

RICE UNIVERSITY

**High Speed Suburbanism:  
Developing Transit Infrastructures in a  
Disconnected Metropolis**

by

**John Riddle McWilliams Jr.**

A THESIS SUBMITTED  
IN PARTIAL FULFILLMENT OF THE  
REQUIREMENTS FOR THE DEGREE

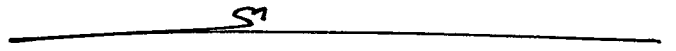
**Master of Architecture**

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## **ABSTRACT**

**High Speed Suburbanism:  
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The current interest in developing mobility alternatives such as high-speed rail and commuter rail systems in our auto dominated American regions poses new possibilities to reimagine our sprawling, disconnected, suburban landscapes. Since the patterns of development that automobile infrastructures have produced over the last century radically differ from the urbanisms that traditional rail systems once served, the integration of new transit systems into this contemporary context has potential for radical innovation.

This thesis examines the impact of new modalities within our suburban environments and problematizes the monofunctionality of a ground plane fully dominated by the automobile. Through a multilayered fabric of mobility infrastructures, garden dwellings, retail strips, working units, and public outdoor spaces, this proposal condenses and reorganizes the suburban landscape into a field condition transit development with emerging nodes of connectivity to the ground, rail, and city landscape.

## ACKNOWLEDGMENTS

I first and foremost want to thank my mom, dad, grandmother, and sisters for always believing in me and being there for me on my seemingly endless pursuit of a college education. They might not have always known what I was doing in school, but they supported me regardless. I thank them for that.

I want to thank my director, Albert Pope, for his brilliant guidance and ability to see clearly that which is in front of him. His support and continual patience with me through my unnecessary struggles was invaluable.

I want to thank Eva for her ceaseless energy. I need to eat what she's eating.

I want to thank Steve Luoni and Aaron Gabriel for giving me the determination to explore new horizons. I am where I am because of you two.

I want to thank David and Alberto for their love of life and child-like fascination with everything in this world. I am envious of their excitement.

I especially want to thank my roommate and friend, Jonathan LaRocca. His conversations, intelligence, and outstanding abilities are inspiring. This project would not have come together in the end without his generous support.

And lastly, I want to thank Meredith. Her loving encouragement and steadfastness to survive not only her own thesis work but all the ups and downs of my own has made her the most wonderful of companions.

Thank you all.

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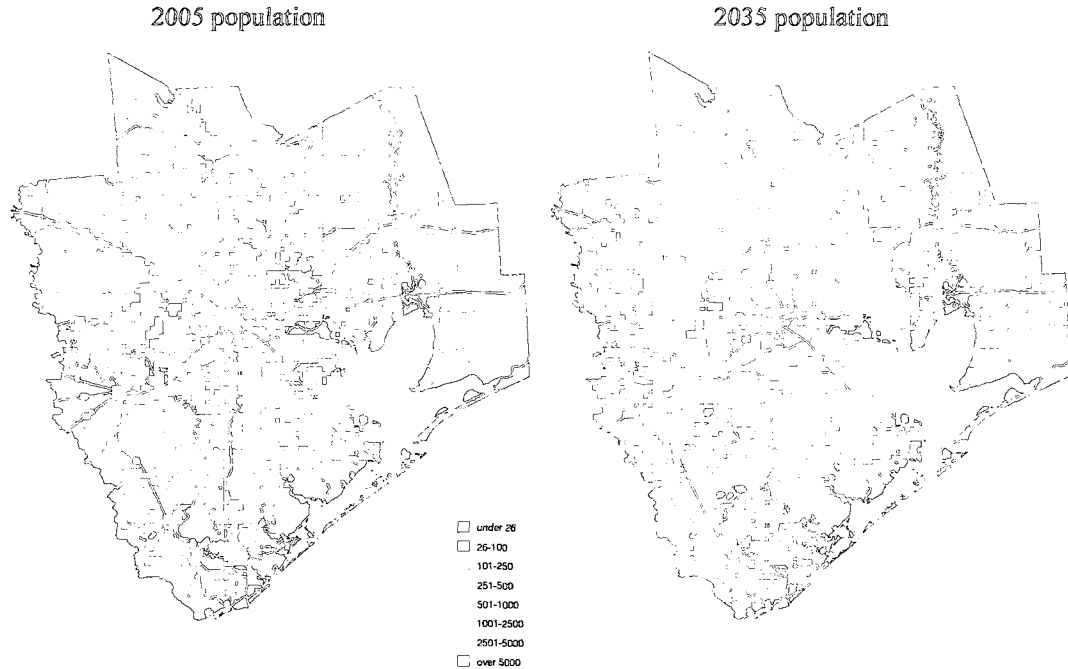
## **1. Houston: A Uni-Modal Metropolis**

The primacy of the automobile as the only means of metropolitan transportation in most American cities has created such vast scales of distance that to travel by any other means is essentially impossible. Likewise, the speed and convenience of automobility has propagated the sprawling, low-dense patterns of development that have characterized our suburban landscapes. As our cities continue to grow outwards and our infrastructures stretch thin, we have been forced to reconsider this method of developing our cities. The current interest in developing alternative forms of mass transportation provide an opportunity to rethink not only the way we move about but also the way in which we live and work along these fundamental infrastructural systems.

Houston, Texas, the fourth largest city in the U.S., is a suburban region sprawling well over the 601.7 sq mile city limit to engulfing over 5 million people and a land area over 12,000 square miles. Having emphasized the automobile for the last century as the sole means of transportation, Houston has continually spread outwards at extremely low densities, building up an enormously stretched urban fabric of freeways and parking lots to accommodate the tremendous amount of drivers. 739.3 miles of freeways and expressways have been built to help facilitate the movement of the 71.7% of the population that drives alone to work.\*

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\* "Census and You" (pdf). US Census Bureau. January 1996. pp. 12. <http://www.census.gov/prod/1/gen/pio/cay961a2.pdf>. Retrieved 2007-02-19.

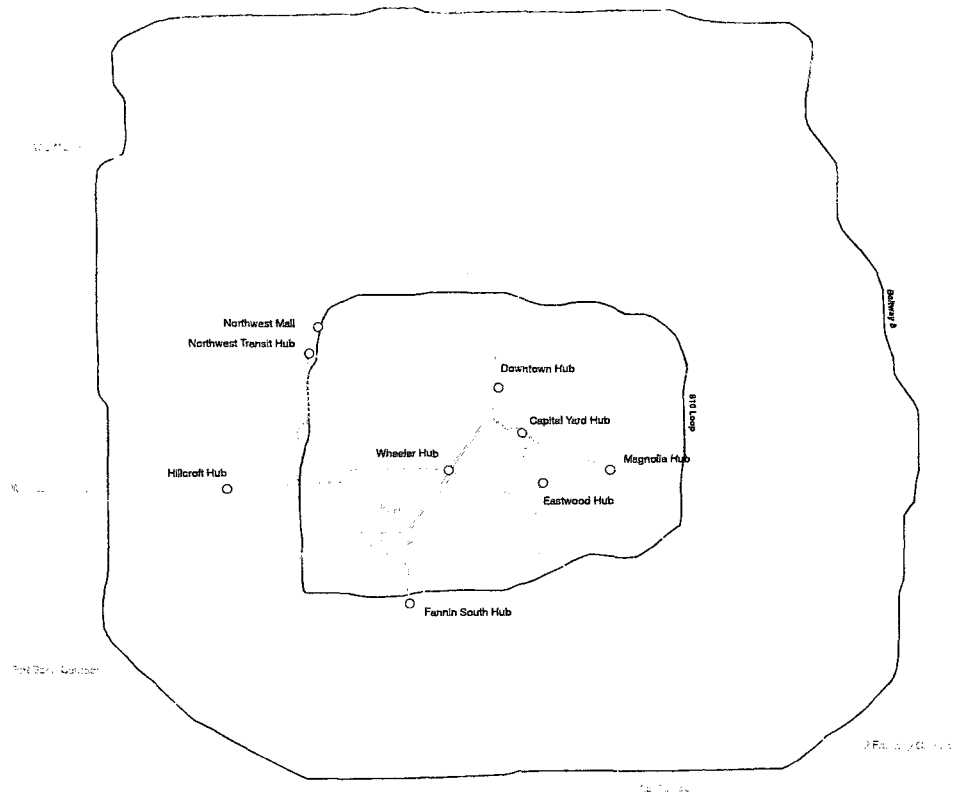


How will 3.5 million more people commute? These two maps represent population per square mile of the Houston region in 2005 and where that population is predicting to grow by 2035.

With a freeway system that is already congested, the challenge for the future of Houston is in figuring out how to maintain a functional transit system when the city is expecting a population growth of over 3.5 million people in the next 25 years. Houston's population is predicted to increase by 2035 from 5,297,000 to 8,835,000 people. This implies an increase of 1,400,000 new households, 1.1 billion square feet of new job space, plus stores, schools, civic services, roads, parking, and other constructions.\* While Houston prides itself on its no-zoning laws, its anti-regulation of industry, anti-planning, anti-taxes, anti-anything, etc.---all intended to encourage a landscape for business (primarily the oil industry) and the economy to thrive---its planning authorities are beginning to consider the impact that its past development practices will have on the viability of the city's economic and environmental future.

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\* Houston Tomorrow. "Houston 2035". p 1.



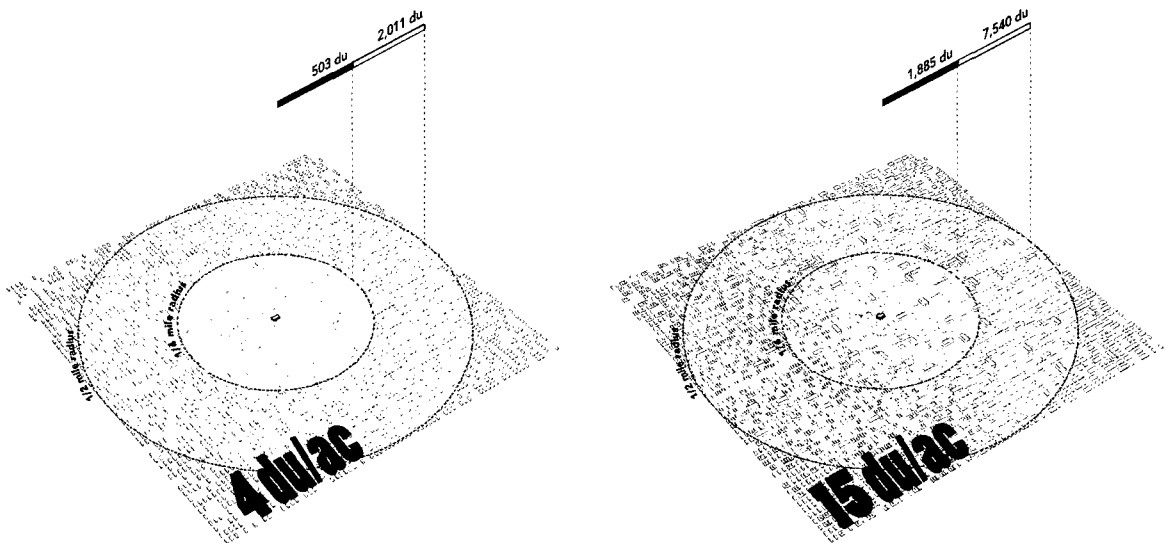
Houston's potential transit map for 2050. As of 2010, only a 7.5 mile light rail line has been constructed.

The Houston Transit Authority (METRO) is planning to expand its current 7.5 mile light rail line (which is the busiest light rail line in the country in terms of riders per mile) into a metropolitan network of commuter rail transit.

