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Integrating Infrastructure and Architecture

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23 April 2004

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INTEGRATING INFRASTRUCTURE AND ARCHITECTURE

Abstract

How can architecture make more stimulating infrastructure, and how can infrastructure make more provocative architecture? Is there a construct of connection, integration or common ground? By creating an Urban Infrastructure oriented development this project will show how architecture and infrastructure can be connected in function, and in design. The project will seek to create a mixed use development on existing and redeveloped transportation corridors in the city of Detroit, Michigan. The project will propose new modes of transportation in which new developments may be spurred upon. The goal of this project is to create an environment where one can live and work, in a walkable urban fabric with easy access to efficient, clean, and well designed transportation infrastructure.

Abstract

PROJECT SUMMARY

Transportation, energy, and other infrastructure networks play a vital role in the organization and functional ability of our cities. These systems control and define space. Infrastructures are the underlying arteries of the city. Our relationship with these systems is required for sustainability of the society. Some of these systems we never see, like those of a computer, they run in the background of our minds. These circulatory networks and environmental substructures are essentially connected to our lifestyles and our cities. It is this connection that has the potential to be enhanced.

Architecture and Infrastructure design have paralleled each other throughout history. Even today these inter-related systems of our built world are designed and constructed by different organizations with different methods and ambitions. Often these systems work separate from each other and as a result can often leave cities dismantled and without coherent legibility. Transportation and utility networks are carefully designed within their own disciplines, often leaving a frail connection to the surrounding architecture. As cities become more complex and/or more decentralized the issue remains, how to create a connection between these systems – how can they be integrated? Additionally, buildings have infrastructure, and in today's contemporary design we see these elements being used in such a way that enhances or even creates spatial conditions within the building. How can architecture make more stimulating infrastructure, and how can infrastructure make more provocative architecture? Is there a construct of connection, integration or common ground?

The goal of this project is seek out new potentials of the city which may arise by integrating all types of transportation infrastructures within an urban environment and architecture. The project should link these systems in a way that enhances their spatial environments while maintaining their functions, even if those functions change or adapt to the new situations or environmental relationships or forms. Furthermore the relationships of architecture and infrastructure should integrate in such a way that the city regains its powerful energy of dynamic complexity. The project will research opportunities that are relevant to the region of Detroit and its transportation network, as it will seek to employ a nodal region along existing and redeveloped transportation networks. The mixed use development will complement and sustain the transportation networks that flow through it and defined its edges, spaces, and complex layered environments. Therefore, the product will investigate various architectures and programs, and their symbiotic relationship to the network and the node.

Architecture and Infrastructure

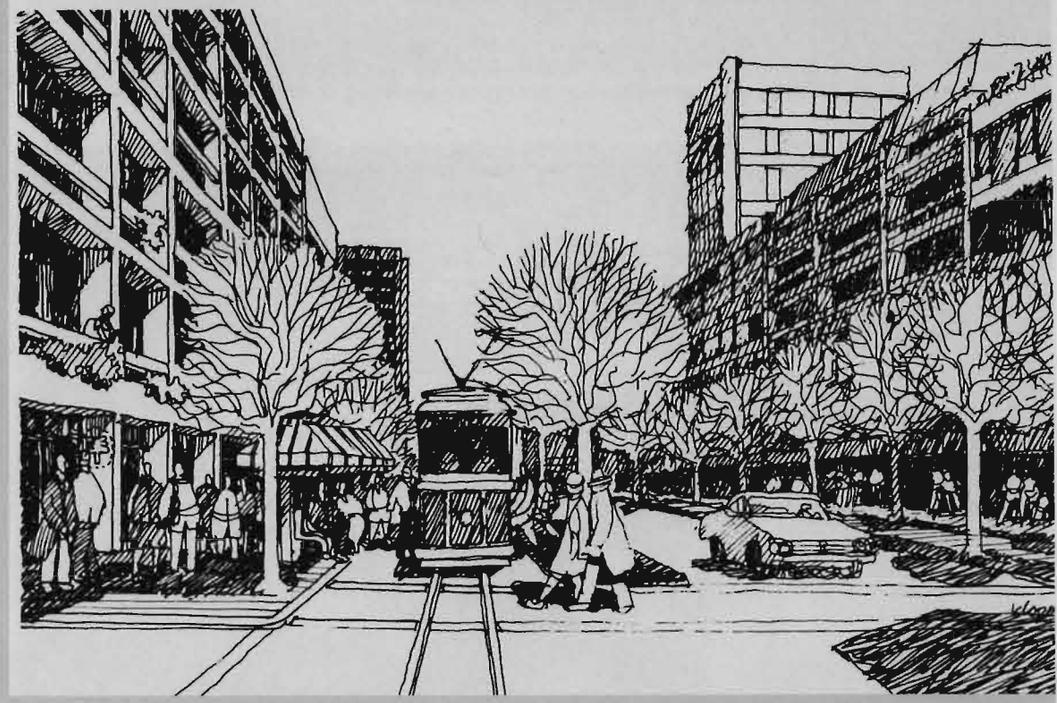
Infrastructure *(Merriam Webster's Dictionary)*
1 : the underlying foundation or basic framework (as of a system or organization)
2 : the system of public works of a country, state, or region;
also **:** the resources (as personnel, buildings, or equipment) required for an activity

Architecture *(Merriam Webster's Dictionary)*
1 : the art or science of building; *specifically*: the art or practice of designing and building structures and especially habitable ones
2 a : formation or construction as or as if as the result of conscious act
b : a unifying or coherent form or structure
3 : architectural product or work
4 : a method or style of building
5 : the manner in which the components of a computer or computer system are organized and integrated
6 : the structure of anything

It should be readily apparent from these two definitions that architecture and infrastructure are similar terms and sometimes interchangeable. So why is it that these two systems are separate ideas? These systems are often built and designed by separate groups for separate goals and reasons. Yet infrastructure can drastically affect the architecture and its surrounding environment, while architecture can drastically effect how the infrastructure is perceived. For example, buildings that turn their back to the street – or the space commonly thought of as being a part of the world of infrastructure – can cause the street to feel uninviting. Neighborhoods that have rows of garages facing the street tend to have no sense of community on the street; rather the back yard is where the activity remains, and when driving through these neighborhoods one cannot get an understanding of community or activity within and between these homes. An alley can feel unsafe, not only because it is dark but rather because there are no 'front' doors that welcome anyone into shelter, and there are no windows to watch over the users of the space. Architecture and Infrastructure share a symbiotic relationship - one affects and informs the other.

Venice, Italy

Rendering for Seatle, Washington
(Barnett, 156)

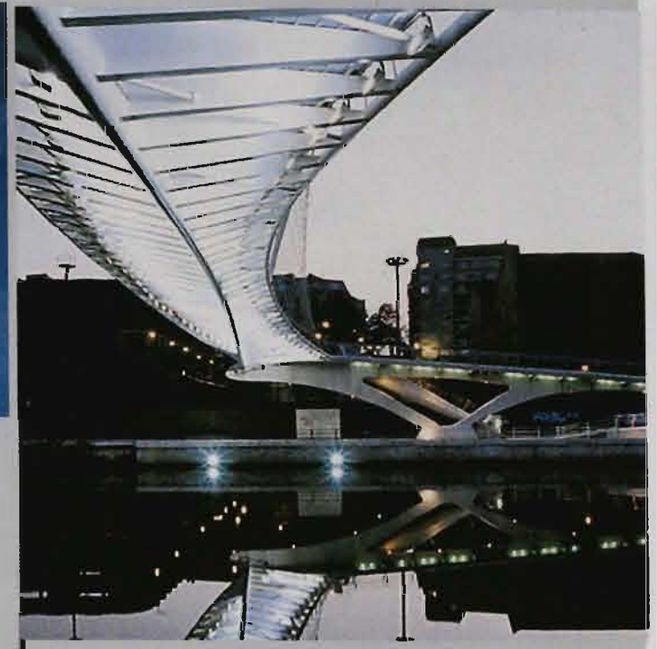


In many broad contexts we can often replace the word 'architecture' with the word 'structure.' In this sense we see architecture as a buzzword in other businesses. Automakers use the word vehicle architecture to describe the basic formwork or framework of the car. Business firms use the word to define an organizational structure to their company or department, and the computer industry uses the word to define integration and organization of components. In any form the word is used it can be replaced with 'structure' or even 'infra-structure.'

Utility networks such as electricity, water, sewage and communications are systems that most people don't every really think about until its missing or broken. This could be said about all infrastructures. But infrastructure is the life giving blood of our cities. Without working networks modern civilization would cease to exist. Without infrastructure we could not move ourselves or our products. In cities especially, we hide this framework underground or in the spaces between walls or ceilings and floors. Infrastructure in not only hidden physically but also psychologically. We don't "see" Infrastructure when it works, only when it's broken and needs repair. This is often why we choose to cut funds and resources to transportation and utilities. When these systems work we assume they need no more money – but it has been proven that any system is more efficient and cost effective with constant maintenance and funding (which in the long run costs less than overhauled projects).

Although architecture is often limited to habitable structures, there is a growing trend to add all structures and spaces into this category of building. Architect Santiago Calatrava designs bridges and poetic structures that are often only thought of as function objects. "By overcoming the borders separating art, architecture, and engineering, Calatrava broadens our collective understanding of the artificial environment and provides new ways to improve cities and landscapes and the human communities within them." (Tzonis, 10)

Communications Tower
Barcelona, Spain
Santiago Calatrava



Campo Volantin Footbridge
Bilbao, Spain
Santiago Calatrava

Alameda Metro Station and Bridge
Valencia, Spain
Santiago Calatrava

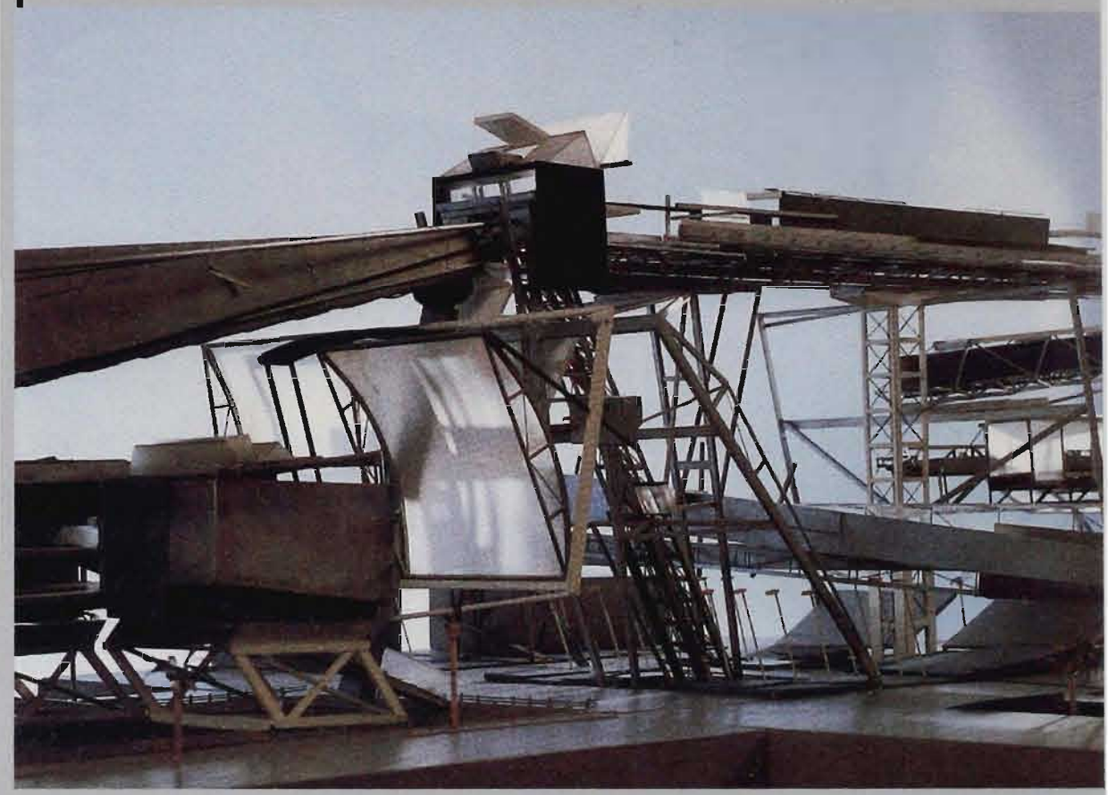
Although we don't physically inhabit the freeway the way we inhabit a home or office, there is still a sense of habitat – a space that we live and grow in. Transportation infrastructure is perhaps the most physically habitable of infrastructures and it has a lasting effect on the habitable spaces of our cities and dwellings. Some projects have attempted to combine architecture and infrastructure in the form of habitable bridges. These projects develop either as a need for more space or as a way to use often wasted spaces. Bridges in the past were primarily only for transportation, but in cities like Venice bridges are shopping centers and places of use. Such is also the case in Bernard Tschumi's "Bridge City" where office buildings can become bridges for a gap in the landscape or the city.

Many architects and artists today are fascinated by the car and the freeway. "Infrastructure design has been a constant theme of architectural discourse since Vitruvius. Transportation networks, more specifically, have been the subject of architectural writings from Alberti to the end of the eighteenth century, and a preoccupation of architects and planners from Haussmann to Koolhaas" (Lefaivre). The interest in mobility has given architects and artists access to the world of civil architecture which in the past had been cast to civil engineers. Some believe that the freeway is one of our most used public spaces in American culture. It is ironic that the freeway, thought to be the destroyer of cities and community, is a communal space that has defined the role of cities and architecture in the 21st century.

Mobility projects are on the rise. A 2003 architectural exhibition in Rotterdam, Netherlands on the concepts of mobility, the car, and the freeway had to be extended due to its popularity. Issues of transportation and architecture have become global experiments because of the car and the freeway's dominance in our societies. Some projects have turned civil engineered structures into works of art, while others have focused on the environment of the car and the street. There have also been projects that have attempted

Farmington Canal
(Urban Revisions)

Asymptote
"Steel Cloud" - Los Angles, California - Movie screen over a freeway

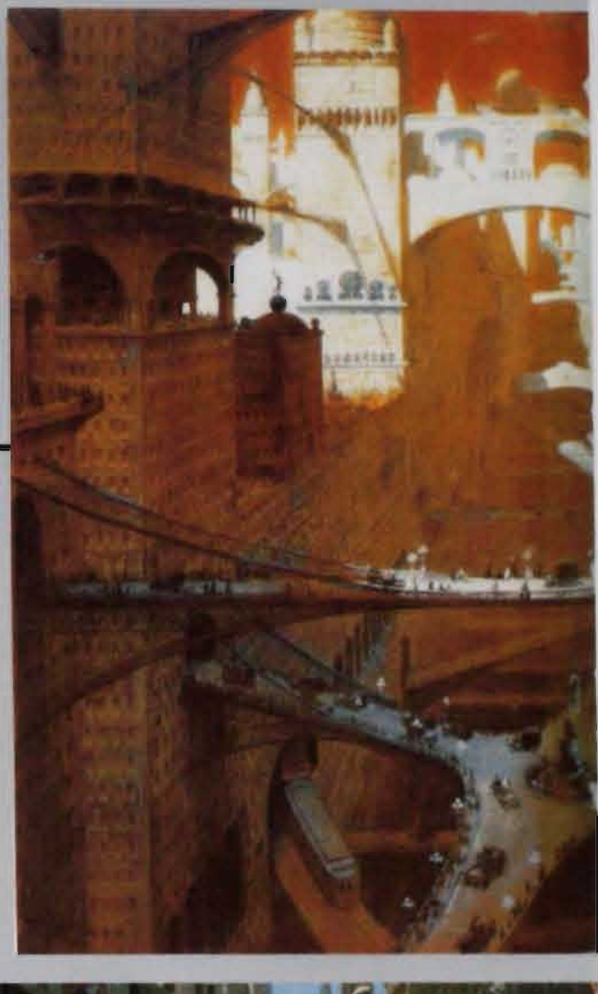


to reclaim or reuse abandoned transportation corridors such as the Farmington canal, and the "highline" in New York.

Modern engineering has allowed for some poetic structures. Ever since the Industrial ages, architects have been increasingly interested in the spaces and beauties of structures and building environmental systems. It has also been more common to express these systems in a building or on a bridge. One of the best known examples of this expression is the Pompidou Center in Paris, France with its colorful usage of exposed ductwork and structural systems. The Pompidou Center also expresses the movement of the building with its exposed stairs and elevators – a concept that also shows the exaggerated importance of the stuff that makes a building function. In the past we have opted to hide these systems, for aesthetic as well as functional needs. Few people really experience the systems that make a city work and give it life. In order for our cities to survive and thrive there must be well maintained sewers, power grids, and other networked infrastructures. These systems are often hidden because they are considered ugly and dirty. Although some systems are hidden for space-saving functional reasons they ultimately are designed without the care of aesthetics. Infrastructure has been mostly designed for function, and in that design there can be some beauty. Many of us, at sometime or another has been fascinated by the inherent grittiness of these systems. There are times when we are drawn to the simple complexities of these networks, and the beauties of their structure and form. When we look at freeways from a bird's-eye-view there is a sense of awe in the tapestry of complex networks. Speed has given the highway a graceful geometry of sweeping curves and cloverleaf interchanges.

During the industrial revolution several artists, authors and film makers depicted scenes of the future city where multilevel pedestrian, vehicular and train bridges would move people through the city. These layered levels of city life have been a timeless fantasy for those who prefer dense vibrant cities. Such is the case in the film, *Metropolis* (1927, 2002), where most of

Scenes from Fritz Lang's *Metropolis* (1927)

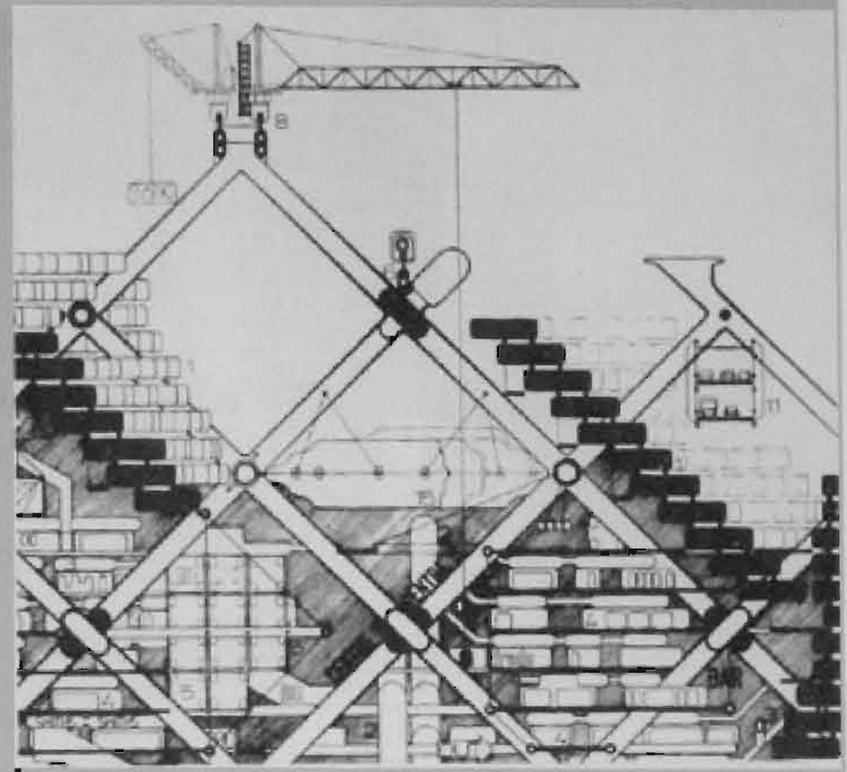


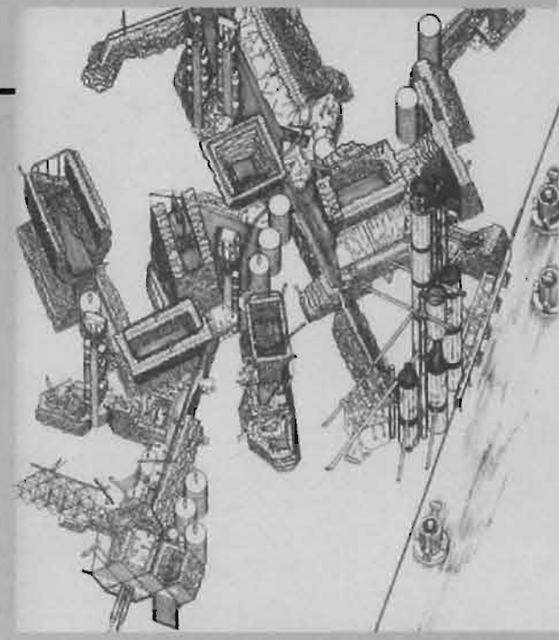
New York City depicted in the film *The Fifth Element* (1997)

the city life is depicted by the vastly layered circulation. The layers of congestion and complex movement give new meaning to the use of the skyscraper – the only building type in these fantasy worlds. No longer would we only be able to enter and interact at the ground floor –in most of these depictions we often never see the ground. Such is the case in the *Jettson's* and in modern movies such as *The 5th Element* where the ground layer of the city has been all but abandoned and only inhabited by dense toxic fog. Landscape and ground is all but irrelevant in these futuristic cites. Rather the skyscraper and the city is the landscape – hard steel and stone that has been precisely engineered by man and machine. 'Sky lobbies" would allow us to enter a building from multiple levels, and as we say the "sky is the limit." But there is no limit to these cities just as there is no limit to the layering and complexity of circulation. For each skyscraper becomes a city of movement and complexity within itself and not just an individual building. In these examples the city becomes a limitless and boundless structure of circulation.

There have also been theories that the city should be thought of as a building. Grand projects like "Plug-in city" and "Walking city" propose large networks of infrastructure that forms a sub-structure for the building. (Archigram) The various plug-in city models use pods or modules of activity such has housing or commercial nodes which connect to the network of circulation that gives structure to the entire city. These cities function more as monumental buildings that act as a city at the same time. If infrastructure is landscape for these cities, then architecture is the points on it. This is typically how we think of these two systems – architecture versus infrastructure. They are not separate systems, but rather symbiotically connected. Projects like the "plug-in city" attempt to bring these systems together – where one system affects and informs the other and vise versa.

The work of Antonio Sant'Elia is particularly interesting for its expression of circulation. Sant'Elia's work attempts to show the city and building as machine. Each project focuses on



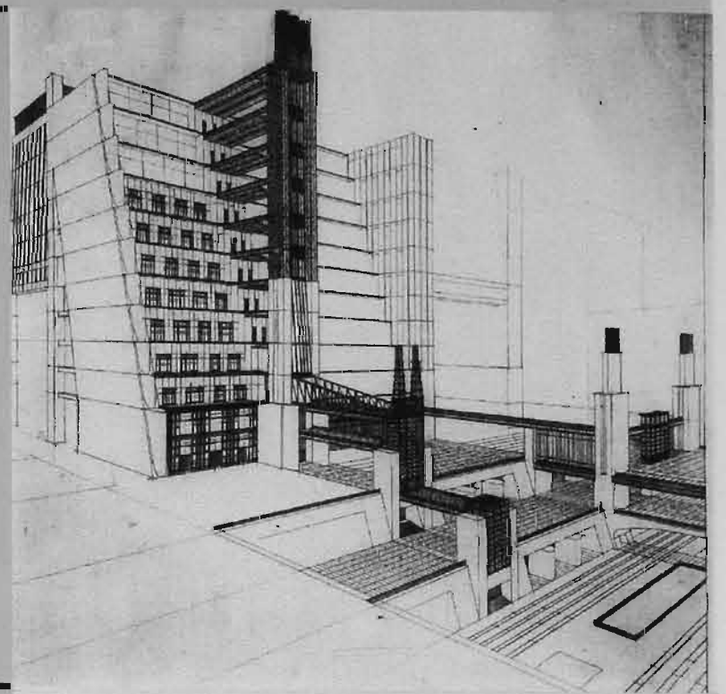


Archigram
"Plug In City"

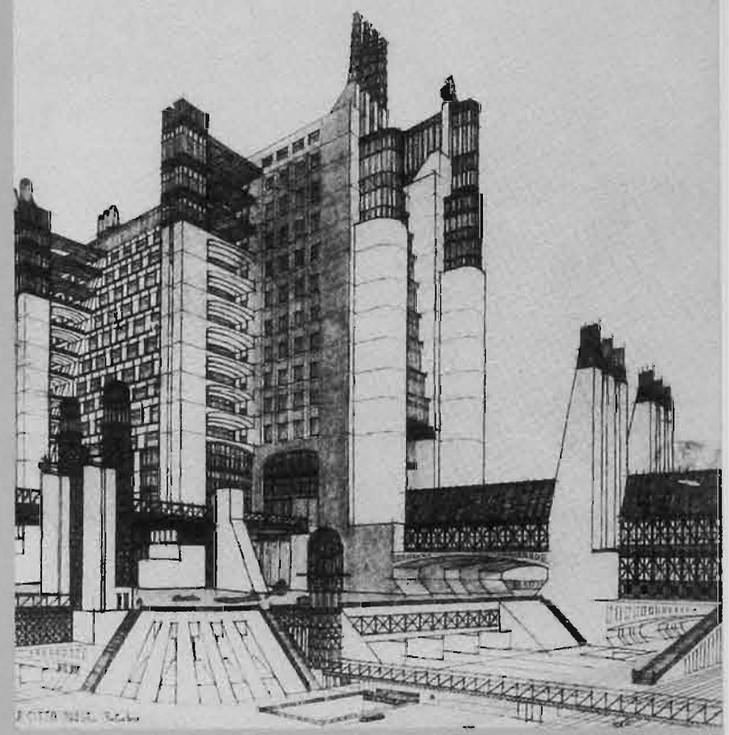
the circulation in, around and through the building or complex. Projects like "La Citta Nuova" and the "Station for Airplanes and Trains" are more about circulation and expression of machine like movements in the city. The machine was an important theme in Sant'Elia's work as well as in the Italian Futurism movement he supported. Futurism sought to destroy history and nature while favoring the new language of the machine. Sant'Elia's drawings and projects evoke precision and complexity with a focus of speed and motion. Oddly enough Sant'Elia chooses to never show the machines that inhabited his spaces. The trains and planes in his works seem still against the edgy architecture of speed and motion. Like the environments in the film *Metropolis*, Sant'Elia layers his cities allowing for the structures of bridges and elevators. Even in these structures we have the sense of architecture as if the building and the habitable spaces reaches out to link the infrastructure that supports it – although in Sant'Elia's work it seams as though the infrastructure is more important and that the architecture is secondary to the freeway and the train tracks.

It is also interesting that much of Sant'Elia's work was devoted to the architecture of the power plant. Sant'Elia seamed to be fascinated by this building type that is typically so utilitarian in form and in function. Much of this fascination is due to futurism's obsession with the machine. Sant'Elia's power plants have a monumental quality that evokes importance similar to a government building or church - later on Sant'Elia would impose these machine-like monumental forms on churches and institutions. Electricity would have been a God-like invention at the time in Italy and Sant'Elia's expression of importance and power would be quite appropriate to the power plants in the most symbolic way. Today these plants seem to go unnoticed both architecturally and politically. But the importance of electricity and the power plants are vital to our cities and way of life. Never have we depended so much on electricity and the machine – yet we show no importance architecturally to these utilitarian systems.

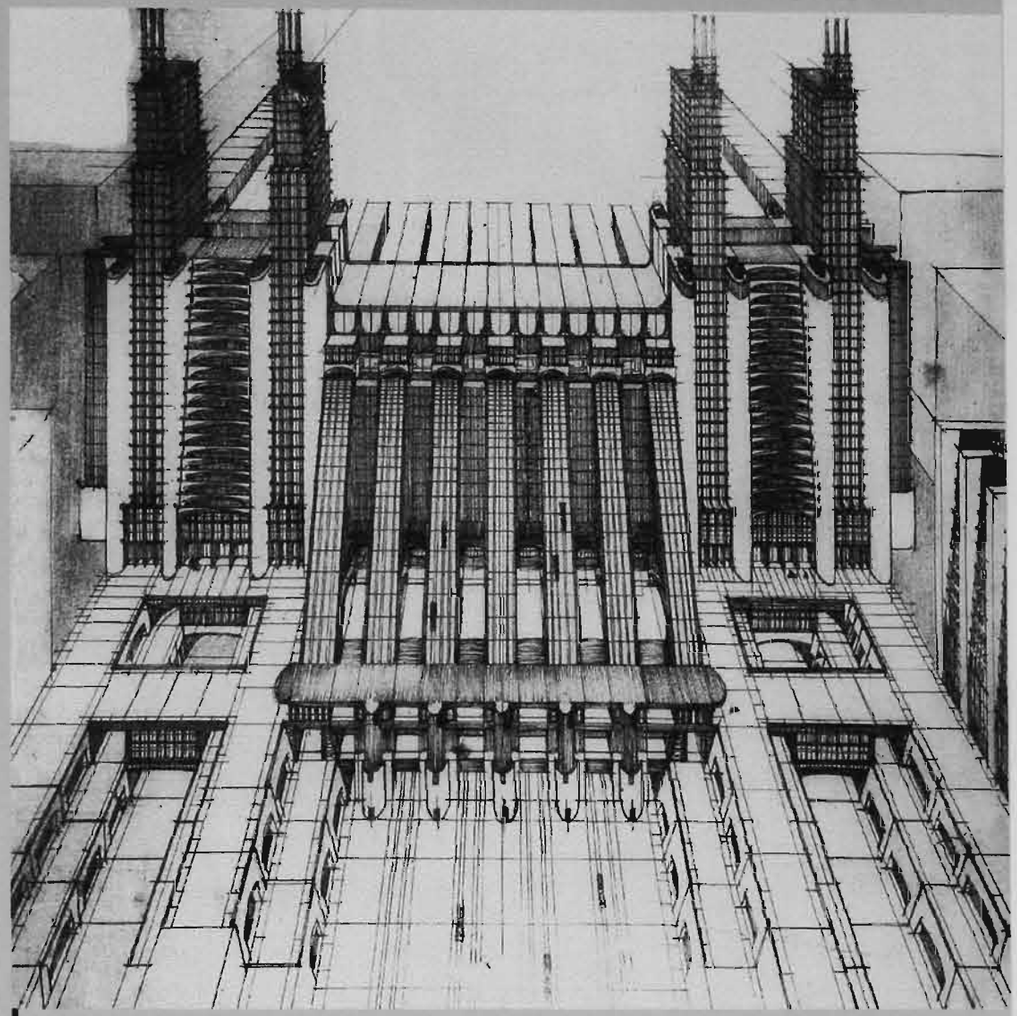
Antonio Sant'Elia.
"La Citta' Nuova."
(de Costa Meyer, 105)



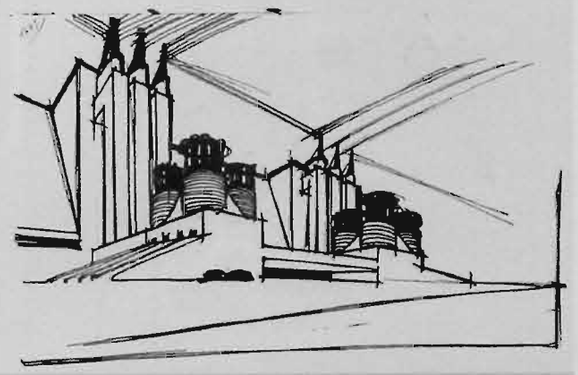
Antonio Sant'Elia.
"La Citta' Nuova."
(de Costa Meyer, 102)



The machine and technology is quite important to our society and our cities. But so is nature – a force that futurist attempted to ignore or wipe out. Many have forgotten that every thing we do, everything we invent is somehow anticipated by nature and is thus a product of it. Some say that the machine and technology are inhuman. Many would also say this about the futurist and their works. The environments that Sant'Elia and modernist have created have been called inhuman and stale of nature. Is the machine not human; not natural? Machines are products of man and we tend to believe that what is a product of man is not a product of nature. The two are often described as opposites. This dichotomy could also be applied to architecture and infrastructure – one is human the other is inhuman or unnatural. I would reason that anything that comes from the ideas of man is quite natural. A computer and a machine are built on the principle and the laws of nature. Concrete streets and power lines all are byproducts of natural elements. Nothing in this world is unnatural or unprecedented in nature, thus anything that could be considered technology or a system of utilitarian use is quite natural and should be used in harmony with that which is a direct creation of the natural world. In futurism the logic was that landscape should be "destroyed" for futurist detested the countryside and nature. (da Costa Meyer, 126) Frank Lloyd Wright's architecture was entirely site driven and could be said to be the polar opposite of futurism. A harmony should exist between the forces of technology and nature – between machine and man – between infrastructure and architecture.



