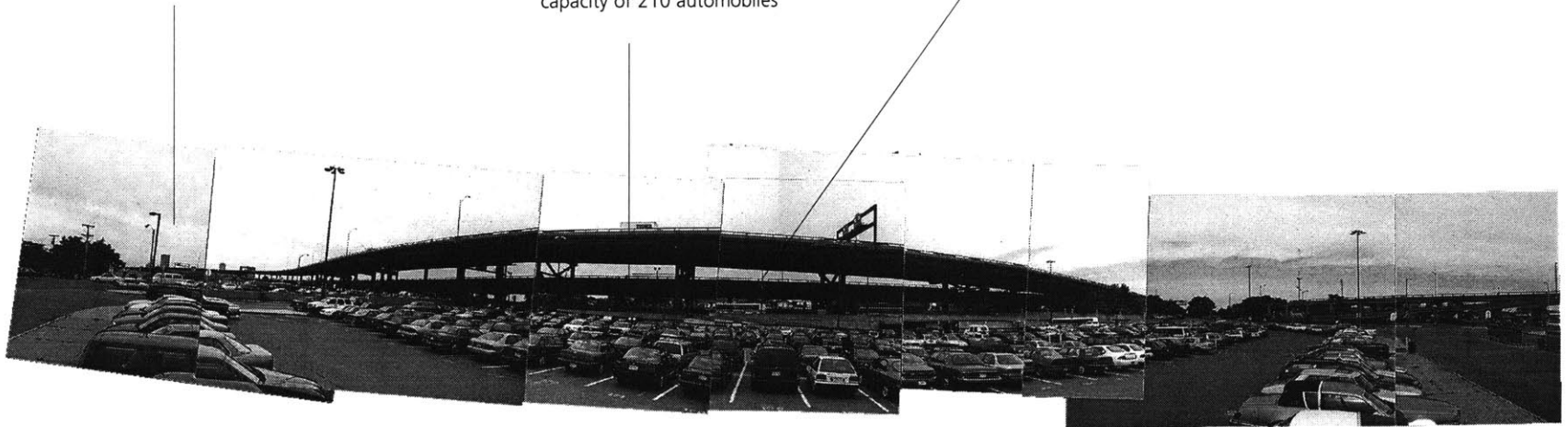
Views to the south reveal the skyline of the Boston Central Business district giving the pedestrian a perceptual sense of orientation to the city's center.

There are presently two levels of bus service

The current parking lot has a capacity of 210 automobiles

The main entrance to the Sullivan Square Orange Line is found on the top most level.

34.01/02. Both of these composite photographs were taken in the autumn of 1996 from the parking lot of the current Sullivan Square.



35.01. View looking from the upper level of the bus alighting zone looking northeast across the parking lot.



Entrance to the Orange Line

Elevated portion of Rutheford Avenue

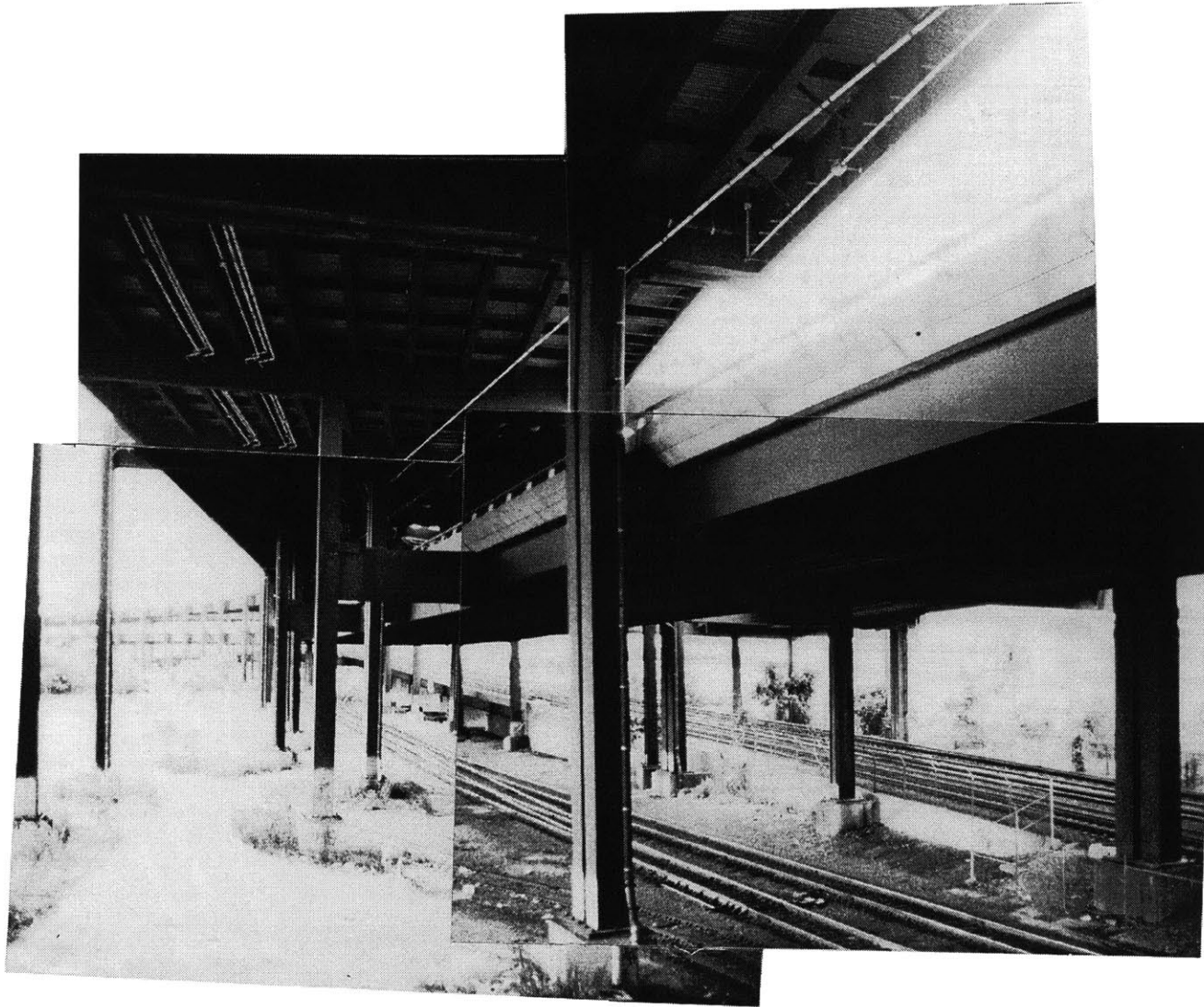
The towering smokestacks of the Boston Edison Co. factory

The Schrafft Center, a converted candy factory used now as multiple tenant office space.

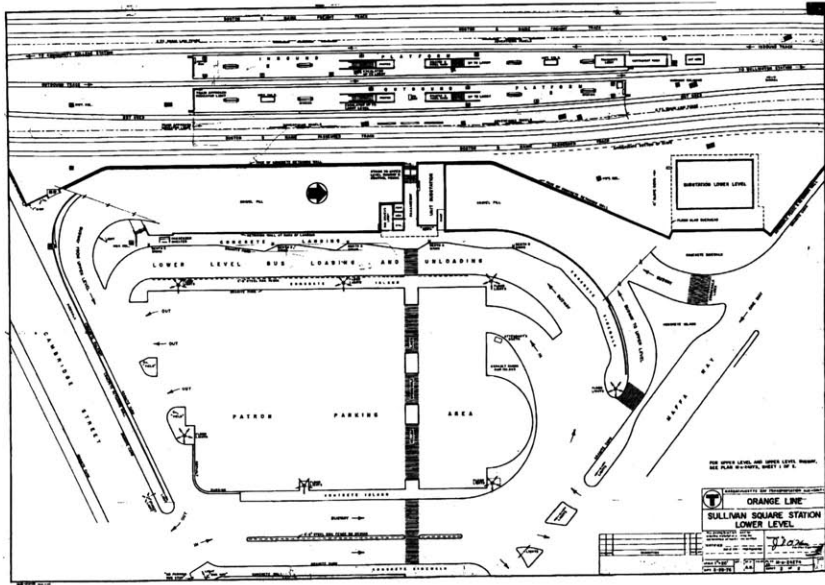
36.01. View north from Cambridge Street to the present Orange Line entrance and the upper level of bus stops.

While the present structure of the freeway creates a dramatic backdrop for the station, it is fundamentally a dark, windy and noisy place which is presently not very pedestrian friendly.

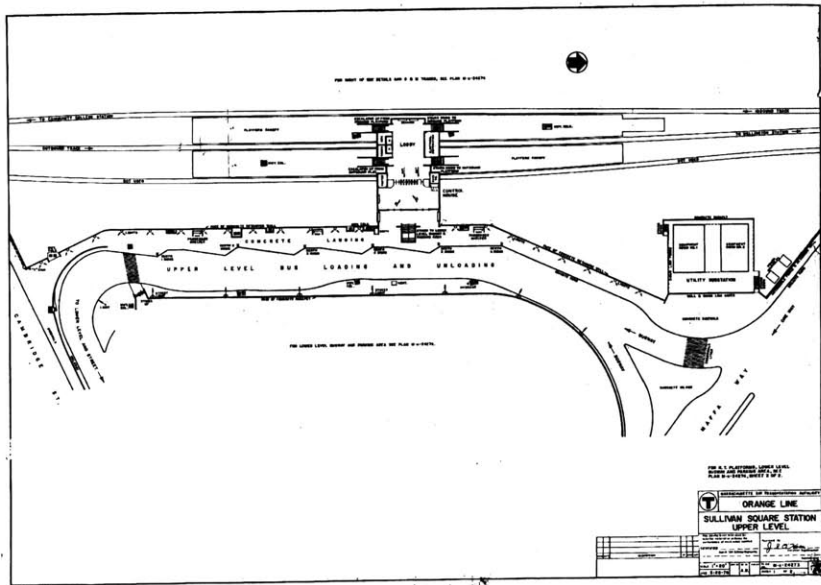




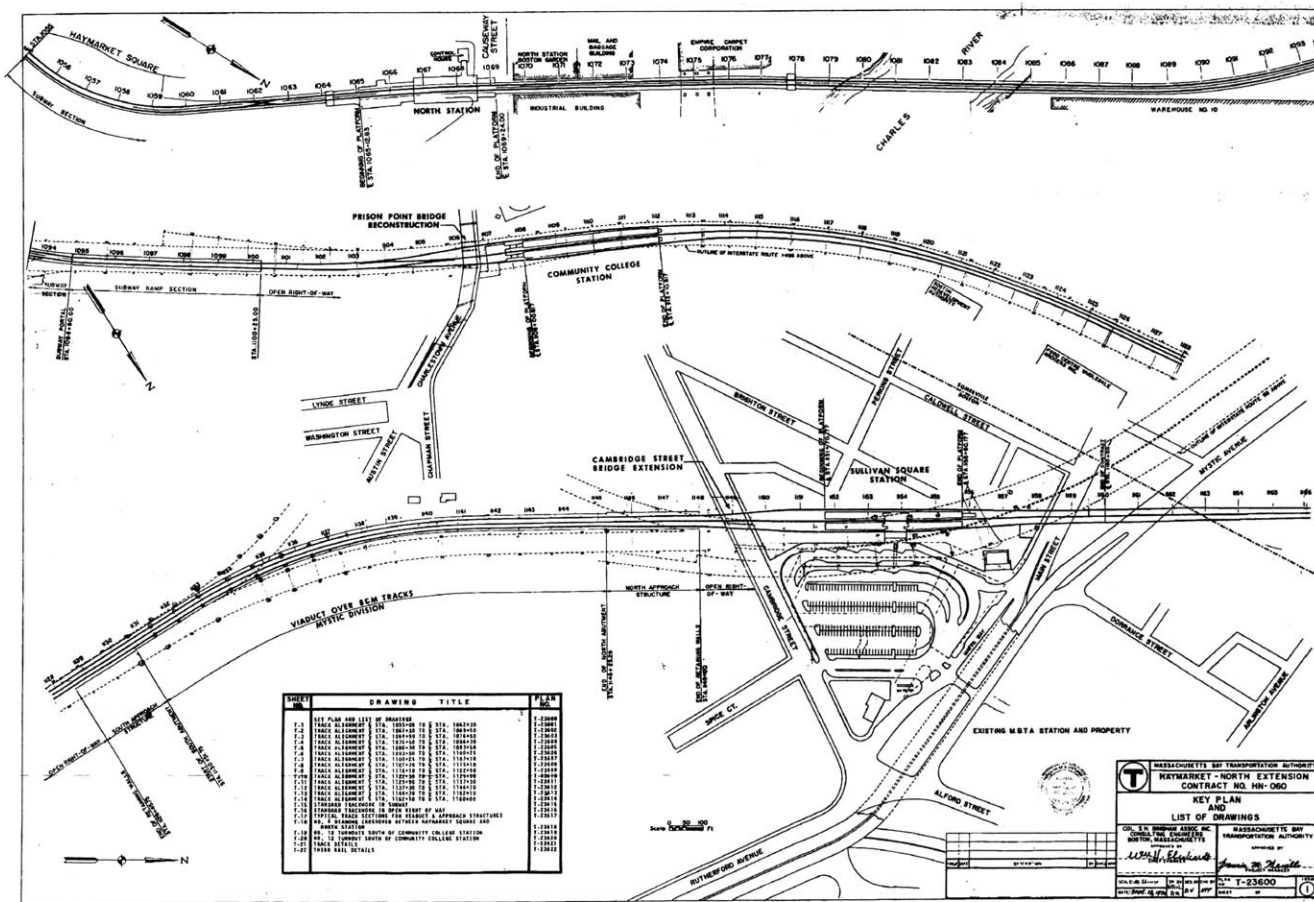
37.01. View south from Cambridge Street showing the existing tracks for the Boston & Maine railroad, the Orange Line and the Commuter Rail. The structure of the freeway is above.