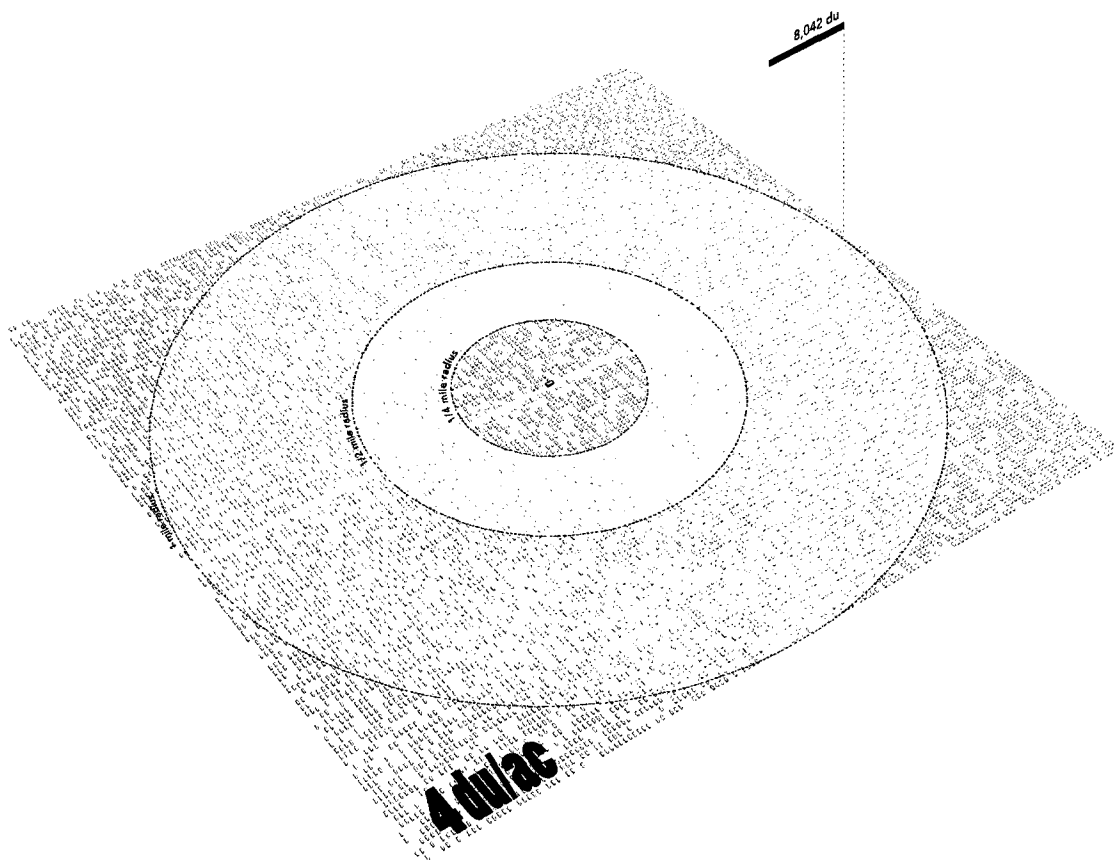
By 2035, METRO claims that Houston could have a fully functioning commuter rail network and by 2050 the possibility of a megaregional high speed rail connection to San Antonio, Austin, and Dallas.



However, the low-density patterns of development that Houston has been built upon complicate the feasibility of these types of rail systems. According to the Urban Land Institute's 2004 publication *Developing Around Transit*, the required density for light rail is 9 dwelling units per acre along a 40-150 sq mile corridor, while heavy rail (commuter rail) would need a density of 15 dwelling units per acre along a 150-200 sq mile corridor. These numbers assure a significant number of the potential riders live within a quarter mile walkable radius of a transit stop which is the acceptable 5 minute walking distance of a pedestrian. With typical suburban densities around 4 dwelling units per acre or lower, Houston's built fabric is nowhere near these required densities.



15 dwelling units per acre (du/ac) is required to support commuter rail services. At 4 dwelling units per acre (du/ac), the suburban fabric is not dense enough to support rail services.



At 4 dwelling units per acre (du/ac), a station must service a much larger area of land to generate sufficient ridership.

Too small of a percentage of the population thus lives within a walkable distance to a particular transit stop to make commuting by rail a convenient option. Either the patterns of development must change to denser environments or the stations must be able to pull in extra ridership from outside a walkable distance through secondary transit systems. A combination of these two strategies is the more likely solution.

## 2. Transport Fabrics

*“[T]he essential purpose of transportation is to bring people or goods to places where they are needed, and to concentrate the greatest variety of goods and people within a limited area, in order to widen the possibility of choice without making it necessary to travel.”\**

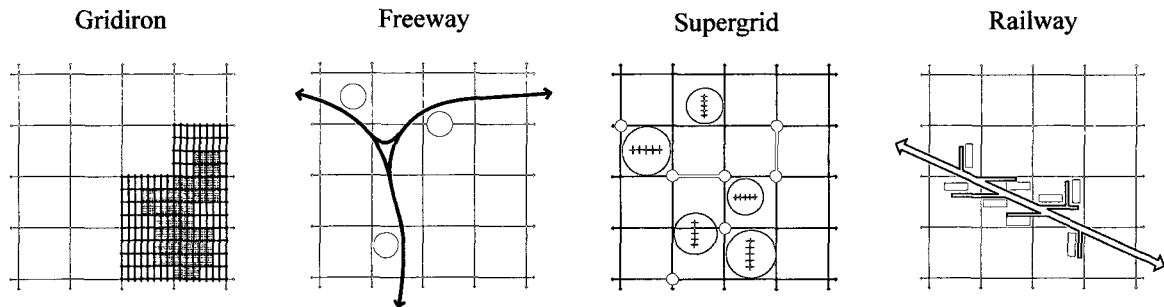
*- Lewis Mumford*

There are four primary fabrics for transportation infrastructures in Houston, two local and two metropolitan in scale. These are the gridiron, the superblock, the freeway, and the rail infrastructures. It is upon these infrastructures that Houston has developed.

The gridiron and superblock service the local-scaled environment through their ubiquitous application of an open gridded field. The gridiron is a traditional, non-hierarchical urban fabric with a compact, highly connected street pattern forming small blocks which can be easily traversed by pedestrians. The superblock is a modern typology with larger block sizes for higher speed movement along a larger grid spacing and closed subdivisions of lower speed movement within each interior block. Thus, this typology has a hierarchy of movement from the open supergrid to the closed enclaves within the grid.

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\* *The Urban Prospect*. New York: Harcourt, Brace & World, Inc., 1968. p 94.



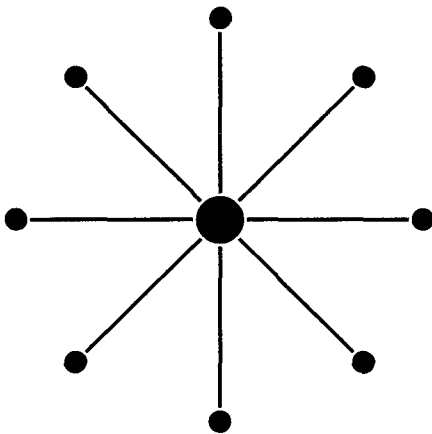
### Houston's Transportation Fabrics

The freeway and rail are metropolitan-scaled networks connecting various areas across the region. As systems, both have the ability to function separately from the gridded networks. The freeways allow jump-cuts in the local grids to enable more fluid movement over longer distances. Through their disconnection and subsequent isolation of a continuous unintersected circuit, the freeways become efficient conduits for high-speed movement. Developments happen as isolated points along these vectors of movement and are typically larger in scale to accommodate the volume of traffic flow that these nodes address.

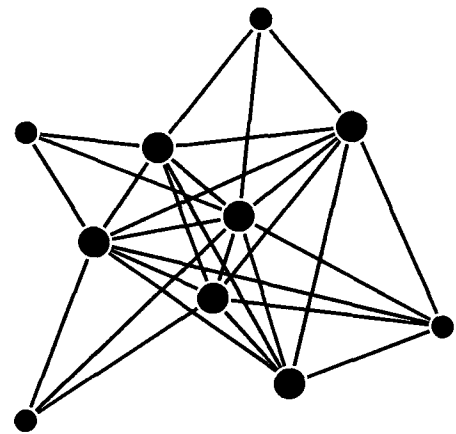
The rail infrastructures, like the freeways, function independently of the local street grids for more fluid movement, but due in part to the trains' highly limited mobility on a fixed rail system the infrastructure requires numerous sidings and offshoots to maintain fluid movement along the system. However, these necessary extensions of the infrastructure enhance the rail network's connection to the local fabrics enabling it as an infrastructure to bridge the metropolitan and local scales.

### 3. Regional Transit Opportunities

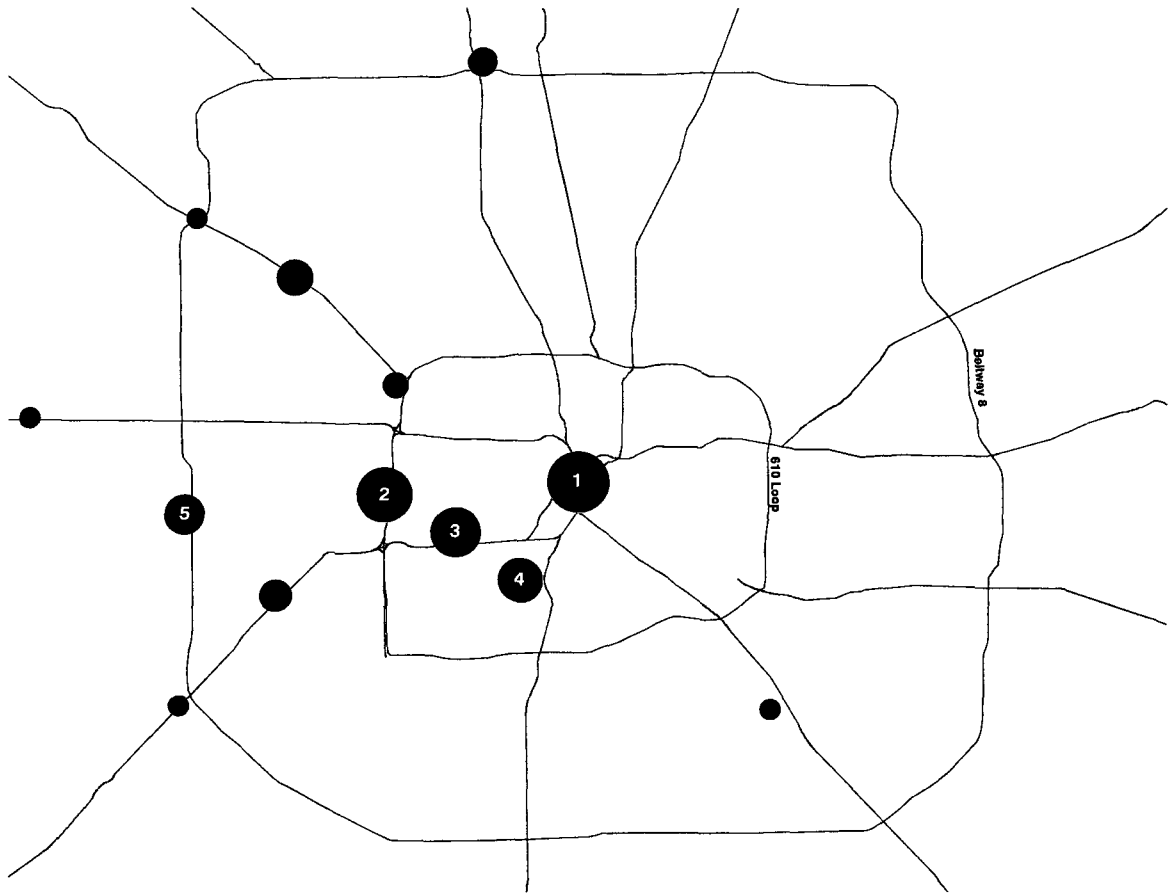
Since the post-war period, American transportation policy has singularly promoted infrastructures for the automobile. In Houston, these infrastructures have developed along the wheel-and-spoke model with multiple freeways converging at a central core and a series of concentric ring roads cross connecting the freeways. This form of development emphasizes a strong center which is then supported by peripheral suburbs. Throughout the last century, however, this traditional model has morphed into a more polycentric sprawl with multiple non-central areas competing with the traditional downtown for importance. Uptown/Galleria, Greenway Plaza, and the Medical Center were all once suburban developments in Houston which have grown into centers with more jobs than downtown San Diego, Miami or San Antonio.