Antonio Sant'Elia.
"Station for Airplanes and Trains."
(de Costa Meyer, 105)



Antonio Sant'Elia.
"Power Station."
(de Costa Meyer, 72)

Networks and Infrastructure Systems

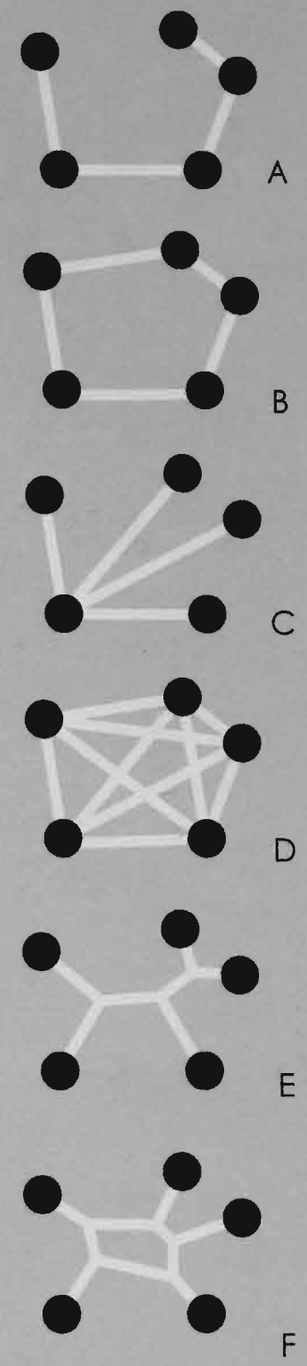
Network Types, Form, and Space

To understand infrastructure we must look at networks in general and their uses in other types of systems such as the body, the computer, the internet, and in utility and transportation networks. There are four basic network 'typologies' or forms – mesh, hub-and-spoke, linear, and tree. A mesh network is created when each point has two or more connectors to the system. The system assumes there is no dimension of hierarchy to each space or point. Rather each point is treated equally. As the mesh becomes more complex it becomes larger and/or has many more connections. Thus some hierarchy can be created with more connections to a given point. This type of network would fit somewhere between a mesh and the hub-and-spoke network. The network allows for various paths, which means that when one connection or point fails the entire system does not fail or crash. (Rodrigue, J.)

Linear networks rely on relay. Because no point may have more than two connections a transfer of units will likely have to pass through other points were it can be delayed or diverted from the straightest and most efficient path. If one point fails it may isolate other points or split the network into two, which will result in the overall network being unsuccessful. Again this system has virtually no hierarchy. The hub-and-spoke network, most commonly used in the airline industry, creates a central point, or hub, with multiple branches. In this system if one branch fails then the rest of the system is spared, but if the hub fails the entire system fails. If some type of unit needs to go from one branch to another branch then it must transfer at the hub, meaning that it will not take the most direct route to its destination. The tree network is a more complex variation on the hub and spoke network which uses one central point. The tree system has various levels of hubs or merger points. If one hub fails all points beyond it will fail until the next hub.

Every network has many ways that is can be formed. "[This] figure presents six different ways to link five places." (Rodrigue, J.)

- "*(**A**) is the minimum construction costs network where all places a linked.*
- *(**B**) is the minimum operation costs network.*
- *(**C**) is a nodal network favoring one center at the expense of others.*
- *(**D**) is the maximum accessibility network. Every point is directly linked to the other but the construction costs are maximal.*
- *(**E**) is least length network where the summation of the links are minimal.*
- *(**F**) is the traveling salesman network. It provides minimal distance for a route between all places.*" (Rodrigue, J.)

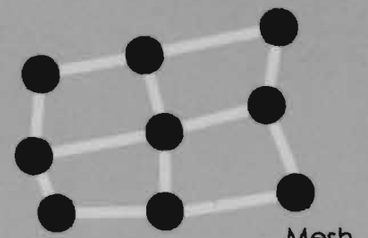


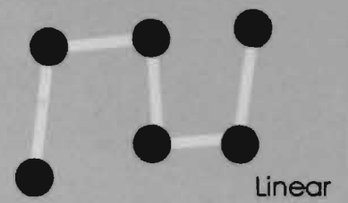
Although these diagrams refer to transportation systems, the typologies are exactly the same in any network. Whether the network be the circulatory, nervous, or respiratory systems of the body or even the model the internet and computers, the form space and function remain the same.

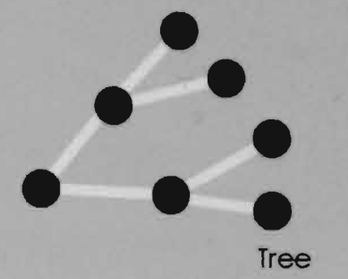
These network typologies drastically influence the way in which we have built cities throughout history. The modern metropolis is built upon layers of grid, meshes, and other patterns. These patterns are directly linked to our spatial understanding of movement throughout the city. Furthermore network typologies can effect how buildings can be built on them within them or around them. For example, linear networks have edges of buildings with large nodes at major intervals. Most cities are built on a grid or mesh typology. This form allows larger developments to be located at the intersecting nodes of the grid while still allowing the city to spread infinitely.

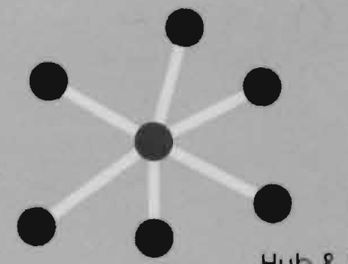
Nature and The Body

Most, if not all, of our technology and modern inventions have come from what we have learned from nature and the body. The human body is a complex machine that relies on various networks to keep it functioning. All organs in the body require blood and oxygen and it is up to the heart and lungs to provide the entire system with these essentials. The heart and lungs are the hubs and the system of veins and arteries are the infrastructures that will provide the various organs with vital nutrients. Like the tree network, a hierarchy of capillaries, arteries and veins move blood and oxygen through the body supplied and recycled by the hub or heart. Many of our transportation systems are described in the same way. Arteries such as highways and main roads provide distribution streets with traffic to various destination points. It is important to understand that the body and every network are complete systems, and we cannot discuss one part of the system without realizing that the part affects the rest of the system. Therefore we cannot talk about veins without arteries, nor can we manipulate highway systems without considering the effect on local streets. One unit affects the other – if one fails so does the other and the entire system.





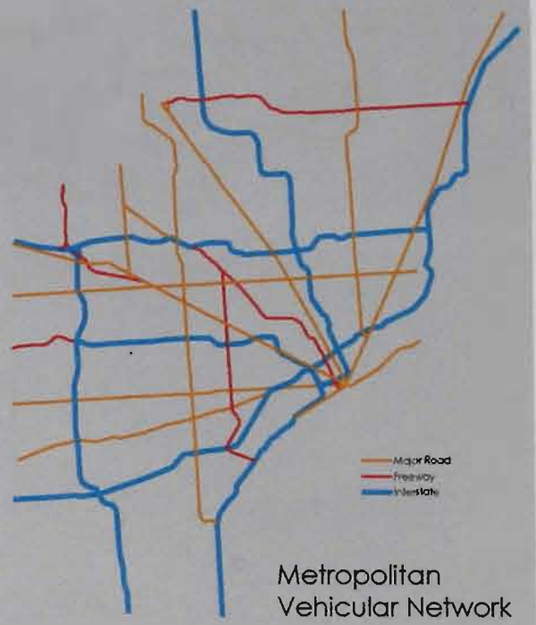




Computers, the Internet, and Decentralization

When connecting computers to a network we can form any of the typologies of networks, but the most common example is the complex system of the internet. Communication systems such as the internet have provided us with the understanding of what it means to be decentralized – or without a center or hub. No one really owns the internet – although various government groups monitor it for various reasons – it is a system that relies on its users to exist. The form the internet takes is a mesh network of points called routers. Routers, which are basically other computers, determine the path between one user and another. If a router is shut off, other routers will direct traffic to other points through other lines. As the internet has grown more complex – meaning that as more users and computers are connected – the system has become increasingly decentralized.

An article by Kevin Werbach of the company *CNet* – an internet based web company that specializes in technology products and news – sums up the need to decentralized systems and why many other complex systems are looking to the internet as a guide for how to become decentralized. Werbach says that especially in the technology and science world "centralized systems are failing for two simple reasons: They can't scale, and they don't reflect the real world or people." As networks grow more complex there is an increasing need to be decentralized. "Networks must carry vast and growing amounts of traffic, with no end in sight. Centralized systems eventually crumble under the strain of that complexity. Decentralized approaches often seem impractical, but they work in practice." (Werbach, K.) "Our minds always want something central and stable to latch onto." As the world becomes more complex and more global in thought, the decentralized model will need to become more common among systems beyond technology. Decentralized systems are common in nature and in certain governments where control of the system is not separate from the users. But decentralized systems cannot just be applied to everything as a way to decrease costs and control while increasing efficiency and flexibility. "The challenge is to find the equilibrium points – the optimum group sizes, the viable models and the appropriate social compromises." (Werbach, K.)



Metropolitan Vehicular Network

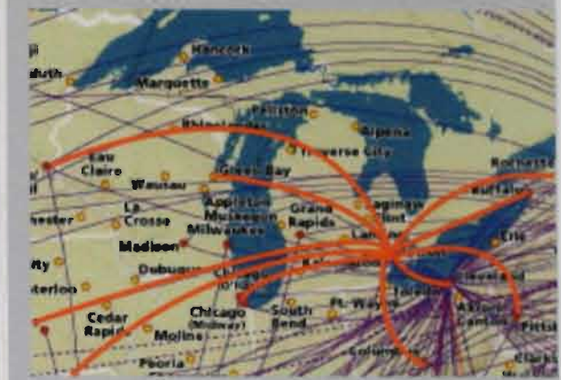
Regional Rail Network

Utility Networks

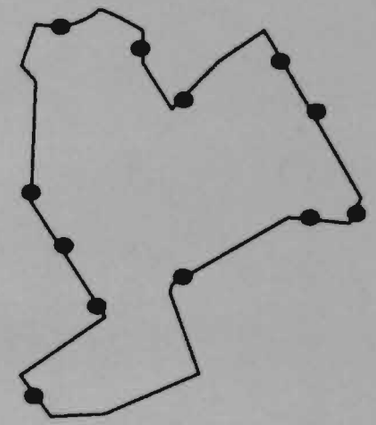
Utility systems such as water, electricity, sewage, and communications are vital to the sustainability of our cities and way of life. Of course this can be said about all infrastructures, but particularly about utilities which are often not seen or physically inhabited by the users. Unlike transportation networks we have little physical connection with utility networks – we just expect them to exist and work. With the exception of rural areas, power and communication lines tend to be located underground, hidden from view. Utility networks are often considered ugly, dirty and wasteful of space when placed above ground. But on an architectural scale utilities are constantly expressed as vital to the building as is the structure. The Pompidou Center in Paris, France, illustrates these utilities can be beautiful systems that can be used to define space or create a visually active space.

Utility networks tend to act as tree networks which have a main hub such as power plants and intermediate hubs such as power substations and transformers. In the case of water systems there are pumps, treatment plants and water towers that act as hubs. Utility systems are also defined by some type of line, as in power lines or oil pipelines. Unfortunately as the population sprawls from cities and these central power and water hubs, the infrastructure becomes increasingly stretched and inefficient. Furthermore, power lines and water pipes have been stretched so far that the expense and feasibility of maintenance is growing disproportionately to the sprawl of the system. Much of the water and electricity of these systems is lost in theses networks. As systems become more complex they can be connected to other systems. Such is the case with power plants that operate near various cities. When these plants are linked the result is a national (and somewhat international) power grid. In the pasts large power plants were built because they tended to be more efficient or only technically capable at a very large scale. Coal, oil and nuclear power plants tend to be very large and although electricity is very clean the power plants are not. As technological advances in power supply become increasingly smaller and more efficient the more likely we may see more models of decentralization of our utilities. For example the possibility of fuel cells and other technologies could allow the home owner to generate clean power right in their home. Another viable possibility is to combine some systems such as communications with power. It is very possible to allow telephone, internet, and televisions signals to be broadcasted through existing power lines. Combining these systems would reduce the overall infrastructure for each system which tends to follow the same network paths. Wireless technology has and will also change communication networks. Although wireless communication already exists it will become more common on a much larger scale as technology continues to be enhanced.

Regional Waterways



Regional Airlines



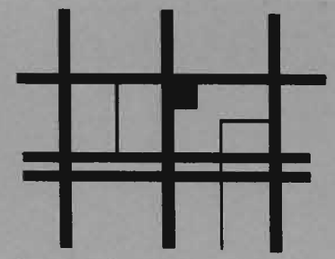
Elevated Rail Network
(Detroit People Mover)

Transportation Networks

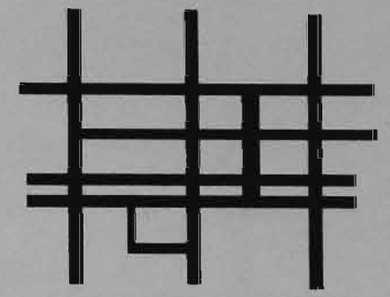
Boats, trains, planes and automobiles have throughout history changed our perception of space and time. Through these vehicles we seem to have conquered time. The increasing speed at which we travel makes distances seem smaller than they really are. Much of the focus of this thesis will pertain to transportation networks because of their close relationship to architecture and the spaces of our cities. Transportation networks are the only networks that we can physically inhabit. There are 5 types of transportation systems – pedestrian, vehicular, rail, water, and air. Pedestrian networks are not just limited to sidewalks, but also include trails, bike paths, skywalks and bridges, as well as underground tunnels. Automobile and rail network use vehicles to move people and goods between and within cities. Air and water networks are predominately used for long distance travelers as well as long distance shipping.

The invention of the automobile revolutionized our understanding of civilization and our quality of life, for it is the most prominent mode of transportation in the United States. The invention and mass production of the first automobile established a dream for Americans of owning their own transportation – which was fast, cheap, and easy. World War II further accelerated the significance of industry, mass production, and capitalism as forces of potential power both in and out of the city. Combine the mass produced machine with a massive super network and you get a united and efficient machine. Thus President Franklin D. Roosevelt realized the need and power of the superhighway and the potential for the country to be connected. In 1986 FDR and congress created the Federal Highway Act, which called for the construction of a network of 2-lane interstate highways that could be used for the defensive needs and the economic growth of the country. Today many of our vehicular networks are so overly congested that the only way out would be to consider alternative modes of transportation. These modes will have a direct relationship on how cities are designed. They also affect the way in which buildings and other structures can be integrated into the network.

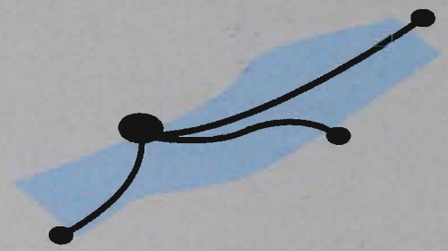
Today transportation networks are very complex. We move ourselves and our goods from location to location, often overlapping and transferring to other modes of transportation. Some networks physically overlap and work together to reduce traffic congestion, and land consumed. An in depth look at the relationships that different modes of transportation have follows on the following pages. This transportation matrix can be used to improve networks and mobility in cities by establishing alternative and complementary modes. It provides a list of problems that effect our cities and the relationships to the structures that surround or could be potentially integrated with the network.



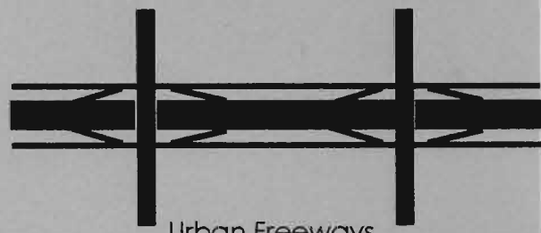
Urban Sidewalks / Plazas



Urban Streets and Alleys

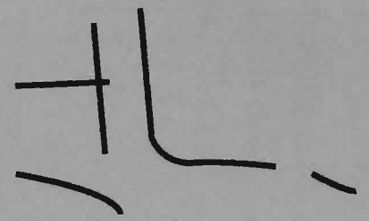


Ferries / Water Taxis

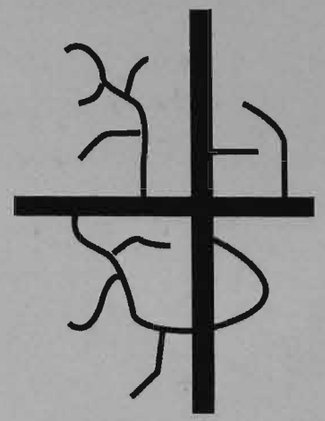


Urban Freeways

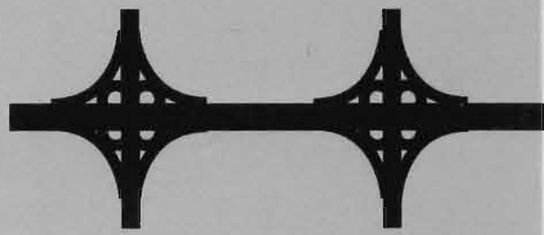
	Pedestrian	Vehicular High Speed Long Distances	Vehicular Low Speed Short Distances	Hybrid (i.e. Bus)	Rail Low Speed Short Distances	Rail High Speed Long Distances	Water	Air
Regional or Global Network	n/a	Mesh; Point to Point -Interstates	Mesh; Point to Point -Scenic Byways	Point-to-point, or tree -Charter Bus	n/a	Hub and Spoke -regional stations; city to city	Tree; Point-to-Point (linear) -Barges, Liners	Hub and Spoke -International and city airports
Metropolitan Network	n/a	Mesh / Grid -Freeways; highways	Mesh / Grid -Main Roads	Point-to-point, or tree -Express/ Commuter Bus/ Tram	Tree or Mesh -light rail	Tree; Point-to-Point (linear) -freight stations	Point-to-Point (linear) -Ferries	Point (cellular-like) -Public or private owned regional airports
Urban Network	Mesh	Mesh / Grid -Freeways; highways	Mesh / Grid -Main Roads; streets	Mesh -City Bus; Trolley	Linear or Grid -Subway; elevated rail; street cars/trams	n/a	Point-to-Point (linear) -Ferries	n/a
Suburban Network	Unconnected Mesh	Mesh / Grid -Freeways; highways	Artery /Branch -Main Roads; streets	Mesh -Suburb Bus; Trolley	n/a	n/a	n/a	n/a
Types	Sidewalks, sky-bridges	Freeway/ Expressway, Highway, service drives & ramps	Highway, Avenue/ Boulevard, Streets, service drives	Any Vehicular road type, Dedicated lane, or street track	Dual track rail, Monorail, guided lane	Dual track rail, Monorail	Oceans /Seas, Rivers, Canals	Air corridors, air space
Vehicle Types	Feet, bikes, skates, strollers	Cars, Trucks, motor-bikes	Cars, Trucks, motor-bikes	Buses, Rubber-Trolleys, Trams	Subways, Light Rail Trains, Elevated Trains	Trains	Boats, Barges, Ferries	Planes, helicopters
Nodes	Destination, Intersections	Destination, Intersections	Destination, Intersections	Bus Stop/Station, Intersections	Stops/Stations/ Hubs	Stations, intermodal hubs	Ports, Docks	Airports, Landing pads
Place	Location of network	Vehicle and Infrastructure	Vehicle and Infrastructure	Station	Station	Station	Port	Airport
[Inter]sections	Sidewalk intersection	Cloverleaf, T, On/off ramps	Signal or sign intersection, 'round-abouts'	Any Vehicular or Rail Intersection	Signal or sign intersection, Switch rails	Switch rails	Port	Airport
Mode Switch	Walk off sidewalk into/onto station or vehicle	Parking Garage or Lot	Parking Garage or Lot	Bus Stop/station	Stop/station	Station	Port	Airport
Main complementary mode(s)	Vehicular, Hybrid, Rail	Pedestrian, Vehicular Low Speed, Air, Rail (freight)	Pedestrian, Vehicular High Speed	Pedestrian, Rail, Vehicular	Pedestrian, Hybrid, Vehicular	Pedestrian, Hybrid, Vehicular	Vehicular, Rail	Vehicular, Rail
Most Common Substitute Mode(s)	Vehicular, Hybrid, Light Rail	Hybrid, Rail, Air	Pedestrian, Hybrid, Light Rail	Vehicular, Rail, Pedestrian	Hybrid, Vehicular, Pedestrian	Hybrid, Vehicular, Air	Air	Rail, Vehicular, Water



Suburban Sidewalks



Suburban Streets

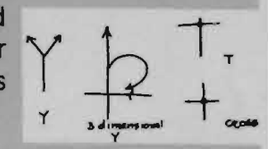


Suburban Freeways

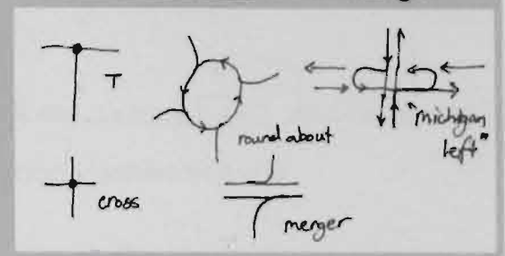
Unit/ Dimension	Sidewalk width -width based on the width of person passing by another person(s) -Closer to curb and building in urban condition -Wider with more density -Avg 3-5 ft wide	Single Lane -More lanes added adjacent for more density -Typically 11'-12' -may also contain shoulder and/or median/divider (of various sizes)	Single Lane -More lanes added adjacent for more density -Typically 11'-12' -may also contain shoulder and/or median/divider (of various sizes)	Single Vehicular Lane -May have rail track (s) -may have electrical cable(s) above lane	Single or Dual rail track -may have electrical cable(s) above lane	Single or Dual rail track -may have electrical cable(s) above lane	Varies/Unlimited	Varies/Unlimited
Space-Time Compression	Very Low	High	Moderate to High	Low to moderate	Low to moderate	Moderate to High	Low	Very High
Space Perception	High - Wide	Low - Narrow	Low to Medium – Somewhat Narrow	Medium - Somewhat Narrow	Medium - Somewhat Narrow	Low - Narrow	High - Wide	Low - Wide
Transport Unit Costs	None	Medium	Low to Medium	Low	Low	Moderately High	Low	Very High
Typical Speed (mph)	< 5	60+	45	35	40	100+	~40	~500
Accent On	Walkers	Passengers and Freight	Passengers and Freight	Passengers	Passengers	Passengers and Freight (more commonly freight in US)	Freight	Passengers and Freight
Target Market / variety of users	Recreational walkers, joggers, etc.	Commuters, Long distance freight	Commuters, Shoppers, Distribution	Commuters, Shoppers, event users	Commuters, Shoppers, event users	Freight, Long dist, business travelers, some tourists	Freight Some commuter ferries	Business, Tourism
Typical Location	Urban, Suburban	Urban, Suburban, Rural	Urban, Suburban, Rural	Urban, Limited Suburban	Urban, Limited Suburban	Urban	Extra-Urban	Suburban
Spatial Constraints	Unlimited	High	High	Low	Low	Moderate	Moderate but growing	Moderate but growing
Land use Densities	Low	Low to moderate	Low to moderate	High	High	High	Moderate	Low
Access at node	Public	Public, Motorized	Public	Public	Public	Public	Restricted	Restricted
Dominant place-connected activities	Residential, Commercial	Gas Stations, Convince Stores, Parking	Gas Stations, Convince Stores, Parking	Commercial, Residential	Commercial, Residential	Commercial	Industry, transportation / distribution services	Hotels, Gas stations, transportation / distribution services
Node-Place relationship	Local dependence	regional dependence	Local dependence	Local interaction	Local interaction	Local interaction, regional dependence	Local dominance, regional dependence	Local dominance, regional dependence
Land consumption per unit transp.	Moderate	High	High	Low	Low	Moderate	Very High	Very High

Management	City Owned and Maintain (some maintenance from public)	Publicly owned vehicles on various levels of governmental controlled infrastructure	Publicly owned vehicles on various levels of governmental controlled infrastructure	Regional or City Government controlled	Regional or City Government controlled	Subsidized, Monopoly No separation between infrastructure and services.	Separate corporately controlled services and infrastructure. Governmental regulated	Separate corporately controlled services and infrastructure. Governmental regulated
Land available for property development	High	Varies	Varies	Moderate	Moderate	Moderate	Moderate	High
Type of Property development	Suburban, Urban redevelopment, Mixed-Use	Various	Various	Urban redevelopment, Mixed-Use	Urban redevelopment, Mixed-Use	Urban redevelopment, Mixed-Use	Suburban, Single- Use, Greenfield	Suburban, Single- Use, Greenfield
Potential Economic Impact	Limited	Sprawl, Decentralized	Sprawl	High increase to all areas served	High increase to all areas served	High increase for long distance business and tourism -	Regional / Global Business	Regional / Global Business, Tourism
Dominant Issues	Mixed use development, pedestrian pockets	Sprawl, Higher Congestion, need alternatives	Sprawl, Higher Congestion, need alternatives	Mixed use development, pedestrian pockets (TOD's)	Mixed use development, pedestrian pockets (TOD's)	Increase regional economic conditions	Pollution, too much space needed; need be near industry and/or freeways and/or rail	Noise; Space; unknown stability of air travel market; location to far from city;
Environmental Impact	Higher Community Value, Healthier residents, Green	Sprawl, Higher Congestion, Noise	Sprawl, Higher Congestion, Noise	Reduce Congestion, pollution	Reduce Congestion, pollution	Reduce Congestion, pollution – less consumed space than airports	Pollution, too much space needed	Noise, High Pollution, too much space needed
Relationship to Buildings	-Urban: sidewalks are adjacent to buildings which are very close to street, some skywalks create multileveled movement through city -Suburban: Far from building and street; use mostly recreational	-Little relationship to building or city. -Single use Developments at suburban intersections -Some freeways have side streets: *see low speed conditions to the left* -Development Spreads far for the infrastructure	-Parking Garages/Lots -Urban: buildings are very close to street, only separated by sidewalk; creates a smaller R.O.W -Suburban: Far from building; culd-a-sacs; garages face street often creating a "no-man's land" environment	-Bus stops can be considered architecture. -May need park and ride lot or bike rack depending on users -Best if users walk to station: can spur development at station (preferred mixed-use)	-Light rail stations can be considered architecture. -May need park and ride lot or bike rack depending on users -Best if users walk to station: can spur development at station (preferred mixed-use) -Stations can be integrated into buildings:	-Trains Stations: can be small cities -Infrastructure cuts through existing development: often noisy -Docks and Intermodal stations allow train to pull up to building to unload	Very little integration used: some docks and marinas incorporate buildings directly on them or on/in water	-Airports: can be small cities -Plane connects to building with umbilical cord-like structure

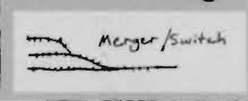
High Speed Vehicular Interchanges

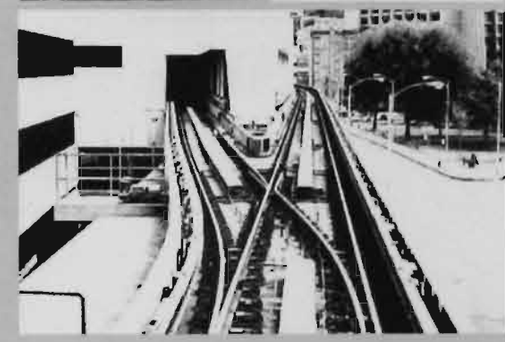


Low Speed Vehicular Interchanges



Rail Interchange





SIDEWALKS / SKYWALKS — TRAILS

Walking Pedestrians
Transportation

Higher Speed - Bikes, Skates, etc.
Recreational

MEGA ROAD — FREEWAY

LOCAL STREET — LARGE ROAD

Lower Speed - More Local Traffic
Parking on street

Higher Speed - More Express
Commuters - Longer Distnaces
More Lanes
Larger right-of way for turns and ramps

LOCAL — EXPRESS

Lower Speeds
More Frequent Stops

Higher Speed
Direct Route Fewer Stops
Commuters from Suburbs

PEOPLE MOVER — LIGHT RAIL

Locol Transportation
Transports Pedestirans

HIGH SPEED RAIL

Intercity / Regional
Transportation
Transports Freight

FERRY — OCEAN LINER

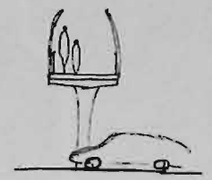
Locol Transportation
Transports Pedestirans and Some Cars
Rivers - Small Bodies of Water

Global / Regional Transportation
Transports Freight
Oceans - Large Bodies of Water

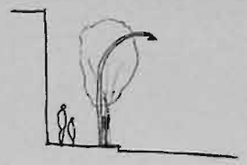
HELICOPTER — AIRLINER

Local Transport
Emergency and News Vehicles
Uses Small Heliports or Pads

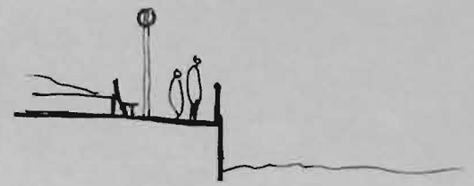
Intercity / Global Transportation
Passengers and Freight
Larger Scale Airport = Longer Travel



Skywalk

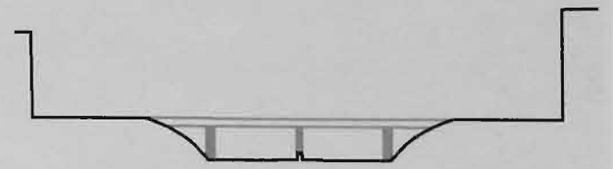


Sidewalk

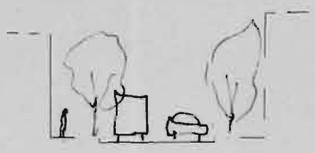


Riverfront

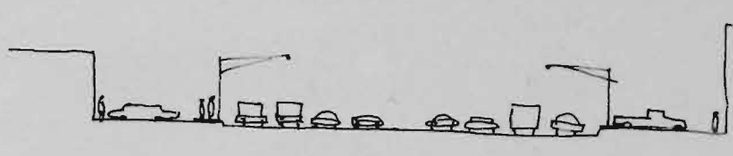
Boulevard (Larned)



Freeway (1-375)

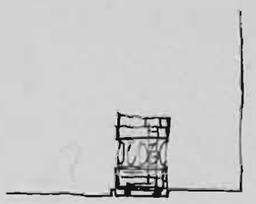


Local Street

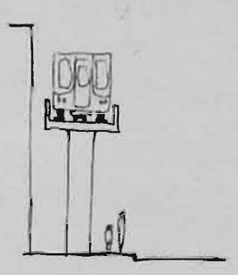


Mega Road (Jefferson Ave.)