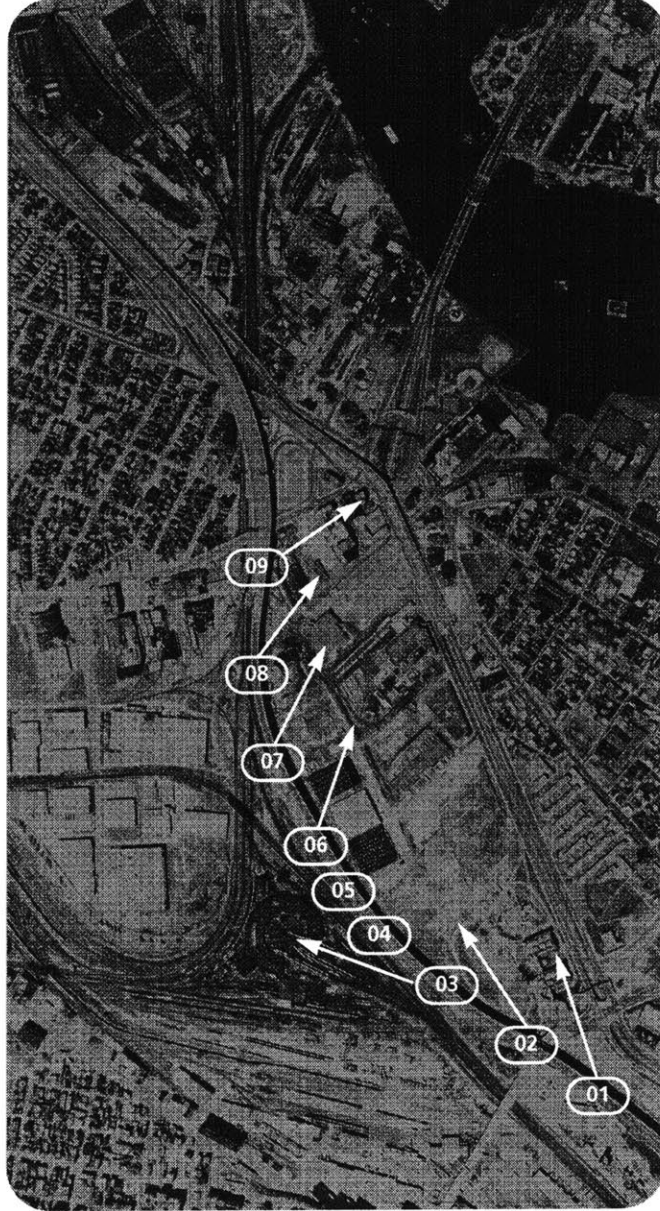
38.01. Site plan of the present Sullivan Square Station highlighting the upper level of the bus turn around and main entrance to the Orange Line Station.

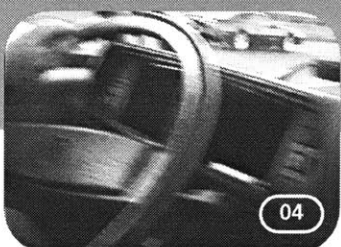
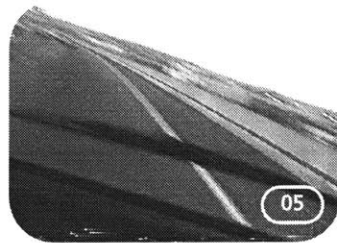


38.02. Site plan of the present Sullivan Square Station highlighting the lower level of the bus turn around and the Orange Line waiting platforms.



39.01. Site map locating the placement of the Bunker Hill and Sullivan Square Orange Line Stations within the framework of the elevated I-93



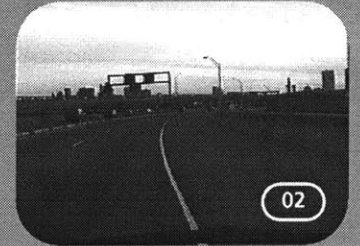
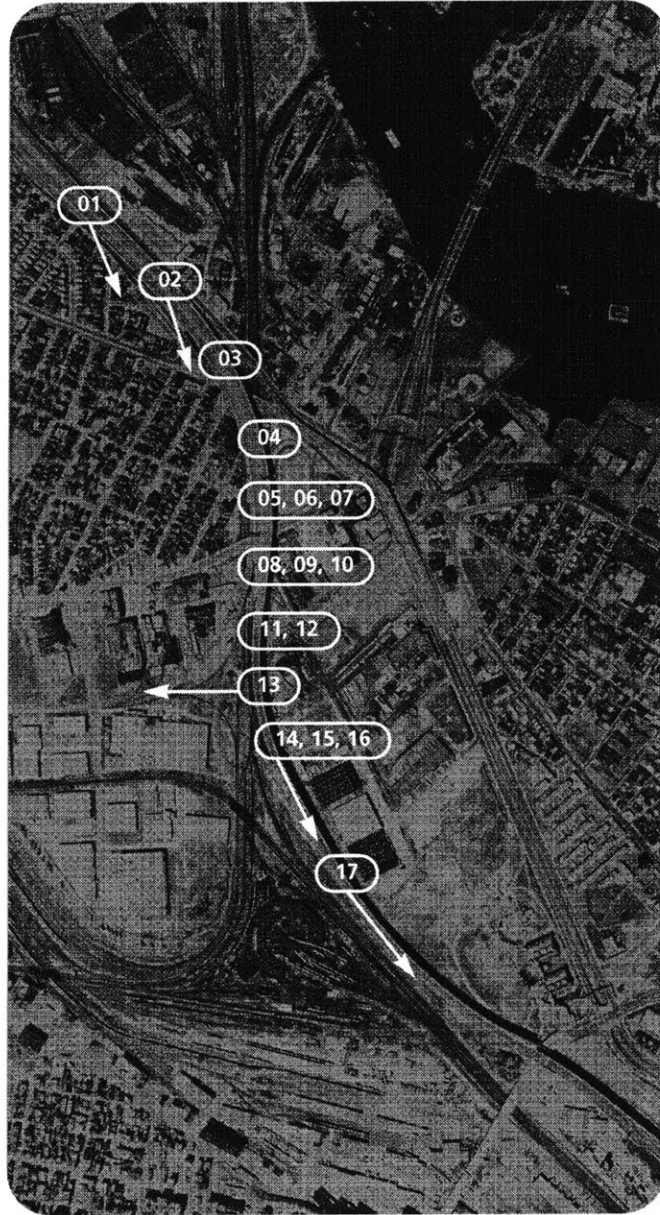


Northbound Interstate 93

video footage taken 11.11.1996

first frame: 04:12:25

last frame: 04:13:45

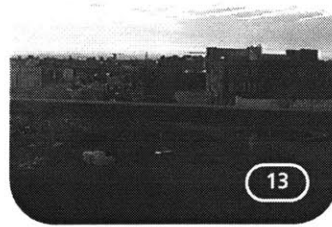




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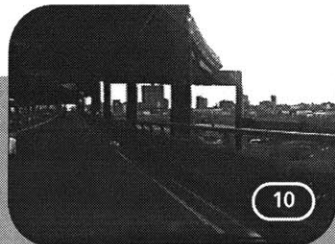
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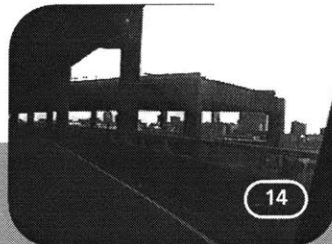
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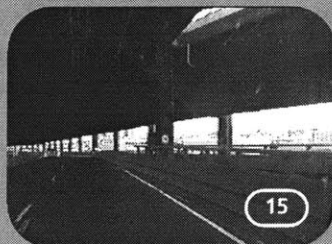
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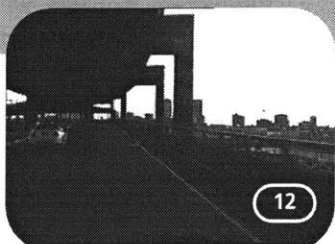
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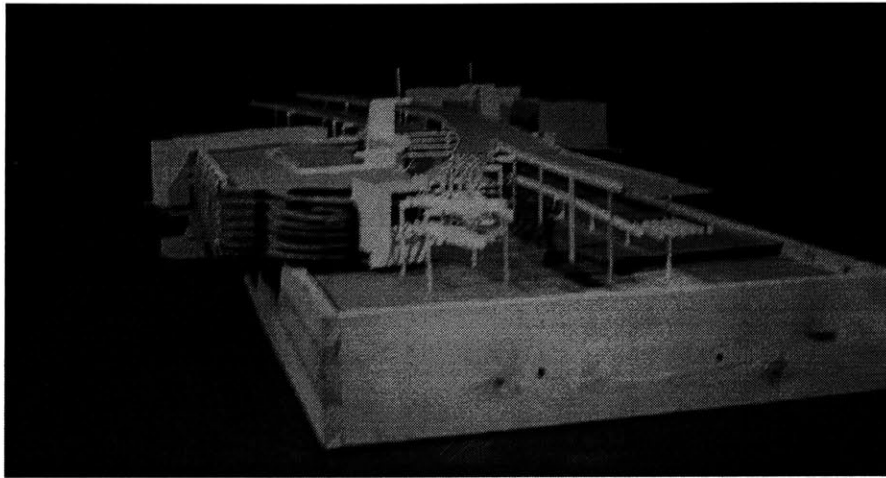
16

Southbound Interstate 93

video footage taken 11.11.1996

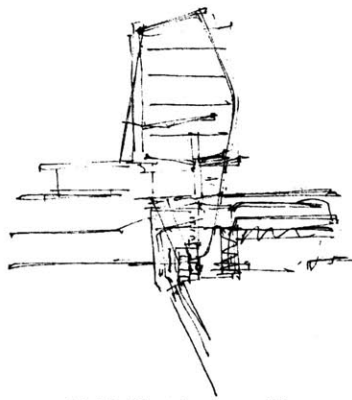
first frame: 04:25:13

last frame: 04:27:51



44

44.01. View of site model showing view to the north-east.



44.02. Sketch of possible vertical development along Cambridge St. with connections to subway below

Description of Project

Making the linkages between the 60 mph automobile and a pedestrian friendly Cambridge Street requires dramatic shifts in scale and architectural expression. The following is a description of the project's development and manifestation in drawings and study models.

The programmatic content of this urban complex is multi-fold. The skeleton of the assemblage is an intermodal transportation center which links freeway traffic from I-93, the Commuter Rail service to Haverhill, Newburyport and Rockport, the Orange Line, the new Urban Ring (conceived in this iteration as a locally underground light rail system), local bus service and local pedestrian traffic together. This skeleton is fleshed out with a number of other non-specified programmatic possibilities in order to create a sustainable neighborhood environment. These pieces include commercial and office space along both

sides of Cambridge Street and a proposed multi-use urban template for the existing low-density Sullivan Square parking lot.

The Parking Structure

The parking structure volumetrically is the largest single component of the project. It has a total of eight floors and a capacity of nearly 1100 cars (providing five fold the number of spaces currently available). Access to the garage has been designed to work independently of local street patterns to the extent that the garage and freeway can function with each other independently. Existing on- and off-ramps constructed in the early 1970s for merging into the proposed Inner Belt are here re-appropriated to draw traffic into the garage. Motorists traveling south along I-93 can enter the garage via the fifth floor and those wishing to exit southbound may do so from the fourth floor. Vehicles approaching from the south enter on floor six and continue north by exiting from the top floor. The issue of slowing traffic sufficiently from freeway speeds to nearly a standstill has been addressed by re-surfacing the freeway off-ramp some distance from the entrance.

The configuration of the garage is quite simple: sloping floors plates with two way circulation and an express helical ramp. This permits traffic flow in two directions through the structure and when necessary easy access to the exits. The specific orientation was chosen so as to minimize the necessary distance to walk from one's car to the station below. Moreover, by building along the length of the freeway I was able to infuse the existing freeway frame with broader programmatic content which

nevertheless seems appropriate for the context of automotive infrastructure.

The Main Station

The Main Station has been constructed so as to link pedestrian flow along Cambridge Street, the parking structure and all three train lines. A large convening space permits commuters to flow from the garage, the street and from the trains and continue to their respective destinations. Information and small commercial kiosks are located along the interior periphery to facilitate commuter needs and activate the space as well as to buffer the transition between station and the garage.

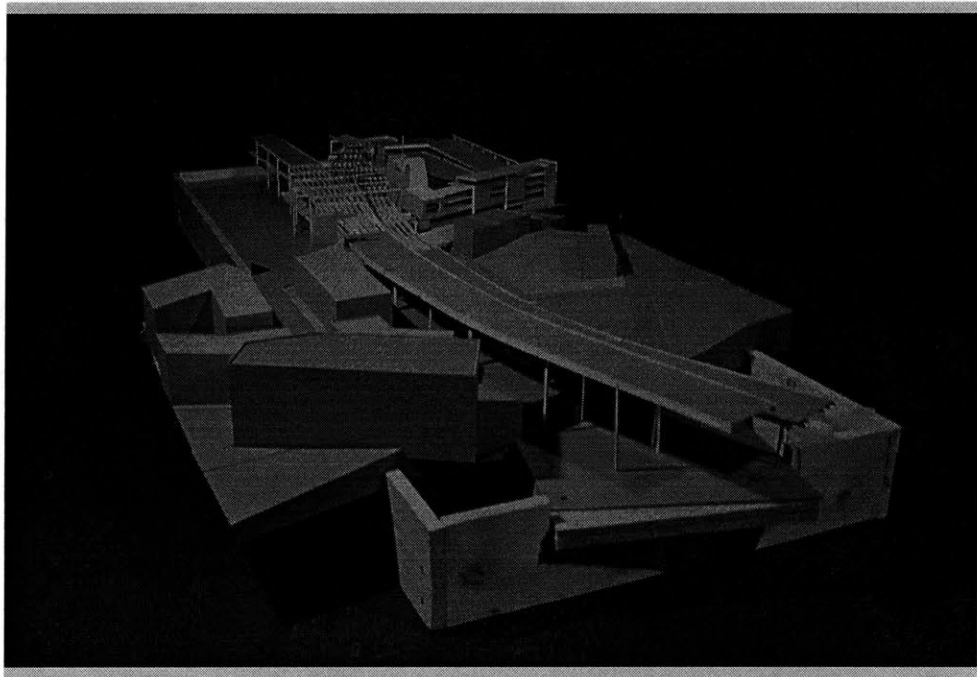
One enters the main station from Cambridge Street by passing underneath a long thin four and five story office block which provides a multi-use interface to the station. Commercial functions, restaurants and shops are located at street level providing activity throughout the day and into the night.

Complementing the main station are alternate entrances and exits to the Commuter Rail and Circle Line on both sides of the freeway and on both sides of Cambridge Street. This configuration, while required to provide sufficient egress, also helps to link the two sides of the freeway. The specific architectural expression of these alternate entrances and exits have been left purposely schematic for I envision them as being integrated into the planned vertical development rather than exist as free standing objects.

The Train Lines

The waiting platforms for both the Orange Line and the Commuter Rail have been relocated south of Cambridge Street and are single loaded providing in- and outbound service on opposite sides. The proposed light rail Circle Line has been placed underground directly beneath Cambridge Street requiring reconstruction of the Cambridge St. bridge over the tracks. Transfers between the two lines occur directly beneath Cambridge Street. Presently, the Commuter Line passes Sullivan Square without stopping. Given the proposed creation of a new MBTA Circle Line intersecting the existing Orange Line there is sufficient reason to plan a platform for this line.

45.01. View of site model showing view to the south-west.



Complimentary Towers which bracket the space of the freeway

Garage exit and entrance portal

Office and commercial development along the south side of Cambridge St.