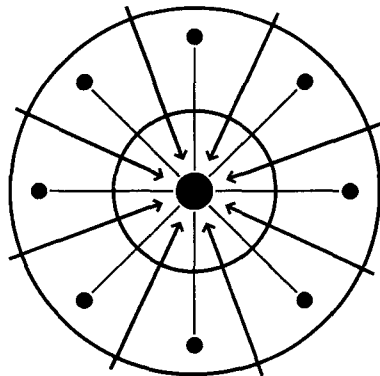
How the Region is Modeled



How the Region Develops

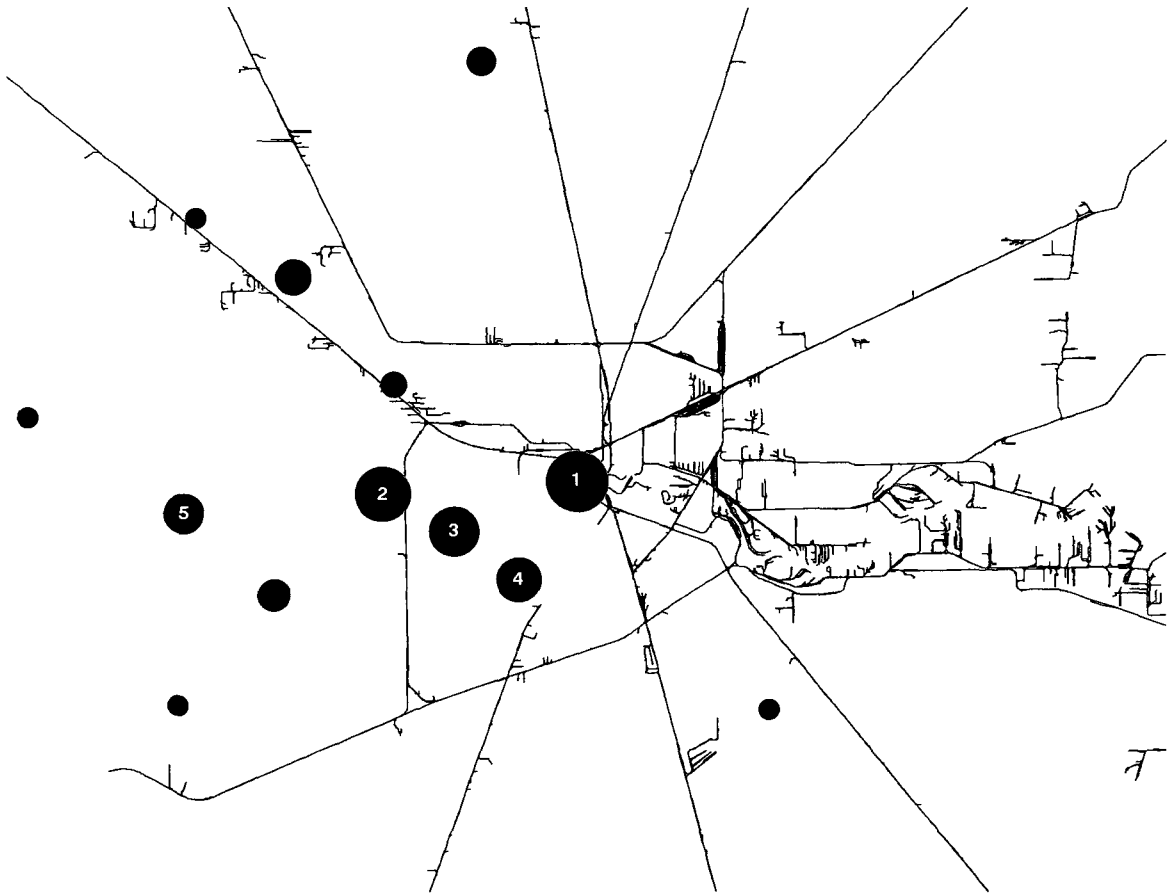


Freeways to Job Centers



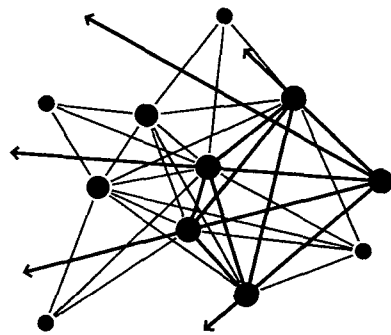
Monocentric Freeway Development Reinforces a Weakened Center

While Houston's job centers are dispersed around the region, the freeway network continues to develop along the monocentric model. All the freeways converge around downtown yet only 20-30% of the jobs are clustered in this part of the region. This disconnect between the infrastructural form and the major centers decreases the efficiency of the system and creates congestion.

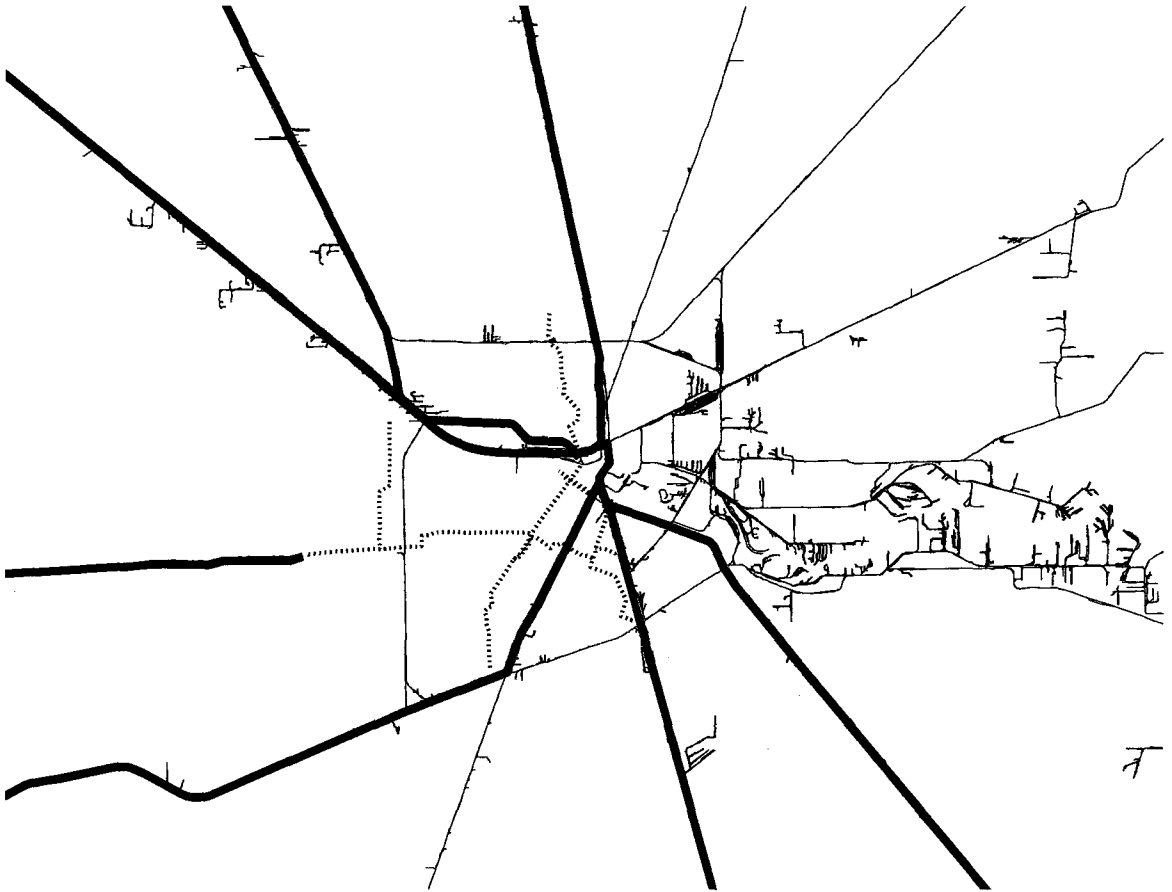


Railways to Job Centers

Rail infrastructures offer an alternative model to the centralized freeway system. In Houston, the rail network takes on an asymmetrical organization densest on the east side of the city due to the port facilities and extends from east to west connecting multiple industrial facilities across the region. Since these rail infrastructures were developed for a decentralized industrial model, the network is a non-hierarchical one more applicable to a dispersed region.



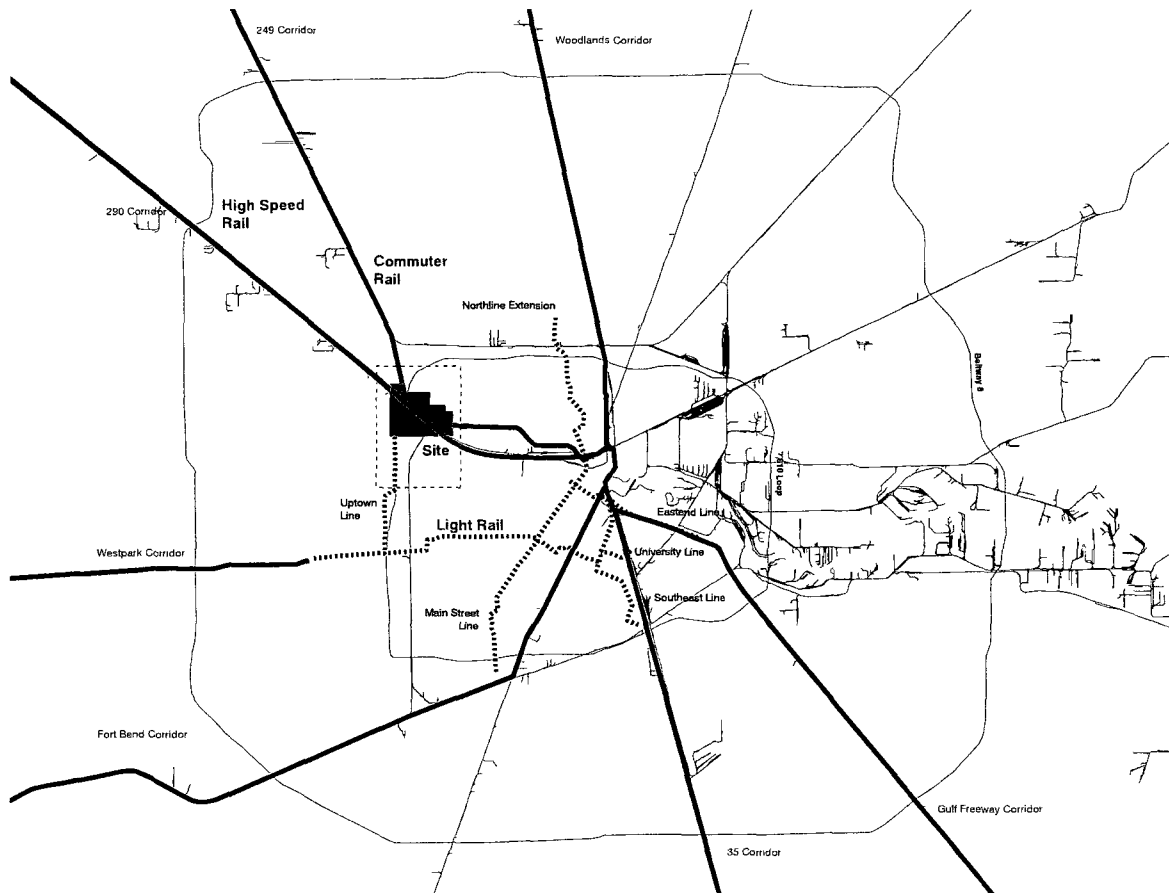
Polycentric Railway Networks  
Flow East (Port) to West (Factory)  
Non-Heirarchically



Converting existing freight tracks into commuter rail corridors (shown with heavy lines) creates an enormous market for the redevelopment of industrial land (shown in light pink).

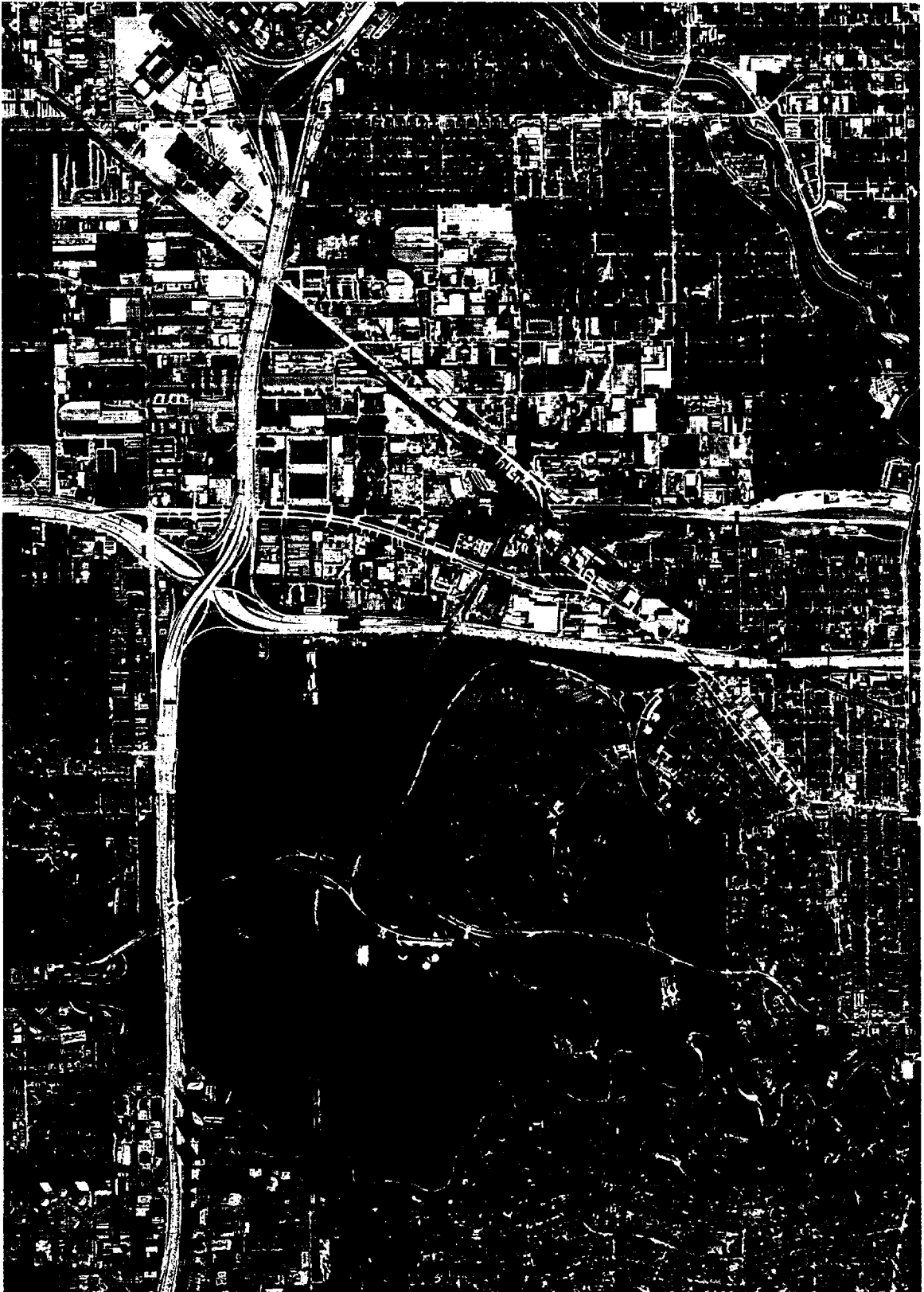
While these tracks are used primarily for freight, Houston's commuter rail network lies along these lines as these existing right-of-ways will be upgraded and expanded to accommodate the new mode of transit. This implies the future redevelopment of many of the industrial sites along these lines both out of necessity to provide the option of dense walkable neighborhoods within proximity to the rail stops and also to capitalize on the rail economy that the new infrastructure will bring to land values along these corridors.