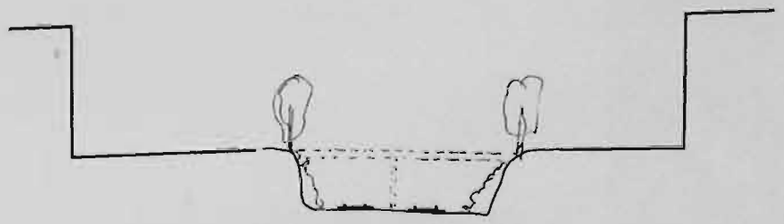
Rail



Trolley



People Mover



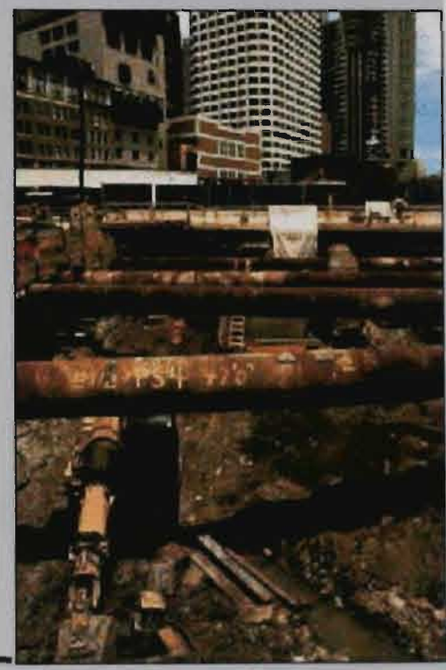
Rail (Dequinder Cut)

Cites and Infrastructure

Today's cities were never planned for such large amounts of traffic, nor were they designed at the scale of the automobile. The cost of upgrading our infrastructure is disproportionately high compared to the urban living styles they destroy. "...A fundamental conflict – a misfit – exists between the scale of cities and the transportation systems that serve them. Dispersed around the region, we can no longer conform our individual paths of travel to the fixed lines of mass transit. And the more highways and expressways we build, the sooner they become overburdened with traffic; no investment in highways seems great enough to satisfy our voracious necessity to travel by car." (Gottman & Harper, 4) "Neither the scale of traditional streets, nor the size of individual parcels, anticipated the growing volume of traffic or the need for off-street parking. Common solutions to making older cities accessible to cars have been widening streets...displacing pedestrians to underground districts or overhead walkways; cutting new traffic arteries between neighboring urban districts... or the middle of cohesive neighborhoods..; and replacing fine old urban buildings with parking lots.... As the highways have taken over, the tightly woven fabric of urban streets has been progressively destroyed." (Gottman & Harper, 5) Infrastructure shares a symbiotic relationship with our cities. Each has the power to take and give life to the other, but if one system fails, both fail.

Cities such as Boston, Massachusetts had to do something to improve the destructive force that the freeway seemed to be causing. As pollution, noise and congestion gripped the city by the throat and strangled it, planners and politicians knew something had to be done to protect the city's lifestyle, community, and architecture from the destructive freeway. So planners and architects alike went to work on the largest infrastructure project ever. The plan was to remove the existing stacked freeway from the core of the city and place it directly underground. The result would hopefully reduce the noise and pollution and

Boston Prior to the "big dig" construction



Boston - miles of layered underground infrastructure

bind the two sides of the city that had been split by the freeway. Parks, new buildings, and smaller more manageable local streets could be placed on top of the reclaimed land over the freeway. Unfortunately the project is over budget and decades behind schedule.

The new tunnel, now called "the Big Dig," is to be a multiple use corridor – meaning that utilities, future trains, and cars will use the same artery. Unfortunately for these drivers there will be no natural light and no views of the city in this tunnel – nothing to look at when traffic becomes congested again because commuters seem to endlessly multiply. Gone also is any connection to the city. One can simply drive through the city never experiencing it, never finding something new.

When infrastructure is buried it will always cost more to society but not always just in terms of monetary value. People will always be concerned with how things work for it is knowledge that drives us and places us within space and the city. Hidden infrastructure has the disadvantage that we may never understand how it works. We may become lost in the tunnels without any sense of direction and without any sense of understanding of the networks we use. If cities are to become more complex they will need logical systems of infrastructure. We should exposes these systems rationally so that we may logically understand the environment with which we work, live, and travel.

Utilitarian systems are important to the function of cities. "Parking Garages are as essential to good urbanism as streets and sewers. Without them, surface parking lots make a city empty and unwalkable. If you were to decant public garages onto surface lots, the city would lose its vibrant urbanity. This structure [depicted on the left], however, is architecturally overdesigned and typologically confused. Besides the fake brick arches, its lavish detailing and overly-prominent elevator give the impression that it is a foreground rather than a background building, as does its corner location. As important as parking is functionally, it

Boston "big dig"
Driving underground without a sence of the city

Constructing the "big dig"

Confused Architecture?
(Kelbaugh, 152)

should remain subservient – in terms of architectural expression and urban placement – to the destinations it serves. "(Kelbaugh, 152)

Automobiles have drastically changed the form of the American cities. "The result [is] an unprecedented scale and pattern: large amounts of paved open space devoted primarily to roadways and parking, with structures interspersed at distances. Every Physical premise of the traditional city disappeared: continuous pedestrian circulation; a well-defined and habitable public domain; and the entire array of architectural details on buildings and streets..." (Gottman & Harper, 5) "Before the automobile, streetcar suburbs made eminent sense. At their outset, automobile suburbs made sense too. Living on a shady, quiet lane with a stream out back and a half-empty school bus to pick up the kids was a tempting alternative to noisy, messy, city neighborhoods. These inner-city neighborhoods were beginning to get cut up anyway, as freeways slashed through them on their way to the suburbs. What ensued is all too familiar: empty downtowns at night; decline of the neighborhood school, church, and store; urban renewal; lots of vacancies and vacant lots; traffic congestion; cul-de-sac subdivisions; wider streets; longer arterial strips and red lights; regional malls and office parks; fewer truck farms; increasing crime; more parking lots and less green space; smog and air pollution; gridlock downtown; big box discount malls; high school violence; gridlock in suburbia..." (Gottman & Harper, 134) The demand to expand father outward for the city core was further marketed to those who sought the dream of owning their own home on their own grassy lawn without the pollution of industry and crime of the inner cities. Ironically as years passed these suburban cultures would become dominated by fully congested roads with highly polluting and massively over scaled automobiles. Crime and debt also increased. At the same time the city saw a reduction in population growth (if not total recession) and the increase of unemployed. Not all of these effects can be blamed on the car and the highway. Racial and political environments also can be attributed, as well as the ideals of the average American.

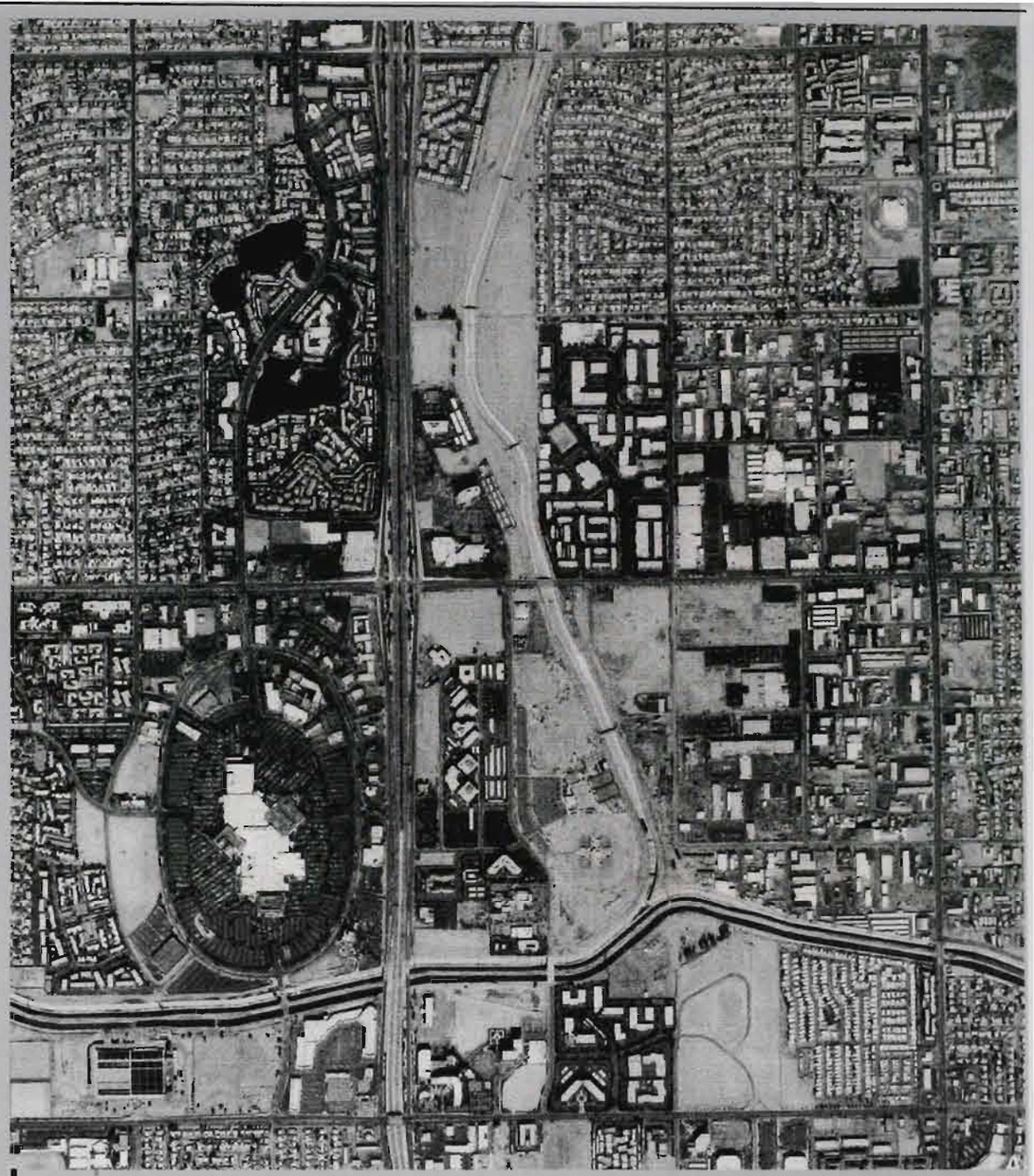
In many American cities such as Detroit, Michigan the urban core is decaying while sprawl continues to expand outward.

Endless sprawl has choked the already congeted freeways

Decentralization is a concept that has become increasingly popular because of the introduction and evolution of the internet and wireless communication. In its purest form a decentralized network consist of only equal nodes on a network that has no hub or central point. Unlike any other form of network if a point on the system were to suffer some type of failure the system would not suffer any type of crash and no other point or network leg would be lost in the system. It can be argued that the decentralized model is uneconomic and wasteful because it can suffer from too much infrastructure. In a digital world there are no limits on multiplicity, but in the real world more connections cost time, money and space. But decentralization is not a concept to just throw away. Unlike any other centralized model a decentralized model only has more connections but they are smaller and only extend from point to point and never back to any hub. Thus in terms of actual miles (or whatever is the unit of measure) a decentralized model covers more distance with fewer infrastructures. Using endless relay methods and multiple channels of distribution, each point acts similar to a hub by means or receiving and resending units to other points but there is no need to ever return to the source.

The concept of decentralized cities is difficult because every system needs to be decentralized. If governments and cities become more decentralized as they become more complex then so too will the infrastructure that spreads over the system. Ownership of these infrastructures will also need to be decentralized. The future could see a world where we each own our means of creating electricity and the other recourses we need to survive. This may not be unlikely since we have already posses a private transportation system – the car.

Sprawl is one form that is challenging the concept of the city as having a definite singular center. Today it is more progressive to understand the city as a megalopolis of smaller districts or suburbs. We address our cities as metropolitan areas consisting of a



Many American cities such as such as Pheonix have sprawling acres of sububan sprawl - Transit corridors like freeways don't have any relationship to the buildings around them - there is no direct support between the infrastructure and the community, unlike mass transit rail lines which develop clear hubs of dense controlled growth.

multiple of governments and decentralized centers. But the concept of city is not fully decentralized even though our technology of communication and movement allows it. People still need a place of commune – a place to meet and to be amongst other people. It is important to note that the forces decentralization and centralization will always influence human society and the cities we live in. A constant fluctuation from one force to another balances the society and corrects it from misguided growth and depopulation. Many American cities are in a rapid decline period, controlled by the rapid growth of the suburban decentralized environment. But metropolitan areas such as Detroit, Michigan are beginning to see its suburbs are directly linked to a regional economy. The potential of connecting these suburban cities to Detroit and the surrounding region would stimulate the areas economy far more than a suburban city can achieve alone. By refocusing on transportation routes that connect and promote smaller, denser pockets of growth the city could benefit from being a regional metropolis. In this sense the region can become decentralized while providing central areas that reduce overwhelming redundancy and control growth. These pockets could bring back the missed community values that come with walkable district sized cities.

In the suburbs it is not always understood which comes first – the development or the infrastructure. When the infrastructure comes first it is usually the result of city planners and potential developers who decided that money should be poured into an area that may one day see growth. New infrastructure often helps to spur new development. If a development is easy to get to then commerce should follow. This type of developing strategy risks failure for many reasons. A change in the economy and the failure to complete the project quickly often leaves city planners with a lost project and a lot of wasted resources. But if development does take off the city planners can pat themselves on the back for pre-planning the expanded infrastructure. In some developments a successful project will require more infrastructure improvements and extensions which often go unseen or unplanned until they are overly needed. When this happens the strategy of development is one of catching

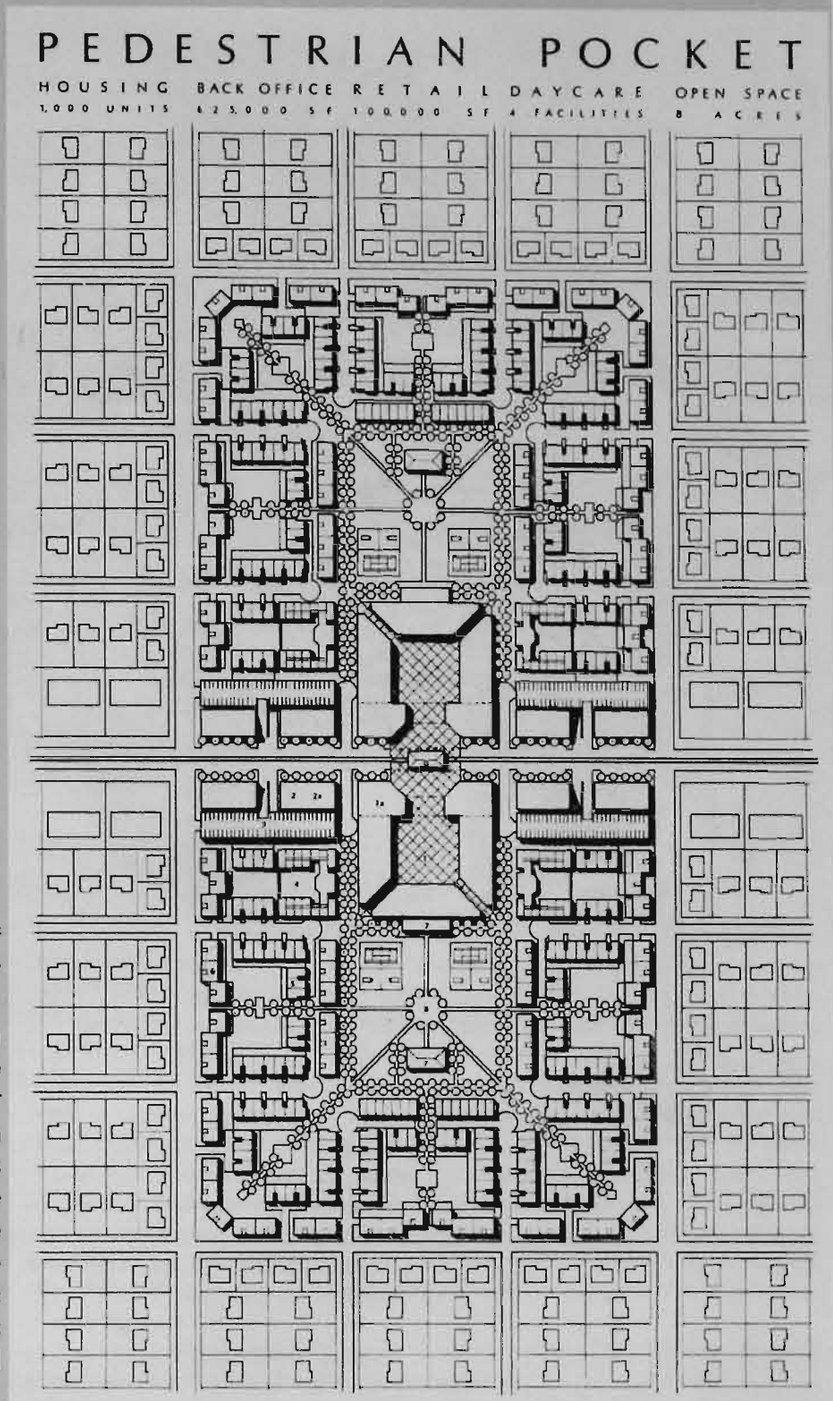
up to growth. When an area is very successful or when it has been improperly planned, the city planners must squeeze in needed improvements for infrastructure. If this is even possible it tends to come at a very high expense and creates the possibility of land ownership and requisition disputes which can delay projects indefinitely. When gridlock and traffic accidents increase, the need for alternative transportation may finally be considered. Again when it's already too late to build a mass transit system or create some new technology to battle congestion the costs will be higher than if it had been planned for. When upgrades are made constantly or at regular intervals, the system will always perform better and costs less. The need for pre-planning and constant upgrading without over planning seems to be the easiest and cheapest as well as most coherent and logical concept of development.

The Future of Cities and Infrastructure

The future of our cities depends upon our infrastructure. From schools to roads, we must be constantly improving and maintaining the infrastructure we have. As population grows and cities become more sprawling, there must be an acceptance for alternative modes of transportation. "But limited infrastructure initiative should not be limited to simplistic ideas about economic productivity based solely upon the efficient transfer of goods, services, and people. Productivity must be supported by a work force living in equitable, attractive, and culturally rich places. People who come home every night to a decaying and dysfunctional neighborhood dominated by automobile traffic and degraded natural landscape cannot be happy and productive workers." (Brown & Morrish, 35)

New Urbanism attempts to reestablish "walkable cities" by constructing medium density pockets of mixed use development. Proposals such as "Transit Oriented Developments" (TOD's) and "Pedestrian Pockets" are small areas, 30 – 150 acres, which situates residential design around commercial and civic hubs. These small cities are kept small to encourage walking to local stores and schools. Each TOD or pocket would be connected by rail or bus systems to reduce dependence on the automobile. These designs try to re-create the idea of a city that is small enough to walk around while establishing a sense of community. (Kelbaugh, 157)

Current designs of TOD's and pedestrian pockets are ridge and tend to copy historic architectures and styles. Just like the suburbs there are no true boundaries to control growth. New Urbanist must rely on zoning controls to establish boundaries for growth instead of relying of the landscape and needs of those people who live there. Furthermore New Urbanism fails to address the cities context. Most New Urbanist projects begin on empty land on the outskirts of cities, further extending the city. This is probably a necessity since many of the designs seem to be drawn on a blank sheet of paper without any reference to existing



Is the future of cities this New Urbanist model? Linked pedestrian pockets can be linked by rail or bus lines. Each pocket maintains a walkable distance to the center of the district whic contains commerce and civic functions.

context or history. This is not unlike the many "Levitt Towns" of American suburbs which are often plowed flat of any landscape prior to construction. New Urbanist also fails to address the city because they believe that the concept of city core has failed. How can this be true when all new urbanism wants to create is the values of which all historical cities have been founded upon – walk-able, live-able places. Even if New Urbanism is failed, the concept of creating a "transit oriented development" in order to re-establish liveable cities is not.

"The next area if infrastructure should not extend outward, creating a third or even fourth ring of roads and transit around the city, but should refocus inward upon systems already constructed." (Brown & Morrish, 35) Cities like Detroit that are too sparsely populated should look to create districts that are transit oriented, for many sprawling cities are too spread out for these potential systems and maybe too spread out for the automobile as well. Infrastructure should also work with nature and the surrounding conditions – not rip through communities, but rather bind them. Future highways should not "subdivide inner-city neighborhoods to accommodate the commutes of suburban workers crisscrossing the metropolitan area." (Brown & Morrish, 37)

What we must all understand is that mass transit and automobile networks should not be thought of as enemies or polar opposites. The only way for freeways to work efficiently is to not have them running at full or over capacity as they do today. Reducing volumes of traffic by way of mass transit lines that run parallel or within the exiting vehicular arteries will allow the systems to work together and fluctuate with demand more efficiently. Multiple use corridors combine many types of infrastructures together to reduce land consumption while allowing development to focus around them or at intersections.

"We have traditionally conceived of infrastructure as neutral, gray utility as objects and spaces devoid of cultural expression or celebration – out of fear of distracting the auto driver; or drawing attention to the city's messy plumbing; or the misguided notion that beautiful, esthetically designed parkways or transit stations are too expensive." (Brown & Morrish, 37) If more care is given to the construction of new or alternative infrastructures then fewer may

Express Buses and light rail systems can be quickly and efficently integrated into the existing fabric of cities. These express systems can run along major arteries while promoting dense pocket growth along those routes at intersections and stations. Modern technology can allow express busse like 'Speedlink' (shown here) to become quite comforable trains on wheels. These busses don't require overhead power lines or elaborate track to built. They can control lights and dedicated lanes to increase speed and effiecntcy. Stations are simply platforms and protective areas which have enormous potential to become masterful works of architecture and public art.

have to be built in the long run. New technologies such as automated highways are expensive and unproven to reduce traffic in the long run. Mass transit lines such as light rail and express bussing are quick, cheap and efficient ways to add transit to clogged arteries. Bussing systems such as "*Speedlink*" can adapt to changing needs in mass transit routes. (Metropolitan Affairs Coalition, 6) If these express bus systems become too populated with users, they can be upgraded to light or medium rail systems that are more permanent and costly, but provide efficient high density travel. Today many of these systems and technologies are so innovative in aesthetics that they are romanticized for their value in communities. Trains and buses have become more aesthetically pleasing and more comfortable to ride. These values can make transit more attractive to communities that wish to enhance their cities and environment.

Our cities depend on regional and global networks, especially as the world seems to become smaller with the age of the internet. In the Detroit area for example, Regional transportation agencies such as DARTA and MDOT must consciously work together with community leaders, architects and city planners to reduce the destruction of infrastructures and increase the potential that infrastructure can have within a sustainable community and/or city. Architects, Engineers, Planners and Politicians should work together with each giving and taking, so that projects can work efficiently for all users. Community members should also have input in large and small projects for they are the ones using them or being effected by them.

In order to reestablish the city as a viable place to live, work and play, we must create new developments and redevelop old ones around transit corridors. Careful integration of mass transit infrastructures will allow the city to regain walkable communities, free from overwhelming, and dirty traffic corridors. Communities can be built around transportation hubs and at node of infrastructures. These transit hubs can create new opportunities for architectural and urban spaces enhancing the city aesthetic, function, and community.

Modern train stations can be very intergrated into the city fabric even though these stations can be very large. As a hub of public activity, the station can spur more dense development increasing economic vitality in the city.

"The station as the focal point for new towns and settlements is increasingly common. It is the USA that still sorely lags behind, although there are some rays of hope, first seen in the restoration of historic monuments and now in some attempts to building significant station buildings." (Dawes, 22)

"Stations that create a focal center and gathering place, rather than introducing an infrastructural divide within a city, can contribute to - and indeed elevate - the quality of life in an area." (Dawes, 23)

Precedent Analysis

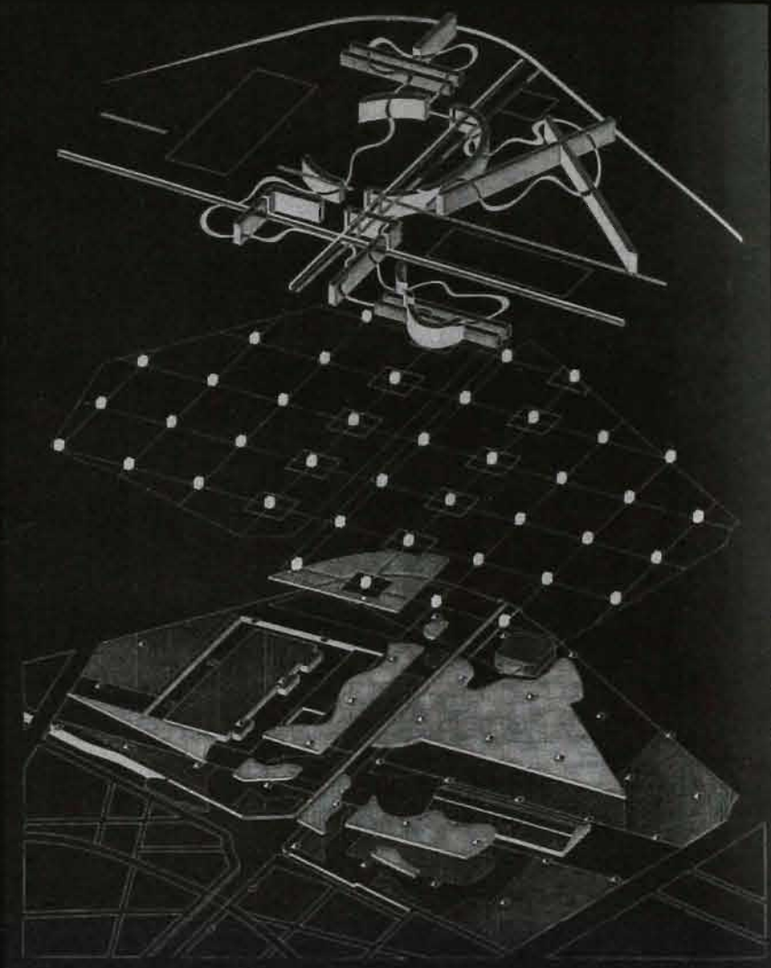
Parc De La Villette

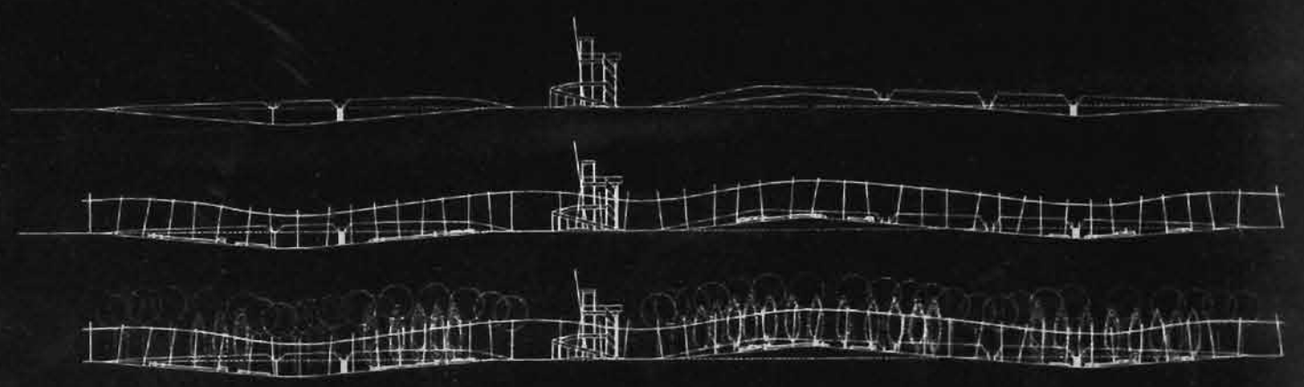
Paris, France

In early 1980's Bernard Tschumi, a Swiss architect, was commissioned to redevelop the 125-acre site of the Paris slaughter houses into an "Urban park for the 21st century" for the people of Paris. Two existing structures, the Grande Halle and the Museum of Science and Technology were already constructed on the site. The park had to provide a connection from one structure to the other which was at the opposite end of the site. The park also needed to incorporate the future museum of music. Tschumi's approach was from a deconstructionist point of view. He would create a park composed of three systems which he called "points, lines and surfaces," in order to give a coherent but program-less logic to the park. Tschumi's systems for the park allows for spaces of discovery, reflection, and imagination. This allows the park to express its goal of combining the concepts of culture, science, and art.

Tschumi was able to create movements of varying speed and discovery throughout the park by giving different forms to the paths. Like the canal that runs through the site, there are direct paths that lead from one end of the park to the other, which effectively connects two subway stations of the Paris Metro. Other paths are more poetic and allow the user to meander through the park and the grid of points.

Tschumi's underlying structure to the park is based on a grid of follies 120 feet apart. Some follies contain cafés while others sit as





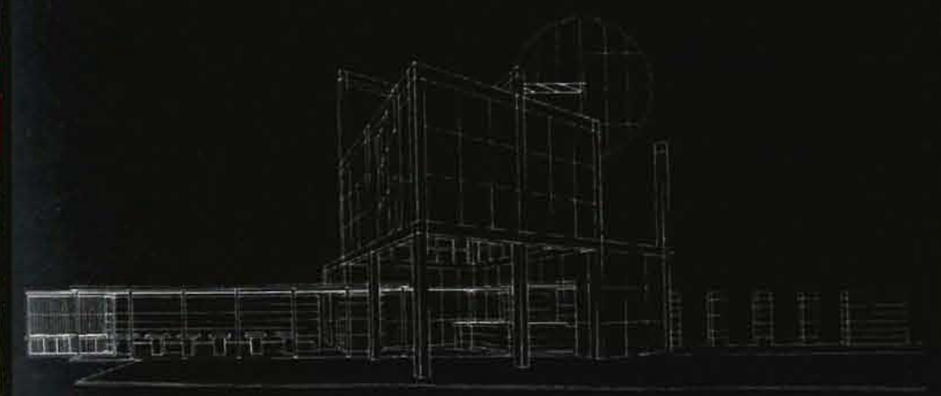
sculptural artifacts. Each folly is essentially composed of a 10' x 10' x 10' grid. This grid defines the space of the follies, similarly to the definition of space the follies give to the park. The programs and paths of the park are free to flow between these grids.

Tschumi created 11 themed gardens to act around the follies. Together the follies and gardens define places for events. They are places that invoke imagination and interest. These focal points give the park a modern twist and engage the concept of "green space."