Existing primarily residential Somerville neighborhood

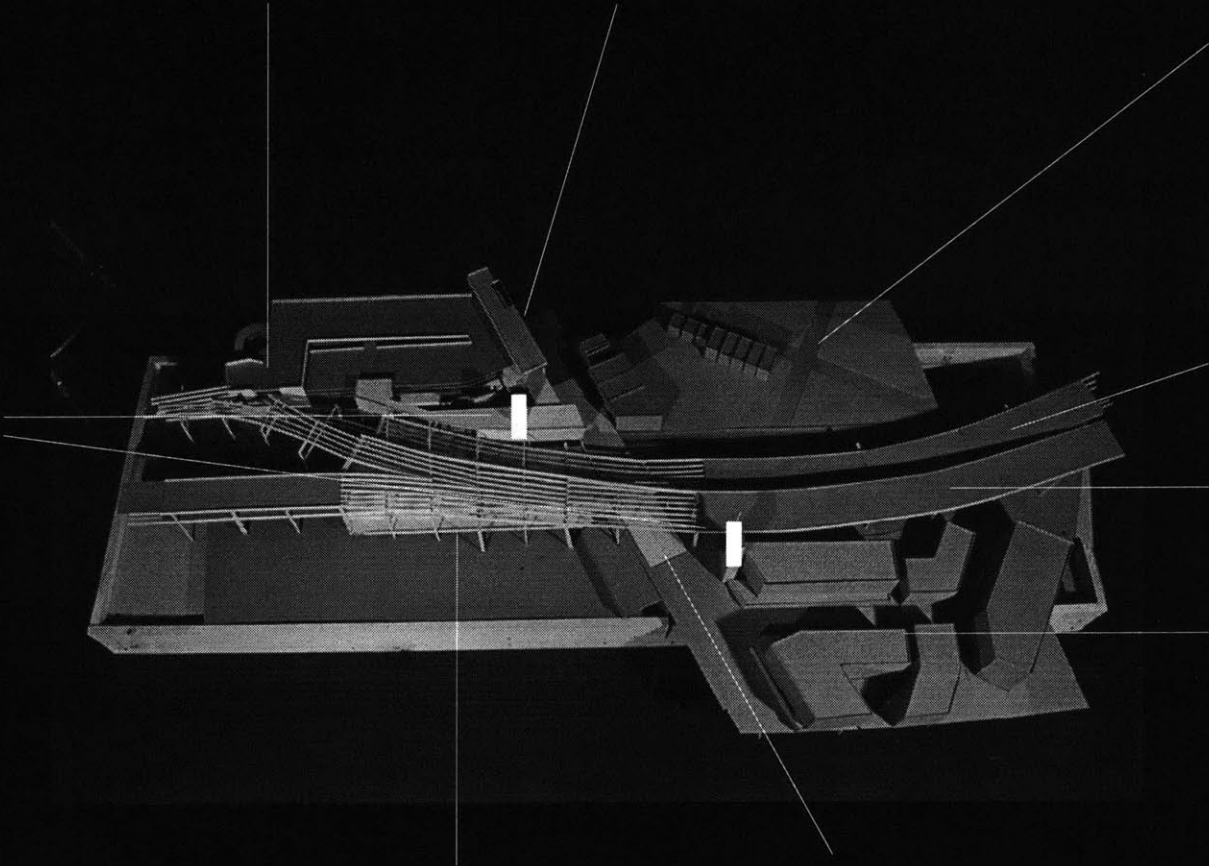
Southbound I-93

Northbound I-93

Proposed new urban development utilizing more densely the site occupied by a parking surface.

Waiting platforms for the Orange Line and Commuter Rail

Underground Light Rail Circle Line located under the Orange and Commuter Line Tracks below Cambridge St.



The Commuter Rail platform is located just to the east and parallel to the Orange Line.

The dream of the Urban Ring is to facilitate lasting connections between adjacent communities. The footings of the freeway structure provide few opportunities to place a light rail platform underneath except along Cambridge Street itself or directly underneath it. Ignoring the logistic difficulties of redirecting traffic during the construction of the underground portion, the positioning of the line itself physically bridges the gap between Somerville and Charlestown. Given the decision to go underground there were a number of structural aspects to resolve. One must maintain the lateral stability to the freeway footings presently provided by the soil which is to be removed. I have conservatively assumed that the footings themselves are twelve feet square. This provides just enough room to squeeze in a two platform station under Cambridge Street. The walls of the station are two feet thick slurry walls fortified laterally by large eight foot post tensioned concrete beams.

Gestures to the Freeway

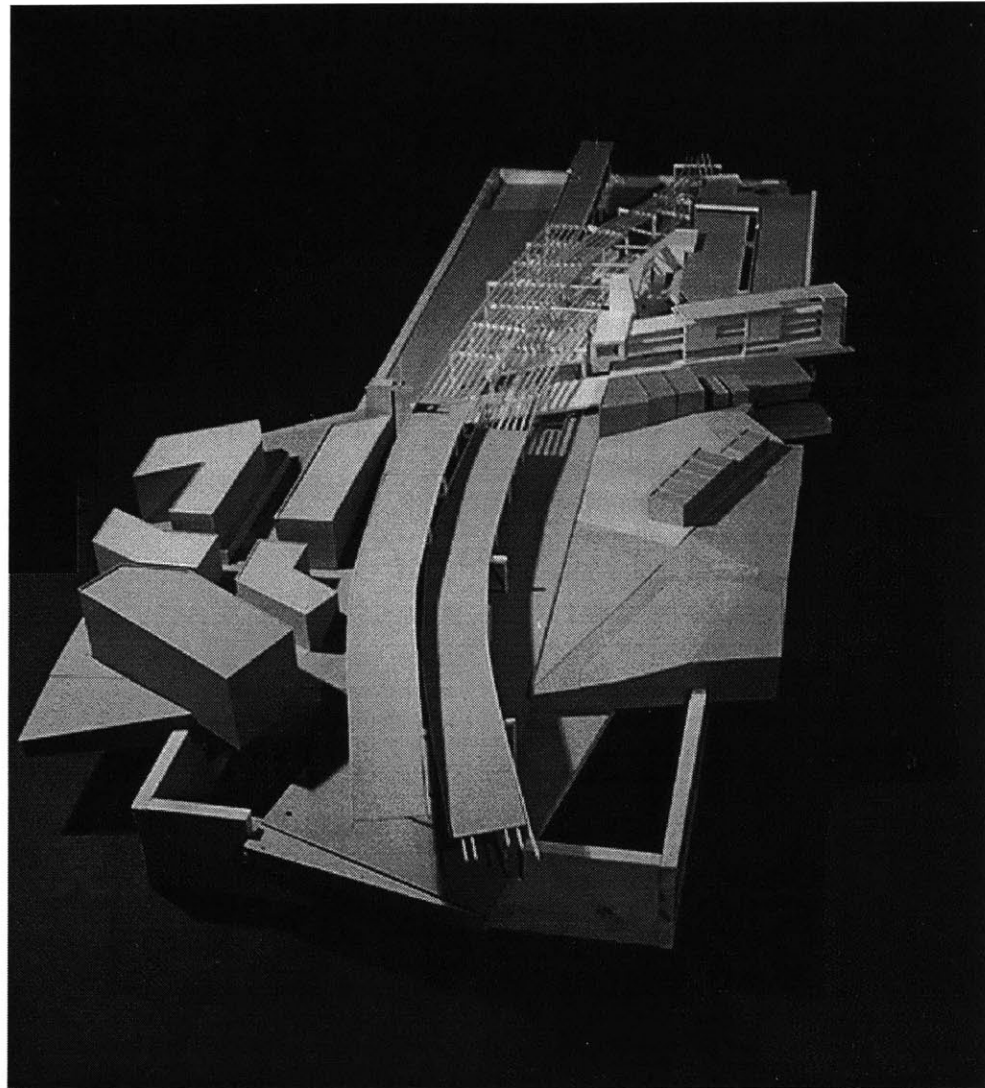
The insertion of the waiting platforms under the freeway does not make them any more amenable to the pedestrians than the current configuration. I hesitated building large structures with the existing freeway structure although I was advised that this could conceivably be done. Instead a light ceiling has been envisioned which would be hung from the bottom of the freeway. Presently, the underside of the freeway is quite monumental in its own right given its enormous dimensions and expressed structure, it

remains nevertheless a dark, always shaded space. The built-in restrictions to natural light suggested that the underside of the freeway might be resurfaced with an opaque white material which could be illuminated from below thus providing a diffuse indirect light for the whole waiting platform area and that portion of Cambridge Street below the freeway. The structure of this new ceiling could be inserted in the interstitial space between the freeway's joists allowing the depth of the ceiling to hang mere inches from the bottom of the freeway itself. I have chosen to extend the roof beyond the waiting platforms north over Cambridge street in order bring these spaces



47.01. View looking down into the underground Circle Line. The beams running perpendicular to Cambridge Street provide the necessary lateral stability in the soil so as to not undermine the foundation footings of the freeway.

48.01. View of final site model looking south along the freeway.

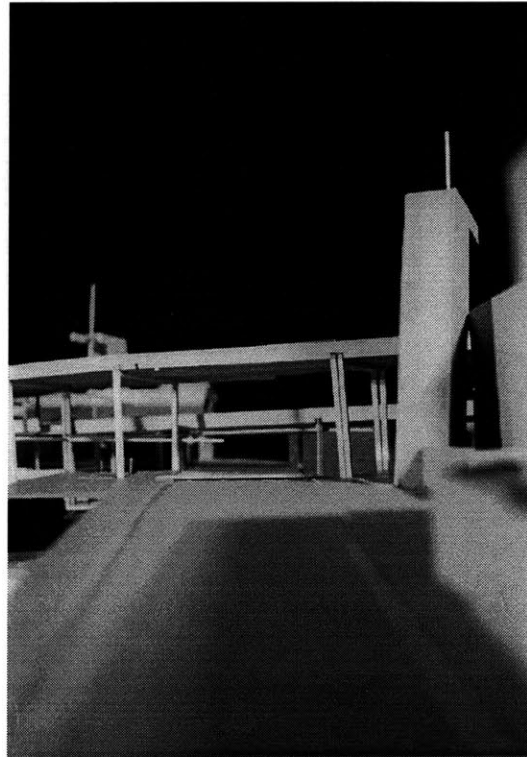


together heightening the kinetic experience of all the different modes of transportation.

Additionally, late in the design the decision was made to build above the level of the top most deck of the freeway with two vertical towers, one on each side of the freeway. The first marks the entrance to the parking garage for south bound traffic and as it is integrated into the main station also announces its entrance from the street. The second tower has been placed over an alternate access point to the Circle Line on the east side of the freeway and on the sunny, north side of Cambridge Street. The towers serve as markers which frame the city for southbound commuters from some distance away. For northbound motorists, their complimentary forms might legitimately serve as a formal gate out of the city.

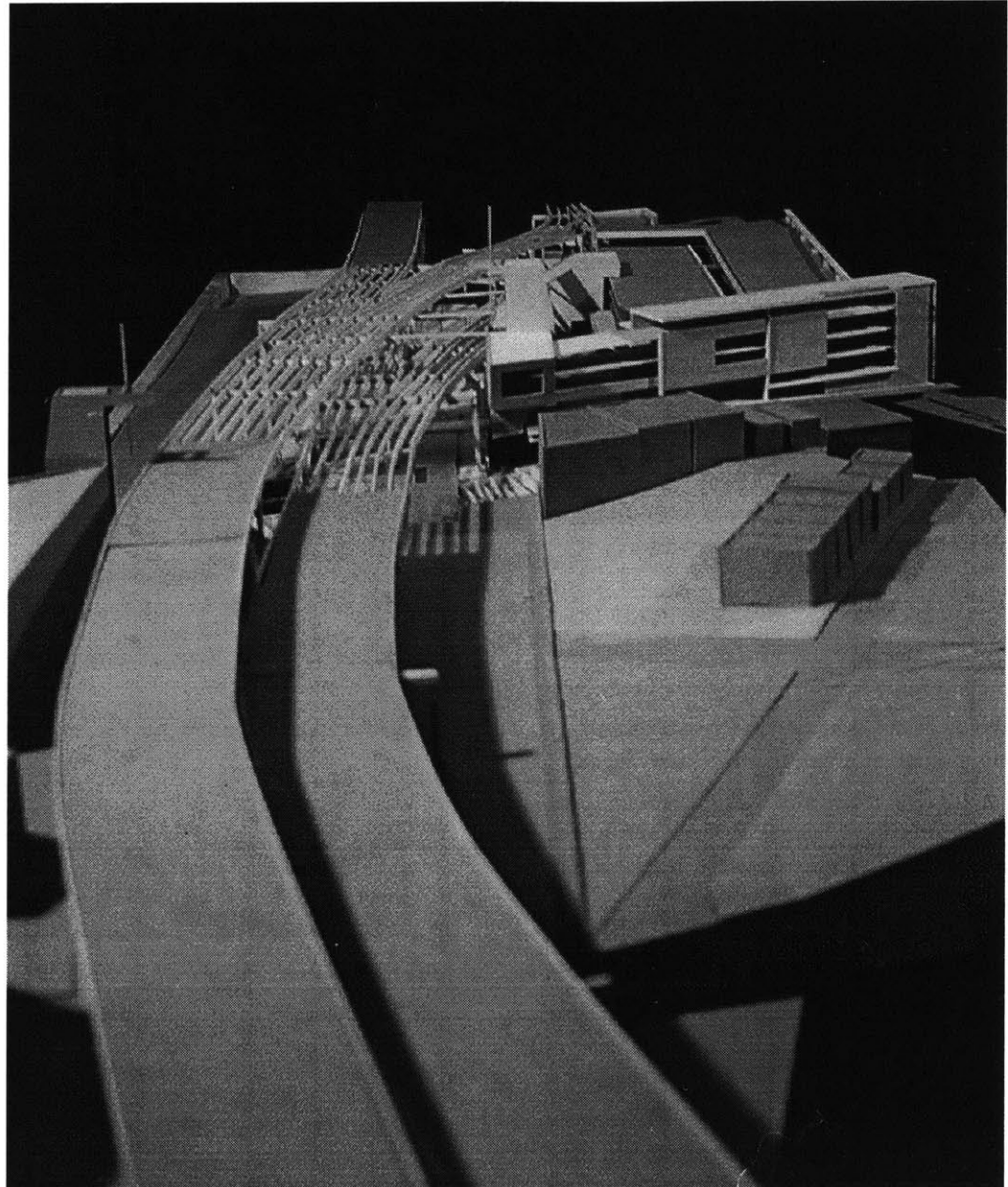
Urban Gestures

The primary concern from an urban standpoint has been to fortify Cambridge Street as a connective thoroughfare between the neighboring communities of Somerville and Charlestown. To this end, considerable multi-use development has been proposed along its north and south sides which will additionally serve as a buffer between the existing Somerville residential neighborhoods to the north and the primarily light industrial fabric to the south. The radial flow of traffic through this site by train and automobile has been given outlets so that pedestrian flow can be directed to the site rather than simply away. Cambridge Street is presently fifty feet wide permitting two lanes of traffic flow and street parking. In an attempt to make the street more pedestrian friendly, a median strip



49.01. View looking west along Cambridge Street toward the freeway and the twin towers.

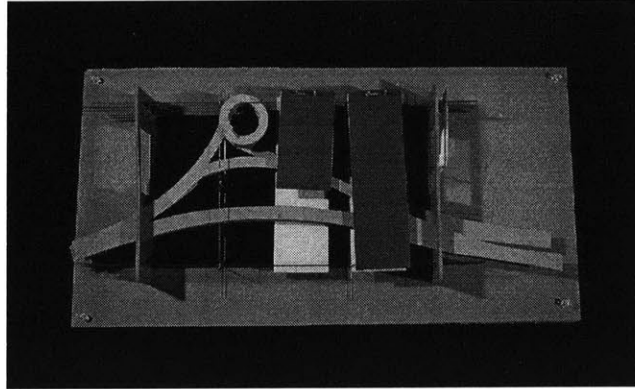
50.01. Detail view of final site model focusing on the main entrance to the main station.