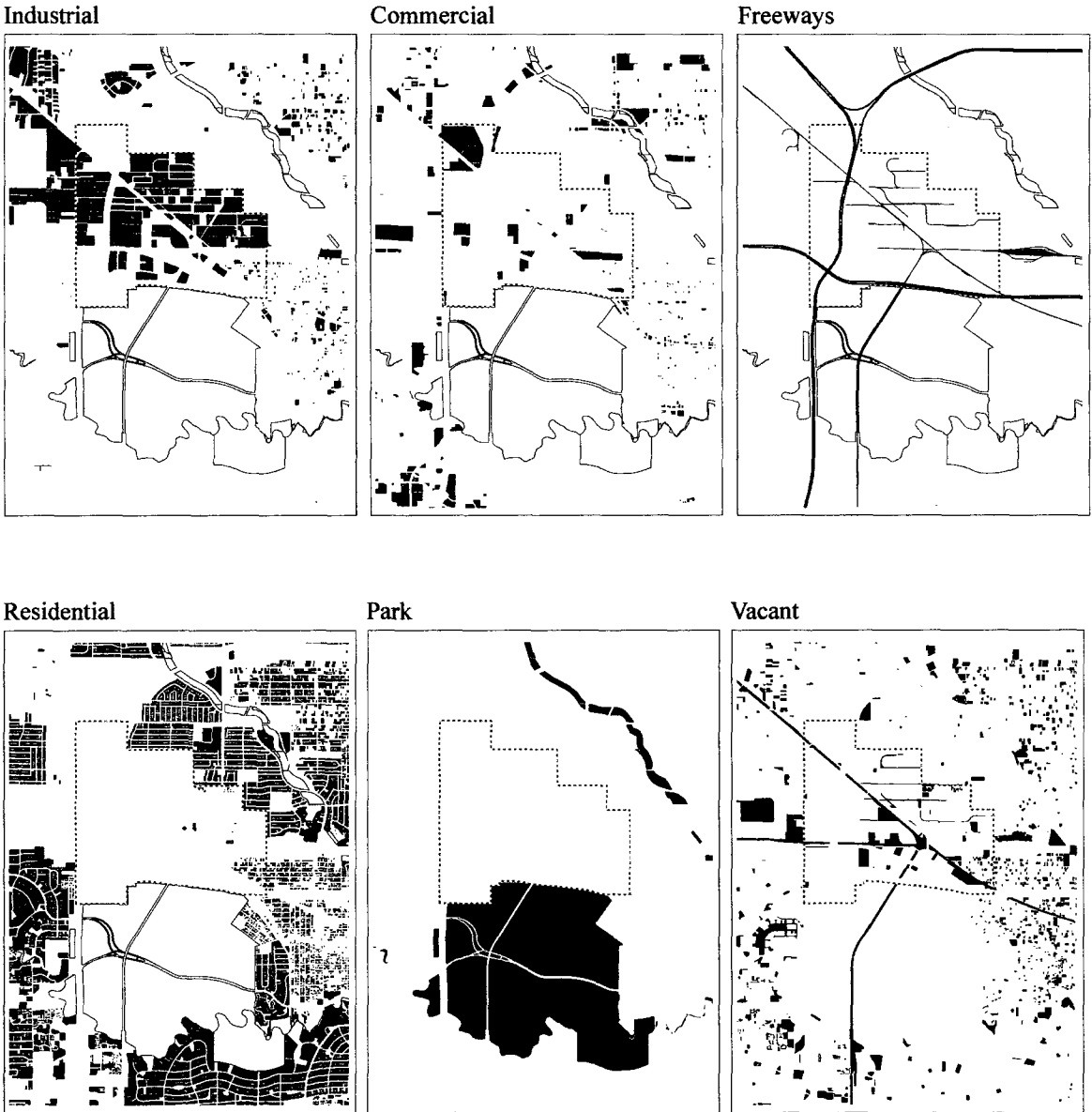
Site location.

As a site for development, I have taken a 1,300 acre piece of land along the 290 rail corridor on the northwest edge of Loop 610. The site is primarily industrial around the existing freight line, surrounded by low-density residential fabric, the Northwest Mall, two freeways with no direct connections to the site, and it is directly north of Memorial Park, the largest park in Houston at 1,500 acres. Furthermore, the site has been considered by the Houston-Galveston Area Council (H-GAC) to be the location of a primary hub site because of the likelihood of commuter rail along U.S. Route 290, high speed rail, light rail, as well as the existing Northwest Transit Bus Center coming together in this location.



Site: 1,300 acres of mostly industrial land, highly connected to multiple modalities, proximate to prime metropolitan park space, and adjacent to a large shopping mall.

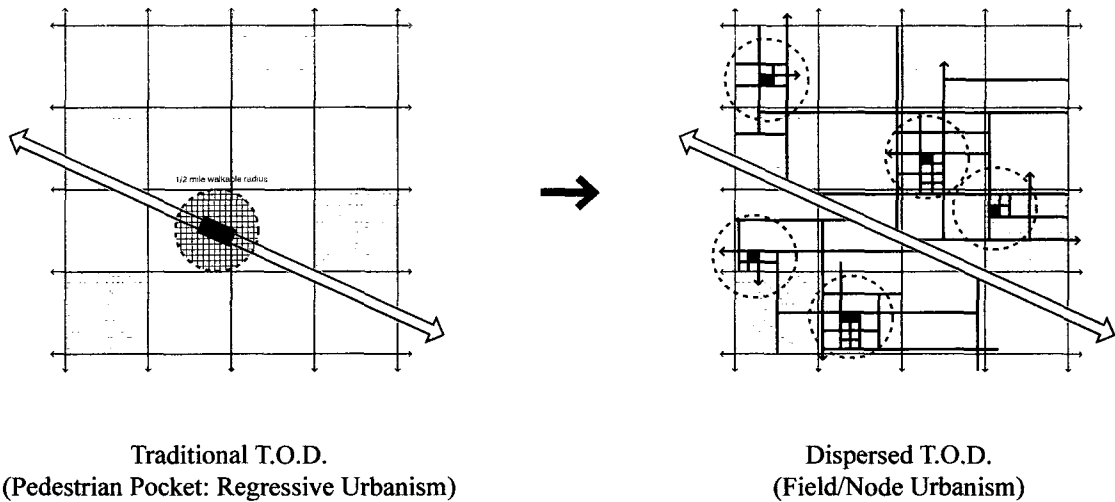
An analysis of the land use at the site reveals the potential for a large-scale redevelopment of the industrial land surrounding the rail lines. Memorial Park could then extend north as a ground for developing a residential fabric that would allow 20,000 dwelling units within proximity of a new transit hub connecting workers to the nearby Uptown/ Galleria and Downtown job centers, as well as having immediate access to the natural environments of Memorial Park's forests, bayou and necessary open spaces.



#### **4. A Field/Node Urbanism**

As a strategy to develop the mega-scaled suburban transit site, the project needed a framework that could cohesively link the metropolitan rail fabric with localized residential and job clusters and still maintain large pieces of land for open space and recreation. This framework would be a hybrid of the traditional street grid in its unbounded, unheirarchical field with the heirarchical, closed order of the superblock enclave development. Stemming from the linear transit spine bifurcating the site, a new supergrid infrastructure would give the site overall coherence and contextual linkages while also allowing for emerging moments of denser, pedestrian neighborhood nodes that could adapt to a variety of modalities. The field/node urbanism thus sets up a framework that is open and unbounded, yet heirarchical to enable the presence of localized, neighborhood developments.

As opposed to traditional, regressive transit oriented development scheme which would focus primarily on the pedestrian-oriented enclave to support transit ridership (purposefully alienating the automobile from its environment), the field/node urbanism operates within the dispersed logic of its auto-oriented context. By dispersing the development across a new fabric of infrastructure, the field/node urbanism can accommodate both the pedestrian and automobile, knitting these two scales of movement together for the redevelopment of an integrated urbanity in an otherwise disconnected field.



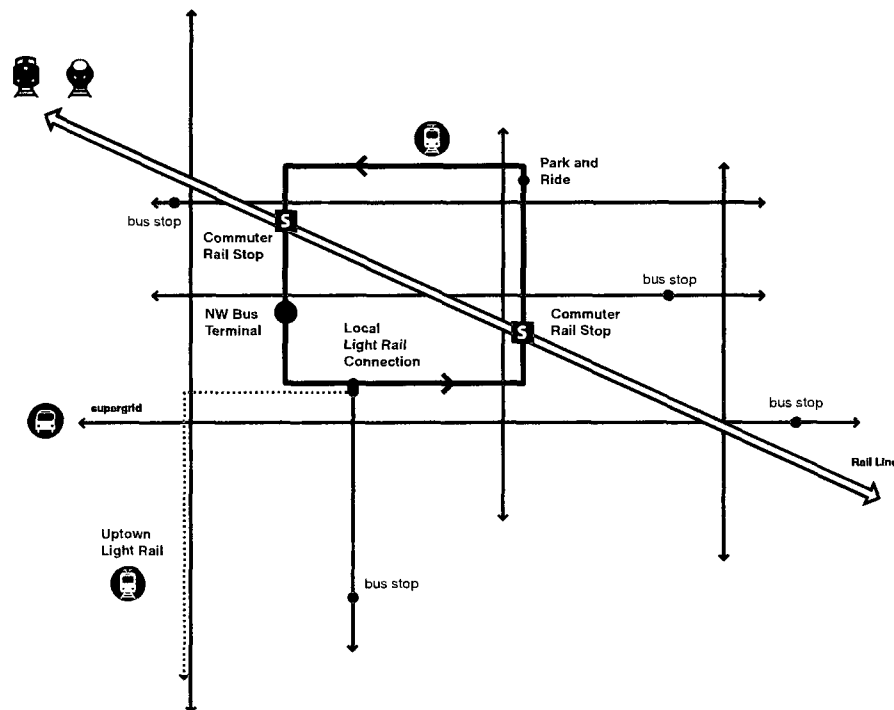
At the metropolitan scale, this field/node transit urbanism would lead to the polynuclear growth of the city inward along the rail lines. As each rail stop expands into a dispersed field of residences, jobs, and open spaces, Houston's porous built fabric would slowly become infilled with localized networks of transit-oriented growth. Over time, a dual metropolitan transportation system supported by both freeway and rail transit would mature such that all residences in the city have a range of mobility options from which to choose.



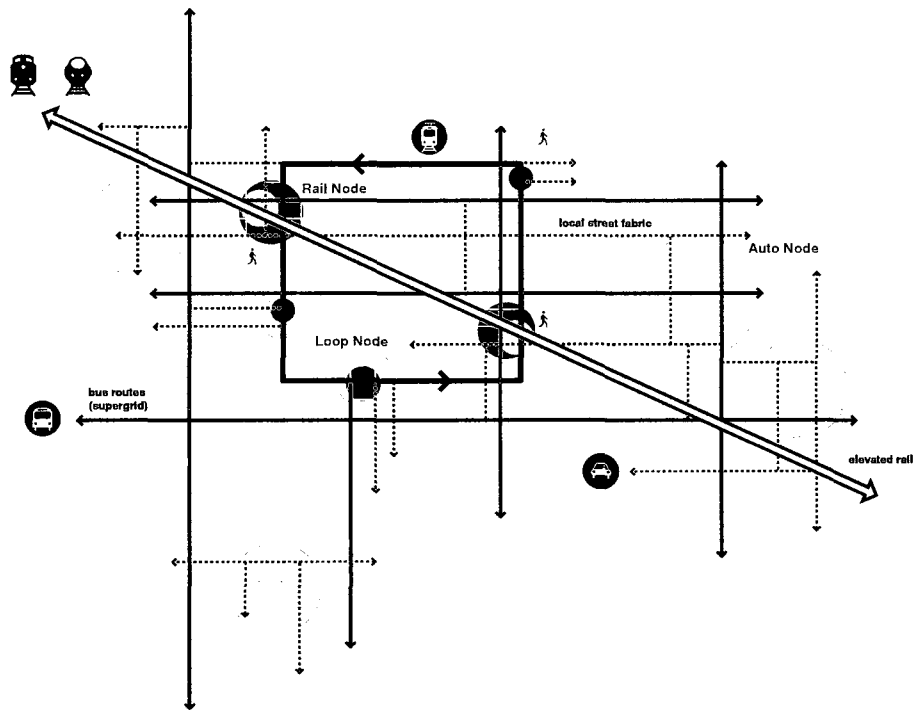
Stemming from the linear transit spine bifurcating the site, a new supergrid infrastructure would give the site overall coherence and contextual linkages while also allowing for emerging moments of denser, pedestrian neighborhood nodes that could adapt to a variety of modalities.