Parc de la Villette has three meadows - the meadow of the square; the circle; and the triangle. These large grassy areas hold soccer matches, band concerts, and even sun bathing. The meadow is the least programmed system of the park.

Relationship To The Thesis

Bernard Tschumi's attempt to combine systems of organization and structure onto a space in a poetic collage is one way in which infrastructure becomes integral to the architecture and the landscape. The overlay of these systems is critical to the park. At the intersections of infrastructure is where new and exciting things await the viewer. If you approach the intersection from a different angle, the view may be very different from the first. This provocative relationship and the combination of very different but often related systems is something this thesis should engage.

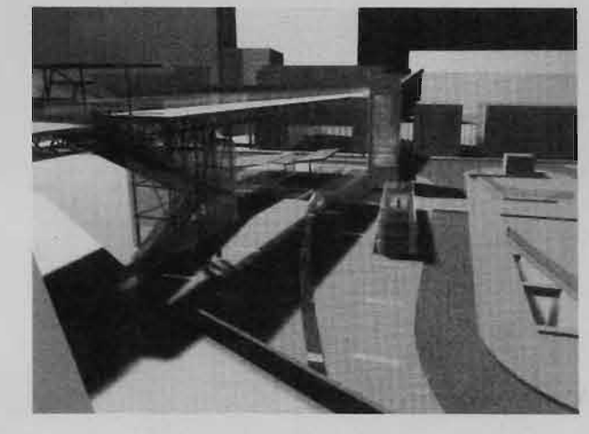


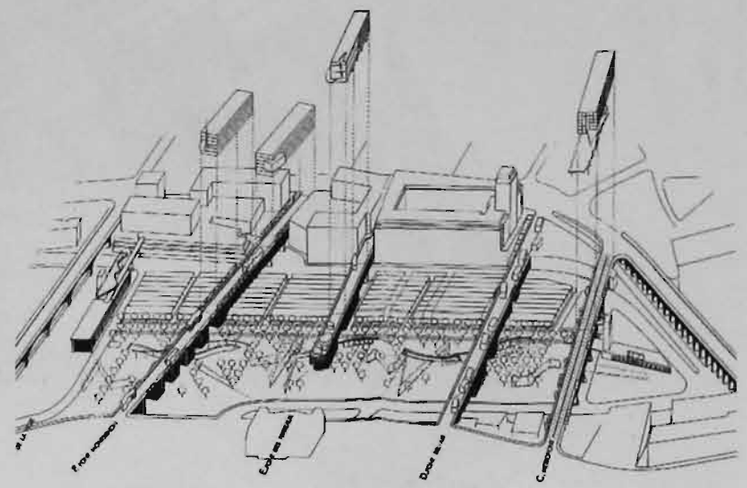
BRIDGE CITY
LAUSANNE, SWITZERLAND

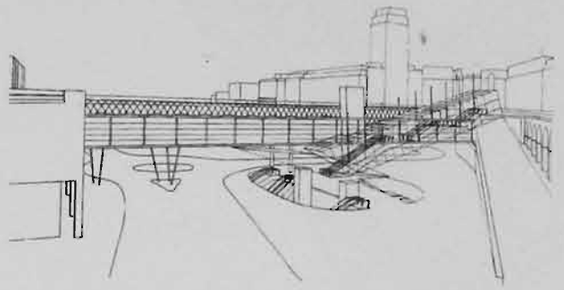
In the valley of the undulating topography of Lausanne Switzerland Bernard Tschumi designed several new bridges to link the divided city. Lausanne's typography allows for places where a bridge can cross over buildings or a road could be constructed on the roof. Tschumi saw the typography as an advantage for the project. The various levels of typography and city created new possibilities for entering a building. No longer would a building just have to be entered from the "ground" level, for there is no definite ground level, in fact there are multiple levels that address the ground. Tschumi creates bridges that are buildings and buildings that are bridges effectively connecting a separated city by a seemingly unusable valley.

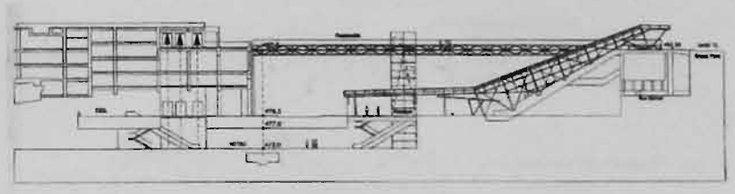
RELATIONSHIP TO THE THESIS

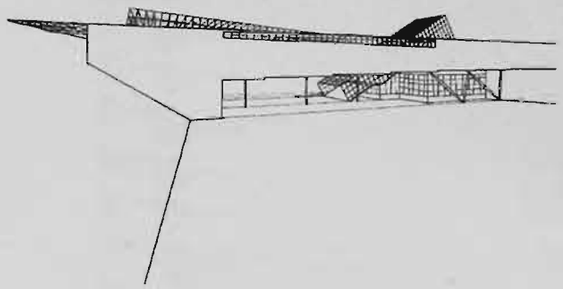
Tschumi's Bridge City begins to challenge the relationship of street to building. Similar to the condition found in the film Metropolis (1927, 2001) the entry of a building may not always be the ground floor. There are many layers to this project. Layers of habitable spaces are intertwined with the infrastructure that connects them and moves though them. Tschumi's buildings have a new symbiotic relationship to the city's infrastructure - the building supports the street while the street brings people to the building, thus supporting and sustaining city life.

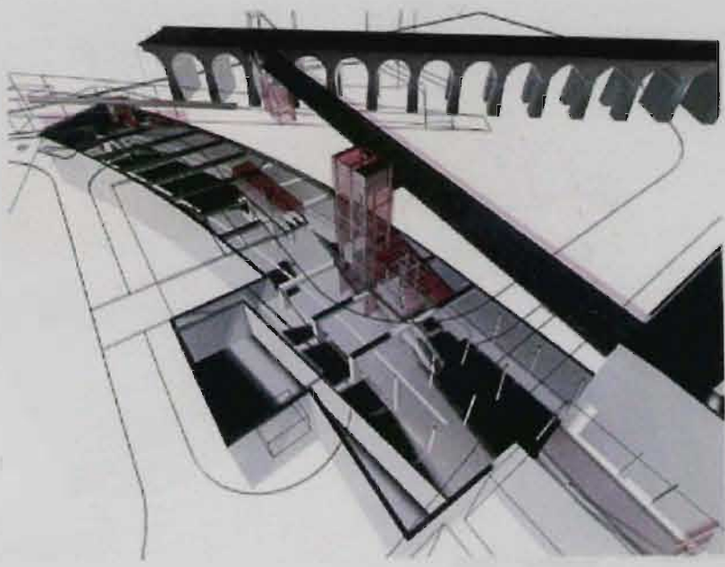


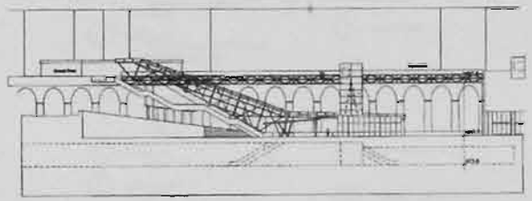












Precedent Analysis

NORTHGATE TRANSIT ORIENTED DEVELOPMENT (TOD)

SEATTLE, WASHINGTON

This proposed development is a new urbanism approach by the city of Seattle to create walk-able city of pedestrian pockets linked by mass transit systems. The project is a mixed-use development with a focus on residential multi-family housing projects. The residential will support a rail and bus routes with passengers who can easily use the system. Adjacent to the site is an existing mall that would further benefit form the increased residential use. This modified urban environment would further be enhanced by open green-space as well as hardscape plazas and promenades.

Project goals

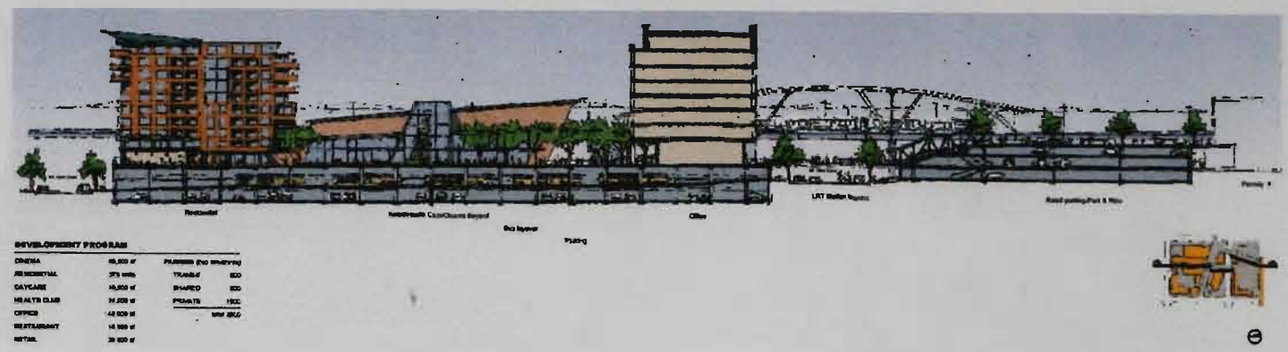
The TOD design ultimately selected for this location will preserve the site as a vital public transportation hub in north Seattle. The site will continue to be an important public transportation transfer point and could accommodate such additional services as light rail and monorail stations. Weekday bus trips through the Northgate Transit Center now total 785, with over 7,000 daily passenger boardings. By 2020, Northgate light-rail ridership is forecast at 10,000 daily boardings, with 75 percent of riders arriving and departing by bus.

Integration of the bus transit center and light rail and monorail stations at Northgate with high-density, mixed-use urban development on the "super block" south of the mall will increase transit ridership and help the City of Seattle achieve its growth management targets. For example,

the 575 housing units shown in Alternative #1 would provide almost 20 percent of the city's 2014 housing target for this urban center.

RELATIONSHIP TO THE THESIS

This project is about the size and scope of the proposal of this thesis. The project's program consists primarily of retail, office, and residential uses. These programs are used directly around the transit hubs. Light rail tracks, a bus terminal, and the adjacent mall stimulate the use of the site. Public plazas and green spaces allow work as pedestrian streets while supporting entry into residential buildings as well as into the bus station below.



BUILDING KEY

- (A) Cinema — 60,000 sf Cinema, 2 Levels
- (B) Health Club — 24,000 sf Health Club, 2 Levels
- (C) Residential — 10,000 sf Day Care at TOD Plaza, 100 Residential Units, 10 Levels
- (D) Residential — 66 Residential Units, 11 Levels
- (E) Residential — 175 Residential Units, 12 Levels
- (F) Residential — 6,000 sf Retail at TOD Plaza, 30 Residential Units, 5 Levels
- (G) Residential — 6,000 sf Retail at TOD Plaza, 20 Residential Units, 6 Levels
- (H) Residential — 15,000 sf Retail at TOD Plaza, 174 Residential Units, 10 Levels
- (J) Office — 12,000 sf Retail at TOD Plaza, 12,000 sf Restaurant at TOD Plaza, 140,000 sf Office, 12 Levels
- (K) Restaurant — 10,000 sf Restaurant at TOD Plaza
- (L) Development — Potential development associated with Northgate Mall

TRANSIT KEY

- (T) Transit Center
- (TL) Transit Layover Access
- (LR) Light Rail Station Access
- (P) Parking Access

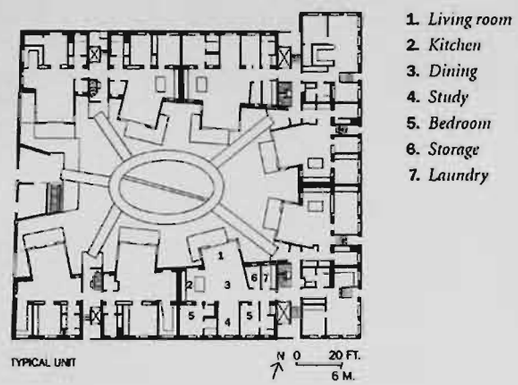
FEATURES

1. Restored wetland
2. Dashed lines indicate Sound Transit right of way above
3. Bus and traffic lanes coordinated with city
4. Signalized cross walk
5. Vehicle and pedestrian access to TOD Plaza
6. Pedestrian access to TOD Plaza
7. Overhead connection to Transit Center
8. Pedestrian island at 1st Avenue
9. Parking structure accommodates Park and Ride and Northgate Mall (4 Levels)
10. Retail at transit level

TANGO BUILDING
MALMO, SWEDEN

Located on a former Saab factory site the new residential apartments are not only ecologically friendly but are also wired for connectivity and control of their environment. "[Residences] live in Tango, a green-and-wired 27-unit complex that decontaminates its own soil, recycles its water into a rebuilt marsh ecology, generates power from renewable sources, uses roof space to put oxygen back into the environment and, through sensors and broadband Web access, allows owners to re-motely monitor and control everything from energy use to electronic key access" (Barreneche, May 2003).

The architects have given a mass living apartment building a touch of individuality. Each colored living room box orientated slightly differently to the internal courtyard, while each balcony and entry is formed uniquely to each unit. Furthermore the units themselves are quite different from each other in terms of spatial form, allowing each apartment to feel special but still



connected to the overall context of the community. The central c

"A so-called intelligent wall runs through the development. A spinal cord for the data system, it allows residents to access, through a portal called Frontyard, many of Tango's heat, power, intranet, and security systems by in-house laptop, remote computer or cell phone" (Barreneche, May 2003).

Relationship To The Thesis

This project shows how a residential complex can give individual units some individuality while centering those uses on a center courtyard. Each unit not only looks onto this central courtyard but also uses it as and entry into the development.

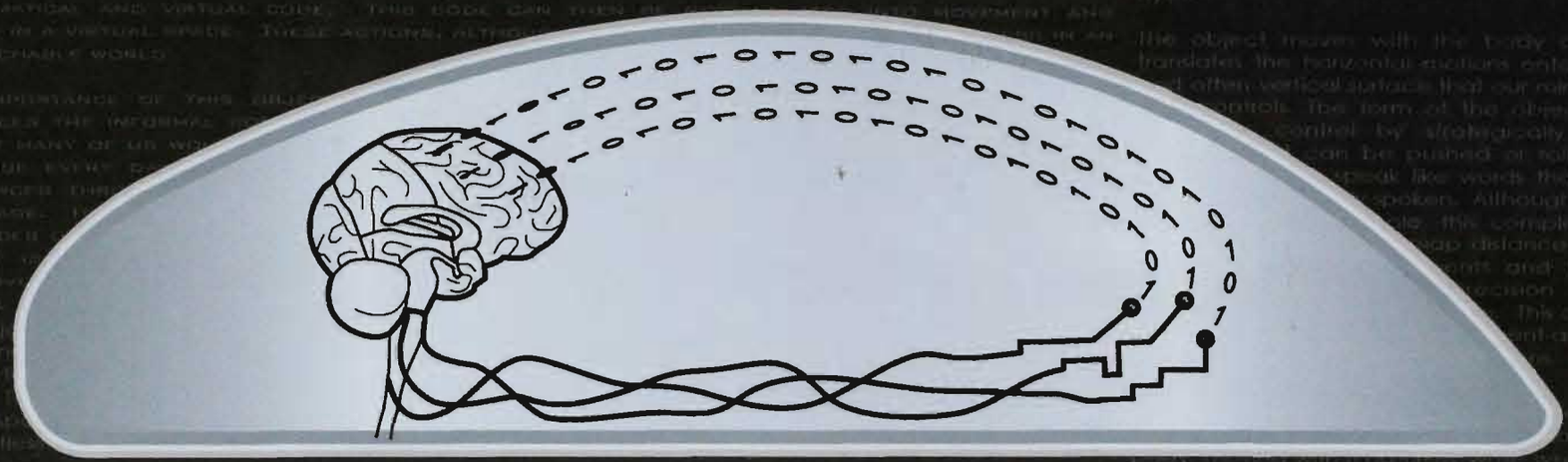
Sketch Problems

[Re]Looking

A computer mouse is an object used to input commands about movement that the user would like to see reflected on the screen. After a period of moving, pointing and clicking, the mouse begins to become an extension of the body. The movement and connection to the computer becomes natural and fluid. We eventually forget the mouse is there at all unless it draws attention to itself - like when it hits an edge or ceases to function properly.

The computer mouse is a form of infrastructure - a framework or structure that is used to input movements to a computer. Most of the time we forget the infrastructure is even there - unless it breaks down. No one really thinks about how a mouse works when we use it. It runs in the background of our operating systems and in our brains. The mouse serves the computer and our minds, thus it is between our bodies and the digital world. It allows us to directly connect to the computer - to become one with it. The relationship helps to solidify the reciprocal movements of information that flow in both directions through it.

This object serves as a direct connection to technology. It becomes an extension of the body, moving with it naturally while synching our thoughts into a visual and virtual environment. The softly curved form comfortable fits under a part of the body resting upon its arching shell allowing it to become one with the body. This connection is important because of the objects ability to symbolically wire our thoughts to a virtual space untouchable by conventional methods. It naturally serves as our motions and our actions in this limitless environment that sits in front of our eyes.



The object moves with the body and then translates the horizontal motions onto a visual and often vertical surface that our mind directs and controls. The form of the object further enhances control by strategically placing surfaces that can be pushed or rolled. The resulting actions speak like words that cannot always be physically spoken. Although it is small and theoretically simple, this complex object uses a tiny red light to map distance while an eye tracks these movements and translates them with clock-like precision into a mathematical and virtual code. This code can then be retranslated into movement and action in a virtual space. These actions, although confined in real space, are limitless in an untouchable world

The importance of this object in today's society goes virtually unnoticed, which only enhances the informal connection of the body and mind to technology. But without this object many of us would be visual speechless and without control of the systems that we now use every day. The object is a tool that can connect us with people, ideas, and resources through modes of communication and media unlike speech, writing, and body language. It is this new form of communication and control with people and objects that enhances our thoughts or ideas and the ability to share them in ways never imagined. The object is one form of connection to this world. This connection is more than touch-sensitive, but rather a natural one that connects the body and mind to the limitless and virtual world of technology.

[re]LOOKING

The 'Pod'

The pod represents two elements that are joined but not mixed into a collective body. The two systems (black and white) are opposites within the same defined category - i.e., supply/demand; input/output. The pipes form a structure, a skin or defined edge, and a space inside, within, and outside of it.

The pod's structure supports itself while still being an infrastructure that moves elements to or from the space. The pod can also be networked to other pods. They can also be extended or built onto to increase the density or height. Pod's are like cities - they are networks of many variables coming together to form one unit.

The pod could represent a way of thinking about architecture and infrastructure. These two independent but related systems can form a cohesive collective body - the city. But the scale does not end at the city. A building; a country; a space, can all be thought of in the same regard.

PROGRAMMING

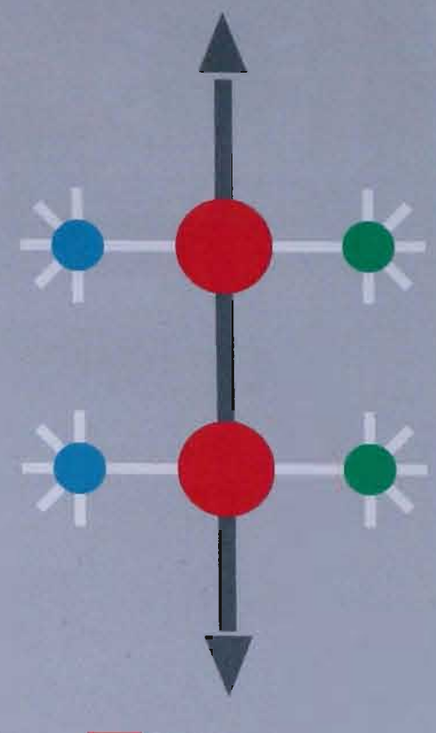
I. General Overview of needs and desires

The project will propose a mixed use development that will complement and sustain the transportation networks that flow through it and define its edges, spaces, and complex layered environments. This development will act as a station for not only those who work, live, and play in the local context but will also be an inter-modal hub for pedestrians and goods that flow through the node. A mixture of commercial and residential programs should create ridership for rail and bus stops that will flow through and terminate at the node. The development or node will support the various transportation infrastructures and stations by providing "rider-ship" for the trains, buses, roads, and pedestrian networks. The node will also support the passengers from other regions by supplying them with retail services and a place to transfer to other transportation systems. Of course this relationship can work in reverse, where the various transportation systems can support commercial services and the need for other transportation modes at a crucial point of intersection.

II. Space Program highlights

A. The "station"

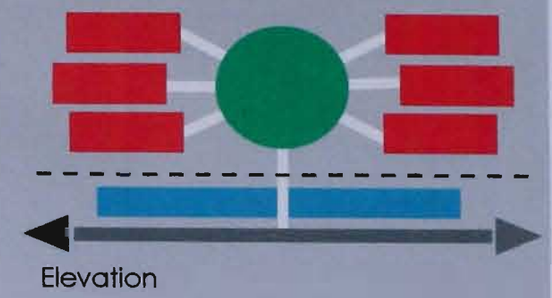
1. This term really refers to the entire development. The station will not be one mega structure, but rather will develop as part of a node containing commercial, residential, and various modes of transport.
2. The station will contain the platforms needed to access the various types of trains and busses that will move through the node.
3. Access from one platform to another for "connection or "transferring" passengers will happen along paths that will be punctured by retail and access to private residences.



4. This path will have a green 'park-like' atmosphere and will act as mode of pedestrian transportation or infrastructure in its own definition. Some sections of the path will be partially or even fully enclosed to accommodate weather concerns for the passengers who will be transferring from other modes of transportation.

B. Modes of Transportation

1. Detroit People Mover Extension (Small scale Mass transit - Elevated Rail)
    a. A new line of this elevated train will be incorporated in the node. Trains should be allowed to move in opposite directions simultaneously. Platforms for each direction will need to be provided.
    b. A platform will provide access for at least 2 cars – with the possibility of expanding up to eight cars.
    c. This platform should be above grade at approximately the second or third story. – Vertical access such as escalators will need to move many passengers.
    d. A ticket area should also be provided. Typically at ground level – separate from the platform.
2. Bus / Tram access (Medium Scale Mass Transit)
    a. A least 2 stops (one local / one express)
    b. These stops are typically at ground level and are usually only a raised slab to allow passengers to easily exit the bus.
    c. Visibility and access to other transportation system will be important to the success of these stops.
    d. The stops contain signage for bus routes and times, as well as seating and covered areas for waiting.
3. High Speed Train (Amtrak) and/or Airport Express Train (Medium Scale Mass Transit)
    a. This mass transit system will terminate at the site / downtown.



b. Because this system includes express trains it will be very likely that all passengers will be switching to other modes of transportation. Visibility and access to all other modes of transport will be crucial to success of this system.

c. This system will include approximately four platforms and tracks to accommodate many trains. The 4 tracks will merge to two (one each direction) just outside the development.

d. A ticket area and train information area will also need to be included.

4. Water Taxi/Ferry Station

   a. Access to the riverfront should support the use of water transportation to areas such as Windsor, Canada; Belle Isle; and to 'hot spots' along the riverfront itself.

   b. Two to eight platforms and a ticket booth will be required for access to the taxis/ferries.

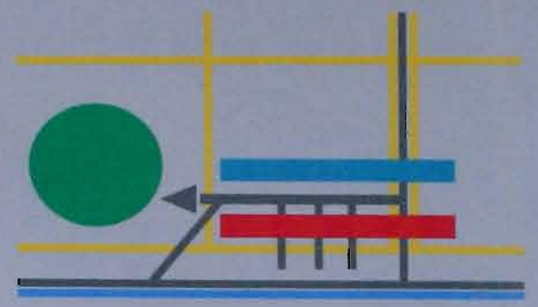
5. Pedestrian Parks / networks

   a. An extension from a new continuous riverfront promenade will provide access to all modes of transportation and their stations.

   b. A bike path will also move through the 'Station' connecting the waterfront paths and "Dequinder Cut" path (an abandoned rail line submerged from street grade). This path should be approximately 8'-15' wide to allow at least two bikes to pass each other while traveling opposite directions.

   c. Other parks will connect the stations and public infrastructure to private residences. They will serve as semi-public spaces and as a buffer between residential units and noisy rail stations. The parks will also serve as a collector space for these units. These paths should have places to sit to admire the view to the stations below.

   d. A market street/park at grade level will mix transportation stations and retail in a relaxing park atmosphere with views to the trains and streets surrounding it. This hyperspace will also be included as part of the collection space



of the 'station' and serve as a public courtyard for residence and travelers. These should contain areas form seating and places to have outdoor cafes.

6. Surface streets

    a. Surfaces streets will be revised to allow efficient access and flow through the node. It will also provide access for busses and integrated trams into the area. The streets and intersections will be spaces of interest and activity. Views from and to stations, parks, and retail will be crucial for understanding of infrastructural flows as well as creation of a successful and vibrant mixed use development.

C. Retail Units.

1. The node will contain various programs of retail including but not limited to services that support the residents, travelers, and park users. - Examples include restaurants, convenience/grocery stores, post offices, news stands, and Laundromats.
2. 2000 – 6000 Sq. ft. units
3. These spaces should be visible from as many transportation systems as possible (via platform, park, street, or vehicle).
4. Retail should be developed at crucial intersections or travel, as well as along common paths of travel.
5. Retail can also develop on platforms and within parks or plazas.
6. Outdoors spaces for eating, waiting, reading, and conversation should be near retail clusters.

D. Offices

1. General office use = 1000 – 5000 Sq. ft. units
2. Courtyards or semi-public parks will collect and connect offices to the various modes of transportation. Emphasis will be on connecting the tenants to mass transit.

3. These collector spaces will allow for possible interactions of office tenants as well as provide a view to the multiple levels of the Station.

E. Residential Apartments / Condos.

1. While the scope of this project will not focus on the individual units of residence, the residential buildings, public, and semi-public spaces will be addressed within context of the station.
2. Courtyards or semi-public parks will collect and connect residents to the various modes of transportation. Emphasis will be on connecting the residents to mass transit for small trips while allowing a space for personal vehicles for other trips.
3. These collector spaces will allow for possible interactions of residents as well as provide a view to the multiple levels of the Station. - Effectively allowing residence to live within an inter-modal station.
4. 500 – 2000 Sq. ft. units

F. Public Parking Garages

1. Parking Spaces will be provided for residential units as well as for general use to facilitate the use of mass transit.
2. Garages will be highly accessible to the street – but should avoid being on the street where retail of offices can be best placed.
3. These building should be placed underground (or away from direct view) – and are only a support function of the development.

G. Public Areas

1. Open Plazas (2000+ Sq. ft.)
2. Ice Rink/wading pool (~4000 Sq. ft.)
3. Amphitheater / Stage (~2000 Sq. ft.)

III. TECHNICAL SYSTEMS ANALYSIS BRIEF OVERVIEW

A. Transportation / Circulation Systems – See Transportation Matrix (p.13-15)

B. HVAC (Allen & Iano, 139-158)

1. Residential – Heating and Cooling can be decentralized in apartments to give control to each. This can also reduce the size and amount of duct work that will be utilized.

    a. Packaged Terminal Units or Through-the-wall Units

    b. Fan-coil Terminals

    c. Closed-Loop Heat Pumps

    d. Hydronic Convectors (heating only)

2. Office / Retail - A mixture of water and air systems can be utilized throughout the office areas. Fan rooms push air over water pipes which are circulated from boilers and chiller's often located in basements. Fan rooms can be anywhere in the building. Sufficient ceiling or floor space should be maintained to allow the use of any of these systems and their potential to be upgraded. Ventilation systems in bathrooms and kitchens will also be a priority and should be given ample space. Need maximum flexibility with minimal system noise.

    a. Variable Air Volume (VAV)

    b. Mutlizone

    c. Hydronic Convectors (heating only)

3. Station platforms – Can use radiant heating to heat pedestrians and melt snow on open air platforms.

C. Utilities – Electrical power will likely be brought from the street through underground conduits. Electrical rooms and step-down transformers will be required. Water and gas lines are pressure lines and can be adapted to almost any layout. The can easily

go up or down and turn fairly tightly. Street mains and gas pipes are relatively small in diameter. Water lines are usually placed below the frost line to prevent freezing. Some adjustment of these utilities may be incorporated into the project do to the relationship of infrastructure within and around the building(s). Creating a distribution system that works within the same space as the transportation of people and goods is one option. Large buildings use transformer vaults with switchgear rooms (combined 900 sq. ft.). Electrical closets split bandwidth to local circuits for each unit.

D. Lighting

1. Site/building – Lighting has an enormous effect on perception of the building's environment. Good site lighting can enhance a sense of security and safety as well as cleanliness. Because the project will be in an urban area street lighting can be used to beautify the area. The design of light poles can increase a sense of community design and appreciation as well as an increase in perception of quality of the district and the site. Architectural lighting on the building and surrounding landscape also enhances the quality of the building, site, and the environment. Lighting the building in certain ways can also enhance certain design features as well as way finding in and around the building.
2. Daylighting – The use of daylight in all habitable space is quite important to the overall quality of the living and work spaces. An attempt to use daylight can also provide a positive way to heat a building –especially in the winter. Orientation of the building and the units towards the sun should be carefully considered when utilizing daylighting principles. Apartment buildings that forget or disregard daylighting tend to result in hostile, utilitarian spaces that require massive amounts of expensive artificial lighting.