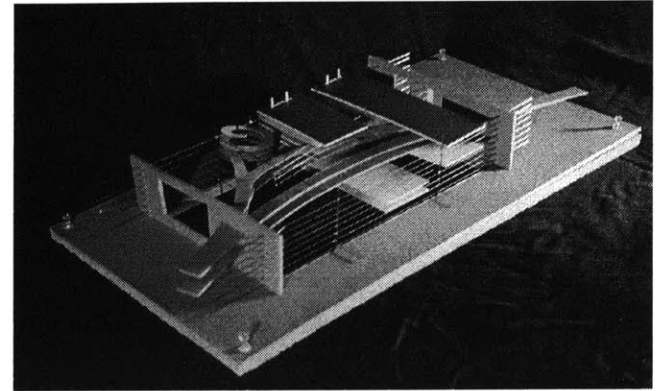
has been added and it and the sidewalks have been provided with planters. The present street parking along Cambridge Street has been co-opted around all entrances and exists of the new station for buses and passenger drop-offs.

The nature of Sullivan Square has further been transformed from a transfer point into a destination by the proposed re-development of the lands currently occupied by the Sullivan Square parking lot. Cambridge Street's new status as part of the New Urban Ring suggests that it become a primary thoroughfare although not necessarily in the sense of the automobile. In order to serve as a boulevard, other pedestrian oriented streets must feed into it. In the urban template suggested for the existing parking lot I have attempted just this. Numerous activities, commercial, business, residential and even light industrial

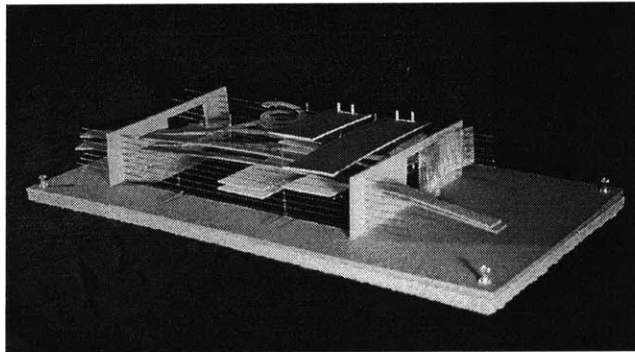
might take place here yet, Cambridge Street remains the primary collector street.



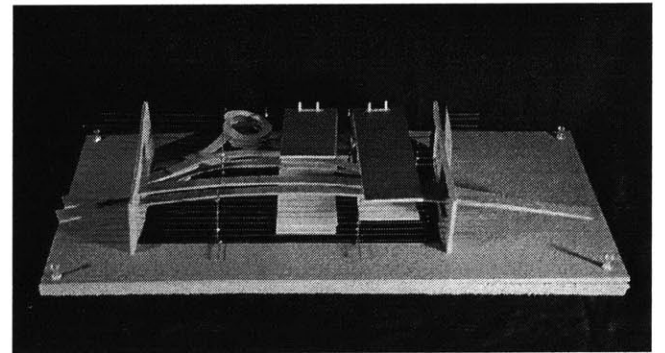
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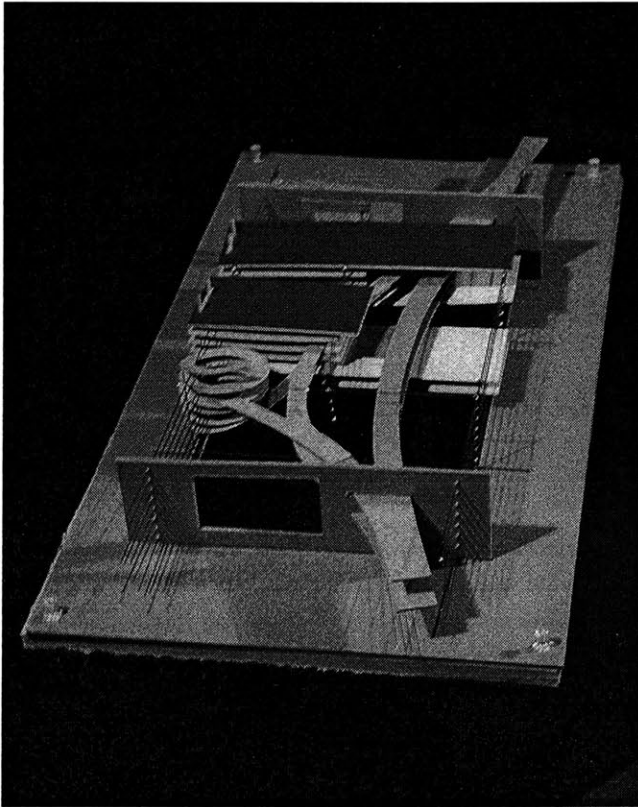
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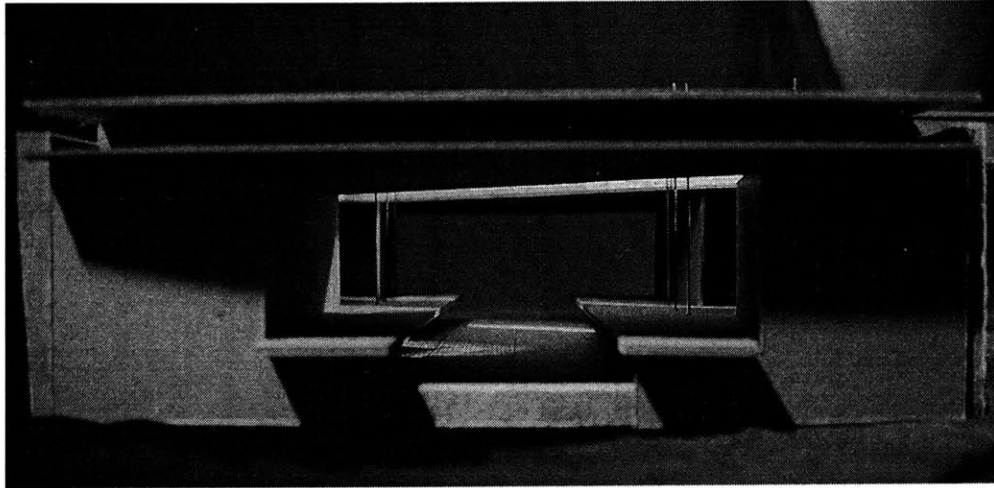
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Study Models

Freeway–Garage Exchange

The first challenge was to reconcile the circulation and velocity exchange between the freeway's 60 mph automobiles and the static parked vehicles in the garage. The pre-existence of on- and off-ramp connections on the southwest side of the site determined to a large extent the garage's placement in this quadrant.

The model to the left was both an attempt to create an initial gesture to the freeway and to address the relationship between the dimensions related to parking structures (stall widths and configurations, floor-to-floor heights, etc.) and the existing elevations of the freeway surfaces and structure. The freeway has always been a wall through this site and so my first attempt was to attack the freeway by creating a structure which contrasted the smooth curvilinearity with a strong orthogonal directionality and which literally swallows a portion of the freeway inside itself. The spiral ramp system displaced from both the garage and the freeway becomes the circulatory interchange between the two modes. There is also a notion in the model that garage capacity could be added over time in a modular fashion. Finally, the model begins to suggest a defined yet porous edge to the garage along Cambridge Street which ultimately manifested itself in habitable commercial and office spaces.



54

54.01. View into the underground space illuminated by the transparent waiting platform above.

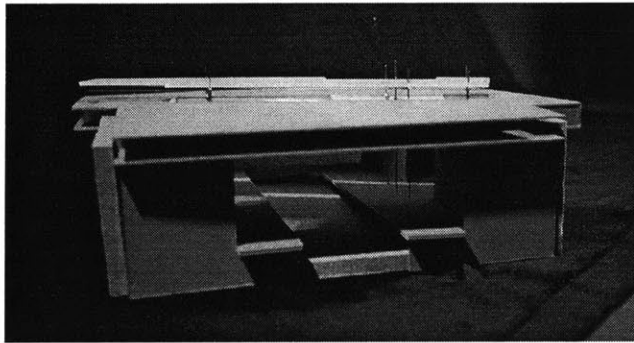
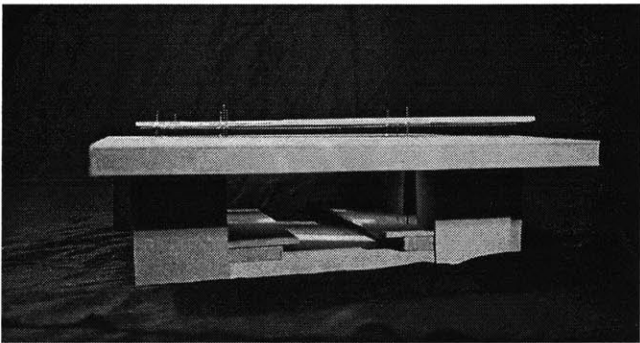
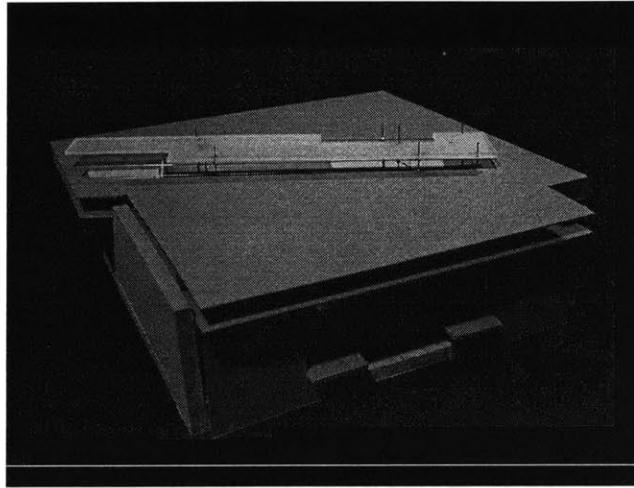
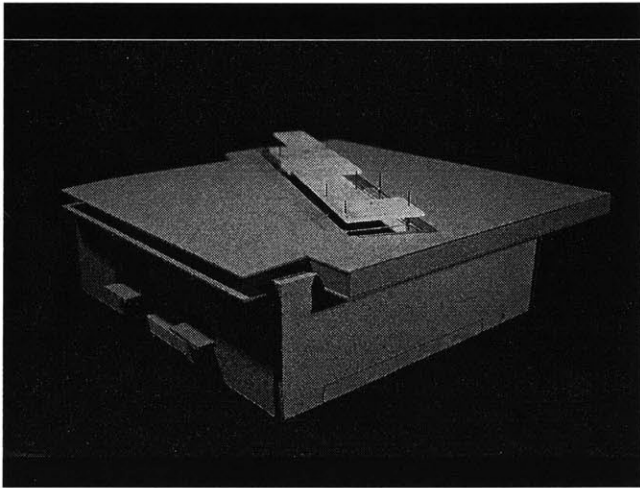
Orange Line–Circle Line Exchange

Within the station itself are a number of conditioned interchanges based among other things the payment of fares. The Commuter Rail does not require one to purchase a ticket to wait on the platform, thus it would not be feasible to have free exchange between the Commuter Rail platform and either the Orange and Circles Lines. Transferring between the Orange Line and the Circle Line is a pre-requisite and also a challenge given the siting of this exchange. Having placed the Orange Line Platform in close proximity to the length of the station resulted in an intersection point at the end of the Orange Line and in the middle of the Circle Line below. This juncture sectionally is first under the Cambridge Street overpass and under the freeway.

The investigation with the model above was to explore the degree light might be allowed to permeate through

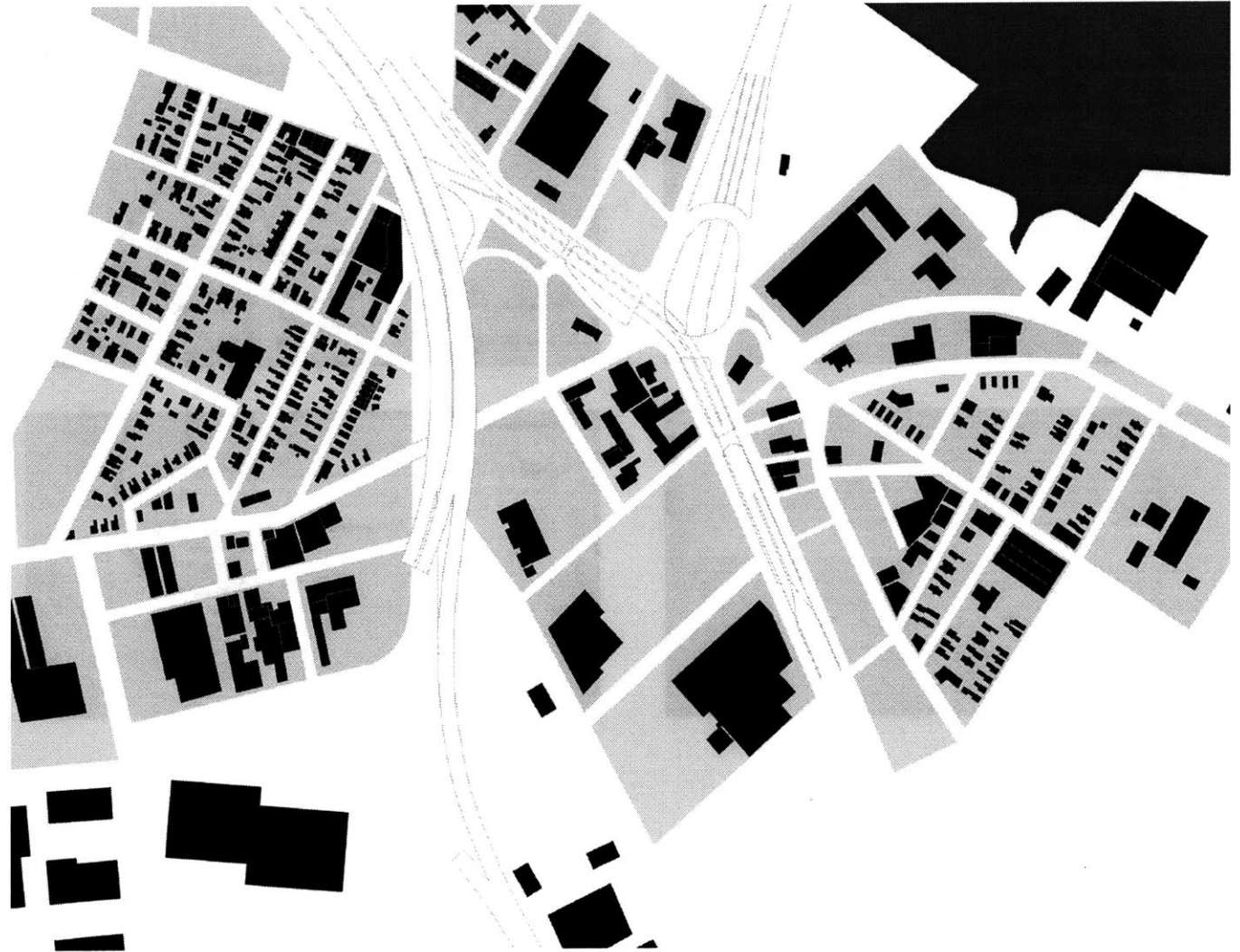
these levels providing a visual as well as physical passage between the spaces. I recognized that the structure under the platforms did not require an enormous foundation and began to imagine possibilities of using an translucent material for the surface of the waiting platform above. The structure under the platform cuts diagonally through the waiting platforms of the Circle Line already offering architecturally a clue to access out of the space. If the floors above the Circle Line were translucent, then commuters could see above if people were waiting, and the floor would act much like a sky light offering an orienting glimpse above.