## 5. Field Station

Within the field/node urbanism of the rail stop, the transit station becomes dispersed onto a field of hierarchically ordered transit infrastructures which I call the *field station*. The field station is a decentralization of the transit facilities away from a single rail location to a network of station facilities both on and off the rail. Commuter rail platforms are at one location, a bus terminal at another; parking garages can be broken down and spread to multiple points such that no single area is overly congested during the intermodal exchanges. A secondary loop infrastructure reconnects the dispersed facilities integrating all the parts into one system.



The *field station* decentralizes the station facilities to activate various parts of the urban field.

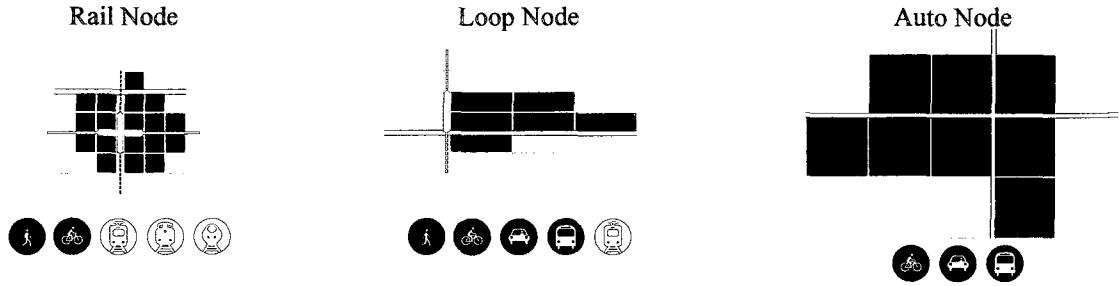


The dispersion of station facilities into the field of infrastructure allows for nodes of development to emerge around those activated moments of interchange.

By spreading the facilities throughout the development, unique fabrics can be built around specific station functions activating various parts of the urban field in different ways. Development is shown emerging as nodes of intensities along these critical overlaps. The level of social interaction varies in degree across the nodes as auto dependency becomes minimized and densities increase closer to the primary rail spine.

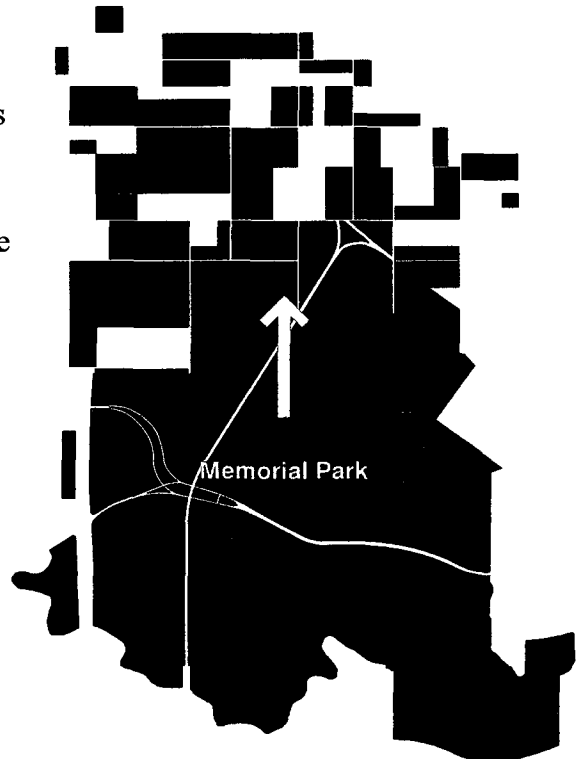
The nodes are classified into three types: rail nodes along the primary rail spine, auto nodes linking into the supergrid and low-density housing fabric surrounding the site, and loop nodes along an intermediating loop infrastructure.

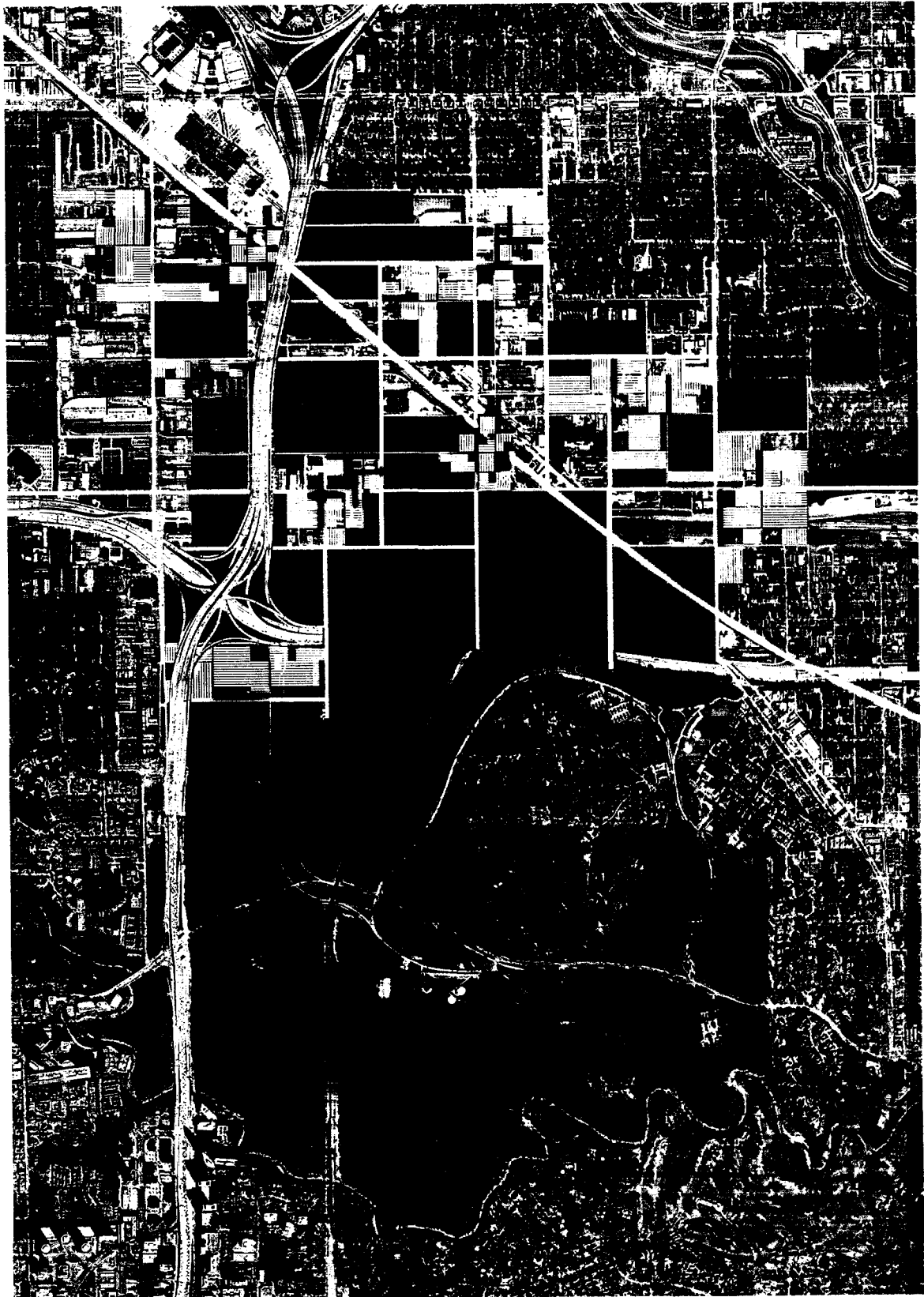




The size of the nodes vary in accordance to the infrastructure they are built upon. Rail nodes are more compact, connecting into the primary rail spine with its high concentration of pedestrian riders. Auto nodes are more spread out to accommodate the scale of automobile movement with parking garages, park-and-ride lots, and residential garages. Loop nodes show a mixture of densities as their fabric develops around a secondary infrastructure to the rail spine, allowing the portion of its residents who do not mind the added inconvenience to pursue non-automotive commuting from the loop to the rail nodes while those that do mind the inconvenience still maintain direct connection to the auto-scaled street grid.

All of these nodes, with their station facilities and various connecting infrastructures, maintain a direct relationship with open space and recreational facilities. Here, the open space of Memorial Park flows seamlessly between the developing nodes of the field station, doubling Memorial Park’s size and creating a metropolitan-scaled park node accessible to the entire Houston transit region.





The Memorial Park Field Station, a 2,800 acre metropolitan-scaled park node, accessible to the entire Houston transit region.

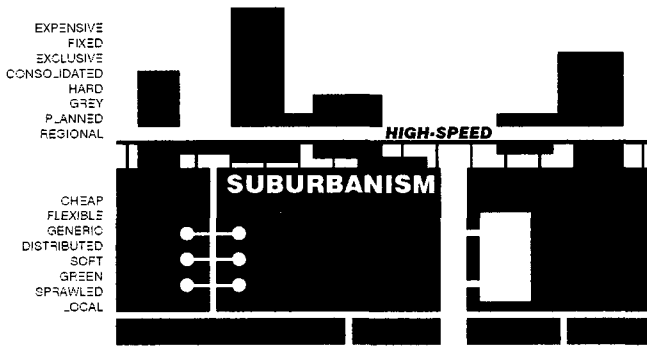
## 6. Mat Building for a Multi-Modal Future

*“The mat approach shifts the architect’s attention from imagery to organization, and from bounded shape-making to the provisional organization of fields of urban activity, which are understood to have a constantly changing character.”\**

Having laid out the mega-scaled redevelopment project of the field/node urbanism and field station catalyst, this thesis focuses in on a particular node to develop in more detail. Of the multiple node typologies diagrammed within the project, I chose the *rail node* closest to the Northwest Mall to design as a model rail community. It was important that this model present the potential of a pedestrian-oriented urbanity that could be dense enough to offer the pedestrian a range of choices and social opportunities yet retain some semblance of its suburban peculiarities such as private open space and seclusion. The mat building, a late modernist typology of opened-ended, formally repetitive structures which through their inter-relationships allowed the possibility of spatial differentiation and adaptable growth, was taken as a precedent for this rail node design. The Northwest Mall Rail Node fits the mat approach by anticipating characteristics of enclosure and openness, adaptability to the multiple modalities, and expandability for population and transit ridership increase that could be applicable to the other node developments.

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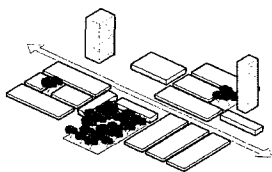
\* Eric Mumford. “The Emergence of Mat or Field Buildings”. *CASE: Le Corbusier’s Venice Hospital*. ed. Hashim Sarkis. New York, 2001. p 64.



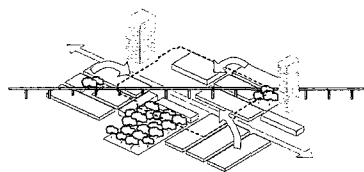
Concept diagram.

The initial concept for the Northwest Mall Rail Node was an elevated platform which would contain an aggregation of transit-oriented programs such as residential units, leasable commercial space and office towers all within proximity to the transit riders along a new elevated rail line. The elevated urbanism is specific to the rail nodes given the likelihood of a rail line off grade. Furthermore, it opportunistically allows the freeing of the ground plane for fluid surface movement at these points, enabling Memorial Park to capitalize on a radical new program of outdoor covered park space.

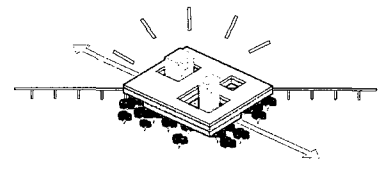
The elevated mass of program is striated into three layers. The lower two are primarily commercial, relocating the Northwest Mall retail spaces to the new site and grouping them around the rail platforms. An upper level of semi-detached housing units support a community with porches and shared lawns to foster a marketable enclave of pedestrian-friendly, transit-accessible, semi-private housing stock. Office towers, hotels, and apartment units then puncture the commercial mass offering its workers and residents transit accessibility and various amenities within the mass and at ground level.