E. Structure – A variety of structures have been utilized in apartment design. Bearing wall or a grid of columns made of steel or concrete are common. Any system considered should use minimal amounts of ceiling space especially as the building becomes taller. The span of the structure is usually related to the width of the unit. Separation of units with fire walls will also be

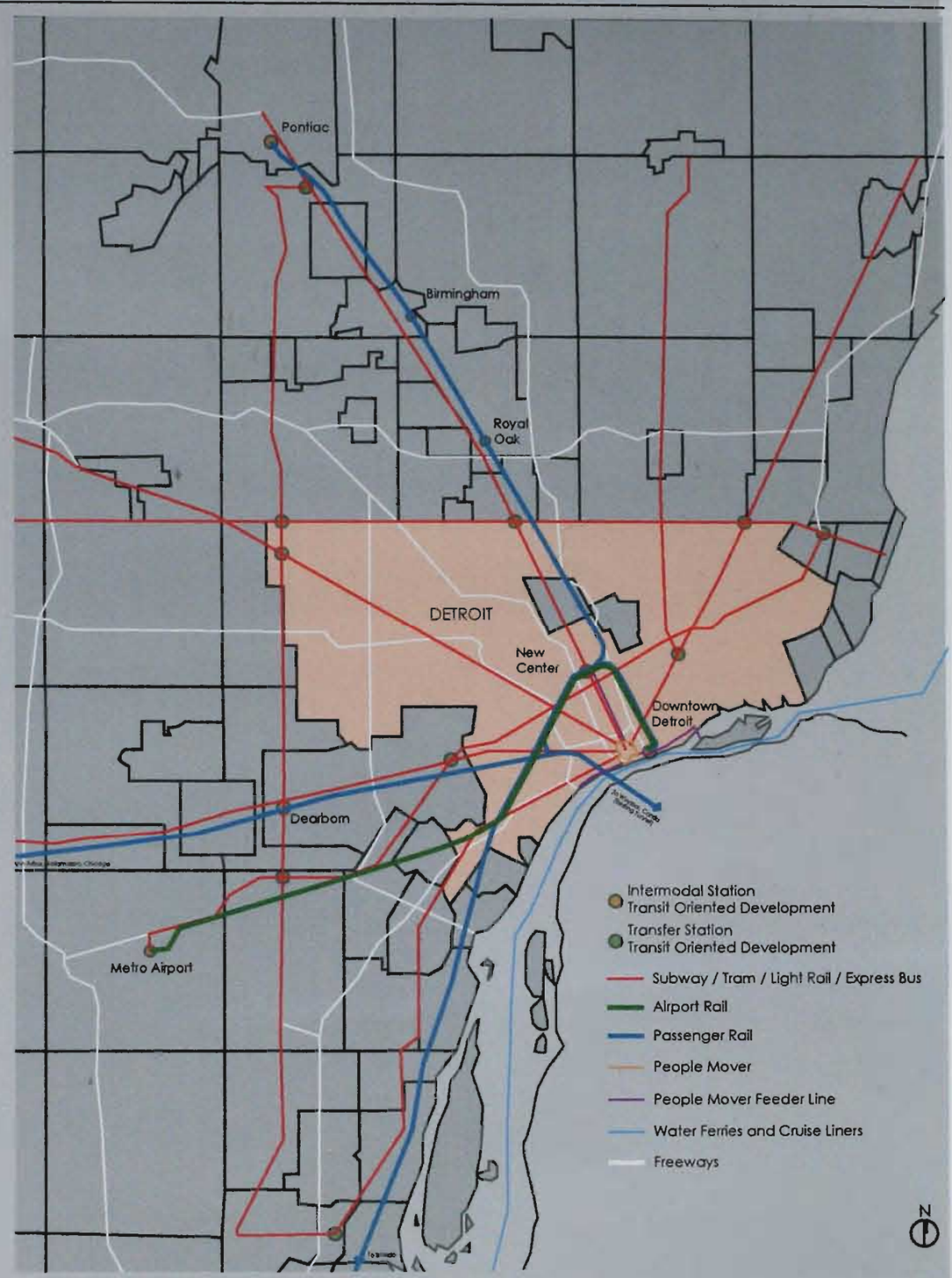
needed and can double as structural walls. Wet walls or mechanical shafts will also be needed and should also be contained in a fire rated wall assembly. Structure system should minimize number of columns in units (especially in retail and residential units).

1. Precast planks on steel beams and columns.
2. Light-gauge / wood stud walls
3. Open web joists
4. Concrete joists (waffle slab if square bay)
5. Core areas can be concrete block bearing walls.

Site Analysis

In order to create a development centered on transportation infrastructure, attention must be paid to the regional infrastructure around the immediate site. The city of Detroit, Michigan and its metropolitan area was selected due to its need for increased efficiency in mobility throughout the region and within the city. Cars dominate the "Motor City" which is home to the three largest automakers. Sprawl has also taken over much of southeast Michigan leaving Detroit to decay after its glorified success during the industrial revolution. The result is that many of the freeways and local streets are congested outside the city. Inside the city there are endless parking lots and an inefficient bus and elevated rail system. Regionally the city has a lot of working freight lines as well as the great lakes which serve as a viable shipping corridor. The Ambassador Bridge connects Windsor, Ontario, Canada to Detroit, Michigan and is the most used connection between Canada and the US. The Region would be greatly enhanced by increases in mobility.

The city lacks connection other than by freeway with its busy suburban airport located over 20 miles away from the center of the city. Limited Amtrak service connects cities around southeast Michigan and to Chicago, Illinois. Michigan has attempted to solve these and other mobility issues with community planning and increased funds to transit agencies. The state has also attempted to create a regional / metropolitan government to control issues such as mass transit. But many of these attempts are under stimulated by funds and needed political support. Recently the various governmental agencies have attempted to establish a plan to create express bus corridors to make the first step in a long overdue transit plan. These busses which are more like "trains on tires" would service Detroit major arteries (except the freeways) to increase business along these corridors. This project will use those corridors as well as rail lines to establish sites for potential mixed use developments at the intersections of these paths.



The project site is the area along Interstate I-375 in downtown Detroit, Michigan. The freeway is the sixth shortest Interstate at just over one and a half miles long. Focus will also be along the riverfront from Jefferson Avenue to the water's edge. This is to allow for the integration of an abandoned rail line into the project as well as for purposes of revitalizing the decaying area. As this development will seek to integrate into the existing fabric of the city, boundaries will not stop at roads or rail lines. In order to weave into an existing context, these boundaries will be pushed to allow maximum adjustablility and integration for the entire project.

THE SITE

The project is located in Downtown Detroit in a district known as Rivertown. This area was the 'silicon valley' of the early 20th Century. The area was home to many of the pre-automotive industrial technologies. Brothels, bars and restaurants intermingled with metalworking shops and foundries. The Globe Trading Company was located here and is said to be where Henry Ford began his industrial career. Other historic structures include the former Stone Soap Company building, the Northern Crane building, and the Detroit Street and Railway barns - most of which are in ruin. Architects that were famous to Detroit also are important to the site. Albert Kahn and Smith, Henchman & Grills (now SmithGroup) have buildings in the historic Parke Davis Pharmaceuticals complex, which has recently been converted to a mixed-use development called Stroh Riverplace. Now the entire site is mostly vacant from the Renaissance Center (GM headquarters) to Stroh's Riverplace. This area is important to Detroit and its history. The site is now under plans for a Tricentennial Park and riverfront promenade that will stretch from Belle Isle (a massive park in the middle of the Detroit River) to the Ambassador Bridge (bridge to Canada). The original theme for a series of "linked parks" was to incorporate the idea of a "working waterfront" (a collection of offices, residences, retail and entertainment). This is appropriate considering that the original site was known for its four "S's": sand, skilled labor; small businesses; and social infrastructure.

A new three mile continous riverfront promenade will reclaim Detroit's riverfront from brownfield and parkinglots, while linking a seriers of parks and marinas.

The site is located between the Renissance Center and an eight story brick parking garage.

Detroit's Riverfornt
Belle Isle Park (foreground)

Site Infrastructure

I have chosen this site and the corridor of Interstate 375 because of its importance to the social infrastructure and urban fabric of the city. This project will hope to revitalize and reclaim the brownfields and riverfront as well as address the freeway culture all in the context of Detroit (known as "the city that moves the world" or the "Motor City"). The site also has an abandoned rail line, the elevated 'People Mover' to the west, and a collection of mega streets and local roads. With Rivertown's history and importance to Detroit's future as an automobile culture as well as the global headquarters for General Motors (the largest automaker) this site has a lot of potential and a lot of relationship to infrastructure within an urban, but crumbling, city fabric.

Utilities

In general most utilities (power, water, sewage, and communications) remain underground in an urban environment. Most Utilities follow the major streets and branch off only to connect a building. Therefore anywhere there is a street we can assume there are these utilities for the scope of this project. The area does have high speed communication abilities as well as several cellular towers hidden upon the tops of buildings. The area used to have water pumping stations at the site- but as larger facilities where required these functions were moved further up and down the river. Power comes mostly from far rural power plants located along the river. There are no local transformer stations in the immediate area. For the purpose of this project and the district most infrastructures with a utility based nature will be looked at on a smaller scale, such as a building or cluster of buildings.

Figure Ground Map

This map (p. 52) illustrates the vacancy of the site and its surroundings. In addition to a great deal of empty space, many buildings along the riverfront are vacant. This is mostly due

The area directly east of the site is known as rivertown. It is home to many warehouses and historic industries. This area has also been called bricktown because of its heavy usage of brick buildings and brick paved streets.

Once a busy area of industry and warehouses facilitated by a now vacant rail line.

The beginings of a riverfront walkway. The people mover also shares this expansive view from above.

to the proposal of riverfront casinos - which has been overturned. Now this area waits for rezoning and construction of the Tricentennial Park and proposed mixed-use developments initiated by the City and General Motors Corporation. Currently parking lots dominate the waterfront and the area adjacent to the freeway. A small park seams to be haphazardly squeezed into the space between the freeway and a small road at a crucial intersection. Although many of these industrial buildings are historically important to the pre-automotive industry, they have nonetheless been neglected and are in need of massive repairs or demolition. The urban grid seams to crumble as development proceeds farther eastward. A sharp contrast in both land use and in density exists along the opposite banks of I-375. The figure-ground relationship is more urban in the city's core and more object-field oriented at the east part of the site. A new development will need to respond to this contrast and repair the urban fabric that has been torn by the freeway. Furthermore more attention should be made to the waterfront and the existing industrial brown fields.

Atwater Street - Crumbling historic structures and streets

The Surrounding City Uses

Although some buildings are mixed use, most are predominantly one use or another. There is no Residential along the riverfront - or even remotely near it - in this immediate area. Residential to the North are various mix-income projects which consist of single and multifamily residences. Most of the industrial uses are now vacant. Furthermore these industrial uses were set up next to the water for the ease of water transportation which is all but unnecessary now. Retail is predominantly in the core of the city as well as on Jefferson due to the need of vehicular traffic to support it. Most of the Jefferson retail consist of suburban gas station, fast food restaurants, and strip malls. Entertainment uses are very scarce in this area - mostly due to a population of office workers who commute from suburbs. Chene Park has the ability to hold concerts and large stage events. The harbor is currently under reconstruction and will become part of the Tricentennial Park. General Motors dominates the area with its headquarters in the famous Renaissance Center Building. GM is

Chene Park is an ampitheater enclosed by a white tent structure along the riverfront.

A view of the site from the 12th floor of the Renissance Center

opening the building up and developing it into a mixed use development. The headquarters will have a hotel, retail, and car museum as well as a connection to the future riverfront promenade

Site Surrounding Conditions

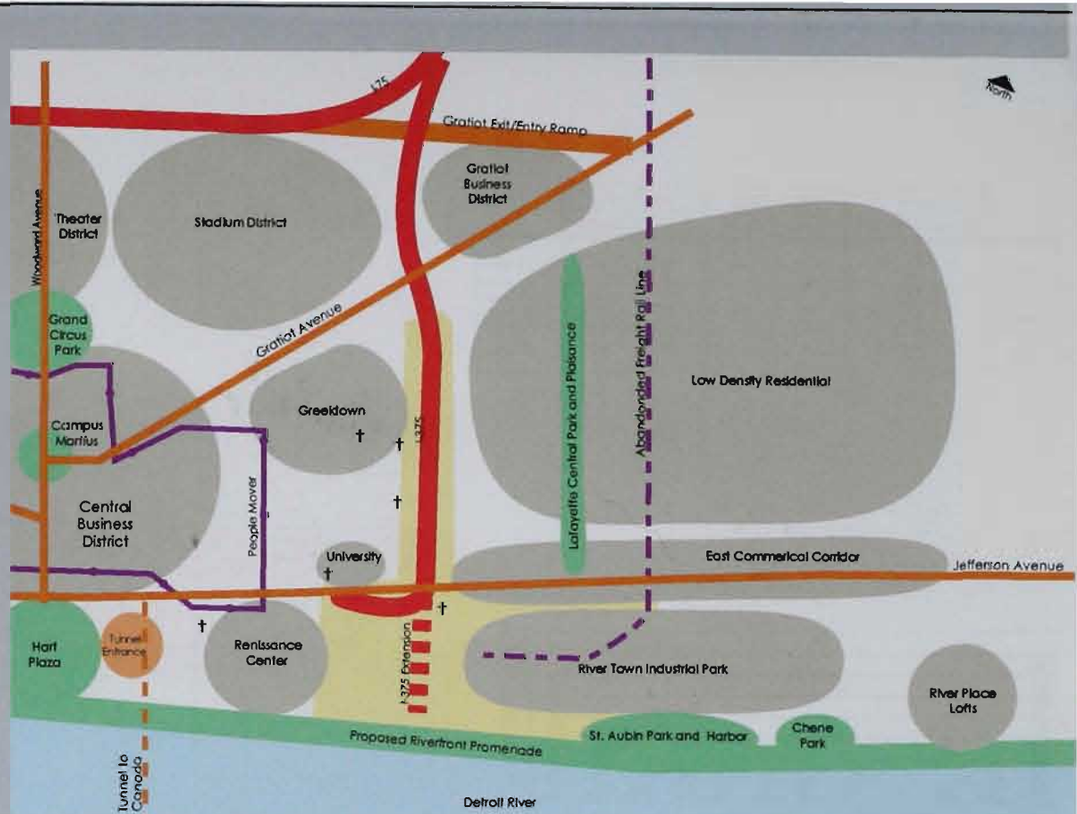
Most of the site contains vacant industrial buildings that date back to the pre-automotive industrial era. Many of the building have broken windows and boarded up doors and other openings. But most of these buildings were so well built that there structure remains intact. Most of the buildings follow a warehouse-typology. Factory sash windows and garage doors are quite common. Some buildings have water towers and strong accents of the early factory architectural style. Many of the buildings have open plans and can be converted to lofts, shops, offices and other similar uses. Such was the case with Stroh's River Place which is just east of Chene Park. Some building near the site should be reinvestigated architecturally. Zoning requirements that allow small gas stations amongst skyscrapers can seem out of place. Such is the case at the corner of I-375 and Jefferson Avenue, where a gas station is detailed as if it where in a distant suburb. Most of the buildings in the area, near the city's core are architecturally significant to Detroit. Buildings such as the Renaissance Center loom over the site. Physical connections from the pedestrian and vehicular scales are almost non-existent into the structure. Although an attempt is being made to make the building 'open-up' to the city by the current tenant - General Motors - further studies adjacent to the Renaissance Center should be looked into to create a more pedestrian friendly environment.

Views from the Site

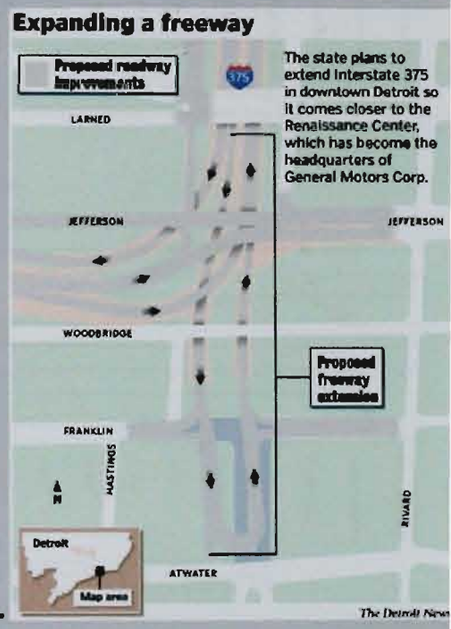
Views along the riverfront and U.S. shoreline are spectacular. Views to Canada and Windsor are also interesting. Casino Windsor dominates Canada's skyline, and it is equally dominate at night. The Ambassador Bridge frames a view of the river to the south. The bridge is also lit at night and is an important image of the two cities. To the North is Belle, Isle - a massive city

Stroh's Riverplace is a redeveloped warehouse that was successfull converted to lofts and offices. This development is adjacent to the crumbling structures and abandoned railroad nearby.

park. The northern part of the shoreline is also dominated by 3 sets of 3 tall concrete silos. Although these companies are being removed for the future park, the actual silos can be beautiful and potentially important if designed into the park and surrounding developments. Chene Park is also to the north with is unmistakable white tent structure. Currently the site is slowly returning to nature with is overgrown bushes and grasses. Many of the tall industrial sites have an eerie and ghostly quality to them amongst the grasses. The site is quite and seems to be far from the city. The Renaissance Center stands tall over the site - a long shadow on a late summer afternoon can engulf the entire site in darkness. The eastern view along Jefferson Avenue seems dull. The street is quite wide and the buildings are small and not always adjacent to the road, causing the boundary of the road to be inconsistent and segmented. The Downtown streetscape of Jefferson Avenue is quite nice with its well maintained and landscaped median. The street contains many examples of Detroit architecture and its history. At the corner of the expressway and Jefferson sits an old stone building that houses the University of Detroit Mercy school of Law. Unfortunately right next to the school and church is a suburban GAS station.



Surrounding Districts



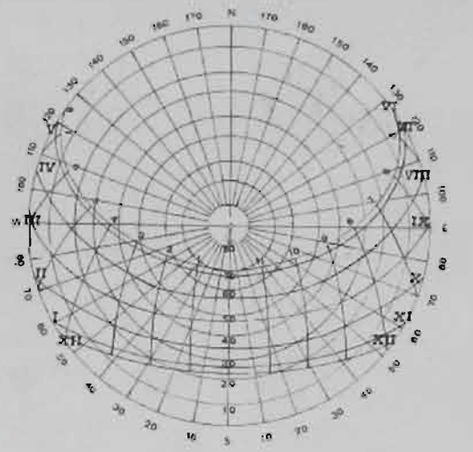
Several Proposals have been planned to extend the traffic from Interstate I-375 to the riverfront.

Site Analysis

Site Topography

Site Analysis

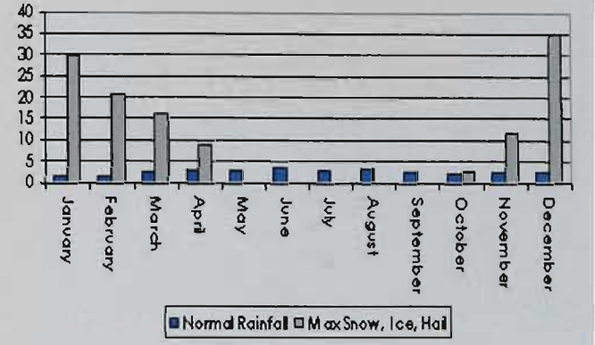
Sun Chart



Sun Data

	8am / 4pm		10am / 2pm		Noon		
	Altitude	Azimuth	Altitude	Azimuth	Altitude	Azimuth	% of Sun
Dec 21	2°	52°	18°	29°	22°	0°	30%
Mar. 21 / Sept. 21	20°	69°	38°	42°	48°	0°	51% / 61%
June 21	35°	90°	56°	64°	70°	0°	65%

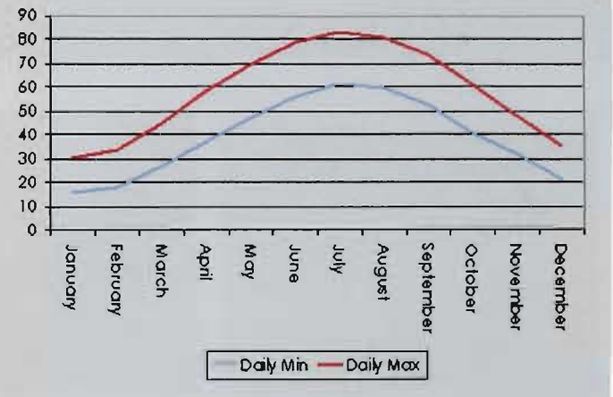
Precipitation



Wind Data

	Winter	Summer
Speed	11.3 mph	8.7 mph
Direction	WSW	SW

Temperature



SITE MAP

I-375 Corridor and East Riverfront

North

Night Views off of Jefferson Avenue

View from Windsor, Canada

General Motors Parking Lots and Structures

Abandoned Industrial Structures & Rail Line

Abandoned Rail Line & Overpassing Bridges

EXISTING SITE MAP

I-375 Corridor and East Riverfront

TRANSPORTATION MAP

I-375 Corridor and East Riverfront

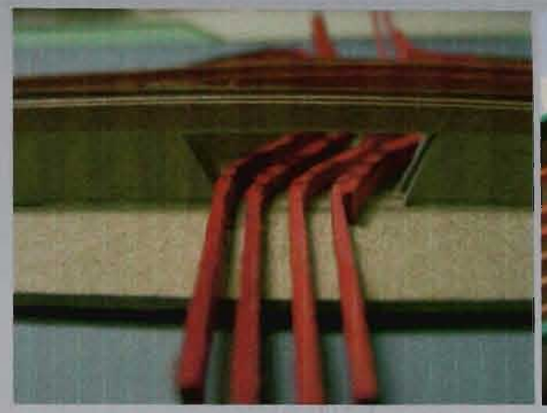
FIGURE-GROUND MAP

I-375 Corridor and East Riverfront

Schematic Design

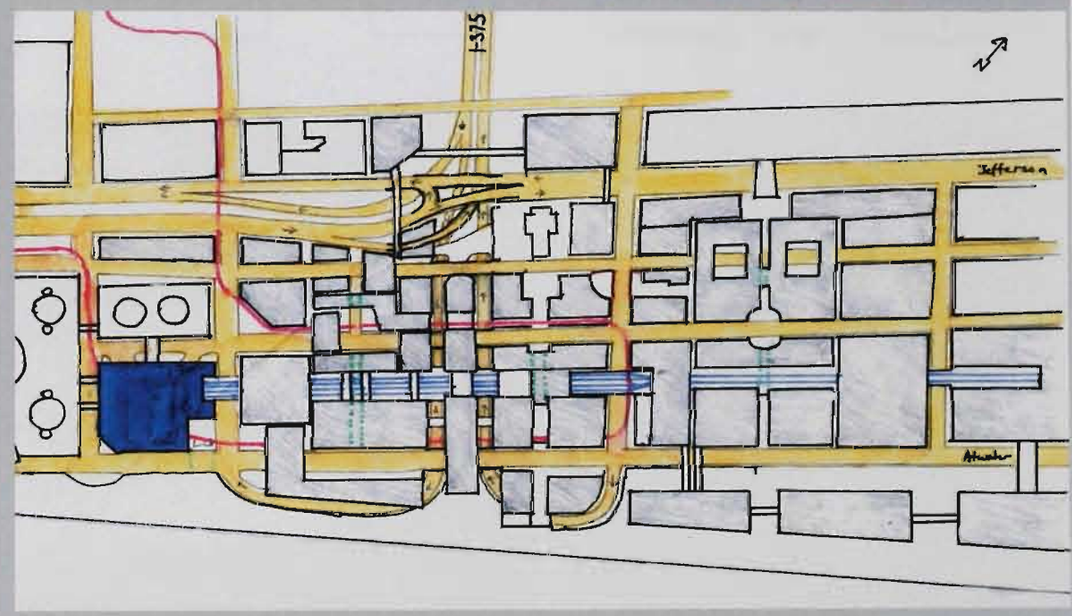
In order to understand where this project is going, we must first understand how all my work has culminated to this point. The process of this thesis discovery, and of the project that will construct these concepts, has been very broad and at times seemingly disjointed. So what have I learned thus far and how will it guide the rest of the project?

The process began with an uncovering of the networks of transportation that define a city. As this process slowly became more detailed in the analysis and description of the parts of the project, it became clearer what the project really seeks to uncover. When I first began the project I felt that I wanted to create a dynamic and complex space within a city using the energy and fluidity of transportation and the computer. My process was to create complexity by allowing so many forces to come together that complexity would end up as a product of the integration of infrastructure and architecture. Working with the infrastructure first I felt I could craft a landscape that architecture could sit within. I soon realized that this process was not as reciprocal as I would have liked. I began to place buildings within a site that became larger and larger in order to achieve the complexity I felt was necessary for the project. The project began to become uncontrollable with too much area to cover and too many variables to manage. I attempted to make the project smaller by focusing on sections of the larger developments. With each new scale I created, I realized that the scale on which I was attempting to design was one I believe an architect cannot (single handily) design. Architects cannot and should not design cities, especially in today's global world where there are far too many variables and forces that should and will influence a city. The city is a culmination and an effect of a multitude of ideas and values projected by a multitude of different individuals and cultures. An architect comes with his/her own knowledge and experience of the city - for he/she is also and individual and a product of that city, but one that is not common amongst all persons in the society. I soon began to realize that the build environment that I wanted to create would need to remain in the details- or at least at an



Early Studies looked at how the I-375 and Jefferson Aveune Interchange could be reworked to provide better access to the site as well as to reduce the destruction the current interchange had to the city fabric.

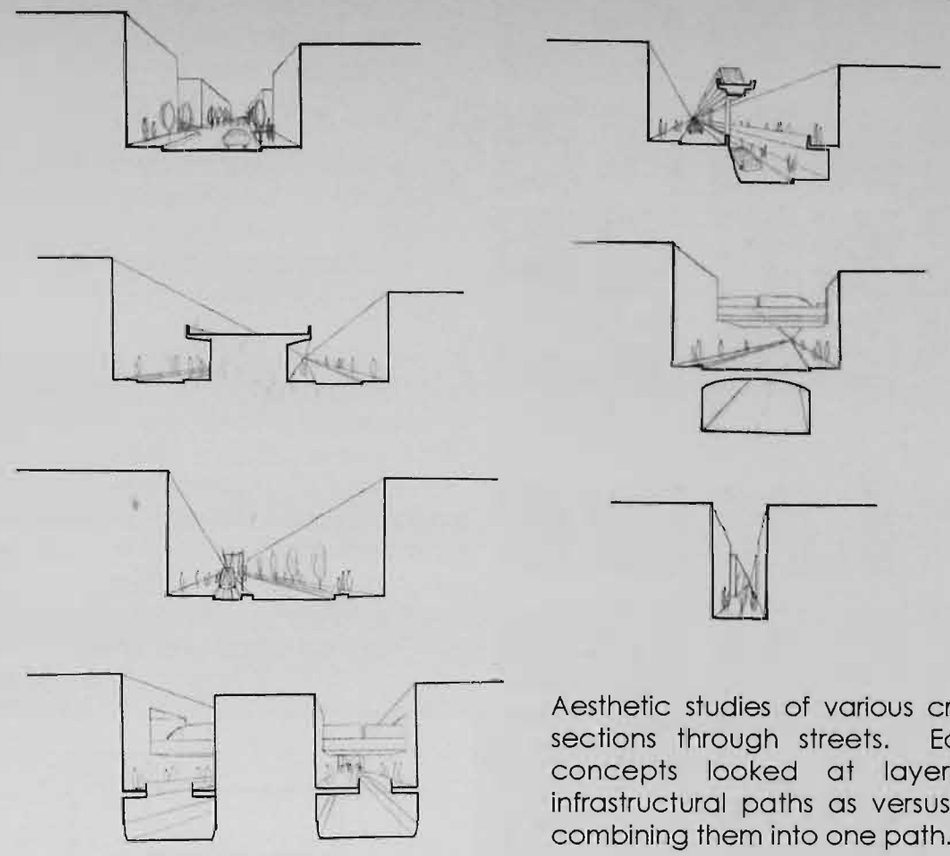
An early plan of how the development might look with a rail station and urban infill of office, retail, and residential.



architectural scale that can be influenced and reflective of those who would live within or around it.

What may seem to be a divergence or change within the project could be said to be important to the project itself. Infrastructure (especially transportation networks) works at a scale far greater than architecture - one that is global or regional. Architecture is (and should be) local to is environment. Thus if infrastructure is to effect the built environment it must be looked at on a more local scale. Through section and detail we can begin to see a relationship that can influence or be integrated into architecture.

I started this process by looking at the section of the street and its relationship to the sidewalk and the surrounding structures. By moving the pedestrians to their own street or level, the area can become safer and quieter. Unfortunately doing so tends to result in spaces devoid of pedestrians especially in less dense cities. Unless something incredibly important exists that can draw pedestrians into a separate alley or away from the street there will tend to be no activity. This is due to the direct connection between pedestrians and the need for an active street. This 'street' can be anything that draws a crowd. In a common urban environment this is a busy street - the activity draws more and more people into the area. If a space is pulled away from the street, such as a courtyard, it will likely be devoid of people. Successful courtyards still have some way of tying themselves visually back to the street or to some other active area. Of course there are exceptions to the rule - but they still have a space, or object to draw in pedestrian life and activity. The concept of the active street is not just limited to an automobile pathway. Waterways and parks can also serve as places to draw pedestrians. These places are also infrastructure. A park tends to be a pathway - one that is often loosely defined - but still a space within the context of its surroundings.



Aesthetic studies of various cross sections through streets. Early concepts looked at layering infrastructural paths as versus to combining them into one path.

Conceptual Site models testing how a freeway extension, parks, and rail could be inserted into the a dynamic city fabric.

If cities are limited to a grid, they will only contain separate elements of architecture and infrastructure. Spaces between the elements tend to feel out of place, if they exist at all. Buildings can only relate to the street in a parallel fashion, thus creating common architecture and place-less spaces. Place is only tied to the street signs that give definition to intersections that look exactly the same. Manipulating the grid into a fishnet like mesh can allow for new opportunities in architectural form while also accommodating various lot sizes for different programs. Most cities designed this way can maintain the easy north-south / east-west movement that is characteristic of the gird. But the mesh can allow flexibility in the infrastructure as well as the architecture.

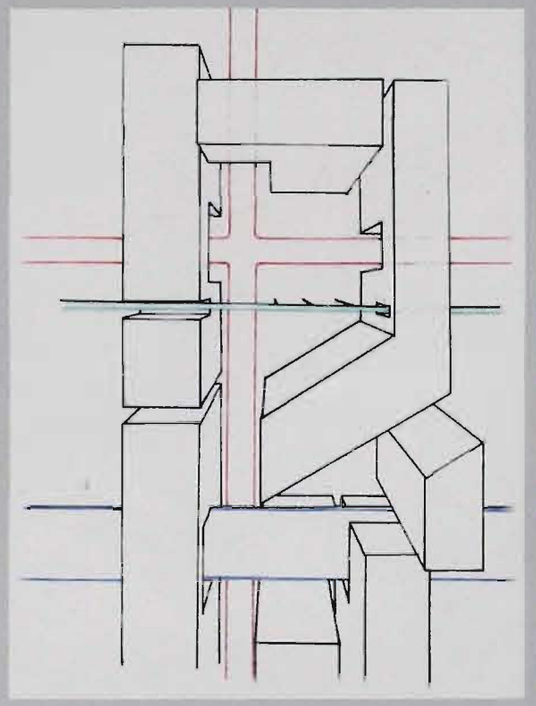
By allowing buildings to cross a street or pull itself away from the powerful edge, we can see new spaces develop at intersections or between the architecture and infrastructure. Plazas, Pedestrian streets and defined edges can create a more defined and place oriented city. These cities grow by layers. Each new building adds a new layer and a new dimension to the city, instead of just filling void space. New edges and complex relationships are created, allowing for new interactions within the city.

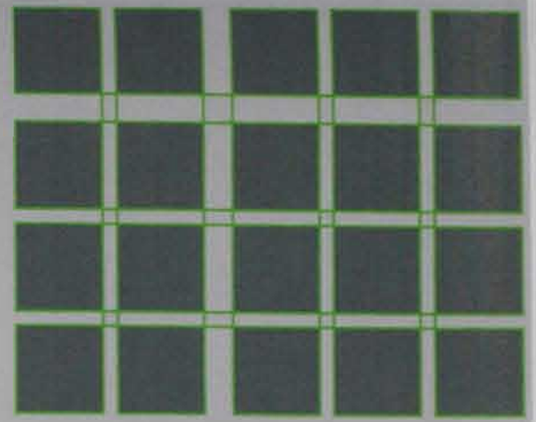
The next strategy was to look at a multiple use corridor concept. Instead of placing the train in the back alley of a building or even hidden underground, I have chosen to make it more prominent and celebrated in the context of street and park. By combining many layers and types of movements into one space a type of market place or active 'street' can be created in such a way that the infrastructure is raised to a higher level of living standards. Instead of creating a 'grey,' utilitarian space for the train and the people mover, I have decided to allow the units to enter and collect in a series of parks that follow the dimension of the rail line. Essentially I want to create a corridor that is active and useful for more than just circulation. These parks allow for spaces that are between the dwelling units and the infrastructure.