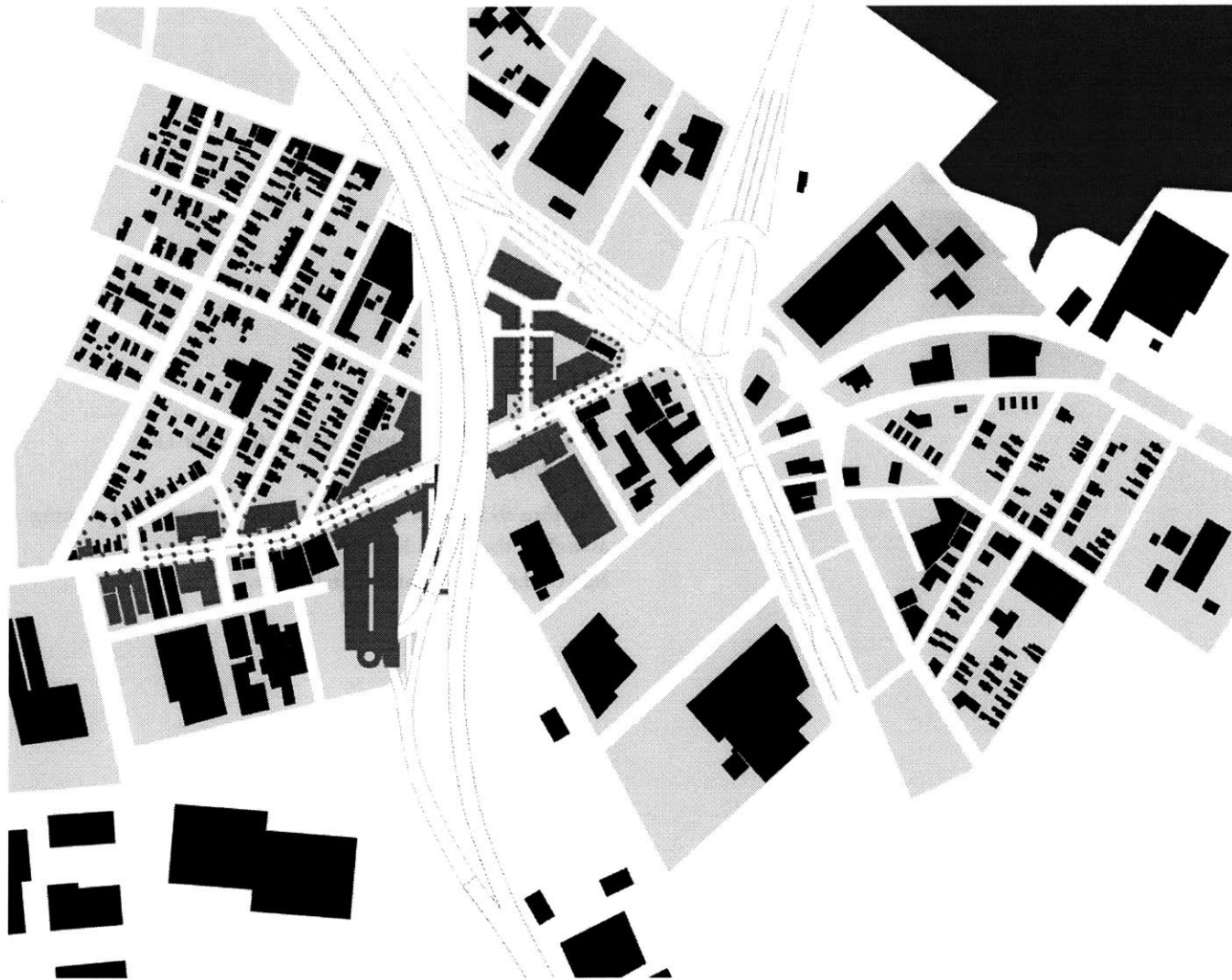
Daylight would in fact penetrate part of the space in the afternoon, however, the primary light source would arrive diffusely by the illuminated underside of the Cambridge Street overpass. Once again, an attempt to use the existing structure in an integrated multi-dimensional way.



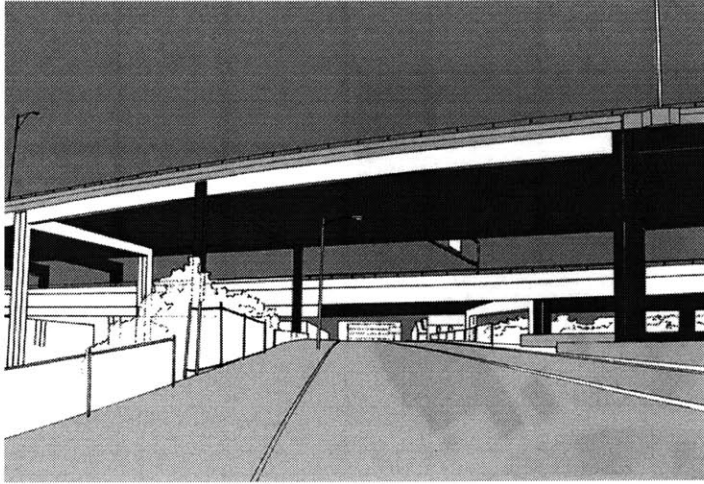
55.01, 02, 03, 04. Views of study model two.

56.01. Site map showing existing conditions around Sullivan Square. The figure ground map makes clear the paucity of development currently in Sullivan Square and along the freeway in general.





57.01. Site with the inter-modal transportation center and an urban template reflecting the intensification of the site along Cambridge Street with new public amenities. (New additions in medium grey)

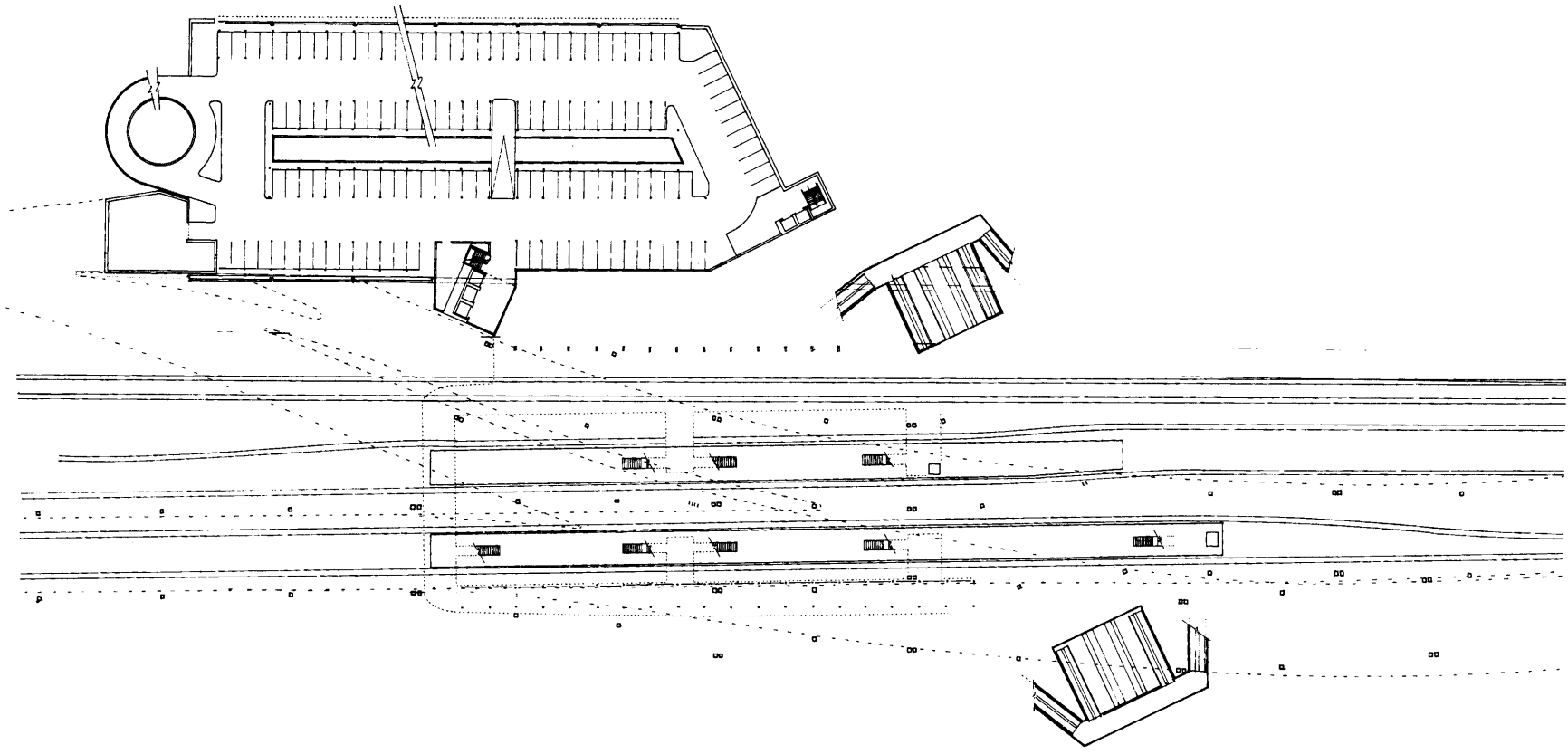


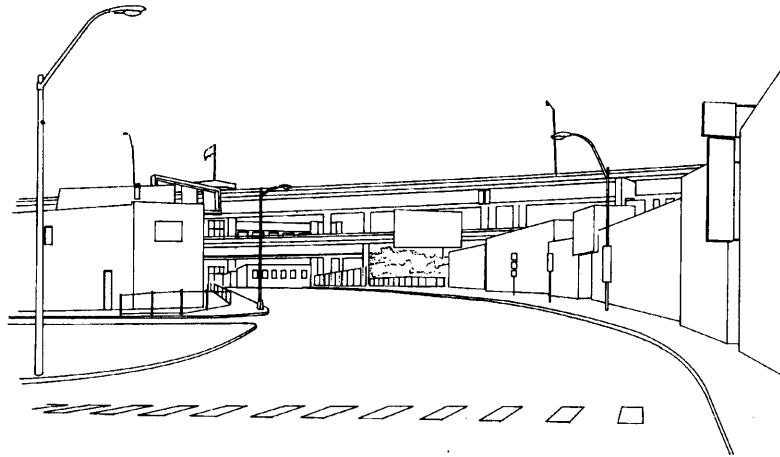
58

58.01 Perspective drawing of the existing conditions taken from the Charlestown side of the Cambridge Street showing the monumental canopy possible from the existing freeway infrastructure.

Plan View above Orange and Commuter Line Platforms

The plan shows one level of partially underground parking as well as the access beneath Cambridge Street to either side of the underground Circle Line.





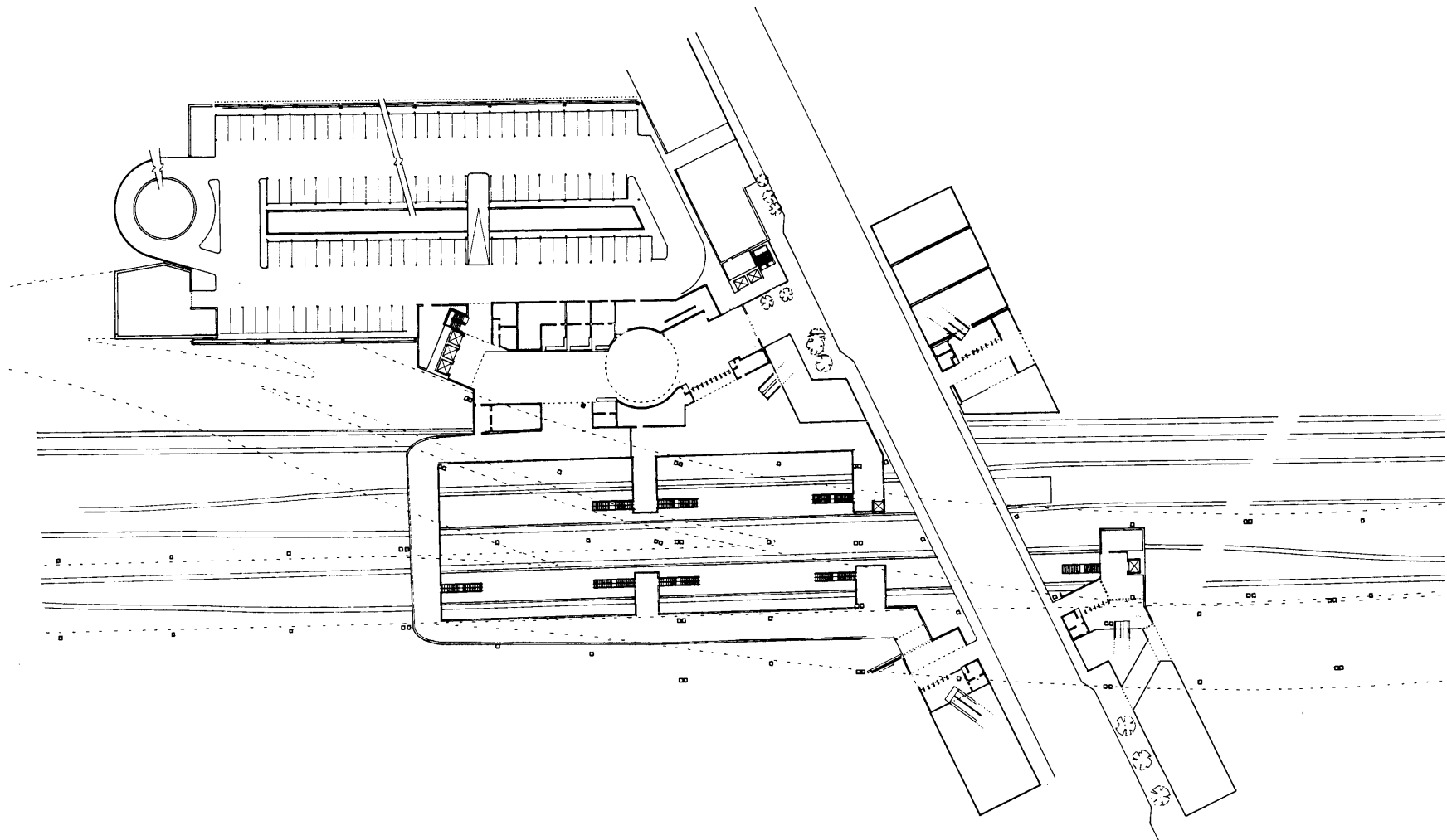
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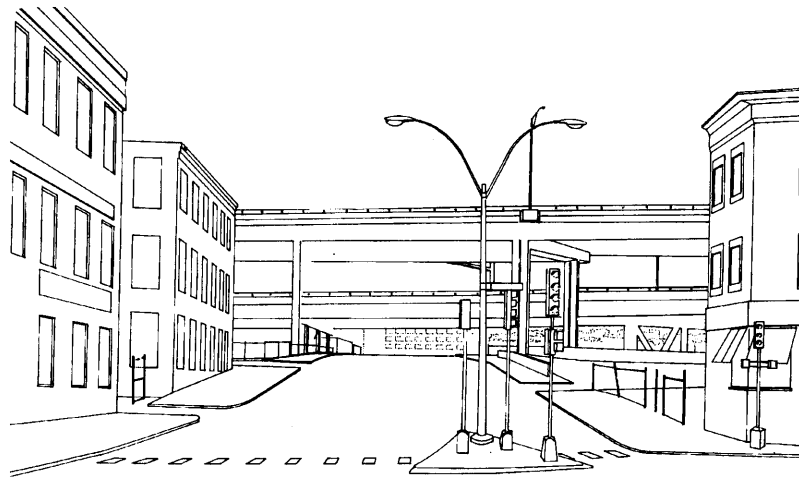
60.01. Perspective drawing of the existing conditions from the Somerville Side of Cambridge Street looking towards the Freeway. Presently the site is under developed. Low density one to two story industrial buildings define the southern edge of Cambridge Street. The northern side has some light commercial development and some two to three story residences.