Horizontal Proliferation

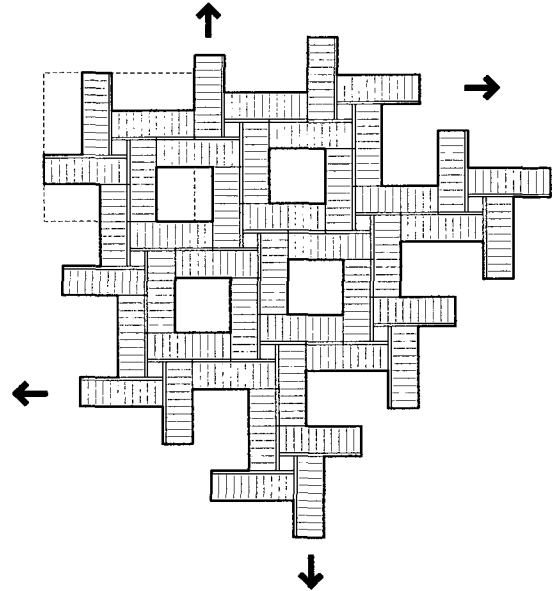
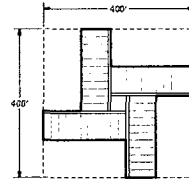


Infrastructural Reorientation



Multilayered Inhabitation

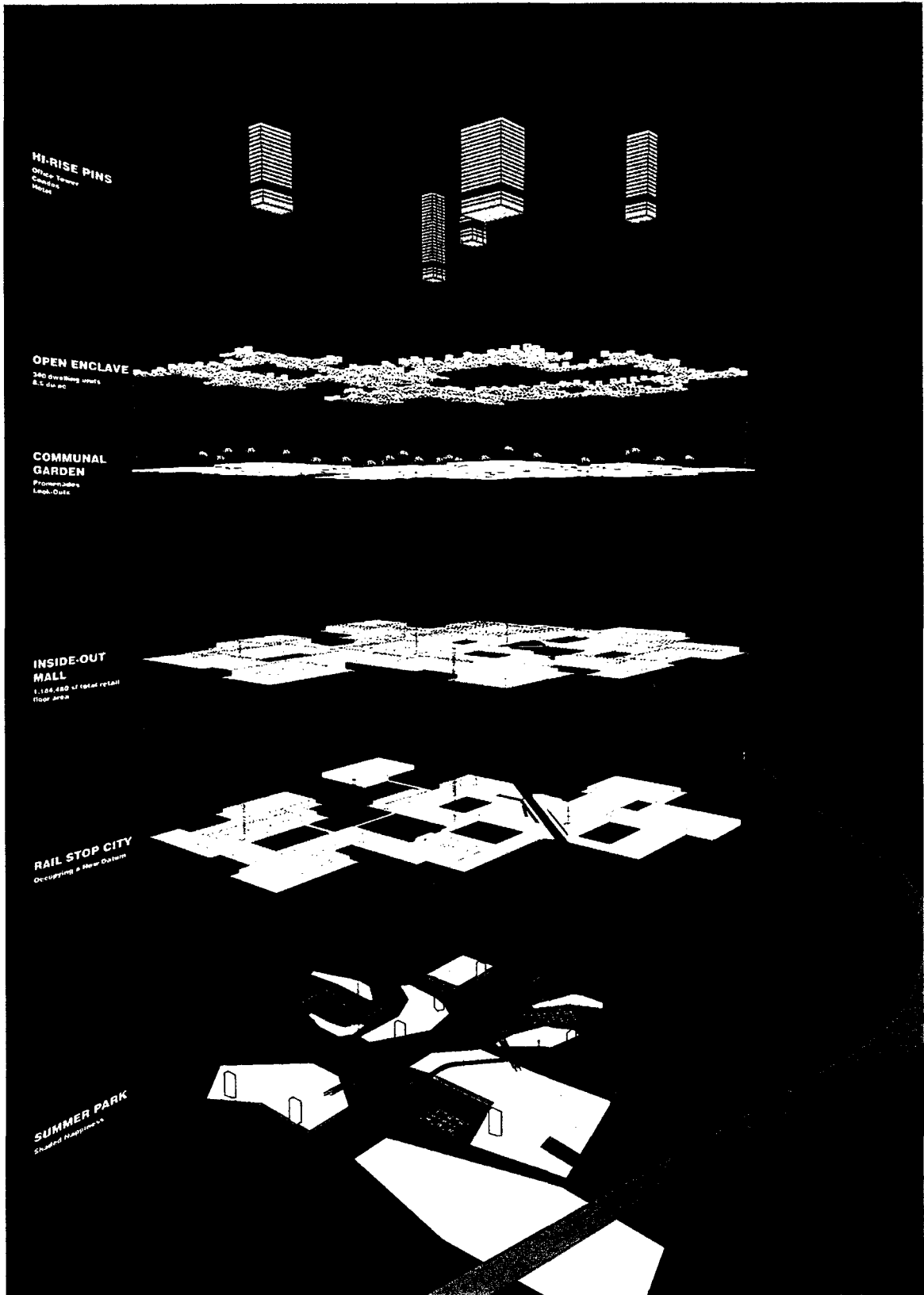
The mat approach gets applied to the elevated mass through a density in plan organized horizontally around a 400' x 400' pinwheel of commercial retail units. The module is comprised of four bars of 20' x 80' units spiraling around a central service core with outward radiating access corridors. When repeated across the site, this unit links service corridors to one another and creates an internal network of service spines with outward-facing retail units. The repetition of the pinwheel form creates a series of interior courtyards to bring in light and air to what would otherwise be a very deep floor plate. With this organization in place, extra modules can be added on or larger programs such as rail platforms or department stores can be inserted within the framework without compromising the integrity of the organization.



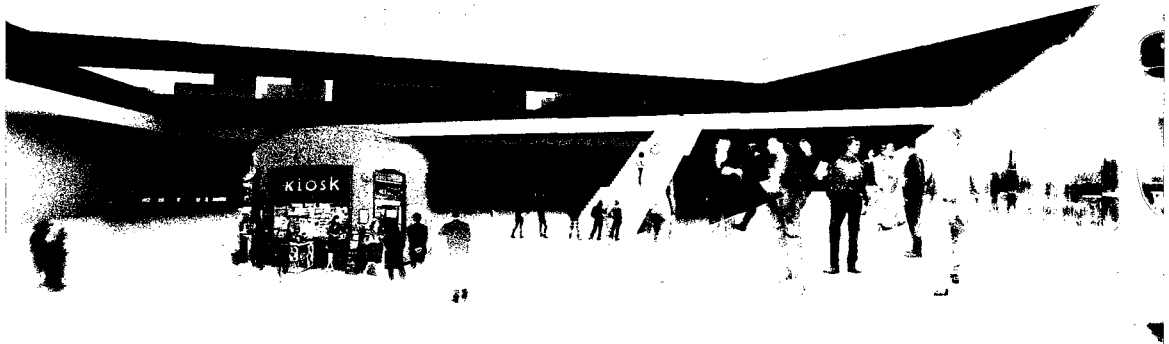
Module unit for the generation of the floor plan. Four bars of 20' x 80' units spiral around a central service core with outward radiating access corridors.



Northwest Mall Rail Node. View looking northeast across Loop 610.



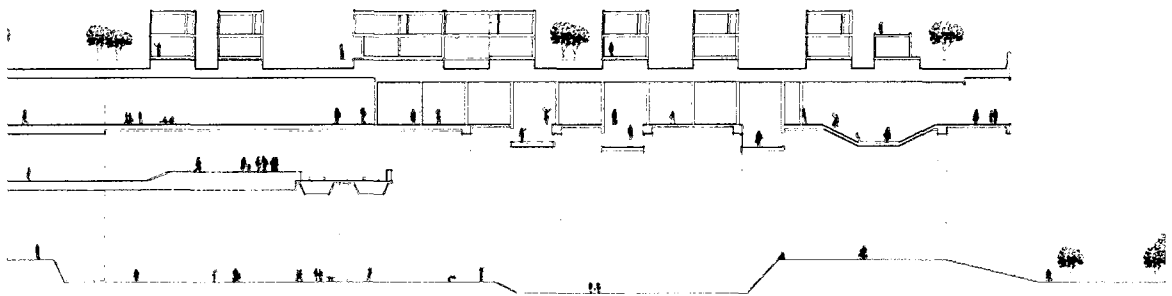
Exploded axonometric at the Northwest Rail Node



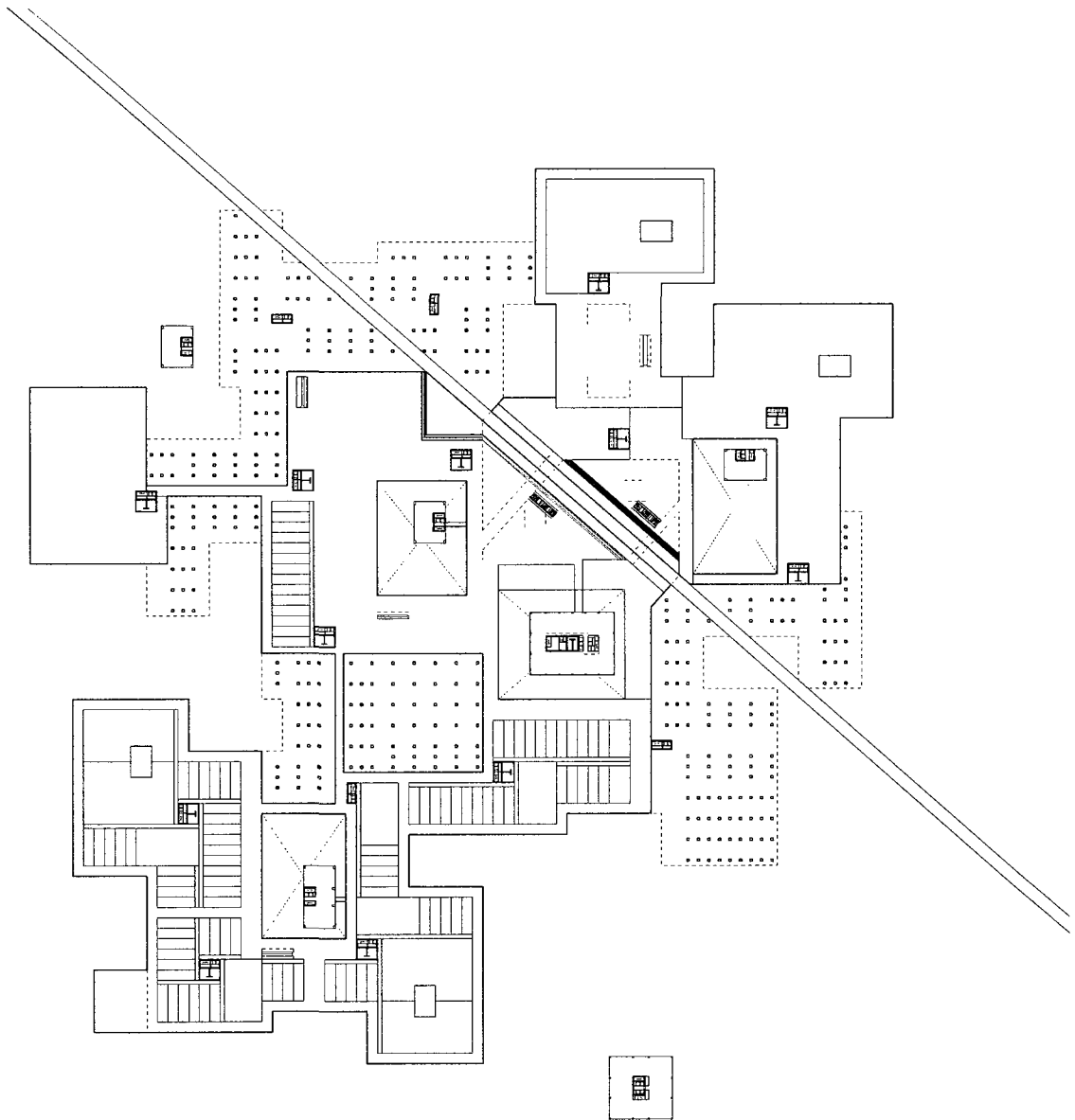
Rail platform within the elevated commercial mass.

### **Rail Stop City**

Elevated commuter rail lines coming from distant suburbs bring shoppers, businessmen and park-goers to the Memorail Park Station to explore their fascinations with the natural landscape, a wide arrangement of retail and activities and to marvel at the diverse populations that Houston has to offer.

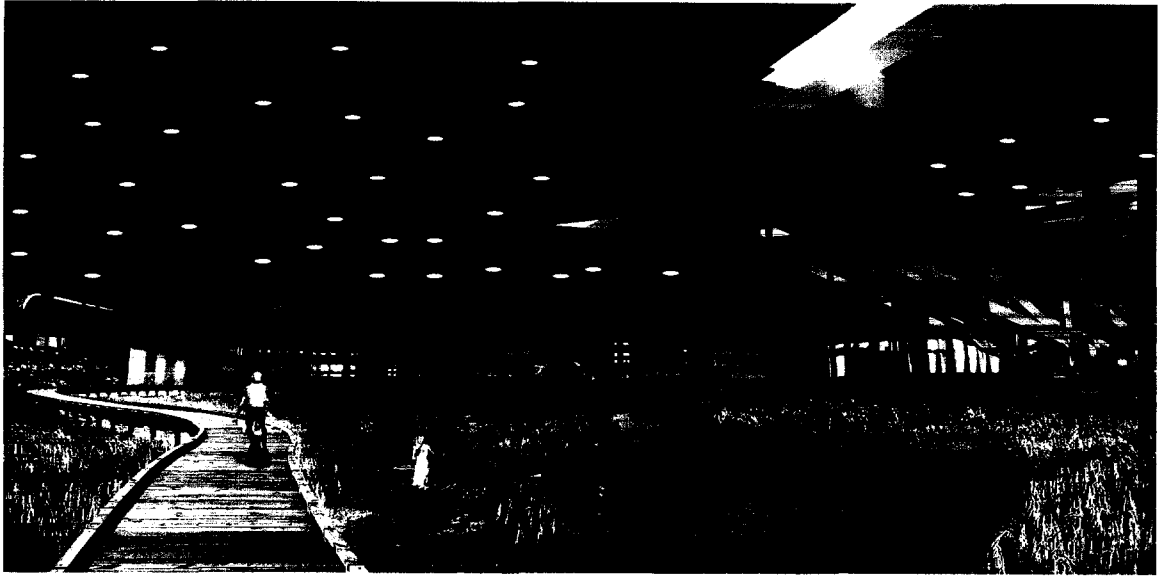


Section Drawing



Level 3: Rail Stop Plan





A radical new extension of Memorial Park.