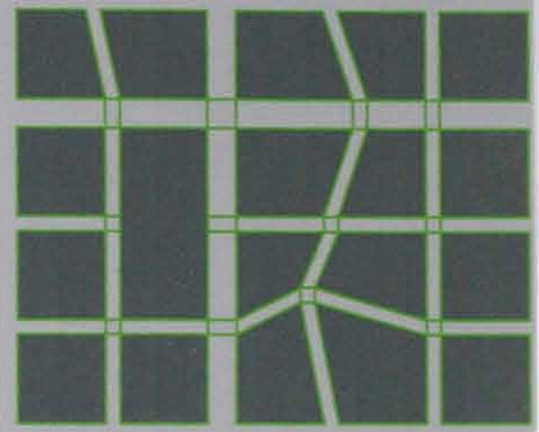
Conceptual Studies of how cities could be made. Most cities are formed on a grid of streets - wherever infrastructure isn't architecture can exist.

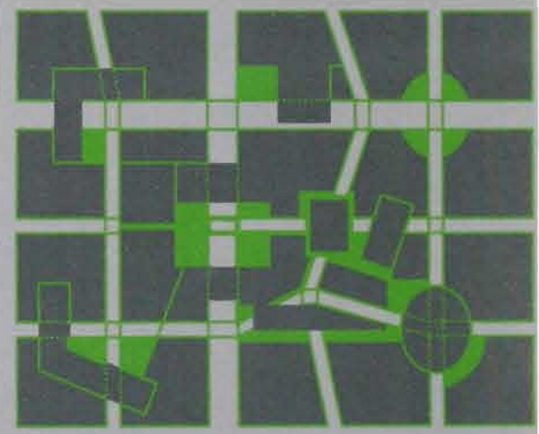
But when architecture is allowed to span over streets and break away from the intersections, new spaces and possiblities can be formed.

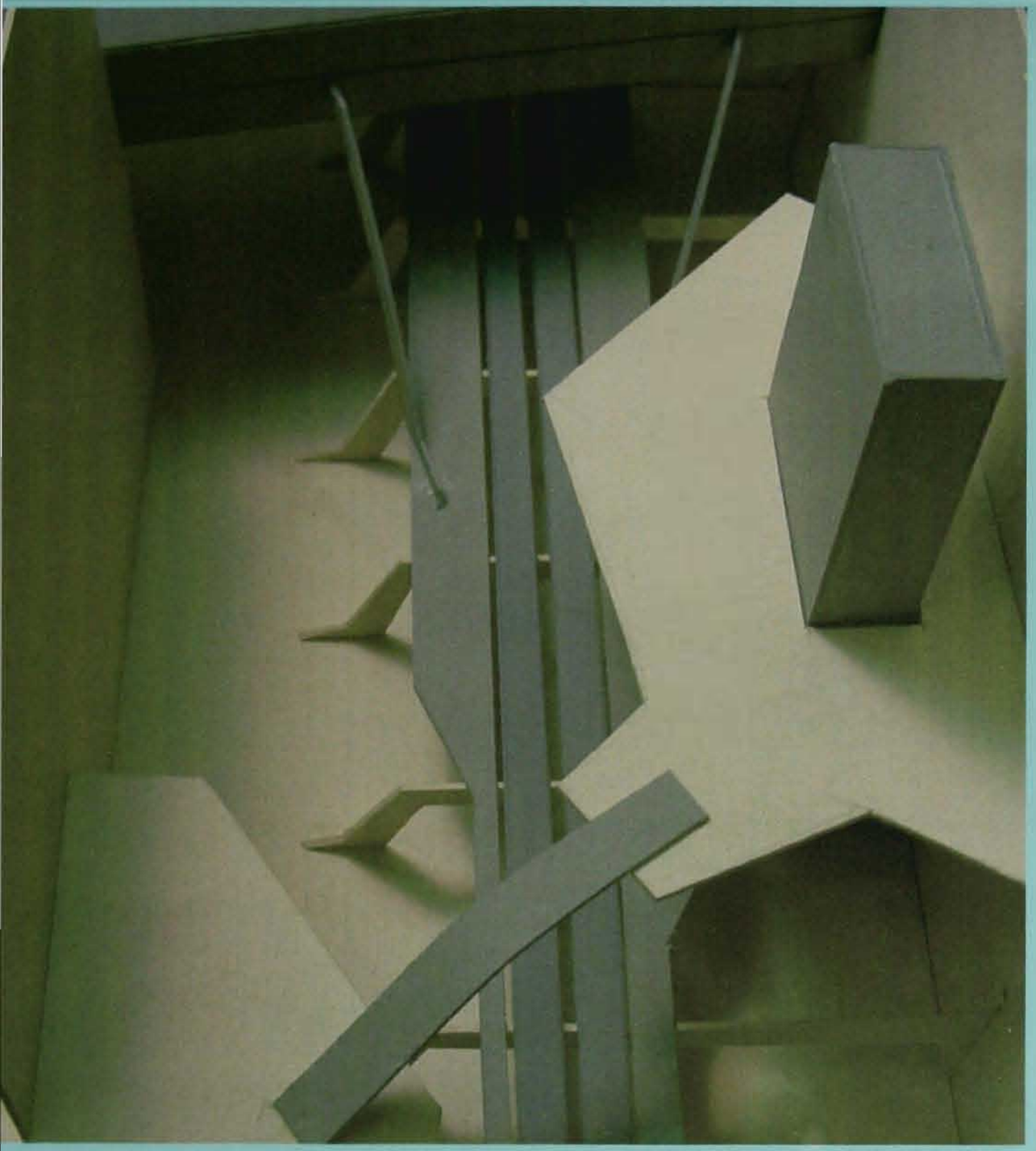
This drawing shows how buildings can create a courtyard around an intersection. This forms a place that is very unique and specific within a city of endless intersections. Buildings and infrastructure can be used to carve new public spaces that are more complex and intresting than ones design without this concept. Each new building expands on how the spaces may look and act.

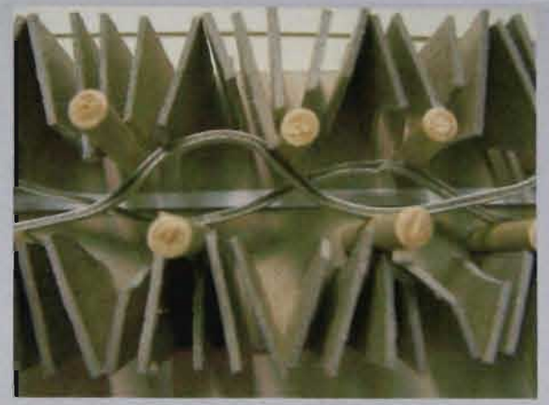




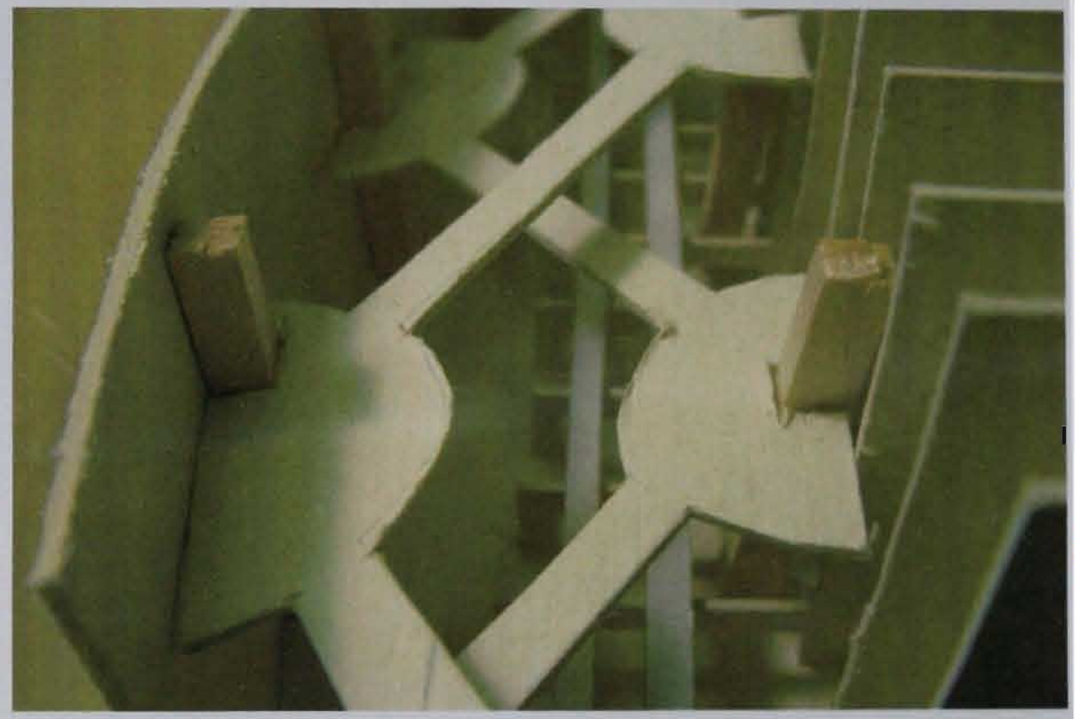


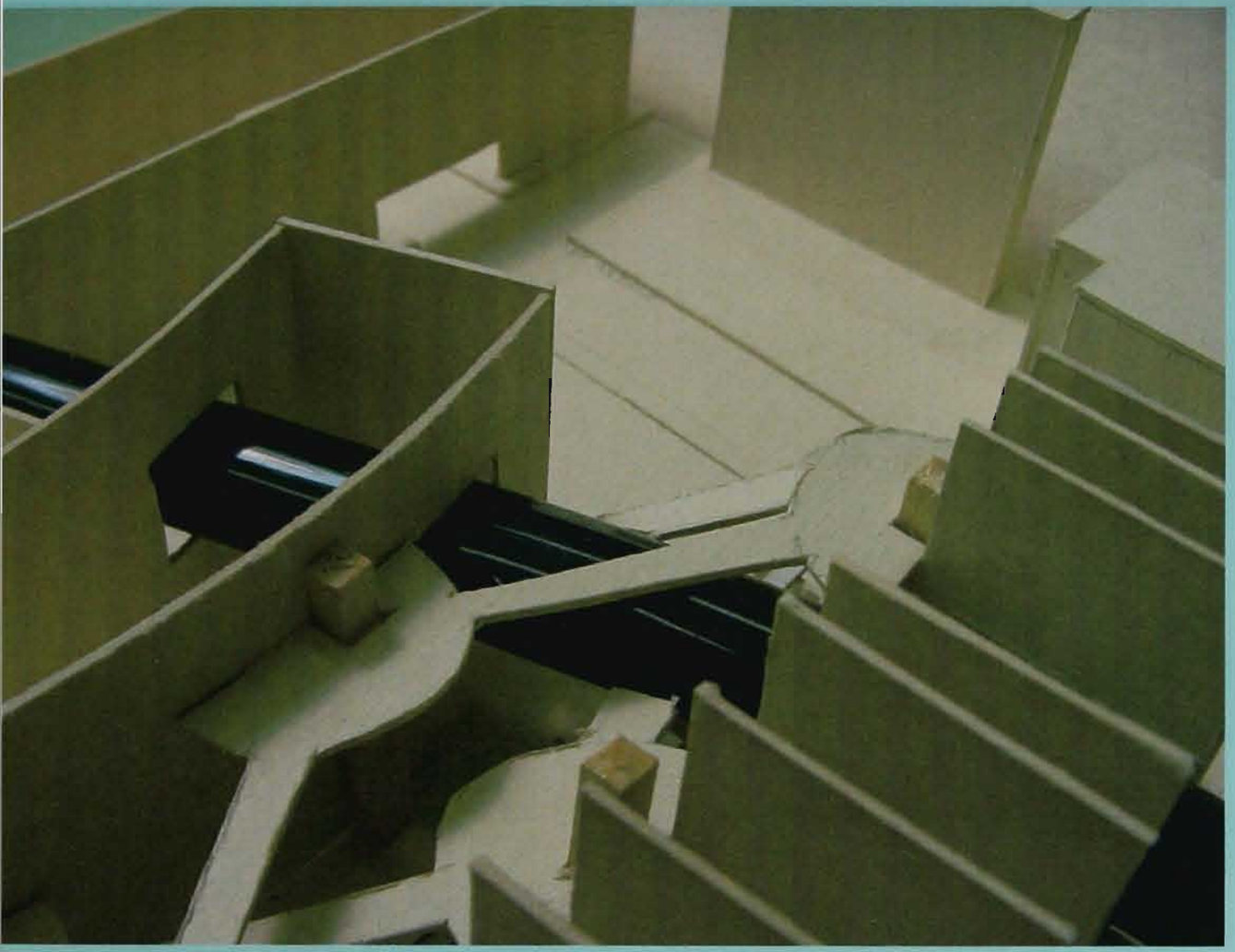


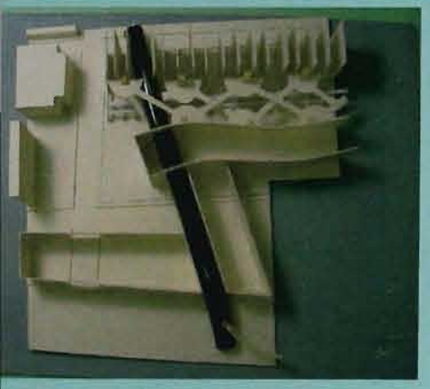




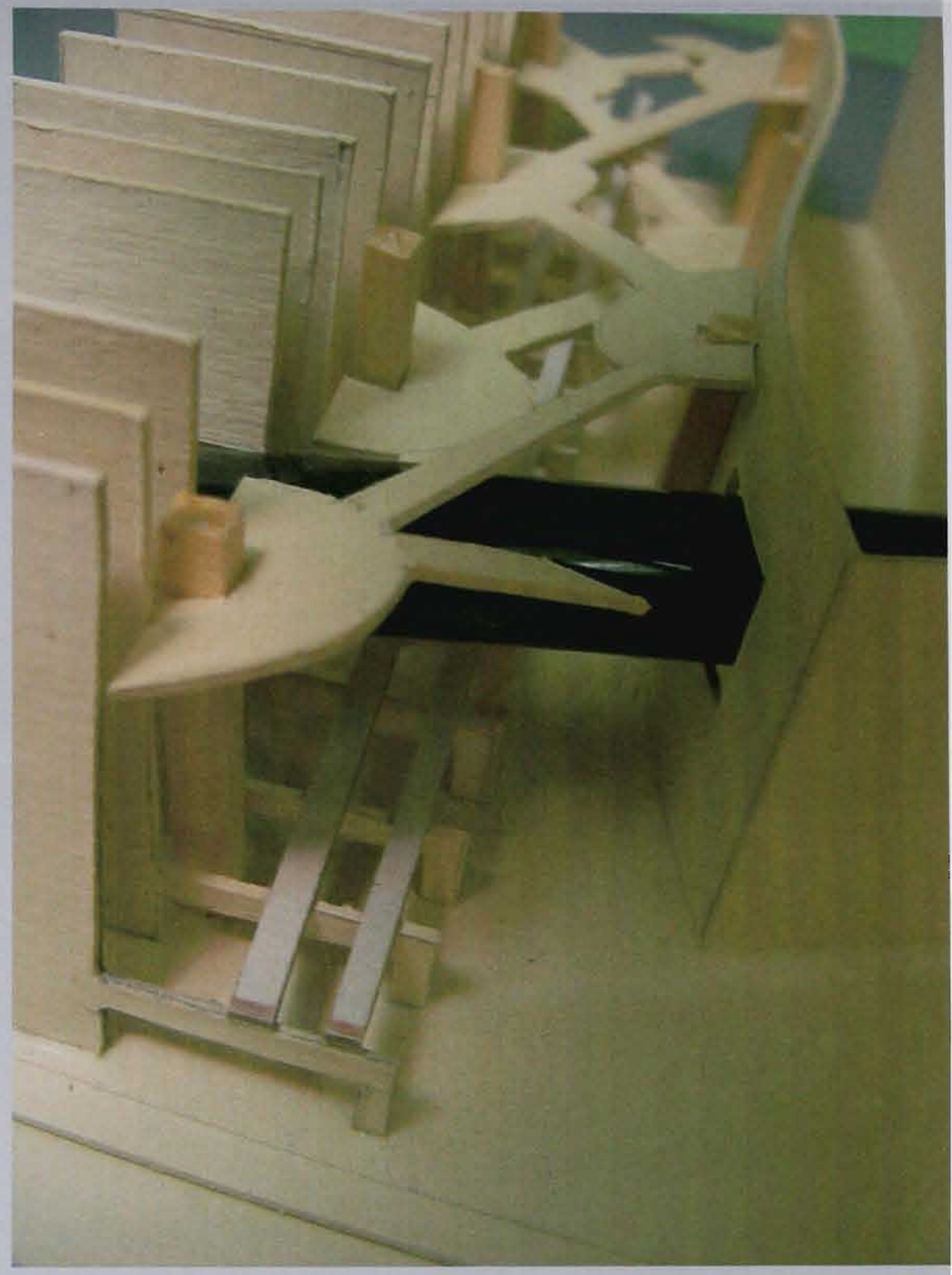
These concept models represent how residential units could be grouped around vertical hubs which are linked to a transportation route below. Essentially a double loaded corridor would be pulled apart to recieve a rail line and linked parks that would serve as gathering spaces for the residential units.

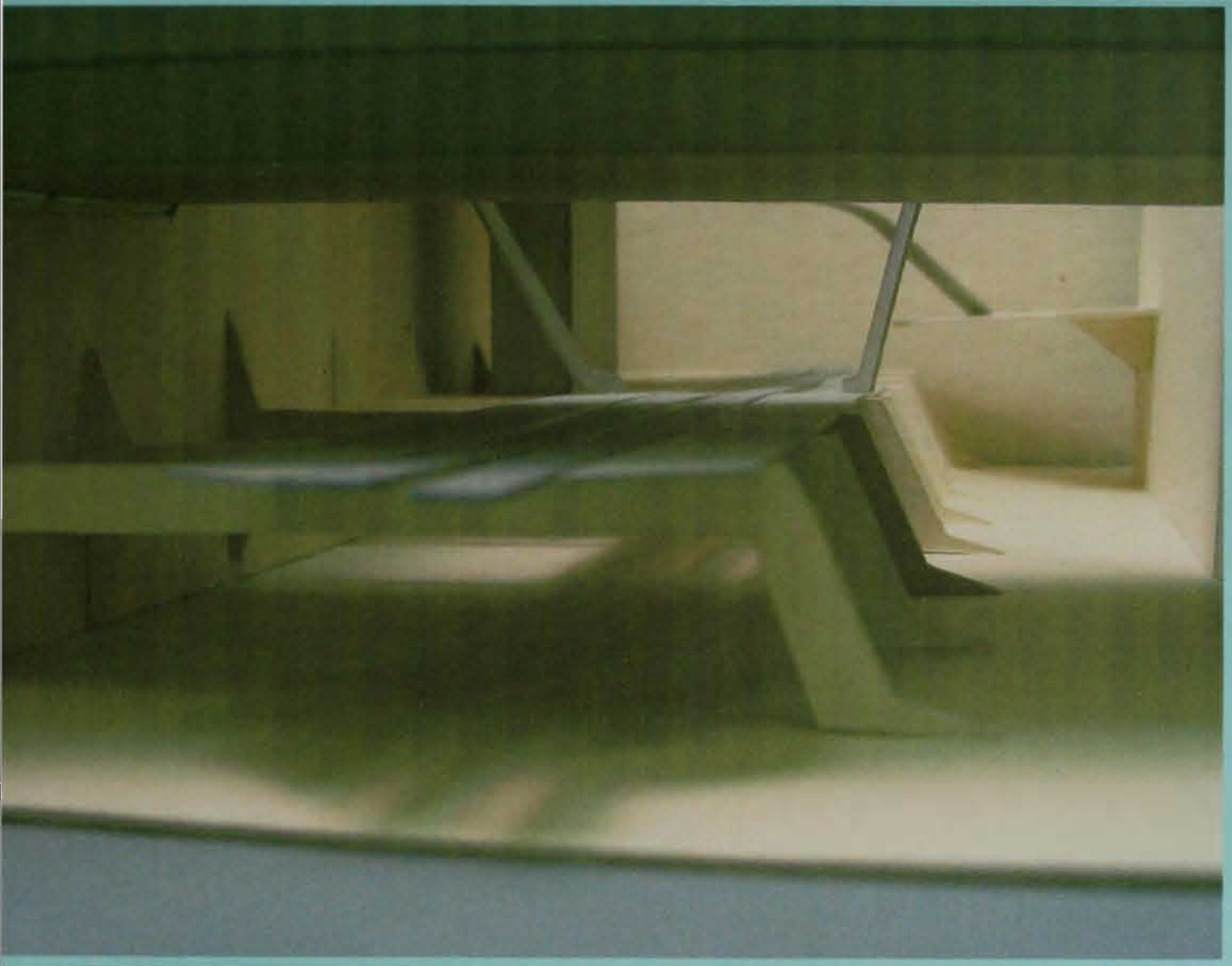




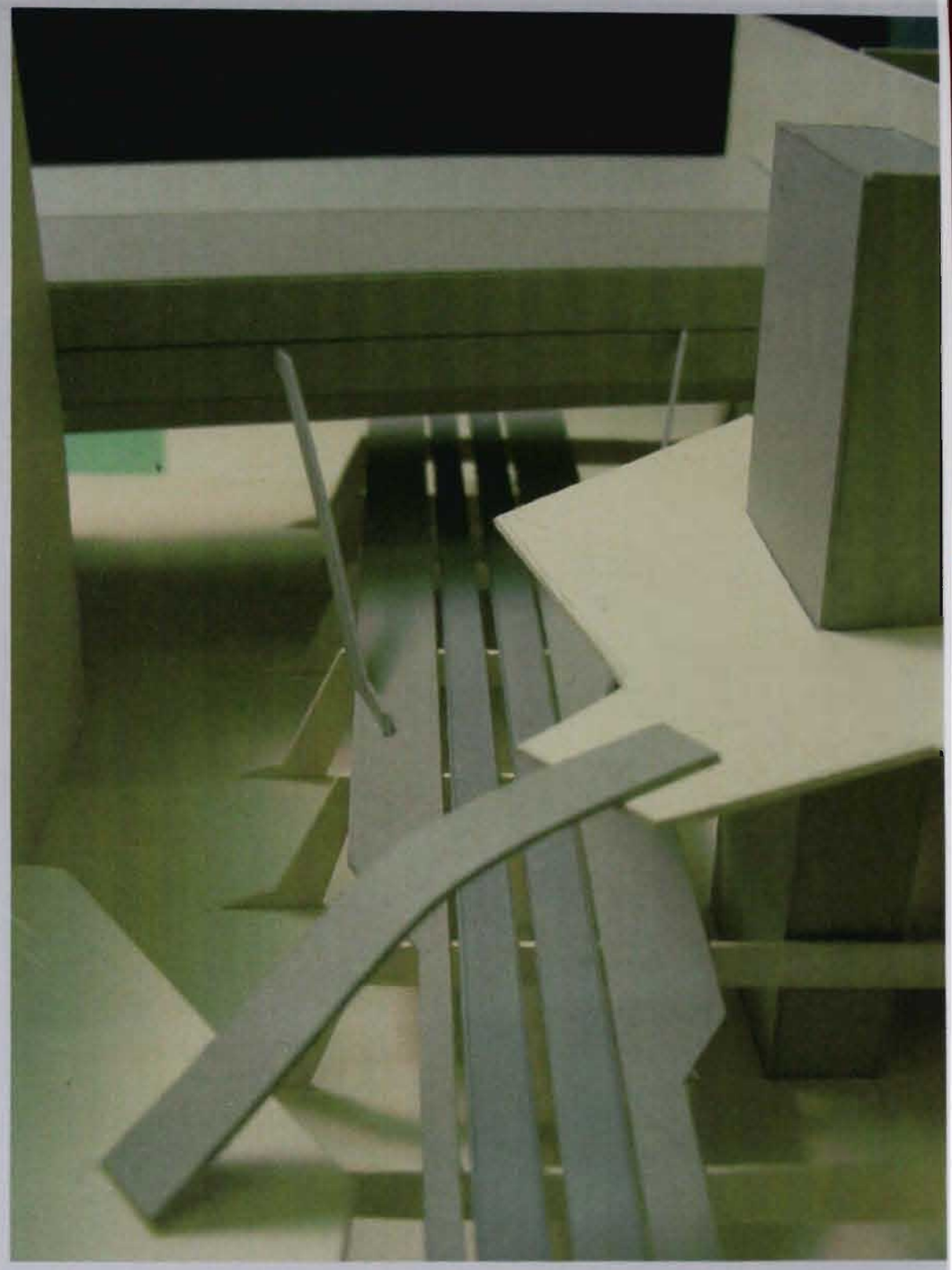


A layered Infrastructure environment could allow for new posibilites in our perception of the city. In this model linked parks serve as entry into residential and office units. Crossing the 'corridor' would be an elevated people mover and green path to link the waterfront to the city beyond. A rail line would bring passengers into a courtyard created by various building setbacks.



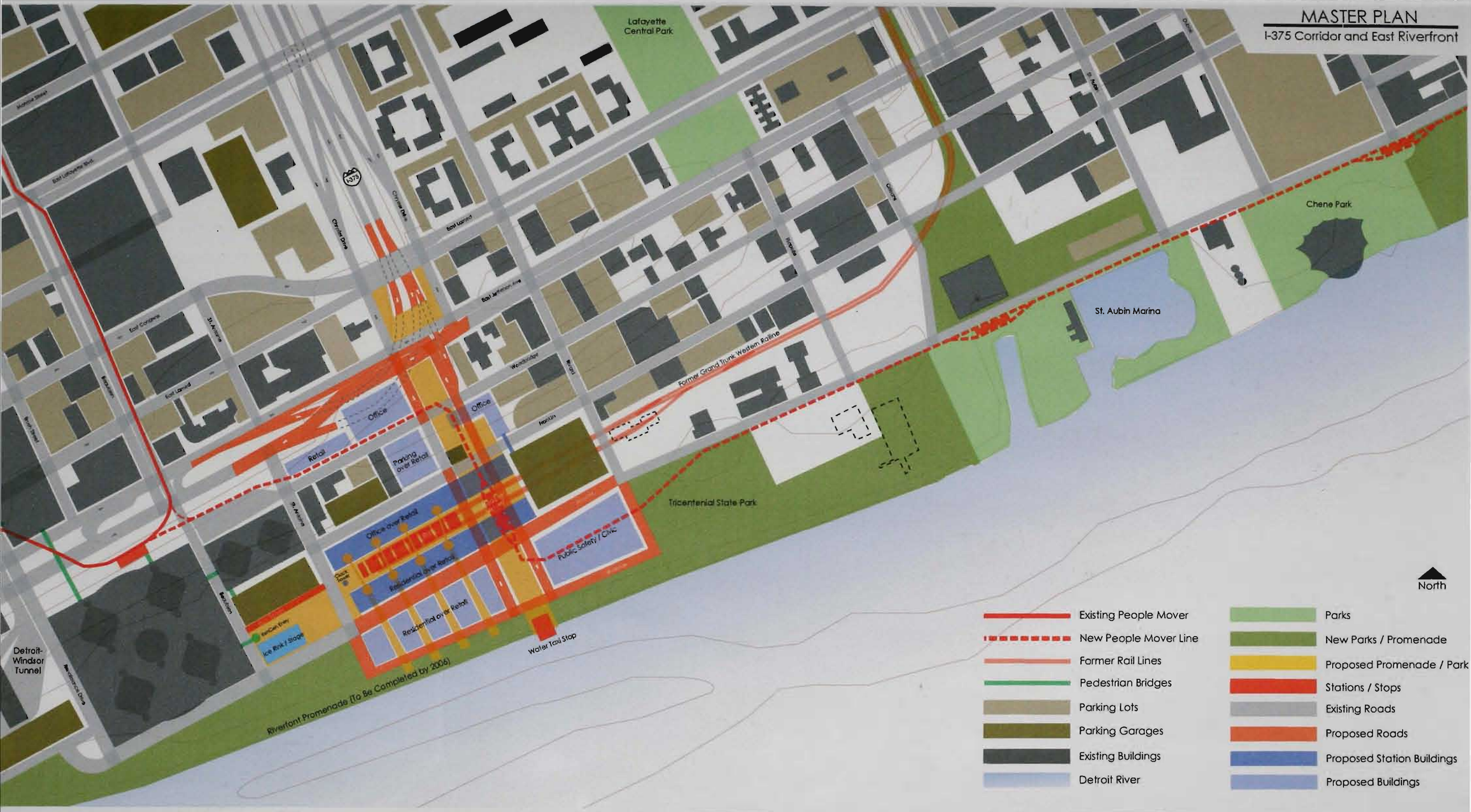


This detail model focuses on how the train could pass through this multilayered space. It is elevated to provide a retail pedestrian street and green space below. Above the rail line are linked parks for the residential units. These parks serve as circulation for the residents and are provide with separate vertical circulation shafts to facilitate privacy.



MASTER PLAN

I-375 Corridor and East Riverfront

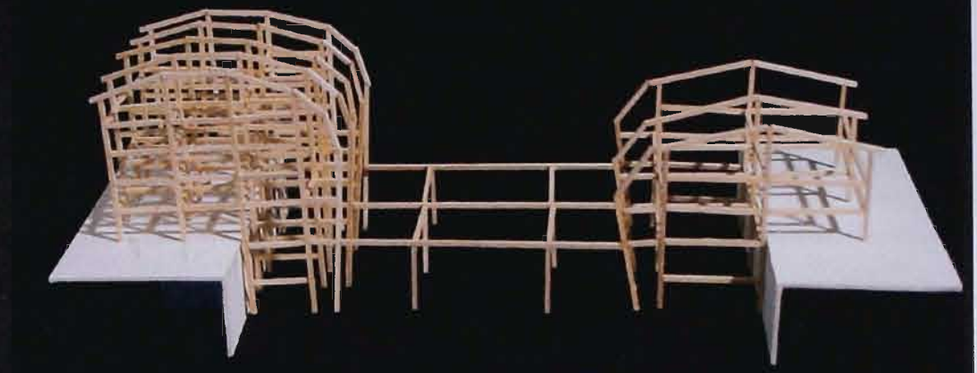


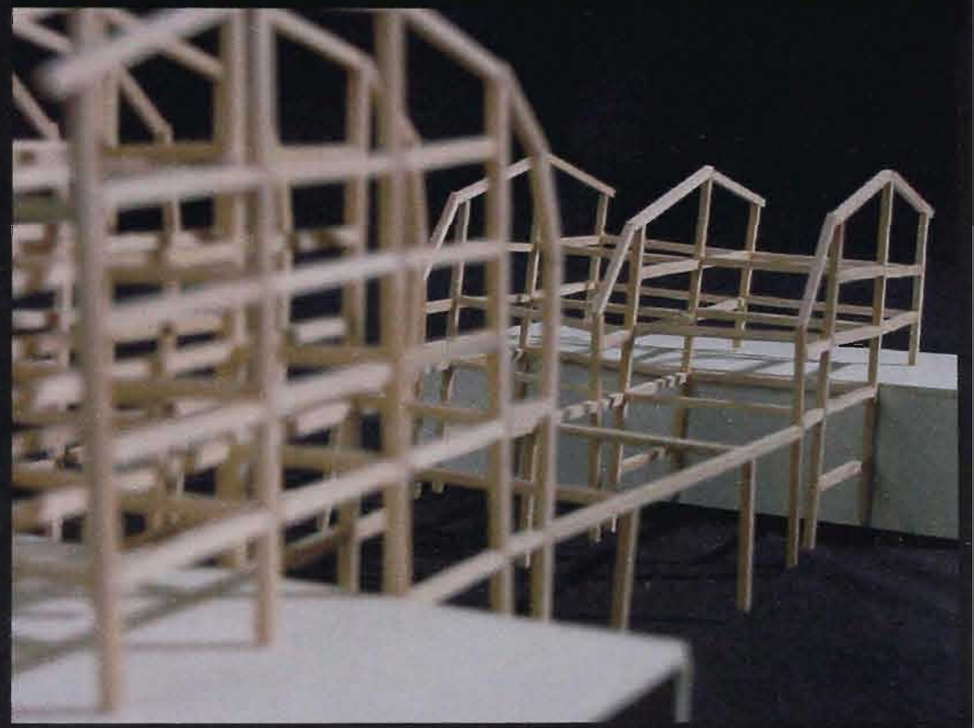
Final Design

The final design concept is one of a mixed-used, inter-modal transit station. In this sense the project establishes itself as an infill development while focusing on how to better use Detroit's waterfront. The project facilitates users and functions on many levels with many types of movement throughout the development. The proposal is one of what could be many mixed use developments at the intersections of major transit lines around the city and metropolitan area.