Plan View from Level of Cambridge Street

The plan at this level begins to show the relationship between the various components of the design with Cambridge Street itself. The waiting platforms have an apron of walkways only a few feet below the level of Cambridge Street. This gives a sense of definition to the edges within the space further emphasized by the over arching ceiling fused to the bottom of the southbound freeway deck.

The main station waiting area collects flow from the garage, the street and from the platforms themselves into a central area where. Alternate exits exist on both side of cambridge street and on both sides of the freeway.



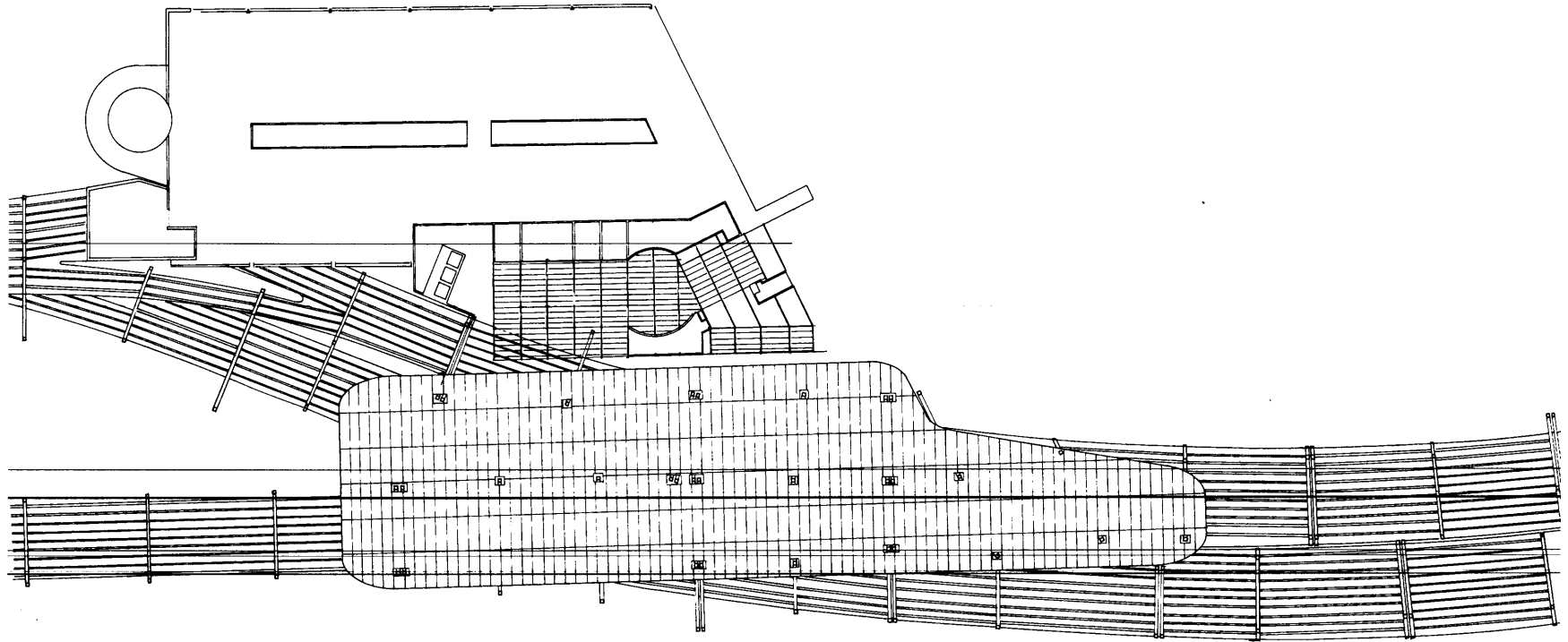


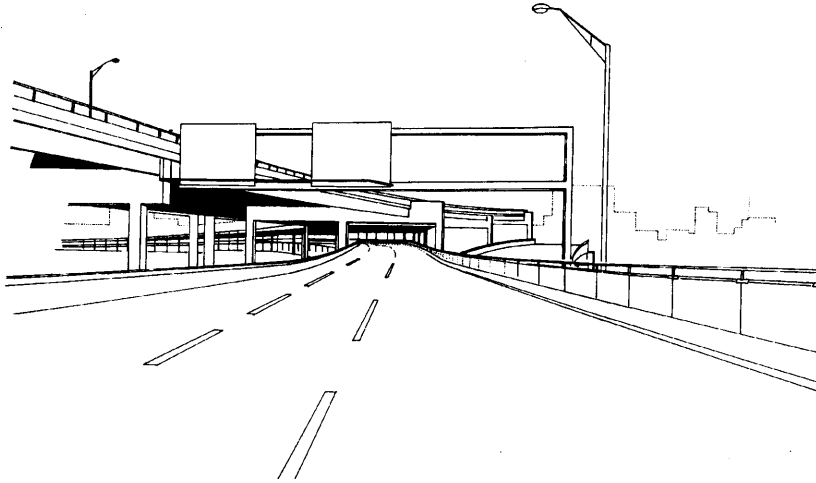
62

62.01. Perspective drawing of the existing conditions from the Somerville Side of Cambridge Street looking towards the Freeway.

Reflected Ceiling Plan

The drawing attempt to convey the one over arching element which unifies spatially all the infrastructure of the freeway, Cambridge Street and the rail lines below. The ceiling is a diffuse white surface which is indirectly illuminated from below and structurally tied to the existing freeway. The dark structural articulation of the freeway is for a moment altered to provide a clean indirect, diffuse light source illuminating the civic space of the train platforms. It extends beyond the platforms over Cambridge Street in order to tie this component into the fold.



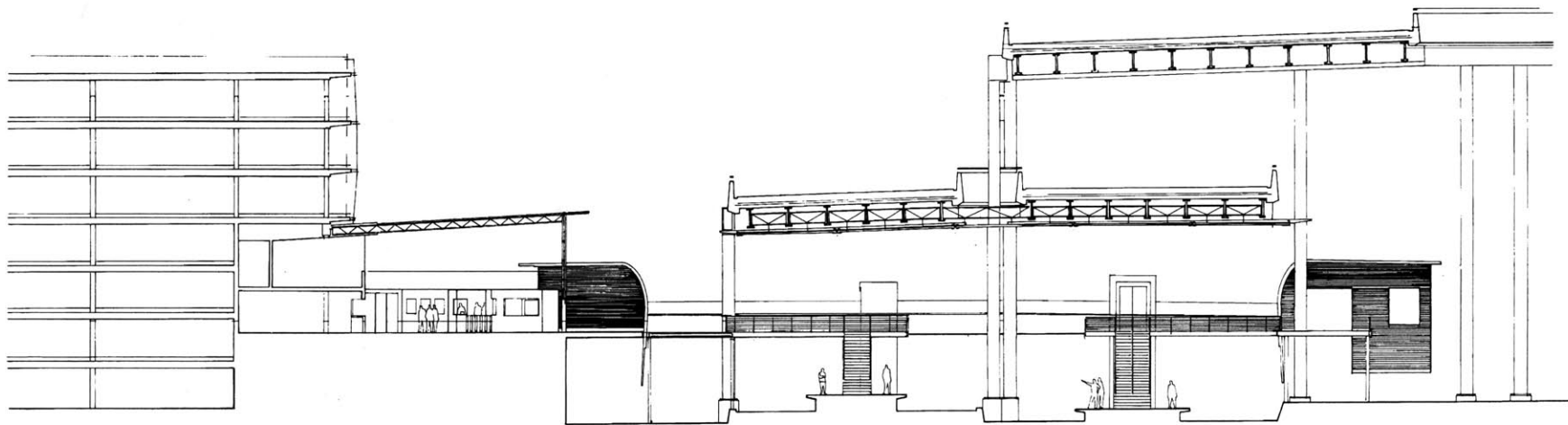


64

64.01. Perspective drawing of the existing conditions from the southbound platform of Interstate-93 as one passes over Cambridge Street. To the left one can see the amputated stub of the unrealized connection to the Inner Belt.

East-West Section through the Station

This section has been updated however, the drawing begins to show the relationship of the unifying ceiling to the structure of the existing freeway. The access apron around the waiting platforms and the relative positions of the platforms are correct.



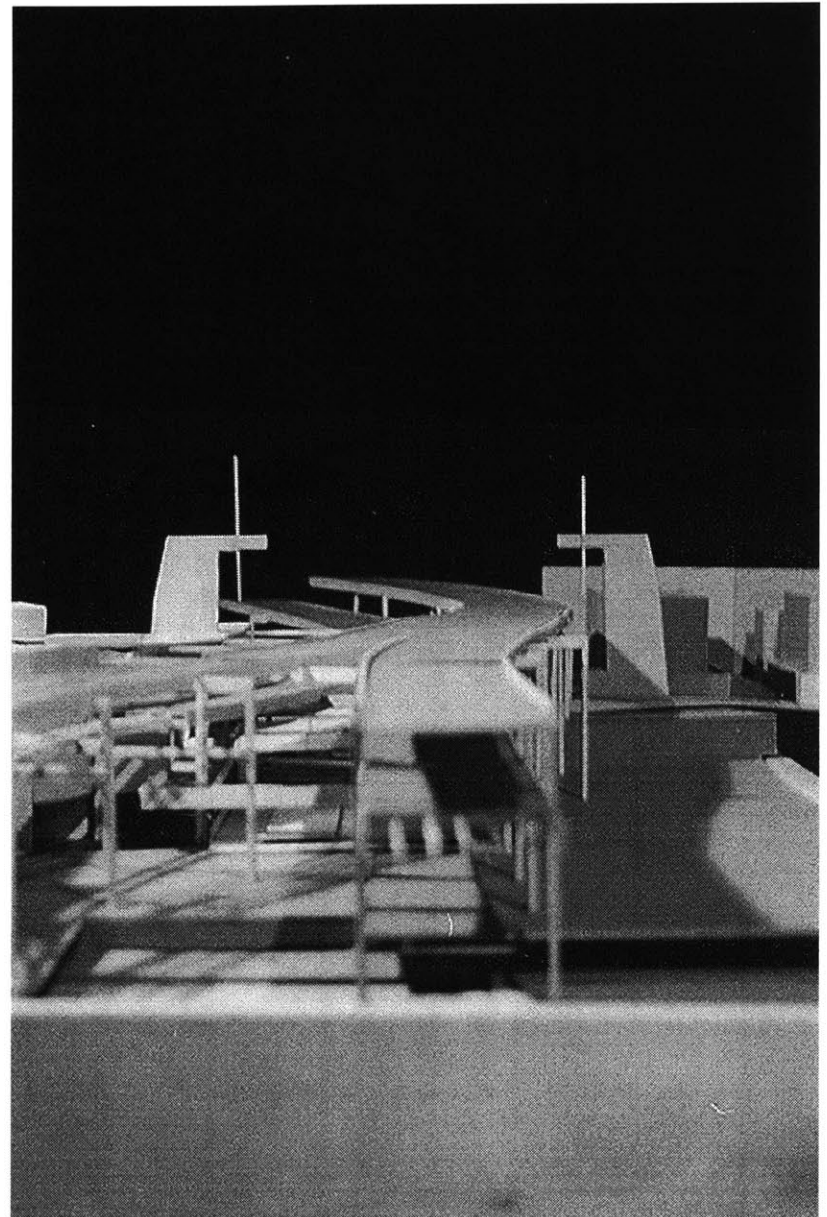
66.01. View from the north-bound lane of I-93 as one approaches the site. The freeway is framed by the twin towers of the station.

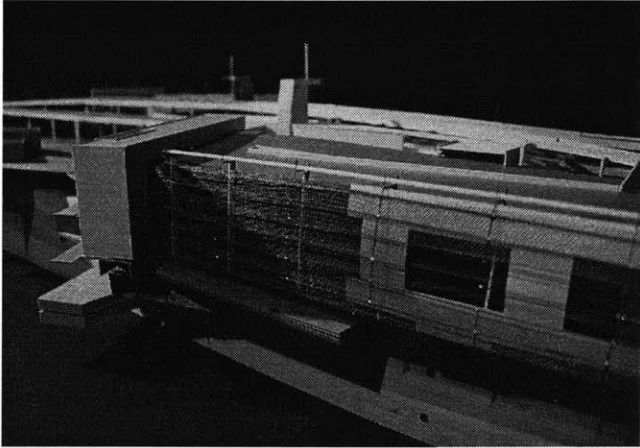
67.01. Detail of the garage's west facade.