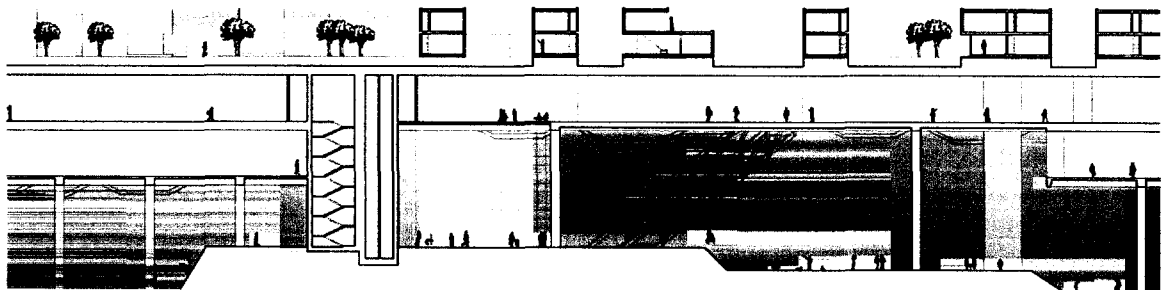
Urban Oven



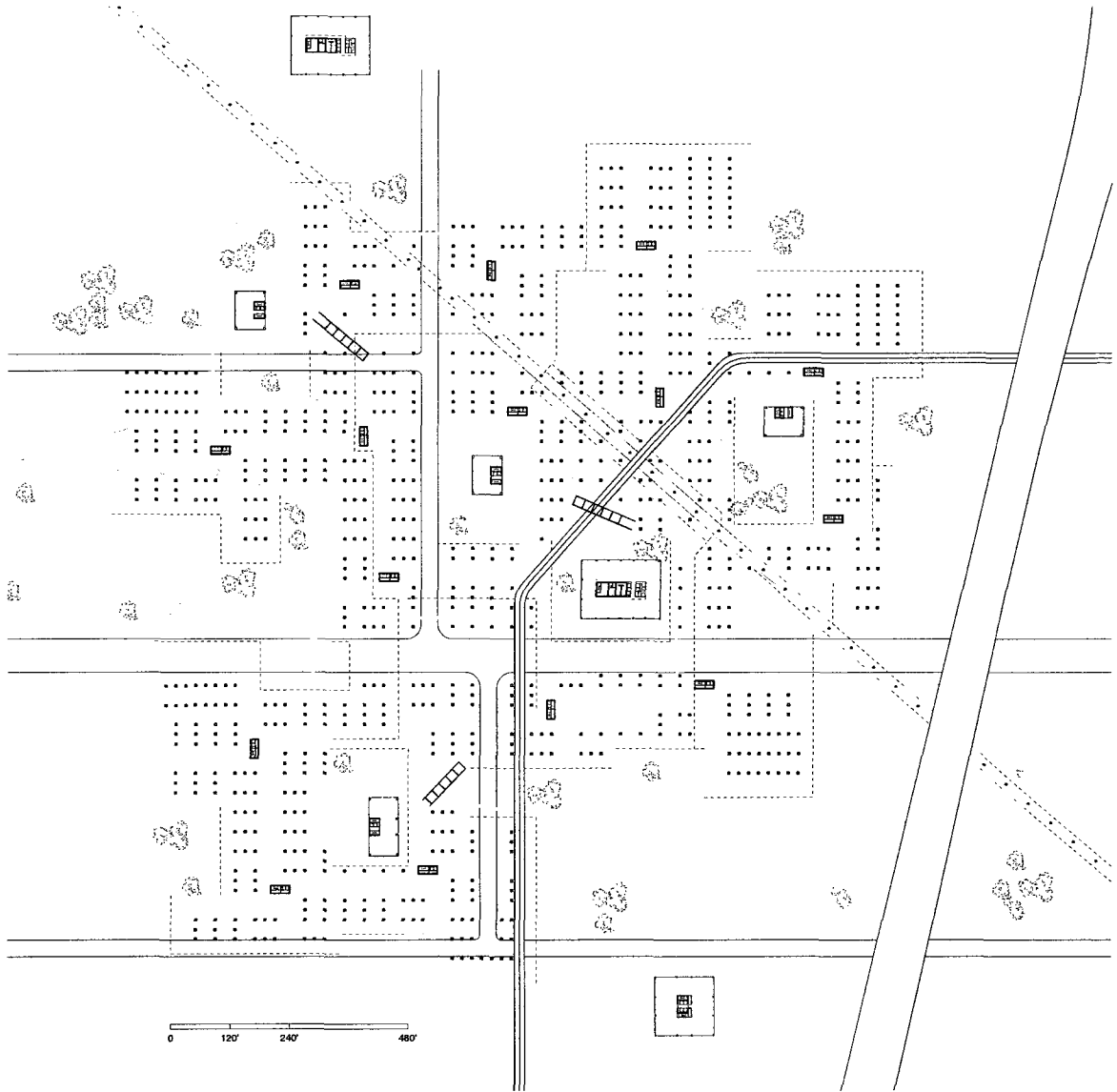
Urban Pavilion

### Summer Park

Wonderfully shaded from the intense summer sun, Houstonians begin returning outside to the radically new summer park space offered beneath the Memorial Park Station. A 50 ft ceiling held up by a forest of columns protects berms, trails, pools and recreational fields for enjoyable outdoor summer activities.



Section Drawing



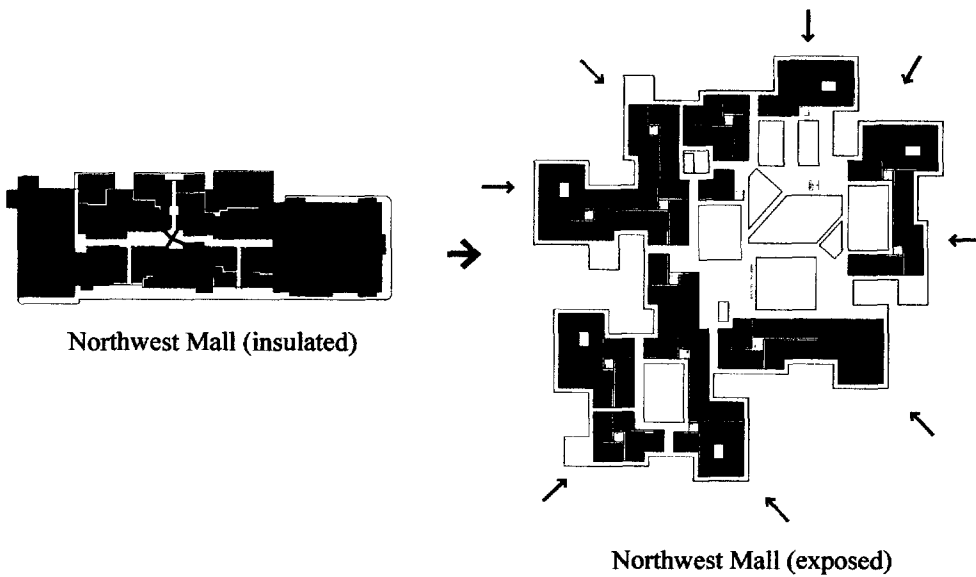
Ground Level: Summer Park Plan

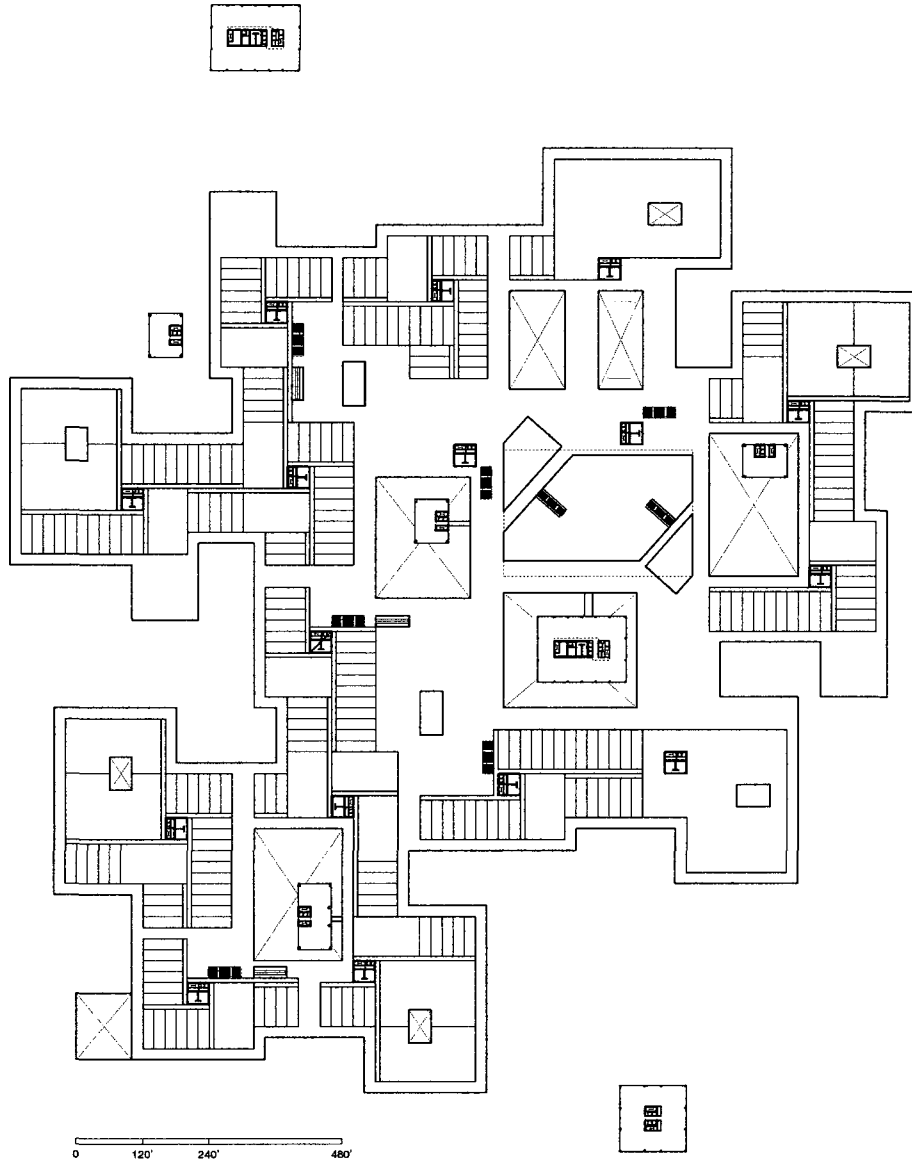


Exposed corridors give retail a renewed public display.

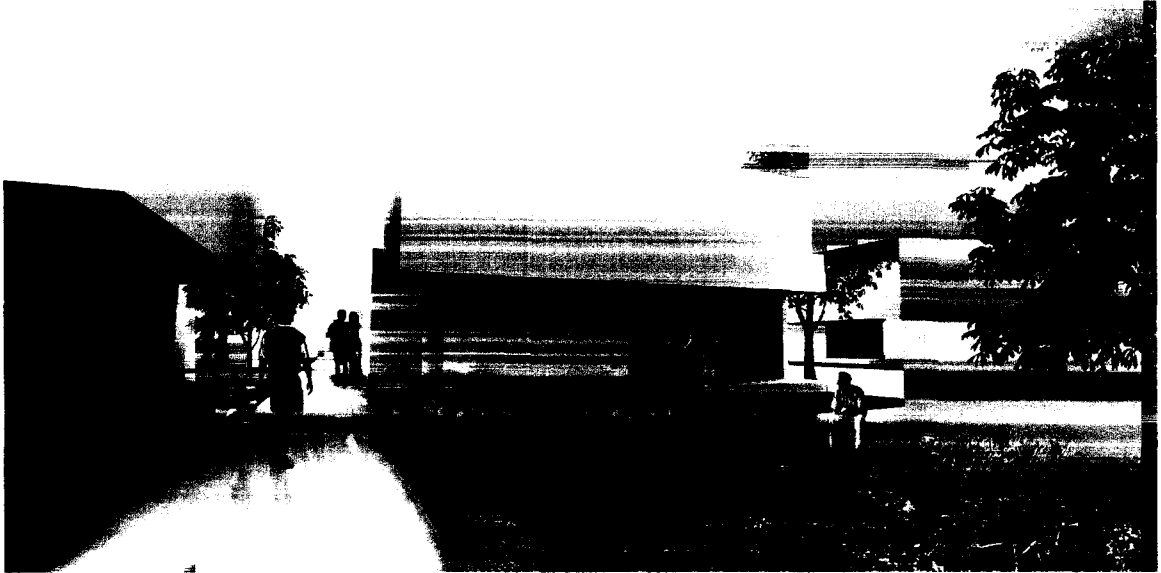
### Inside-Out Mall

An inversion of the traditional interiorized shopping street, the Inside-Out Mall exposes the urbanity of retail to the public park and community---an unconventional gesture of publicness in the otherwise privatized suburban context.