The project's main focus in integrating infrastructure and architecture is through the mediation of parks and plazas. These parks serve not only as infrastructure in terms of circulation, but also they serve as a defined place. There are two types of parks that unify the development. One type of park uses a system of paths to link the various programs of the district – I will refer to this type as a" ligature park." The other type of park acts as a courtyard and plaza allowing it to

This study illustrates the idea of creating a unifying structure for the entire development. This structure would act as an infrastructure for the development by creating a framework or coordinate system that the various programs could be place on or within. The curved structure reflects sound away from the residential units. It also creates a facade for the building even when the architecture inside the frame recesses away from the frame.

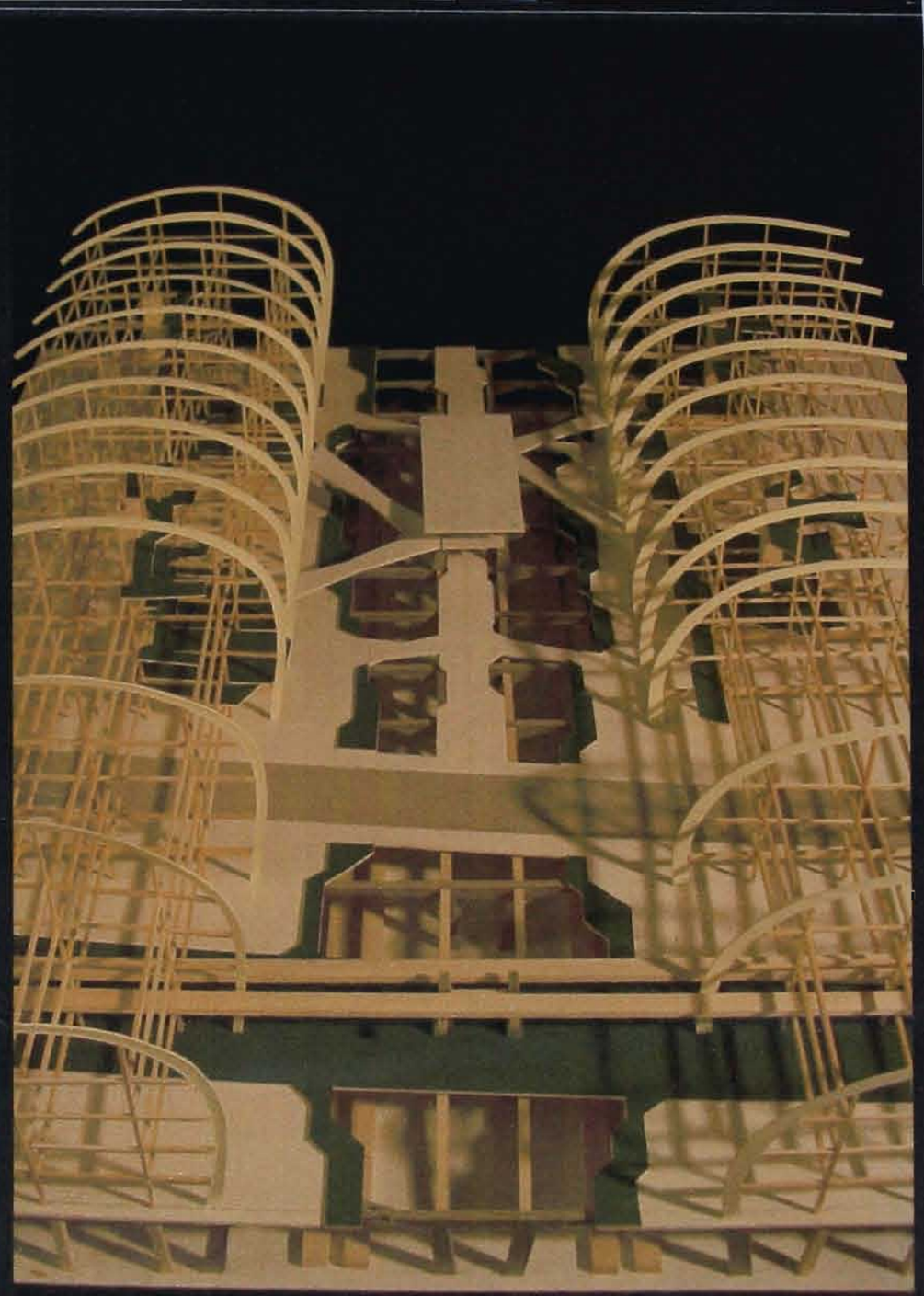




facilitate entry and gathering near the more private dwelling units. Courtyards act like nodes or hubs on a network while ligatures act as lines connecting the hubs. In the development these parks serve as mediator for the more private architecture and mostly public infrastructure. In this way the parks are between architecture and infrastructure and thus effectively integrating the two systems. Each type of park serves as a collector from both architecture and infrastructure. The parks unify the development as well as those who pass through it.

Both the courtyard and ligature are defined by the architecture that exists within and around them. The dynamic shifting of the paths responds to the speed around the development. Each shift provides new places for activity such as outdoor seating or a play for play. The parks also act as infrastructure – circulating pedestrian throughout the development.

The final design of the "station" combines office and retail into a single mixed use development situated on a rail line, a people mover extension, and a bus depot. This model (only shows half the building) allows residential units and office units to focus a view to a public zone of infrastructure below. The street level contains retail and greens spaces that serve as bike paths and soften the environment with trees and bushes. Four rail lines stop underground at this point of the construction. A visual axis is maintained to the train but is layered by trees and shifting planes of the ground plane. The people mover runs perpendicular to the rail lines.



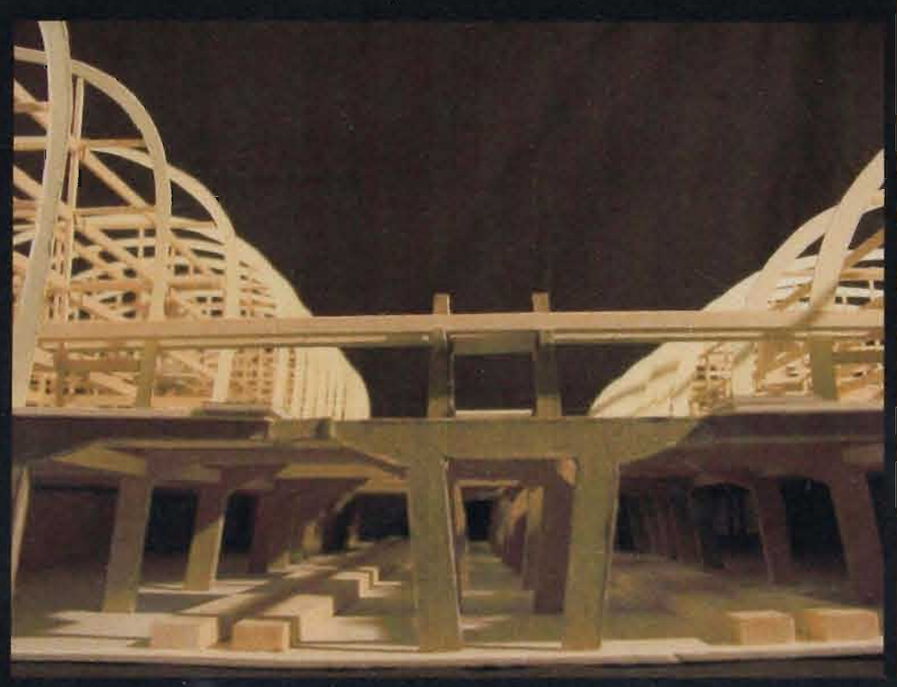
The structure is also a very important issue in the development. Early on the structure began as a framework or coordinate system that architecture could be placed within, no matter what its program was. The structure forms a shell and commonality that unifies the development while still allowing individuality in each dwelling unit. Courtyards are carved out of the building but still exist within the structure. In this form the structure acts as a canopy and enclosure even if the space is not enclosed. Because of this the courtyard acts as part of the architecture even though it is a circulation system. Courtyards also act as the entry vestibule to the units. Everyone passes through this space before entering or exiting their place of residence. These courtyards are raised to the second floor above the retail mall. This allows a view from a residential unit to pass through the courtyard and see the park below and a train passing between the trees. A multiple layered park environment

Courtyards on the second floor allow residential or office units to gather under the structure of the district. These areas are not covered allowing grass and trees to grow in a park-like setting. This allows a view from the residence to connect to the lower level where a bike path and linear park system sits. When looking from a residential unit one would see trees and grass in the courtyard - beyond this they would see trees and grass in the linear park where bicyclist and joggers move. Through these trees the residents could see glimpses of the train pulling into the station below. This layered view allows the units to be situated within the "station" while remaining separate by means of access and privacy.

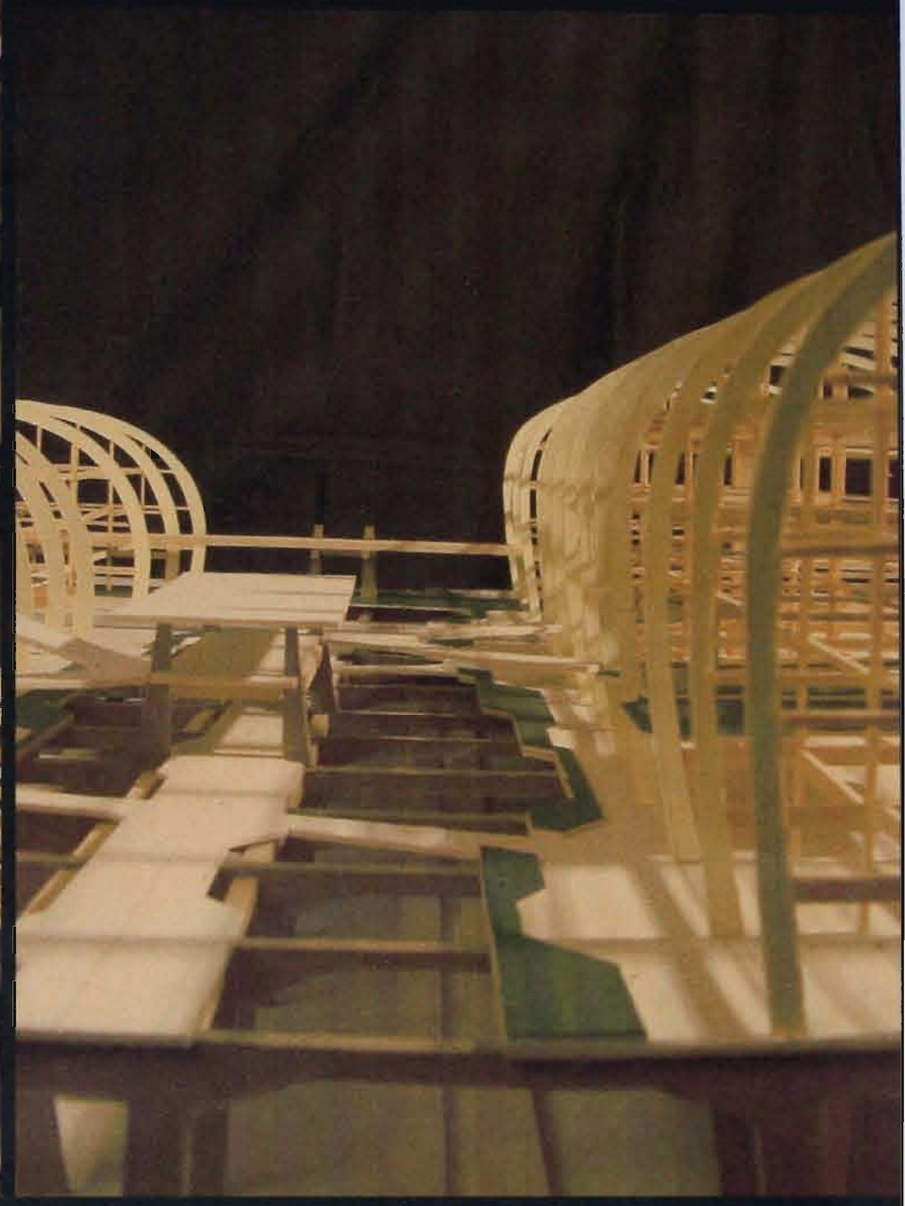
reduces the dry utilitarian aesthetic that is commonly associated with infrastructure. This type of architectural planning allows people to live and work near rail lines and other public infrastructure with a sense of value. Thus a symbiotic relationship between the development and the infrastructure is formed – residents support the need for transportation, while transportation facilitates a dense pocket of pedestrian activity and a need for stores, offices, and potentially residential units.

Unlike the New Urbanist "Transit Oriented Developments (TOD's)," this proposal takes a position of integrating itself into the fabric of the city. Detroit's need for transit could be justified through the usage of defined districts within the city and throughout the metropolis. These Urban TOD's would facilitate and support the need for mass transit between nodes. These mass transit lines would support a denser pocket of growth while allowing the city to remain decentralized in from. This

The rail lines remain open to the development in a way that it becomes an aesthetic focal point and a layer of architecture.



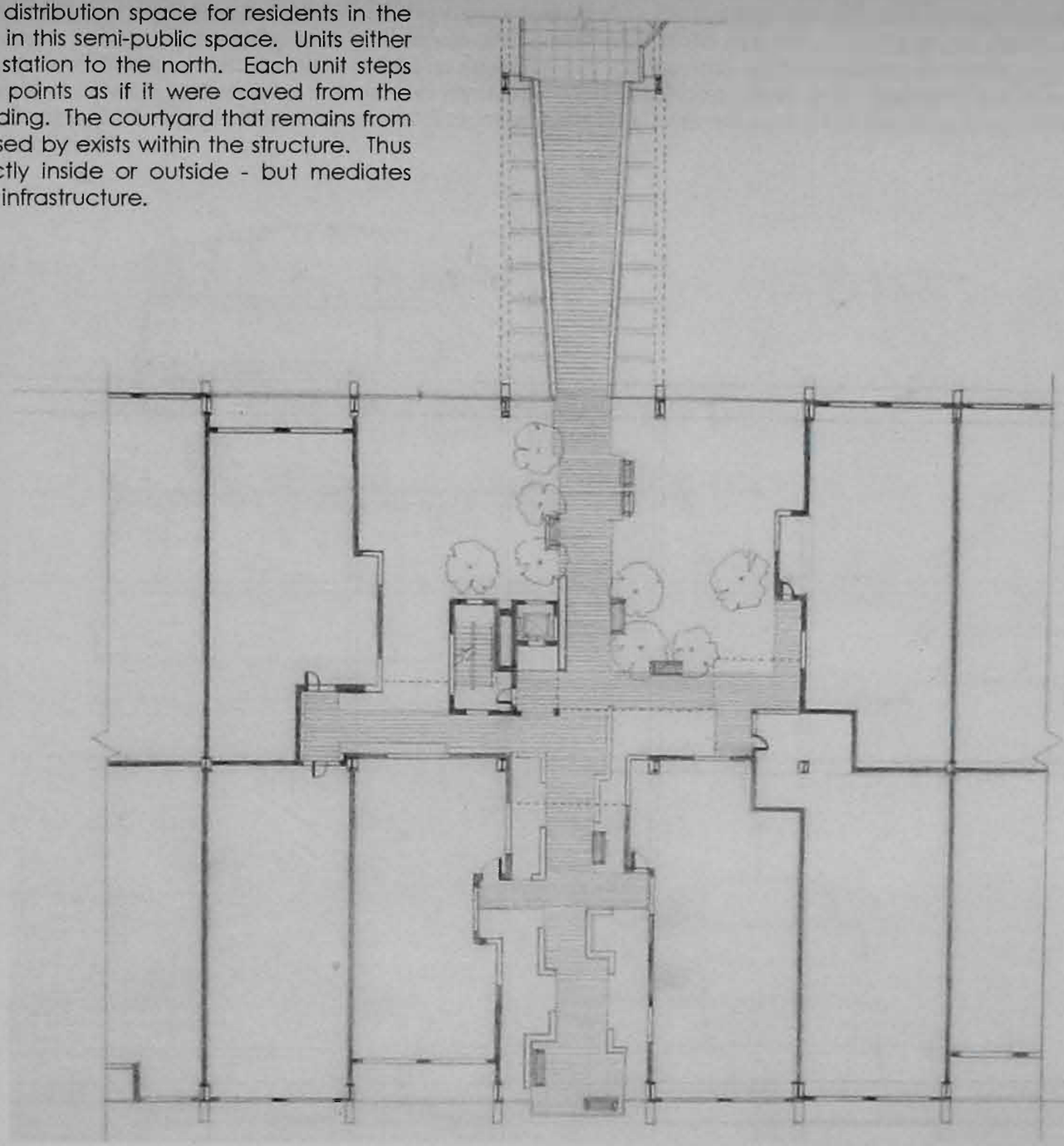
Bridges connect the second level courtyards to the central space. These bridges provide another layer to the development which increases areas of shade and weather protection. The shifting form of the ground plane allows for cafe seating and places to relax on the grass under a shade tree. These projections also cover the rail platforms below.



type of controlled growth should work with existing city fabrics, to revitalize historic centers and in this project, the Detroit riverfront.

By locating the project directly adjacent to Detroit's Renaissance Center (now the headquarters for General Motors Corp.) the project works with the city and the functions of that building to support itself and the adjacent area. All types of travelers would move through the development interacting with it while supporting the retail and other uses within. Local users such as residents and office works can use the people mover to move form one district of the city to another. If a certain type of store or office does not exit in this development than the possibility of it existing in another development could be more likely, thus requiring a trip for the resident. The concept of this development is not to eliminate the usage of a personal vehicle but to reduce the dependence on that use. Short trips in an urban area can be a

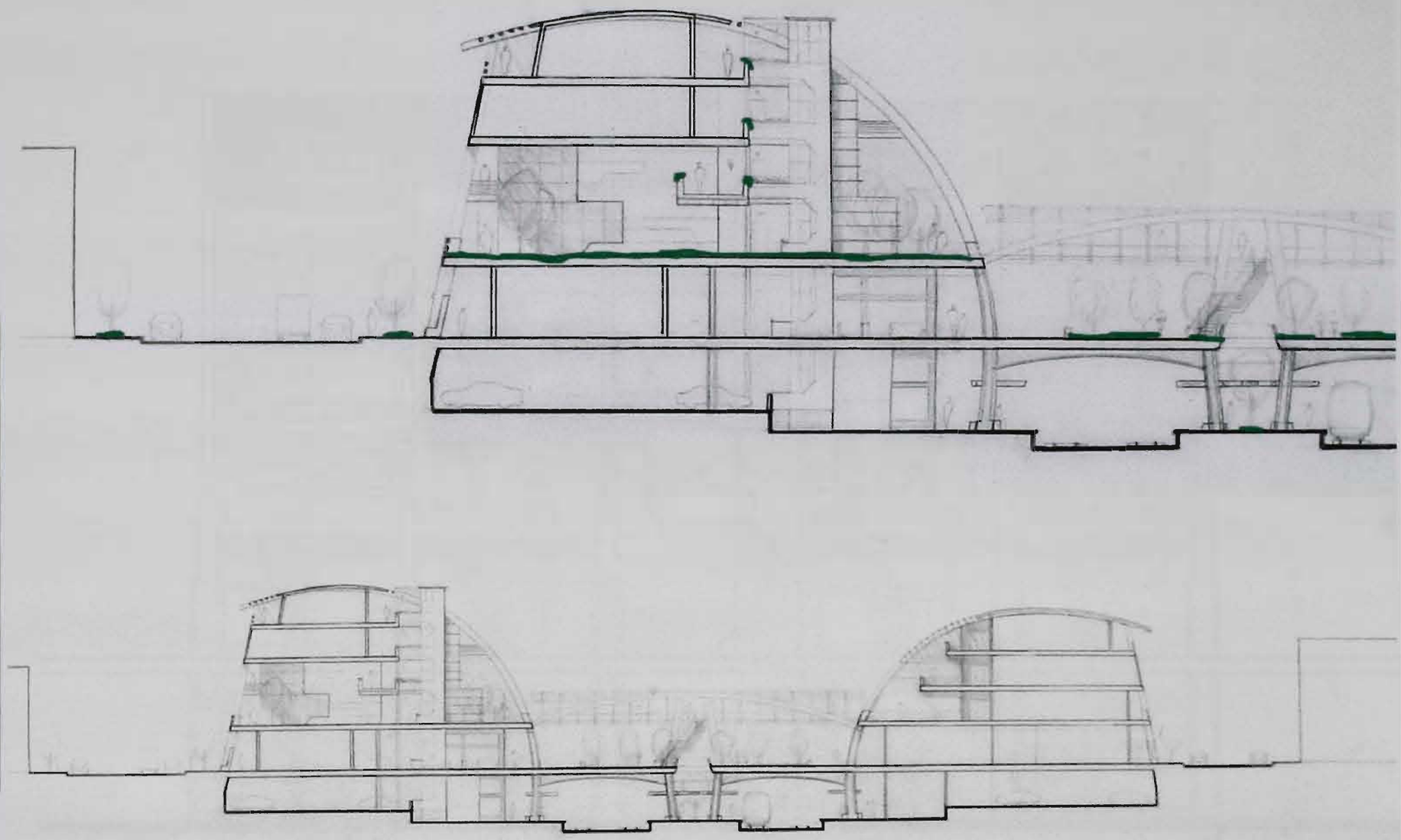
Courtyard Plan
Each courtyard acts as a distribution space for residents in the complex. Everyone meets in this semi-public space. Units either face the street or the rail station to the north. Each unit steps back or shifts outward at points as if it were caved from the overall structure of the building. The courtyard that remains from this courtyard in not enclosed by exists within the structure. Thus the courtyard is not exactly inside or outside - but mediates between architecture and infrastructure.



nightmare when finding a place to park your car. Not only is time wasted circling block after block for a parking space but valuable land is used to facilitate this redundant requirement. Transit lines would reduce parking which could allow for higher densities and more walk able cities, uncluttered by large areas of asphalt.

There are also regional and metropolitan commuters that will pass through and interact with the development. An airport shuttle train would facilitate business and tourist travelers with direct access to the city form the airports which are located far outside the city. Passengers from this shuttle could transfer to nearby busses or the elevated people mover to increase the serviceable area of the train. Regional travelers along a high speed regional network could travel across the state or to cities like Chicago quickly and efficiently from this development. All of these passenger as well as the residents would support retail and

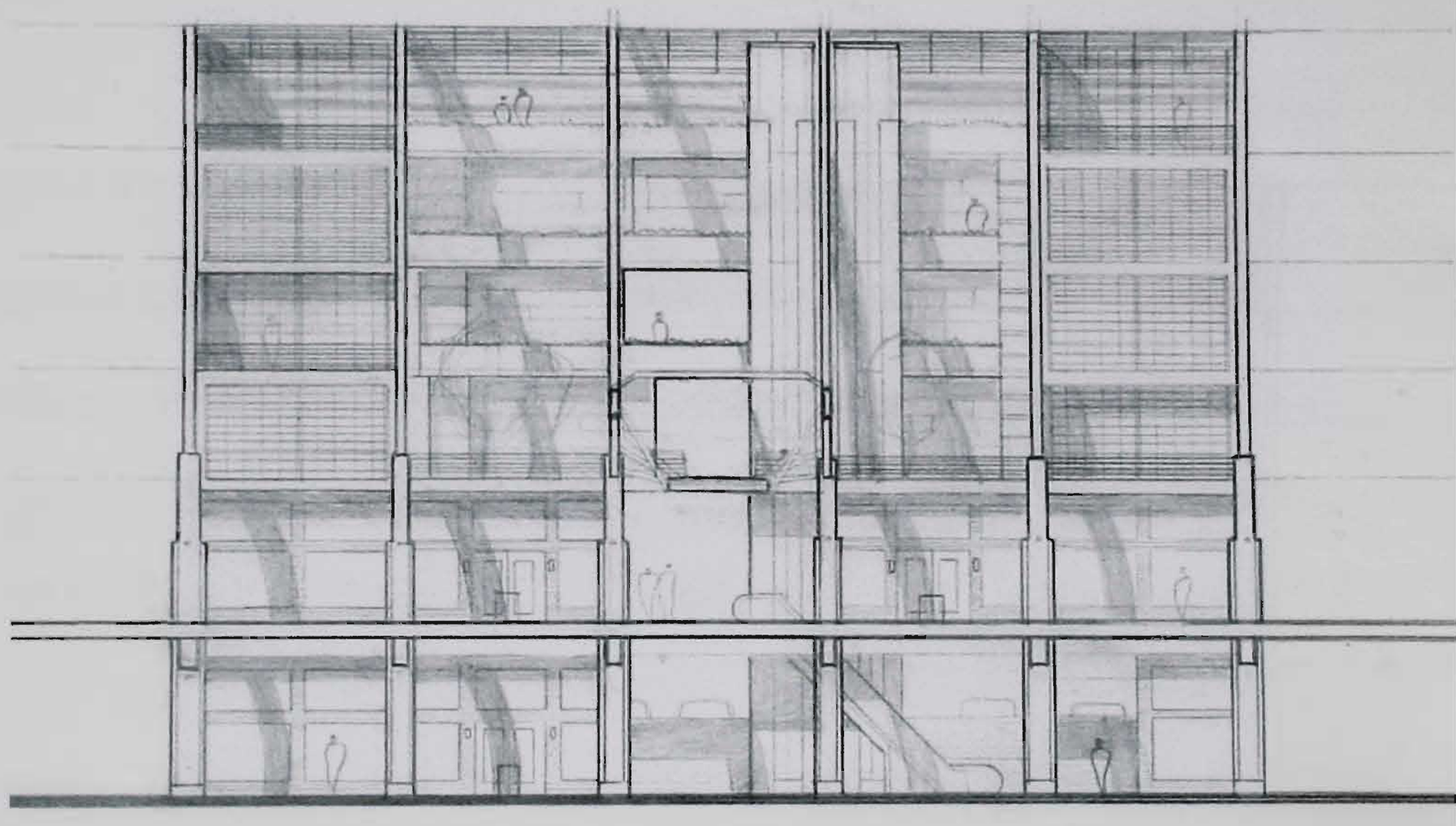
Sections
The lowest level contains a parking garage and is the level of the actual train station for the high speed network and airport shuttle service. The street level is just above the rail station and serves as a park that links the bus station and people mover at opposite ends of the development. This level also contains retail in a market-street fashion with outdoor seating for cafes and a cover arcade for usage in the cold Michigan winters. The second level begins the retail and office units. Residents are in the building closest to the waterfront (right building below). A central circulation core distributes residents while allowing them views to the courtyard on the second level.



restaurants throughout the district. This proposal places the retail in the path of those travelers who are transferring from one mode of transit to another. The green spaces improve the environment and path of these travelers while reducing noise that could find its way into the residential units. Any noise that does make its way to the units would be reflected by the curve of the façade and structure of the buildings.

The architecture of the units attempt to connect to the surround site in many ways. The buildings are composed of a light carbon fiber structure. As the massive curving columns penetrate the ground plane they are met by bases of brick. Glass garage doors that look like factory sash windows relate to the former industrial uses that surround the structure. These doors also facilitate a fully open residential unit and view to the water front beyond. Large trellises span between the columns to shade the building from excessive sunlight.

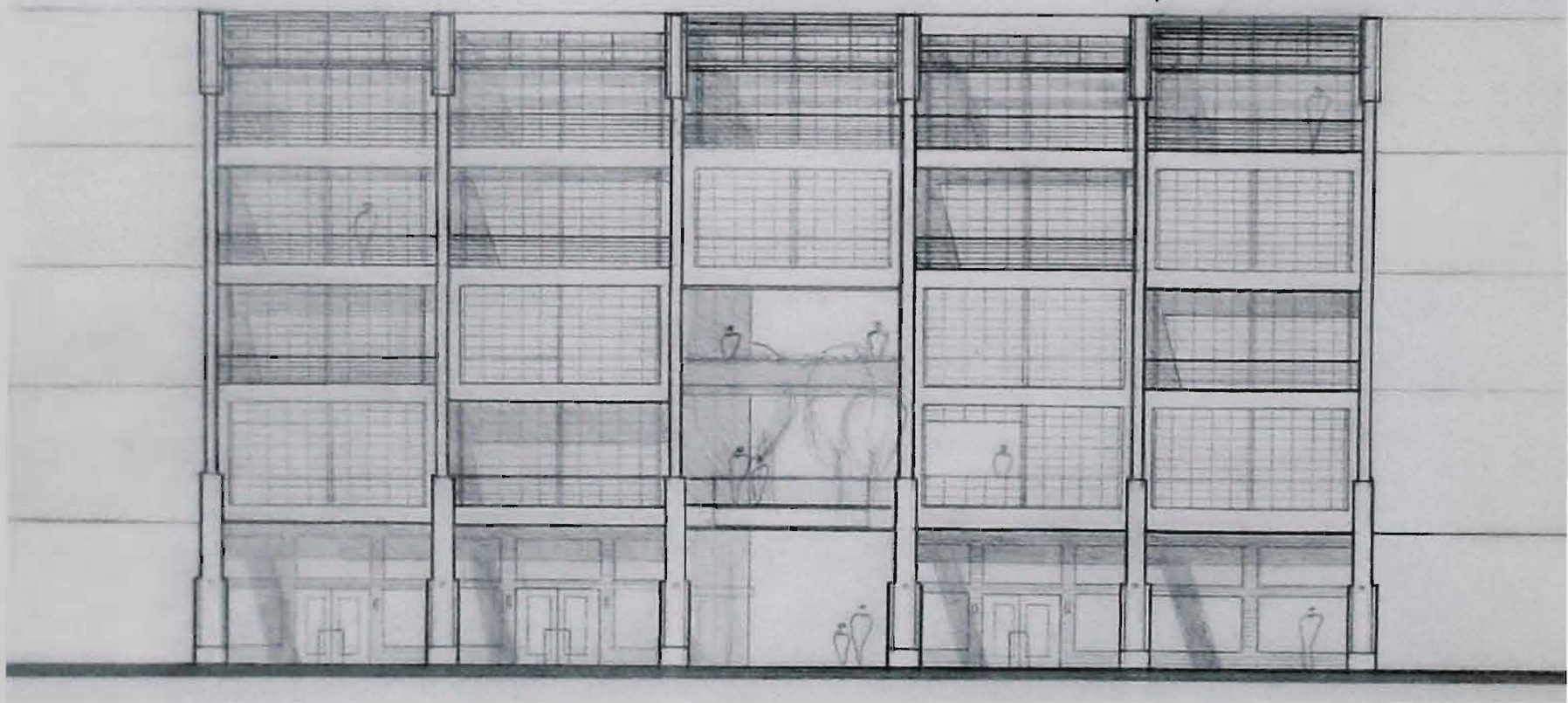
Partial Elevation
This elevation of the residential building faces the rail lines in the center of the district. The lowest level is the train station and parking beyond. The street level contains retail units with a pass through to the other side of the building and Atwater Street. The courtyard remains open to the elements but is shaded by trellises above. Large glass and steel garage doors face the rail lines. When these doors fully retract the entire unit is open to the exterior. This accommodates situation where there are not balconies for the units. It also brings the outside into the unit.