67.02. View through the freeway at the over arching ceiling over the Orange Line and Commuter Line platforms.

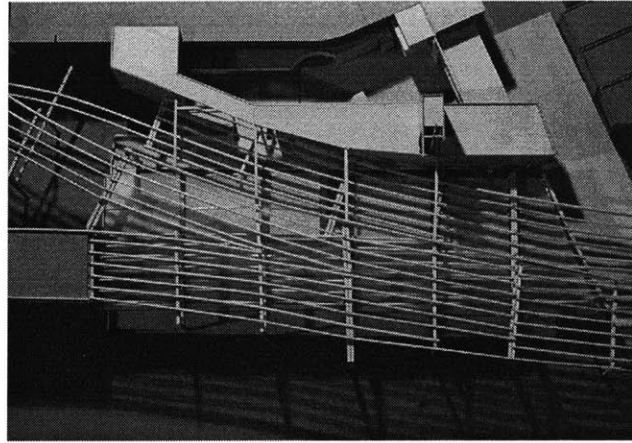
67.03. View south along I-93 showing the framing of the freeway by the station's towers.

67.04. View showing the configuration of the main station next to the freeway.

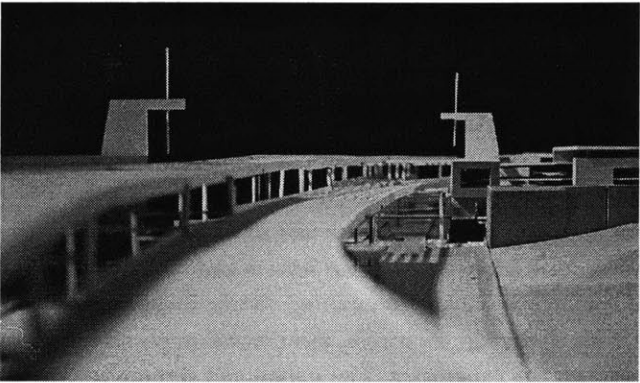




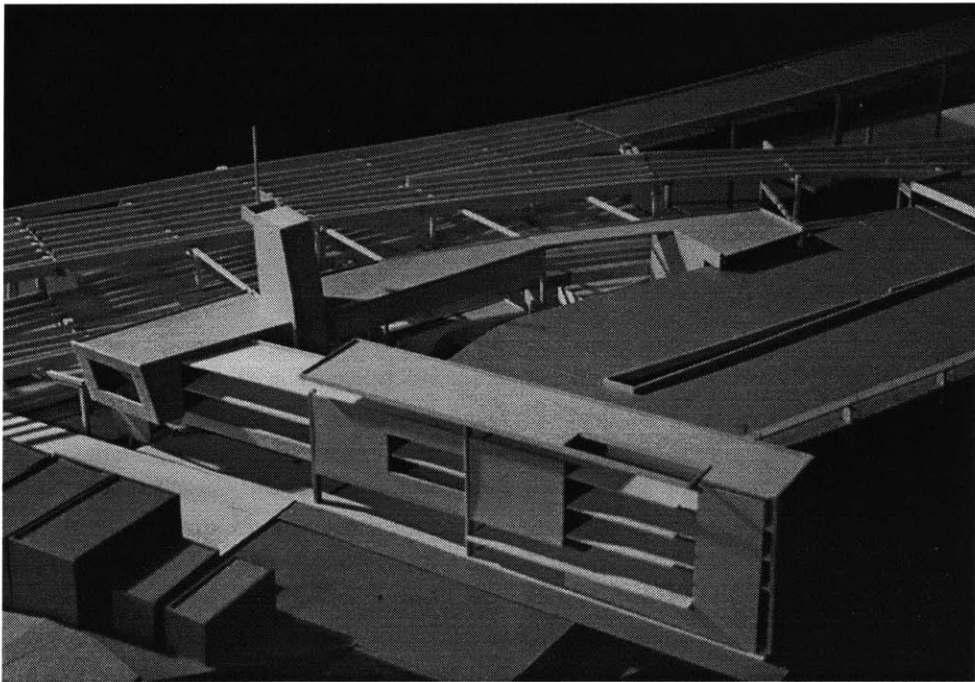
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69.01. Site map highlighting significant vertical elements in the landscape visible from the Sullivan Square Station. These include clockwise around the map: the Boston Edison factory (Everett), The Schrafft Center and the Bunker Hill Memorial (Charlestown)

Appendix A

Design Development

The following are a number of the self-imposed parameters used in the process of siting and designing the project. I have included them in an appendix as background addendum for the project. These were originally notes to myself and have been incorporated largely unedited.

Framing the Site

The station's architecture orients the commuter by framing familiar local and distant icons: Charlestown has the Schrafft Center and the Bunker Hill Monument, looking south are the familiar towers of the central business district. What is less clear are which views characterize Somerville from this site - perhaps the residential character to the northwest and the definition of Cambridge St. are sufficient. This lack of definition argues for improvements to Somerville's new entrance along Cambridge Street:

widening the street, planting trees, encouraging development.

Sullivan Square has a unique sectional nature which reveals simultaneously numerous modes of transportation: the MBTA Orange Line and Urban Ring intersection, the MBTA Commuter Rail, north and south bound freeway traffic, local street traffic, a bus service and hopefully pedestrian and bicycle commuting. While there is a danger fetishizing this kinetic nature, this dynamism potentially also feeds the experience. The station and accompanying development must frame this unique quality advantageously.

Bridging the I-93 Wall

The urban ring line must not lie to one side of I-93 - this would only serve first to reinforce the present wall-like character of the freeway and secondly would unequitably

favor one community interests over another. The object is to create a bridge between the communities.

Reinforce Sustainable Zoning

The development must happen near to Cambridge Street for the simple fact that this road has come to serve as the boundary for different zoning regions most visibly in Somerville. There is considerable justification for maintaining a light industrial base in this area both as a means to provide much needed blue collar work for the communities residence as well as to animate the space both during the day and in the evening - a 24 hour. character.

Bridging between Scales

One of the concerns is how in a concentrated space to negotiate the extremes of an automotive scale at freeway speed to the human scale of the pedestrian. Much of the potential energy of this programmatic infusion is a direct



consequence of the convergence of all this speed and activity localized in one site. I hope to emphasize this kinetic nature in the architectural setting as well. There is unquestionably a limit to how one goes about intersecting the various modes of transportation so the site will be shaped to offer protection while simultaneously maintaining experiential contact with the surrounding activity.

Assumptions for Construction

The existing conditions of the freeway infrastructure necessitates the urban ring line to come through the site along Cambridge Street. This is presently the main vehicular connector between Charlestown and Somerville so it would seem reasonable to maintain it. Consequently, the decision has been made at this particular node to place the Circle Line below ground. This by no means implies that the line as a whole must be a subway, there are numerous examples of such conditions for other than heavy rail transport, for example, the MBTA Green Line incorporates tunnels in the city for its light rail system.

The tunneling under the road suggests its reconfiguration to reflect the new nature of the Circle Line and should therefore include pedestrian amenities: landscape, a bike path, commercial development. There will also be the opportunity to reconstruct the portion of Cambridge Street which bridges over the existing Orange and Commuter lines. This infrastructure too may be “inhabited” in a capacity which bridges between the north and south sides of Cambridge street.

Formal Articulation

The garage should on the outside have a shape which is smooth and dynamic along its length and in section. This might be dangerous in terms of creating another wall, but at least it bends to the sun and to the highway. Moreover, it will be inhabitable.

The whole complex should read as a whole, an ensemble which in the large scale reads as a transposition of the freeway, smooth, clean curves on a heroic scale. The linearity of the road and the Orange Line should be re-enforced spatially, setting up view corridors down the length giving the station a sense of being connected to the larger urban infrastructure. The structure, on the other hand needs to begin to break down the scale of the automobile and move in a direction perpendicular to the prevailing spatial direction. Articulation of the platforms with material and light under the canopy of an integrated hung ceiling.

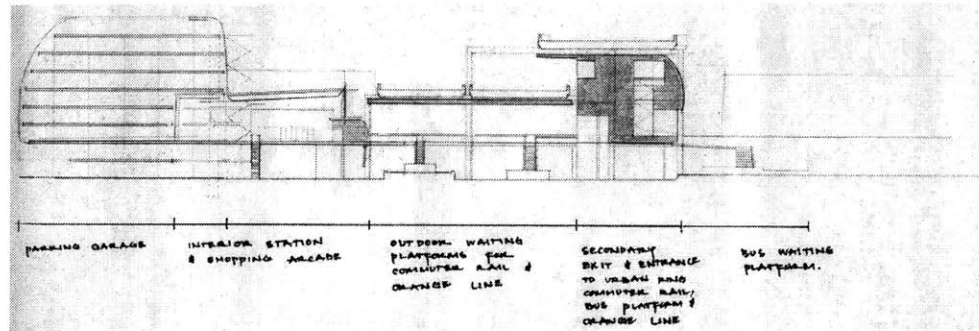
The direction of Cambridge street and of the Circle Line beneath will also see considerable intensification. Perhaps the whole underside of the freeway should be crammed with program, so much so that in addition to being a transfer station it becomes a destination as well. What must be maintained are the views along the tracks, both to give a sense of the activity of arrival and departure but also to not cover up the drama of the highway structure.

Engaging with the Structure of the Freeway

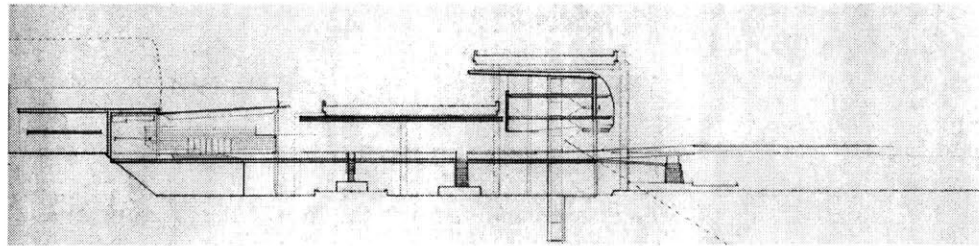
The primary context for this site in the existing superstructure of I-93 which looms above creating a wall,

both visually and physically, between Somerville and neighboring Charlestown. It's dominant presence has only one physical purpose, to facilitate the smooth operation of traffic flow in, around and through Boston. It is imperative to somehow engage tangibly with this underutilized space, to program it with the pedestrian and residual automotive needs which have basically been ignored. The Urban Ring is an attempt to tighten the spread of sprawl to the outer belts of 128 and 495, to maintain a sustainable urban density and activities. The decision to begin on this real estate has a number of consequences:

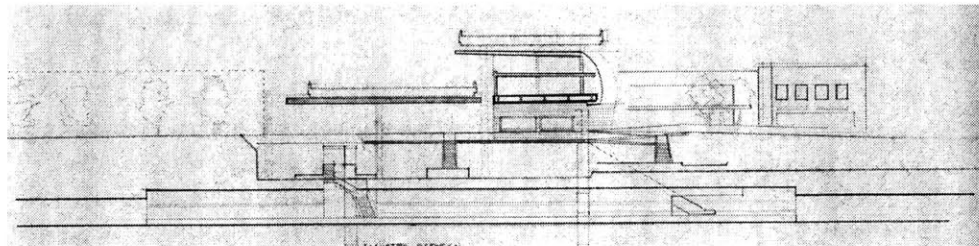
1. it can begin to mediate between the two adjacent communities whose perceived edge is presently the banal wall of the freeway but could instead become a common destination for inner city travel.
2. it re-invests the infrastructure of the freeway with new purpose. The shelter provided by the concrete trays can be transformed into a Pirinesian space which celebrates transportation in a significantly more stimulating way.



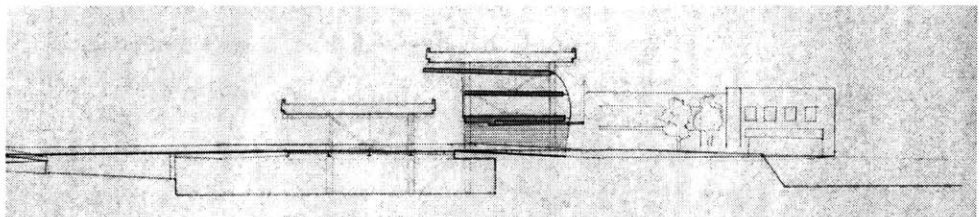
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Appendix B

The Acoustics of Underground Stations

Introduction

As an addendum to my thesis I would like to report some of my findings concerning the acoustics properties and design parameters of urban subway stations, both within stations themselves and the effects of trains running under the city.

The nature of a train's linear configuration and subway line construction below ground, subways will always be long structures built from ferro-concrete. Inside these stations, finishes of other materials are applied which must take into consideration vandalism, weatherability, maintenance and durability. Consequently, most applied surfaces are hard and smooth: tiles, enameled metal panels, concrete, metal panels etc., making these spaces noticeably reverberant.

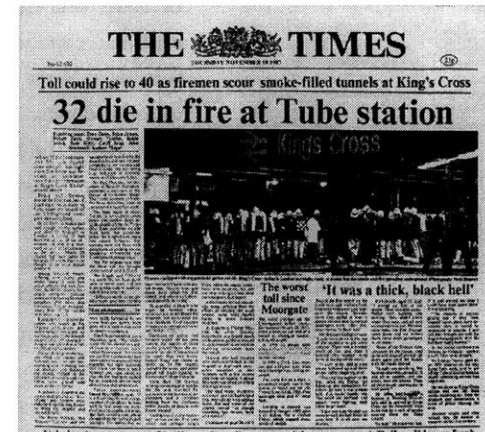
When starting this project I was concerned first for the abatement of the noise of incoming and outgoing trains. I realized however, that there is considerable benefit for the audible recognition of a train's approach before it reaches the station. First, it is expected, and often a welcome rumble if one has been waiting for some time or is simply anxious to move on. Secondly, there is some measure of safety accompanied with the knowledge of the trains' approach: one isn't surprised or startled.

The primary acoustic concern is speech intelligibility on the waiting platform. I recently learned of a tragic event in 1987 at King's Cross Tube Station in the London Underground. A fire broke out on the platform and as a result of the smoke it was not possible to negotiate one's way visually out of the station. The only source of information during this emergency came from loud speaker announcements. Tragically, the inherent high

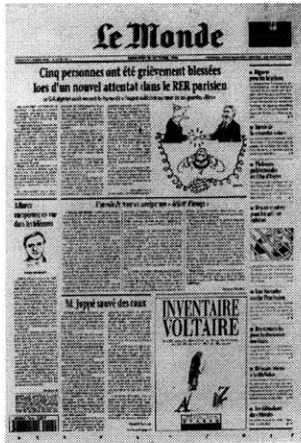
reverberance of the space prevented any hope of intelligibility. One experiences this phenomenon in Boston's own subway system. On a number of occasions I have strained to understand whether an announcement was telling me that a train has been delayed or that I am not permitted to smoke on the platform. Unlike an auditorium or a classroom where one can modify the geometry of the space to ensure that every member of the audience can clearly hear what the speaker says, subway stations have by nature an awkward morphology: a linearly extruded section. The London Underground gets its nick-name "the Tube" from its circular, extruded section, making each station a long cylinder. Many Boston T stations also have curved walls, but typically have flat ceilings. Hence, the solution must come from the intelligent choice of finishes and from electro-audio enhancement.