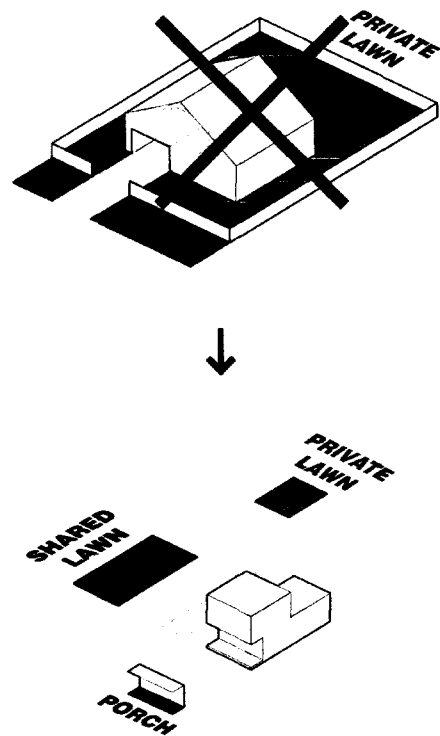
Level 3: Inside-Out Mall Plan



Pedestrian streets, porches, and productive lawns become the new suburban norm.

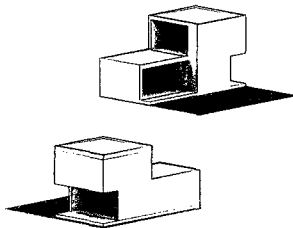
### **Open Enclave**

Without the necessity of the automobile and its garage, drive-way, and traffic, the suburban enclave can condense and shed its barriers to once again allow a more sociable inhabitation with porches and shared yards. Lawns as buffers become lawns as gathering spaces, gardens and rainwater catchment areas. Pedestrian streets move neighbors from home to the rail platforms and amenities below. Nearby park overlooks allowed by the elevated living provide large spaces to meet and play. A new suburban community is made with an abundance of light and air yet without the social isolation of its former counterparts.

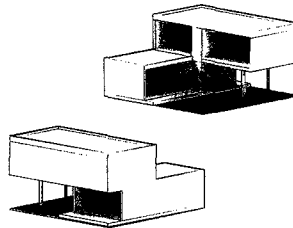


The housing stock of the Open Enclave is based on a 20' x 20' dwelling block. Each house is a combination of multiple blocks sited upon a 40' x 40' plot of land. Although minimal in size, the blocks can be recombined in various ways to add bedrooms or extra living spaces. Each house always maintains a relationship to the pedestrian streets with a forward-facing porch, receives light and air from an outdoor courtyard or sideyard space, and has accessible roof gardens for a more secluded outdoor area.

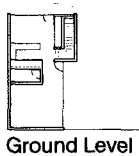
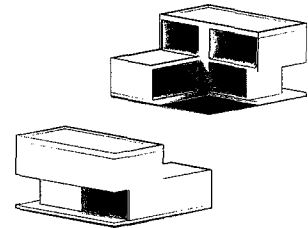
**Housey A**  
1,200sf  
2 Bedrooms



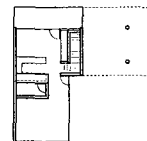
**Housey B**  
1,600sf  
3 Bedrooms



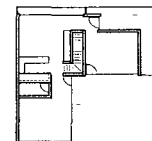
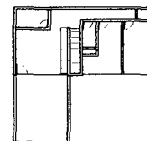
**Housey C**  
2,000sf  
4 Bedrooms



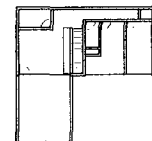
Ground Level

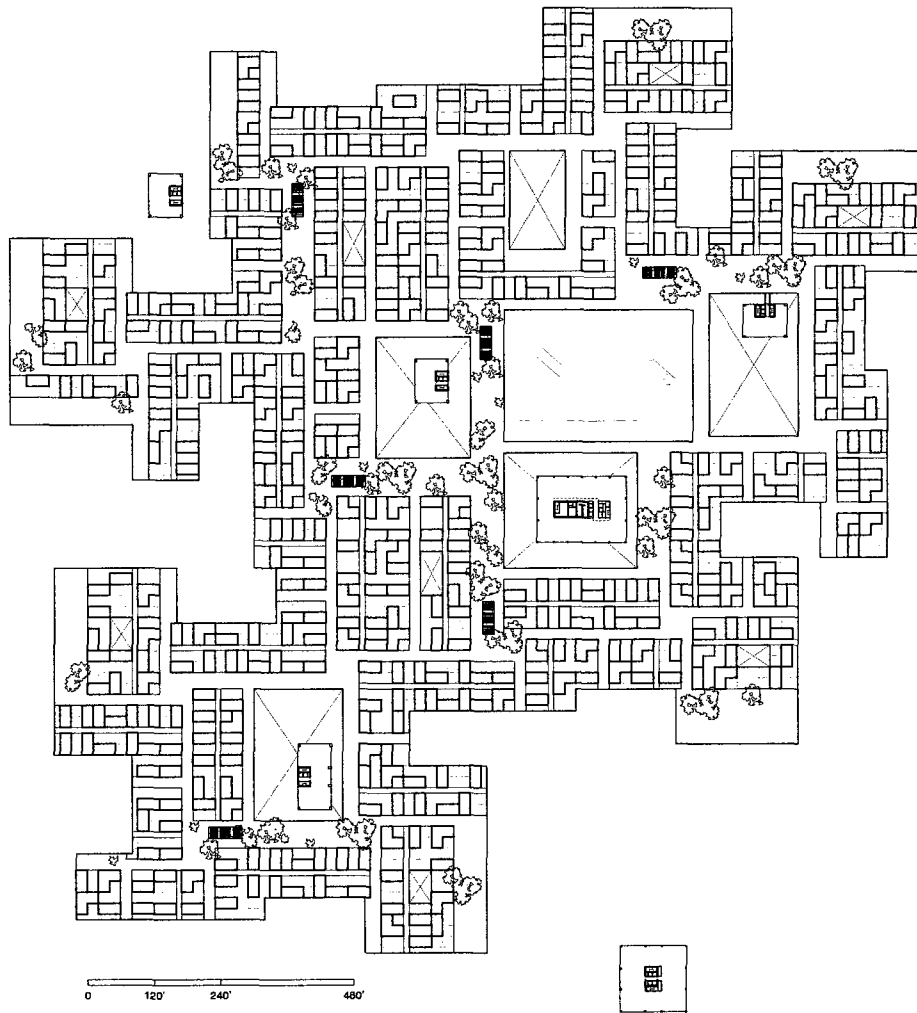


Ground Level



Ground Level





Level 4: Open Enclave Plan

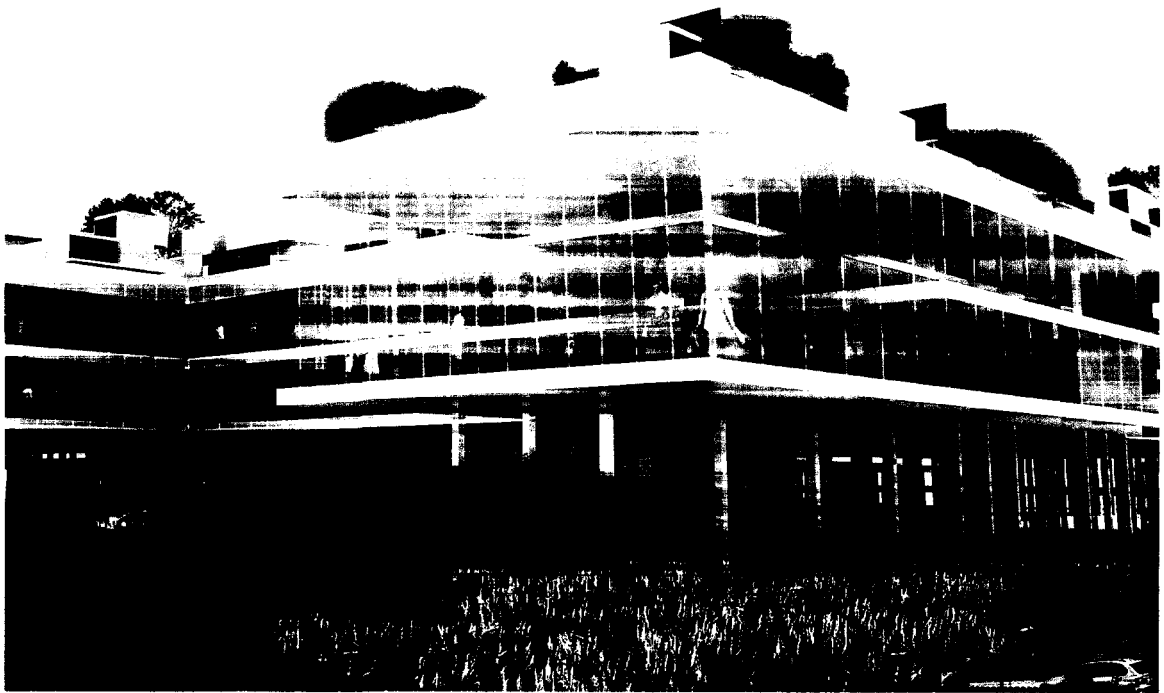


Photo Collage

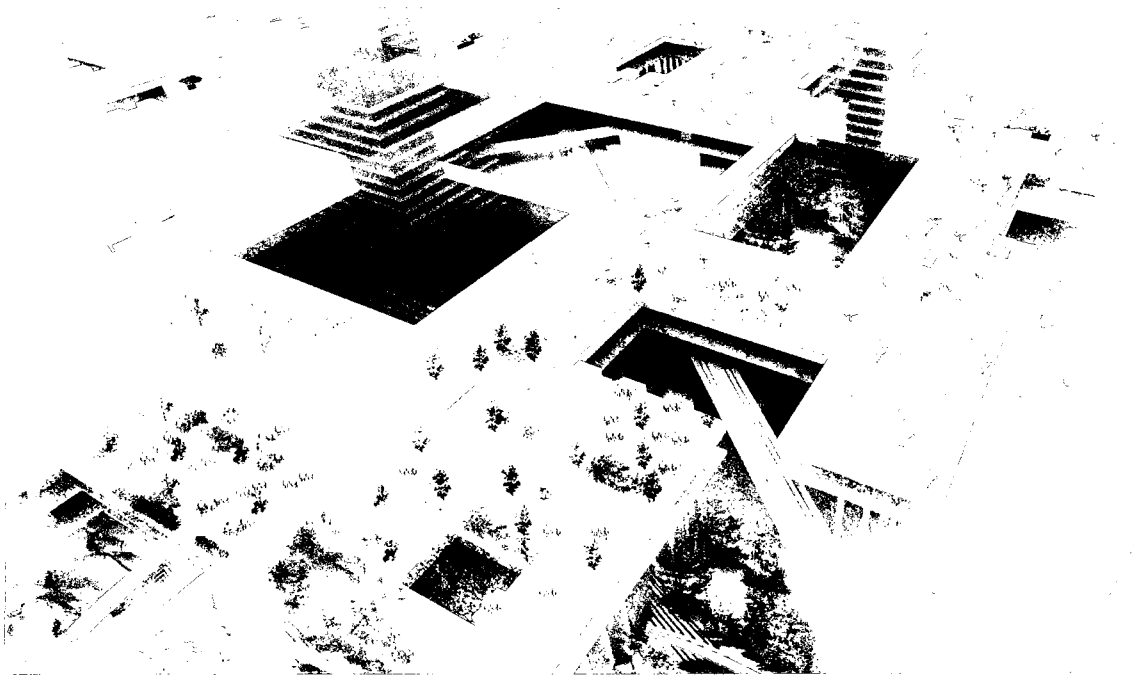


Photo Collage



## Conclusion

The integration of new transit infrastructures into our suburban regions can do more than simply offer a mobility alternative to driving: it can provide a framework for the mediation of the various speeds of movement, densities of development and social interminglings that a multi-dimensional transit system will require. With this in mind, the actions we take to capitalize on the potential of these new systems should continually push the bounds of our urban imaginations and not simply regress back to older forms of known urbanities. There is no doubt that over the last century the automobile has overrun our roads, cities, and transportation desires, or that the future of our urban transit relies heavily on a reduction of this means as a primary mode of movement. But, to think that auto-mobility will ever fully disappear shows a lack of foresight and good judgement. The future of our cities will depend on how our metropolitan regions actively integrate new forms of mass transit with the predominating automobility and scales of development the typify our current conditions. This proposal is but one instance of those exciting new possibilities.



High-speed suburbanism.

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