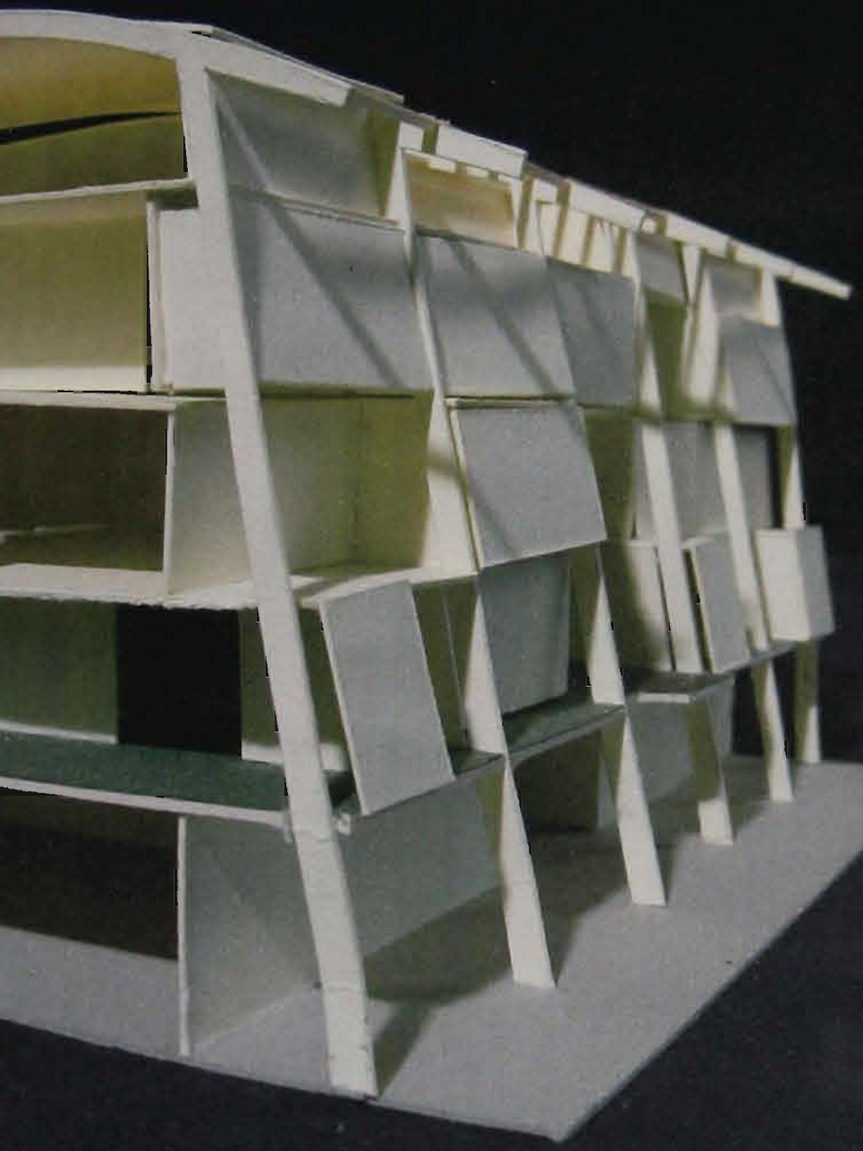


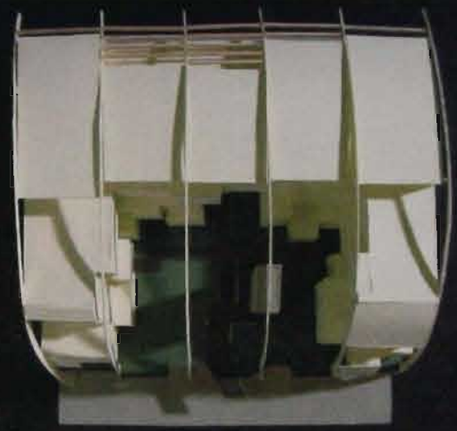
The proposal integrates many type of transport infrastructure while establishing itself in the city. The development's position to the waterfront allows for and extension of the new promenade to pulled into the city. This path would allow those who travel to the district by bus, train, or car to have access to Detroit waterfront facilities. The path also establishes a bike path for residents in the city to use as a safe means of access to all the parks and marinas.

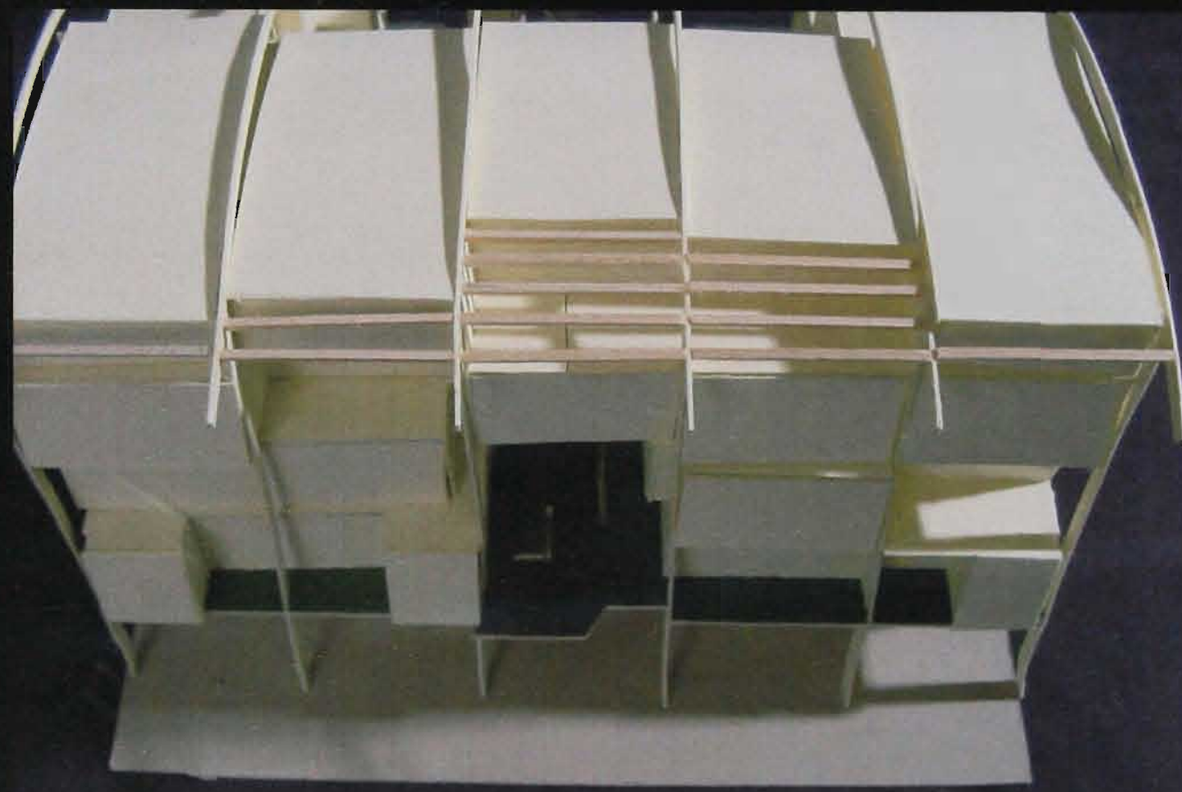
Nature's role goes far beyond the aesthetic or environmental need in the project. It is used to establish path and place within the area. Planes of grassy areas lined with trees form an infrastructure like a rail line or street. They also define areas of rest and play. Nature is vital to the project. It serves to mediate the relationship between architecture and infrastructure.

Partial Elevation
This elevation of the residential building faces the Atwater Street.





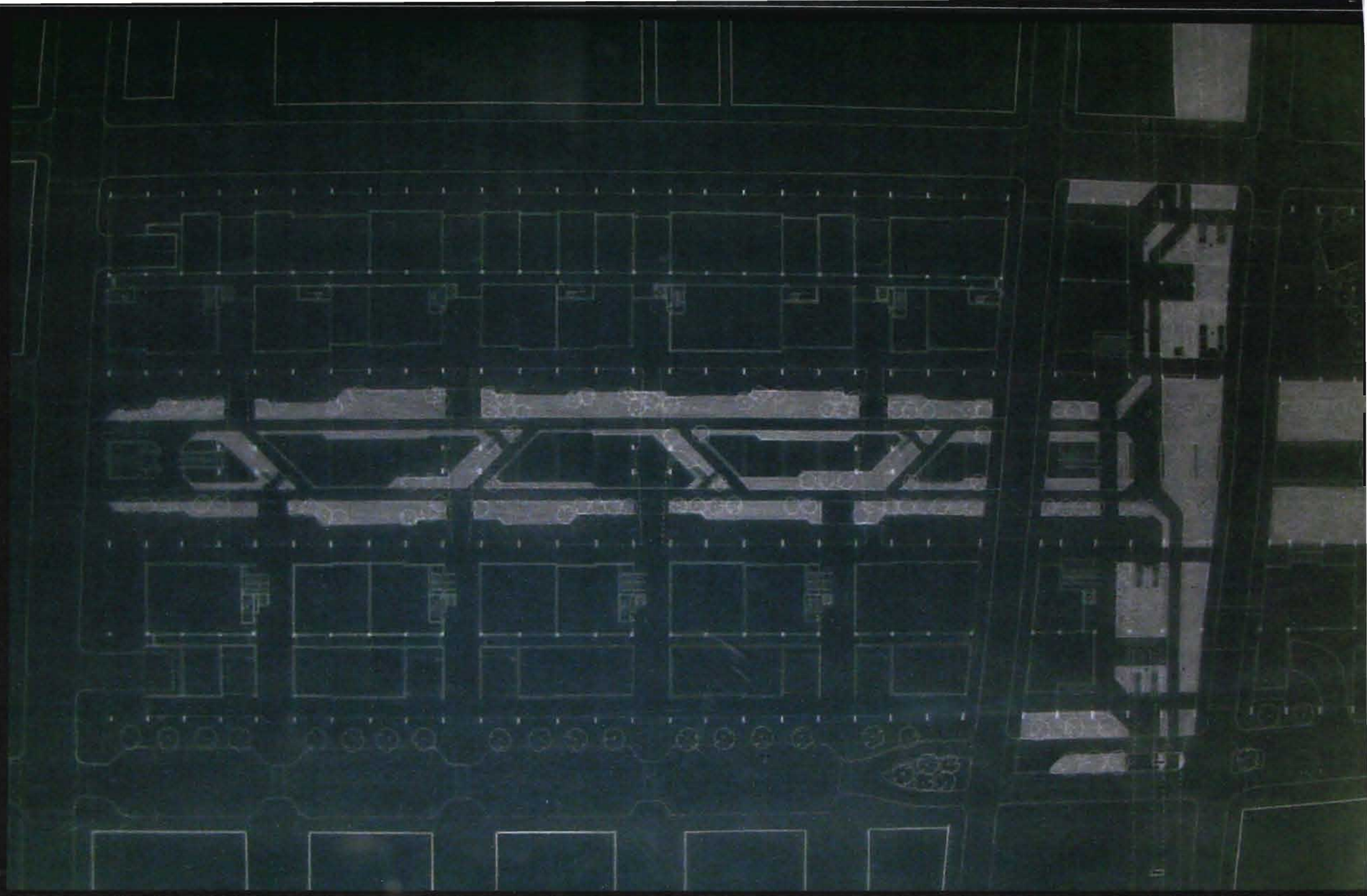




Final Design

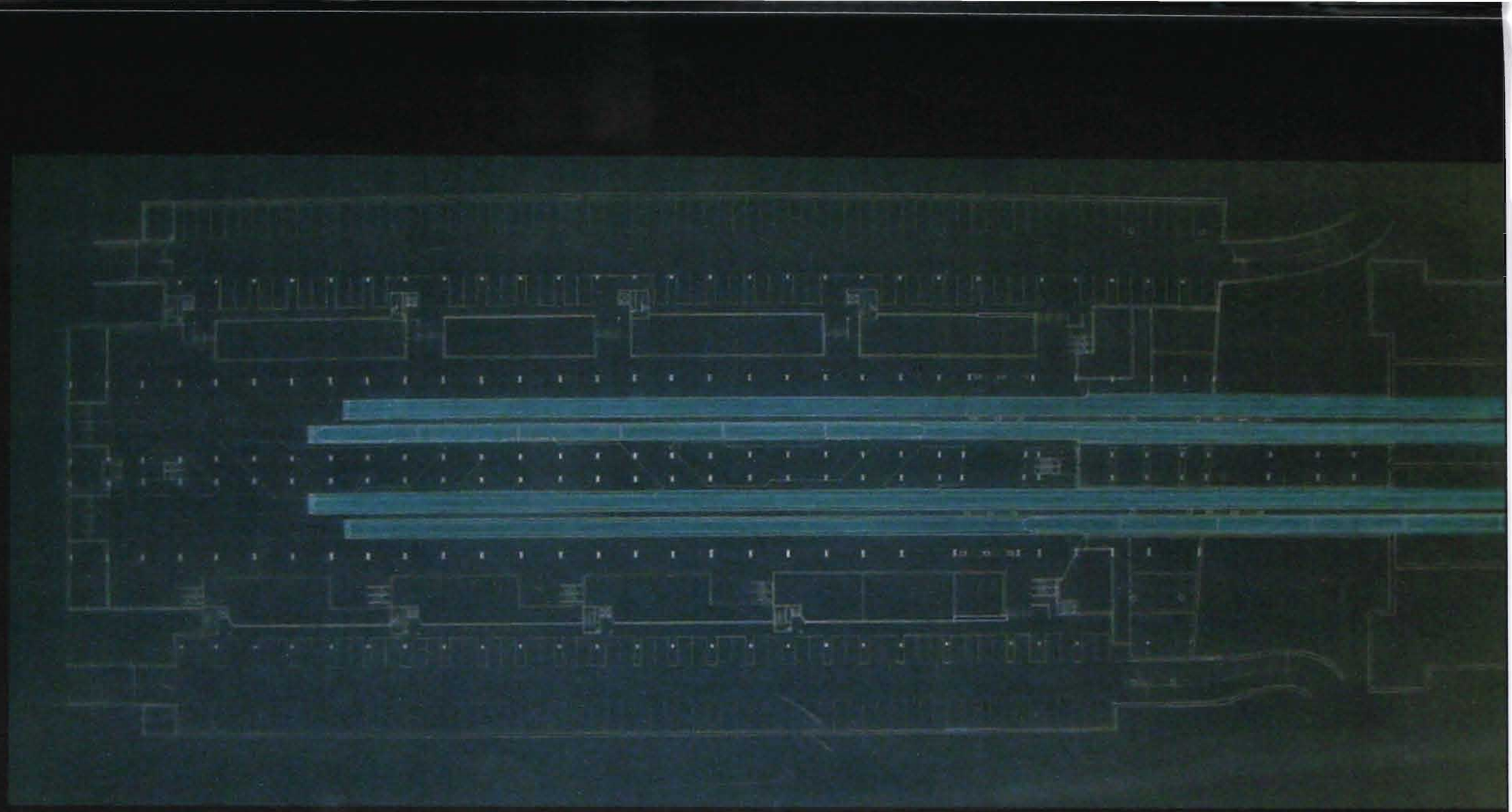
Ground Floor Plan

-Retail
-Promenade extention with bike paths.



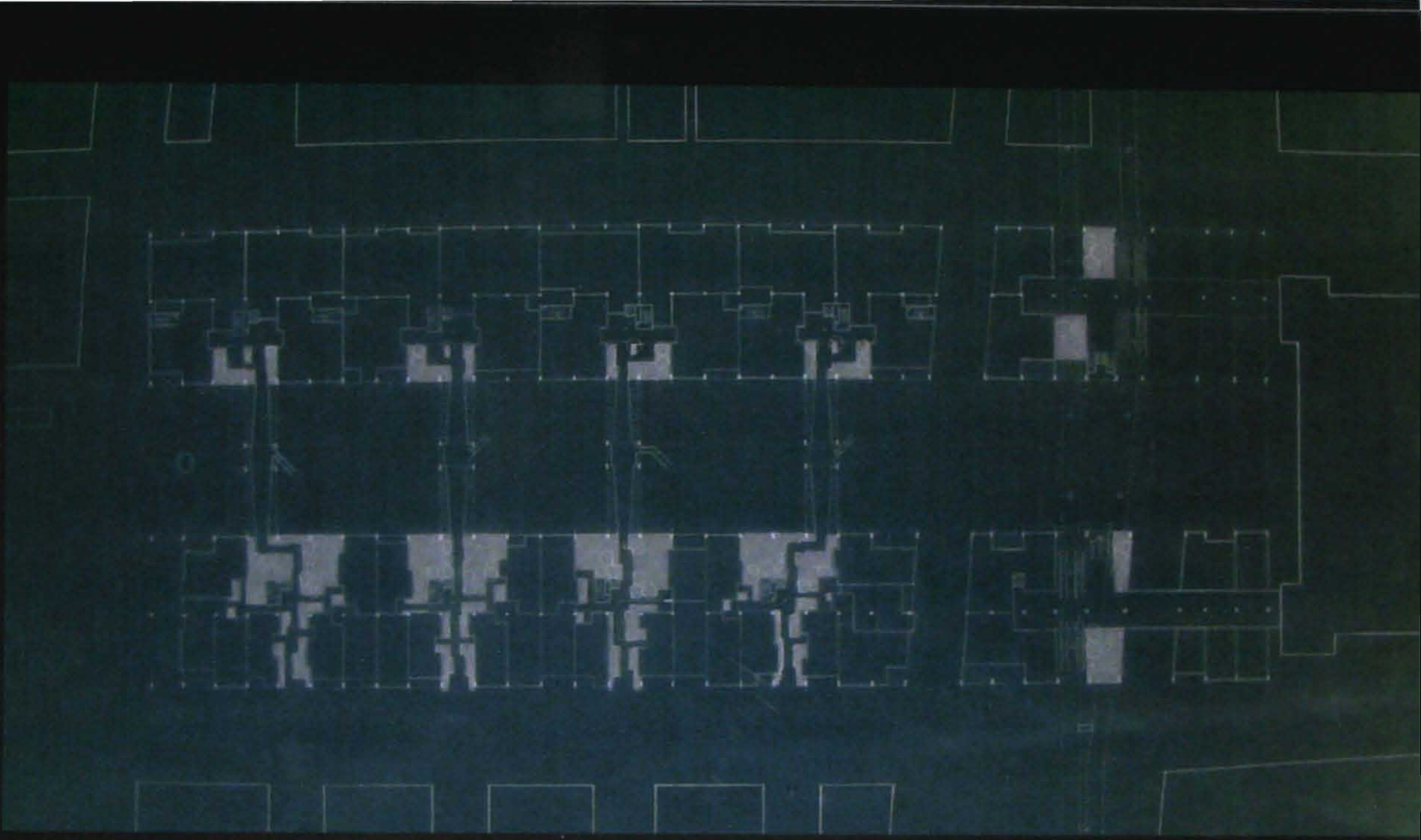
Lower Floor Plan

-High Speed Rail
-Parking Garages



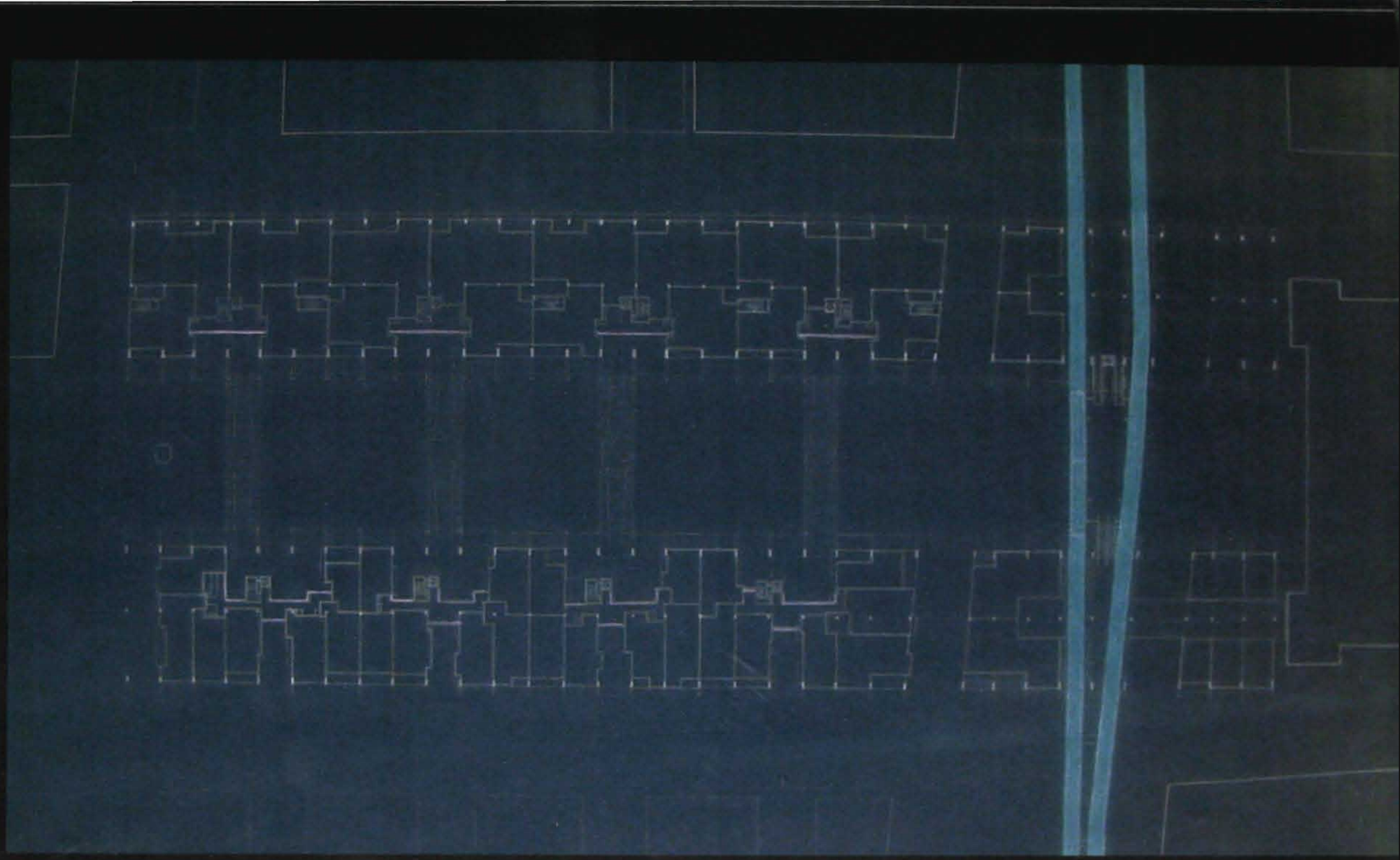
Second Floor Plan

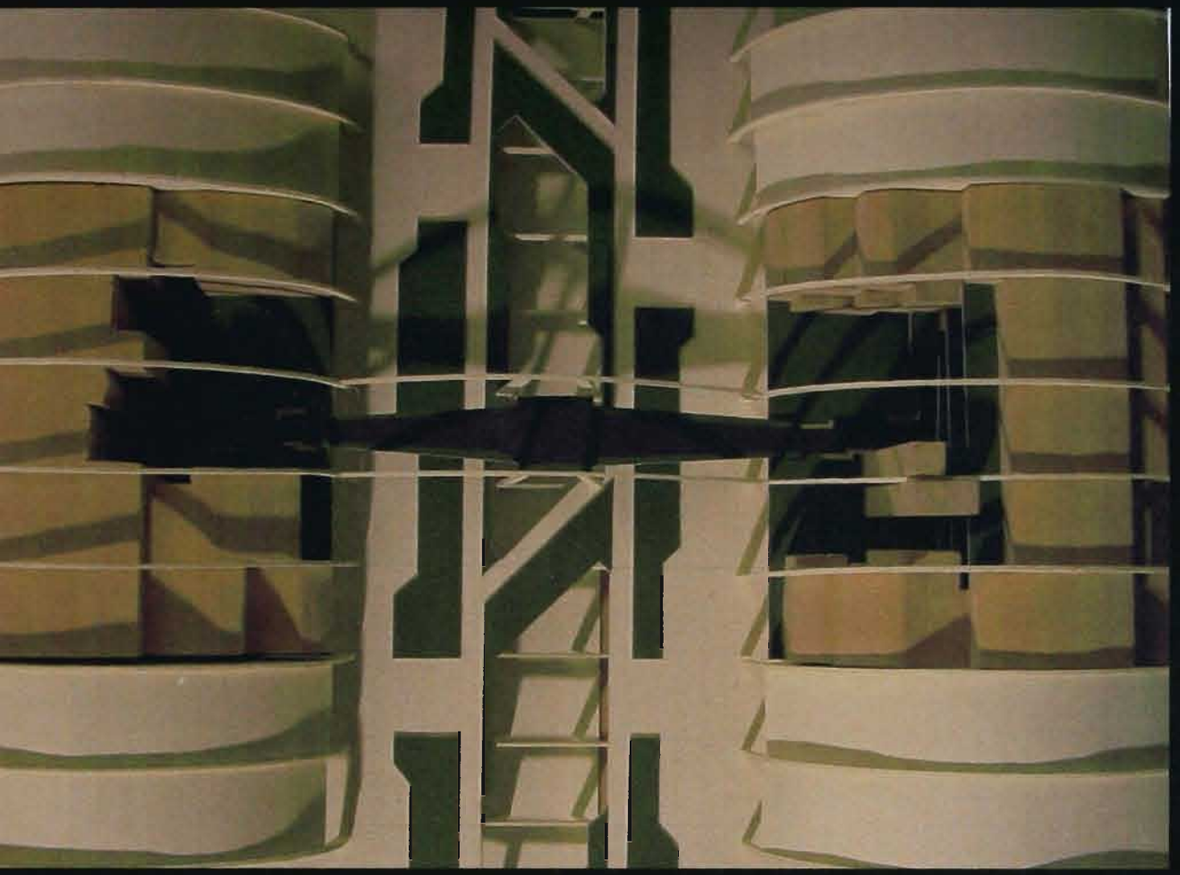
-Courtyards
-Bridges
-Residential Lofts (south)
-Offices (north)

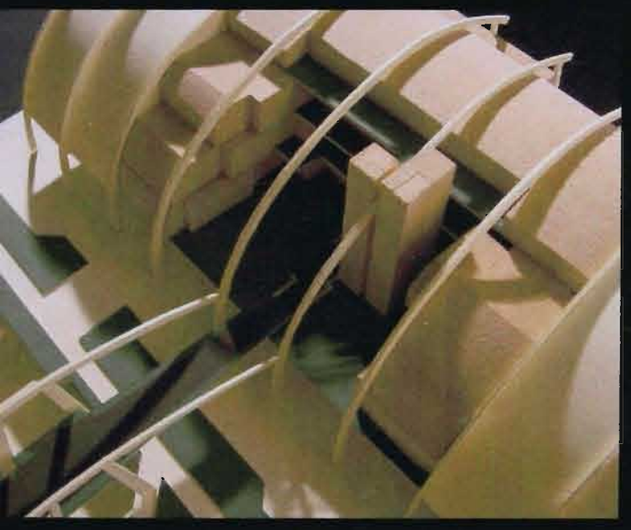


Third Floor Plan

-People Mover Platform
-Residential Lofts (south)
-Offices (north)







Conclusion

Roads, rail lines, utilities, and other forms of infrastructure are vital to the success of our cities. These flows bring rivers of economic growth and sustainability to the city. But their importance goes far beyond function. Infrastructure plays a vital role in the aesthetics of our cities. When streets are designed with landscaping and quality surfaces, we find a sense of pride in our environment. Infrastructure must not be thought of as a gray space devoid of life because they serve only functional role. It is hard to imagine living on a rail line or adjacent to the freeway because of noise and a polluted view. But it is possible to make these infrastructures an attractive place to work and live.

By creating nodes of dense mixed use developments at mass transit intersections, infrastructure could bring new life and reclaim the idea that the city can be an attractive and efficient place to live and work. Transit corridors provide quick and easy mobility and allow for a controlled growth which the suburbs cannot provide. Theses pockets of dense urban dwelling could still allow for the decentralization that is attractive in sprawl. Infill developments and transit oriented designs should not erase the city and begin new. Rather they should work with the city to create sustainable communities supported by high quality infrastructure.

By allowing nature to mediate the integration of infrastructure and architecture, the city would not feel dirty, gray, and devoid of life. Parks as public infrastructure can provide new spaces for interaction in the city. They can serve as pathways for recreation and sport. Green spaces can become plazas and courtyards which would facilitate the movement from the public infrastructure to more private dwelling spaces.

In order to reclaim the city from its post-industrial decentralization, we must look at new alternatives for growth within existing neighborhoods. Cities like Detroit can strategically infill and redevelop to create neighborhood districts centered on transportation routes. By integrating Infrastructure into a category of quality architectural space, the city may once again find walkable, community based places only found in denser pockets of controlled growth.

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A short pamphlet on the discussion of Sprawl in terms of economics, urbanism and the neighborhood. Although the book describes sprawl and its alternatives, some focus is also given to the defense of sprawl and its benefits to society and the individual.

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A look at American urban sprawl, its history, its future, and its positive and negative impacts of the urban fabric.

Girling, C, & Helphand, K. (1994). Yard, Street, Park: The Design of Suburban Open Space. New York: John Wiley & Sons.
A look at suburbia, sprawl and urban renewal projects such as TODs in light of their association to the public realm. Dimension of yards and street scapes are also discussed as relevant to the overall city / suburb fabric.

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Halprin, L. (1966). Freeways. New York: Reinhold Publishing Corporation.

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Kelbaugh, D. (10/03/2003). Repairing the American Metropolis: Common Place Revisited. Lecture at the University of Detroit Mercy.
An overview of Douglas Kelbaugh's book with an emphasis on Detroit. A look at projects form the Kelbaugh's Design Problems for new urbanism and revitaiztion projects for the City of Detroit. See book - repairing the American metropolis: common place revisited

Kelly, K. (1994). Out of Control. Massachusetts: Perseus Books.
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