Speech Intelligibility

According to Parkin, Humphreys and Cowel, speech sounds consist of the flow of various combinations of vowel and consonant sounds. These combinations are woven into a main structure of certain predominant tones (formants) which form the characteristic natural attributes of the person speaking. The major difference between the male and female voice is the pitch of these formants. Consonant sounds are almost always very short and rapidly changing sounds with very little acoustic power, however, it is the correct recognition of consonant sounds which is the principle factor for speech intelligibility. Reflections of the speech sounds which arrive at the listener's ear not later than 35 milliseconds after the arrival of the direct sound tend to re-enforce the speech. However, as in the case of the subway station, if the space is overly reverberant, then the sound of each syllable will be obscured by the still audible previous syllables.



73.01 Front page of the London Times, November 19, 1987, reporting the tragic consequences of a fire in London's King Cross Underground Station.



74.01. Front page of Paris' Le Monde, October 18, 1995, after a terrorist bombing in the Paris Metro.

Initially, one must reduce the ambient noise associated with such spaces. The first step is to attenuate the loudest sounds at their sources. The noise associated with the train wheels' contact with the rails can be reduced by improving the smoothness of the rail, avoiding large expansion joints on the tracks (which causes the familiar clack clack) and adding absorptive ballasts to the track. Additionally, noise in these environments comes from mechanical brakes, impulsive air release from the brake system, door operation, air conditioning and train auxiliary equipment. To address these measures has the effect of reducing ambient noise and thereby potentially reducing the noise to signal ratio, but does not reduce the space's reverberance. There are two means of accomplishing this.

Surface treatment with absorptive materials. One can control the reverberance of the space either through choice of material finishes and modification of the space's geometry. Unfortunately, the form of a typical subway station shall always be a geometric parameter with which to contend. Given the requirements for easy maintenance and vandalism resistance, absorptive treatments can be affectively applied best on the ceiling, along the far wall opposite the waiting platform and underneath the floor of the waiting platform (where the train wheels are in closest contact). This is potentially a significant percentage of the stations surface area. While the application of absorbent materials will certainly reduce the reverberance of the space, one cannot use the standard calculations based on surface area treated because a subway's configuration does not qualify as a sabine space. Sound energy is not distributed evenly throughout the room.

Electro-audio enhancement. The second means of effectively increasing speech intelligibility is to increase the signal to noise ratio of the speaker. If the listener is close to the speaker, then the signal is comparatively strong and the disruption caused by reverberation is less significant. As the listener moves away from the sound source, the strength of the original sound signal reduces by the square of the distance and reverberance will confuse the original signal. One commonly used solution is to place a number of loud speakers along the length of the waiting platform so that at any given point one's distance to a sound source is sufficient to maintain intelligibility. Given this approach one must be careful to prevent overlap of signals. If the confluence of signals all arrive at the listener's ear within the critical 35 milliseconds, they actually reinforce the sound pattern. If, on the other hand, the interval between signals is greater than 100 milliseconds, they will be perceived as discrete echoes and will confuse the intelligibility of the first signal.

The issue of perceived directionality of the sound source, so important in an auditorium is often less important in subways systems. There are incidences, for example in some Berlin U-Bahn Stations, where an attendant makes announcements from a cabin located in the center of the platform. Understanding that this is the source orients one to where potential help or information can be sought. Under such circumstances one needs to consider the Haas effect which simply states that one perceives the source of the sound from the source which one hears first (even if it is not the loudest). Given that orientation is a basic human requirement for comfort, one might consider making this an element in subway design. By incorporating a time

delay along the length of the station one's attention might be directed to an exit. Anything which improves one's sense of orientation, even if quite subtle, might be just the information one needs in an emergency.

Noise from Trains in the Urban Setting

Another acoustic affect resulting from the placement of trains below ground in the city is transmission to the surface above caused by the train rolling through its chamber. A fellow student who lives in a Massachusetts Avenue apartment not far from Porter Square, has commented that regularly during the day a deep low rumbling can be heard (even felt) through the apartment as the Red Line passes below. When a train moves along a track the interaction between the wheels and the rails excites both the vehicle itself and the track and support structure setting them into vibration. This vibration if not addressed can pass through the foundation to neighboring foundations and result in this type of acoustic effect. While researching this topic I found an interesting example where this problem was tackled by the Swedish government. The group carried out a number of measures to minimize the acoustic impact of the intersection of new large scaled housing developments over existing train transportation.

Several tests were conducted to determine the maximum tolerable noise level from trains passing below. Data from a number of testers was compiled to produce a maximum threshold of 30 dB. The sound expected to enter the new housing units without any measures taken was anticipated to be as high as 50 to 55 dB(A). Clearly, it was necessary to attack this problem on a number of different fronts.

The first intervention was to place the trains on a thick ballast mat. Below the ballast material, on which the sleepers with rails are carried, there is a 40 mm thick rubber ballast mat with vibration isolation properties. Rail ballast and mat are laid on a concrete trough with a base thickness of 700 mm (the addition of mass changes the frequency of vibration). The system has a resonant frequency of 20 Hz and thus acts as an isolation from frequencies of about 30 Hz up.

Secondly, the concrete decking which bridges the track area and carries the buildings above is supported by the foundation walls via vibration isolators (multi-layer, elastometric springs). Without this protection sound would be carried through the foundation straight to the apartments above.

Additionally, the roof of the tunnel is clad with mineral wool which from an acoustic standpoint dampens airborne sound in the tunnel and to provide a measure of insulation decreasing the amount of sound which penetrates into the houses above.

There are number of factors which influence groundborne noise levels. One could have also insisted that trains pass more slowly under the housing. Finally, there are parameters such as axel load, carbody suspension, resilient wheels and tunnel construction which can be modified.



75.01. Front page of The New York Times, March 21, 1995, with a headline about the poison gas assault on Tokyo's transit system.⁷



Appendix C

The Promiscuity of Helvetica

Few fonts in the twentieth century have achieved such overwhelming use as Haas Grotesk, more commonly referred to as Helvetica, the standard barer of mid-century Swiss typography. Helvetica's clean lines and harmonious unadorned proportions have been appreciated by designers for decades. Many of the modernist ideas which influenced mid-century design in architecture were in mind in the creation of this typeface: stripping ornamentation to the absolute minimum so as to democratize its use. But like most addictions there are side affects which could never have been foreseen at the beginning. Given that Helvetica is the default font for many influential word processing applications one can be assured that well into the next century we will all be Helvetica junkies.

But what precisely is the downside to an over reliance on something as innocuous as a sans serif? I have often been

asked why such an anonymous, indeed practically invisible, typeface should have so provoked my attention. It is precisely the fact that most often no thought goes into the choice of this font and consequently it is overused and has lost its capacity to further an identity. Precisely because it has disappeared into a morass of undifferentiated use: from the sacred to the profane and everywhere in between. I was quite surprised to discover even Rem Koolhaas has an opinion on this matter:

*"The city used to be the greatest sexual hunting ground. The Generic City is like a dating agency: it efficiently matches supply and demand. Orgasm instead of agony: there is progress. The most obscene possibilities are announced in the cleanest typography: Helvetica has become pornographic"*¹

In 1965 the decision was made to make Helvetica Medium the typographic face of the Massachusetts Bay

Transportation Authority, a decision which at the time was undoubtedly founded on much of the mythological associations still attributed to Helvetica: its uncompromising legibility, its clarity and unadorned simplicity as representative of a "progressive democratic modern age." Helvetica at the time was in its vogue and a natural choice. Indeed, it was an enlightened decision by the MBTA to formalize the graphic standards and to insist that all aspects of the Authority be graphically consistent:

*"The Authority's standard alphabet, called Helvetica Medium, has been chosen for maximum legibility as all sizes and availability in many media. Since the consistent use of one alphabet on all signs, maps and printed matter contributes substantially to the Authority's visual unity, no other alphabet should be substituted however similar it may appear to be."*²

In the time since these formal guidelines were constructed the industries which manufacture signage and letterforms used in these applications have slowly (perhaps unintentionally) generated a number of Helvetica variants. The original typeface has been copied numerous times for commercial purposes resulting in subtle variations between different manufactures - Helvetica Medium is for all practical purposes several different fonts. Moreover, with the advent of computer technologies, type which formerly would not have fit in a space can be linearly scaled (horizontally or vertically) with drastic consequences to the integrity of the original face. Helvetica has fallen victim to this sort of pushing and pulling perhaps more than any other font simply because it has been demanded to perform in so many applications.

In the three decades since Cambridge Seven drafted the MBTA's Graphic Guidelines and Statement of Purpose,

1. Koolhaas, Rem, **S, M, L, XL**, © 1995 Rem Koolhaas and the Monacelli Press, Inc. p. 1264

2. **Manual of Guidelines and Standards for the Massachusetts Bay Transportation Authority, Volume 5, Graphics**, © 1966, Cambridge Seven Associate, Inc., Consultant Architects., p. V.C1.0

the “visual unity” of the MBTA has to fallen victim to as many years of Helvetica variations. Indeed, the original intentions of carrying the MBTA’s identity with the help of this sans serif are no longer possible. Perhaps this is the reason the MBTA has apparently abandoned Helvetica and with it its statement of purpose*.

The Capacity for a Font to Establish an Identity

In principle, the adoption of Helvetica for a system wide identification package is not a bad idea, rather one which has been subverted because of the admittedly very difficult task of quality control. The MBTA should not abandon its commitment to a coherent graphic identity but might consider instead the design of its own unique typeface which it would then have the capacity to strictly control.

The policy I am advocating is not without precedent. Numerous very successful typefaces have been developed over this century to address the needs of a signage system and the requirements of a unified system design. Adrian Frutiger developed ‘Frutiger’ for the Paris Poissy Airport. Frutiger’s ‘Univers 55’ was adopted by the Paris Metro. The contemporary type designer, Erik Spiekermann, developed Meta in 1985 for the Deutscher Post which also suffered from the same Helvetica difficulties plaguing the MBTA. After the fall of the Berlin Wall the East and West Berliner U-Bahn required a new consistent signage system. Spiekermann customized a new Frutiger typeface just for the Berlin system giving unity of identity to the disparate systems which had evolved since 1962.

Perhaps the best example for success of a unified design approach based around a fundamental typeface is the London Underground. London’s “Tube” is one of the world’s largest urban railways with 284 miles of route covering an area of 630 square miles from 273 stations and is one of the best recognized. The system itself has evolved over 130 years and has to its credit managed to restrain itself within clear and well recognizable standards of design and legibility.

This process of developing a distinctive “house style” was initiated very early in this century by the Underground Group (formed in 1902). In the ten years after its inception it had taken over control of the District Railway, most of the tube system, three train companies and the biggest bus operator. The typeface of the London Underground, *Johnston Typeface*, was originally created at the behest of Frank Pick, a visionary who believed that all aspects of the transportation system should be functional, ordered and harmonious. Pick asked the calligrapher Edward Johnston to develop a typeface for display purposes in 1916. After 1919 the face spread throughout the system and only a small number of approved printers were used resulting in system wide consistency until 1979. At this juncture London Transport (a consolidation of the Underground and the Bus System) undertook a complete review of all its publicity with the help of the firm Banks and Miles. Colin Banks modified Johnston Typeface to include more diversity (a bold and a light version) and made it into a font. Throughout this century the same commitment to consistency and quality design has made the London Tube system the most recognized and easiest to use subway systems in the world.

* There appears to have been an abandonment of the graphic coordination throughout the system. Current “T” passes, signage in the stations, the identity of the busses within the system all use a different design language which sadly is increasing the faddish language of commercial advertisement. Presently, for ten thousand dollars you can completely cover a bus (windows included) with your message - erasing completely any sense of the civic identity which this fundamental unit of infrastructure must preserve.

Given the success of this commitment to clarity of information design and the capacity of a typeface to legitimately help carry the unity of identity I endeavored to create a font for the MBTA. I have purposely placed it as an appendix as it is not yet finished. Its design was derived from a close study of a number of influential twentieth century sans serifs, their proportions, ratios of thick and thin strokes and kerning pairs. A number of these fonts are presented on the following pages.

The prototype which I have included in this document is not yet suitable for use (there is neither a bold nor an italic version, moreover, it has not yet been kerned properly). Many of the letterforms require further modifications. There is, however, a sufficient amount completed to allow me to discuss the principles I have been using to generate the alphabet.

The sans serif is being designed with the intention of use in signage. I have consequently opted for letter forms which have a restrained playfulness to them. For example, the curved finish on the lower case 'l' and the exaggerated stem of the 'g'. Legibility is always of primary concerns in transportation settings and studies have shown that a typeface is most legible when it has differentiation amongst its letters. In response I have begun to exaggerate the ratio between thick and thin strokes (for a sans serif) much like Syntax or Optima. This is clearest in the tapered the bowls and curves of the b, d, h, m, n, p, q, and u.

ABCDEFGHIJKLMNOPQRSTUVWXYZ
 abcdefghijklmnopqrst
 uvwxyz
 1234567890 & £

The image shows a page from a London Underground Journey Planner. It features a grid of station names under the heading 'Index to stations'. To the right, there is a section titled 'Journey planner' with the London Underground logo and contact information. Below that is a large graphic of a £10 note with the text 'Don't forget to pay up front... and avoid a £10 Penalty Fare.' The page is densely packed with text and small icons, typical of a transit guide.

36 pt Frutiger

abcdefghijklmnopqrstuvwxyz

36 pt Futura

abcdefghijklmnopqrstuvwxyz

36 pt Helvetica

abcdefghijklmnopqrstuvwxyz

80

36 pt Meta

abcdefghijklmnopqrstuvwxyz

36 pt Syntax

abcdefghijklmnopqrstuvwxyz

36 pt Univers 55

abcdefghijklmnopqrstuvwxyz

36 pt MBTA prototype

abcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUVWXYZ

ABCDEFGHIJKLMNOPQRSTUVWXYZ

ABCDEFGHIJKLMNOPQRSTUVWXYZ

ABCDEFGHIJKLMNOPQRSTUVWXYZ

ABCDEFGHIJKLMNOPQRSTUVWXYZ

ABCDEFGHIJKLMNOPQRSTUVWXYZ

ABCDEFGHIJKLMNOPQRSTUVWXYZ

The upper and lower case for a prototype font for the Massachusetts Bay Transportation Authority. The letters have been monospaced simply because the kerning is not yet correct.

A B C D E F G
H I J K L M N
O P Q R S T U
V W X Y Z

a b c d e f g

h i j k l m n

o p q r s t u

v w x y z

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