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ignition: A Research and Design Center for DaimlerChrysler in Detroit, MI

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ignition:
A Research and Design Center for
Daimlerchrysler in Detroit, MI

by
William DeRoin

A Terminal Project
Presented to the Faculty of
The College of Architecture at the University of Nebraska
In Partial Fulfillment of Requirement
For the Degree of Master of Architecture
Major: Architecture
Under the Supervision of Professor Thomas Laging, FAIA
Lincoln, Nebraska
May, 2007

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intent narrative

Spring 06

Term Project Abstract:

This Project was founded through the study and understanding of the parallel circumstances facing the automotive industry and architectural profession. Both fields are organized and structured in similar manners, and both share similar problems. Primary among them is the recent need to shift design focuses from viewing sustainable practices as necessary, a move unpopular among many designers and consumers because of the perception that with sustainable design comes a boring, unappealing design. This project will attempt to offer an architectural solution that through program (a design and research center for sustainable vehicles) and design, will challenge these stereotypes and blend the two fields together.

Site Selection:

The site chosen for the project is a waterfront location in Detroit, MI. As the traditional home for American automotive companies, the area is symbolically significant for a new shift in vision for vehicle design. The specific location within the city is along the Detroit River at the highly ceremonial axis that crosses the eastern terminus to the city's waterfront experience with the ceremonial corridor of East Grand Boulevard that leads to the city's largest park, Belle Isle. The specific site is the abandoned UniRoyal Tire Plant, a

heavily damaged Brownfield site that has sat undeveloped for twenty-five years. The project will focus on the design center as the catalyst to the redevelopment of the blighted section of the city.

intent narrative

Design Goals:

To Translate the design principles of sustainable vehicle design into an architectural solution that promotes a dramatic, visually engaging design backed by sound, sustainable concepts.

To feature the design center as the catalyst to the redevelopment of the blighted portion of the city, linking the ceremonial corridor of East Grand Boulevard and Belle Isle to the pedestrian waterfront and Jefferson Avenue commercial experience.

Provide remediation to the poor existing conditions of the site through large, innovating design gestures that benefit both the building's function and efficiency capabilities and surrounding community's development.

intent narrative

Theoretical Pursuit:

As of 2005, the city of Detroit has planned to invest \$25 million to clean up the abandoned UniRoyal site along the waterfront. The site is expected to be redeveloped as a medium to high density residential community, and act as one of the final pieces towards rebuilding and remaking the Detroit waterfront. The site is rich with the history of Detroit, and a valuable link to many plans for improved tourist activity, yet a fairly rudimentary and unexciting proposal is being set forward for such a site. With this terminal project and expression of architecture, therefore, I wish to explore the value and impact of the symbol in architecture versus the expected market solution.

As one of the terminating points to the heavily-planned renewal of Detroit's Waterfront, I wish to argue that the final design piece along the main side of the river should be an element that symbolically represents the rebirth of the city of Detroit as a proponent for change. This project will seek to prove that a symbolic architectural gesture architectural gesture (in this case a design center for green technologies in the automotive industry) will have a far greater impact on the community than would a more traditional (and perhaps more needed) housing development. The allure and interest generated by my design, not to mention marketing opportunities and publicity generated, will be a more successful long-term alternative to a standard housing solution.

The project should also fully explore the role of technology and perceptions with regards to sustainable architecture. One of the prime current systems of evaluation, LEED, is in many ways a flawed construct. While beneficial on certain levels, the LEED system also has tendency to promote complacency in design. The image of an unappealing box with sun-louvers has come to be associated with green design, a problem in the profession.

This project will therefore look closely to the automotive industry to draw inspiration from technologies and strategies presented in vehicles. The architecture should follow, in many ways, the leads set forth by the more successful green programs of the automobile industry. The final project should come to represent the imbedded technology to the design, and much like an automobile, the final form should be a fluid expression of design and function.

The success of this project will hinge on the final comparison of whether my design solution shall prove a more beneficial creation to the city of Detroit than a block full different housing solutions. I will need to showcase the power of a powerfully symbolic, yet entirely functional building, on a symbolically rich site and context, and have the design seem plausible as if it were always part of the masterplan.

research / analysis

Spring 06 - Fall 06

research / analysis

Site Large Context

Detroit was chosen as a site primarily due to significance the city has historically with the automotive industry. Once a thriving production center for nearly every domestically produced automobile in the United States, the city more recently has suffered greatly as the “Big Three” auto producers have restructured their operations and relocated many facilities away from the city of Detroit. Detroit now is actively trying to rebuild itself into an effective tourist center. One of the main components of this strategy of renewal revolves around the redevelopment of its waterfront property.

This new design center fills an important gap along the waterfront and will prove to be an essential component to the city’s plan for urban renewal by acting as a catalyst to the blighted area. The reinvestment of funds to the area would allow for a completion of a strongly connected urban waterfront, linking the downtown section of the city with some of the wealthier residential zones along the river.



Key Locations on Site

- 1 – Project Site, brownfield site that was formerly a UniRoyal Manufacturing Plant
- 2 – Downtown Detroit, the project site is located east from the main downtown of Detroit
- 3 – Belle Isle, an Olmstead designed island park

- 4 – Jefferson Ave. and E. Grand Blvd., the two nearest arterial sources of traffic to the site
- 5 - University of Detroit Mercy, a downtown-based University featuring a college in engineering and technology

- 6 – The Major Road Systems, the arteries that direct traffic to the downtown Detroit area

research / analysis

Site History

Formerly located on the selected site was a manufacturing plant for the UniRoyal tire company. Built along the Detroit River in stages (the first beginning in 1905), this factory was once one of the founding blocks that built Detroit into the leader of the automotive industry.

The factory, which began as a single 900,000 sq ft building, ended up developing into a complex of 20 different structures, and occupied over 3 million sq ft of plant space. During the factories time of peak production in the 1940's, 10,000 workers filled the plant, producing as much as 60,000 tires each day. As time wore on, however, changes in market demand and technology cut hard into the company's profits. By 1980, the UniRoyal company announced the closing of the plant after 75 years of service.

That same year, the property rights were quickly purchased by the city with the intention of developing the valuable land into a prime waterfront location. The city's wish, however, went unfulfilled, and the land stood still as a vacant, contaminated brownfield site for over 25 years. Only recently have talks begun again on the redevelopment and cleanup of this symbolic site to the city.



The UniRoyal Plant along Jefferson Ave. under demolition



The giant stove from the site and the giant UniRoyal tire along I-94



The UniRoyal Plant a year before its demolition

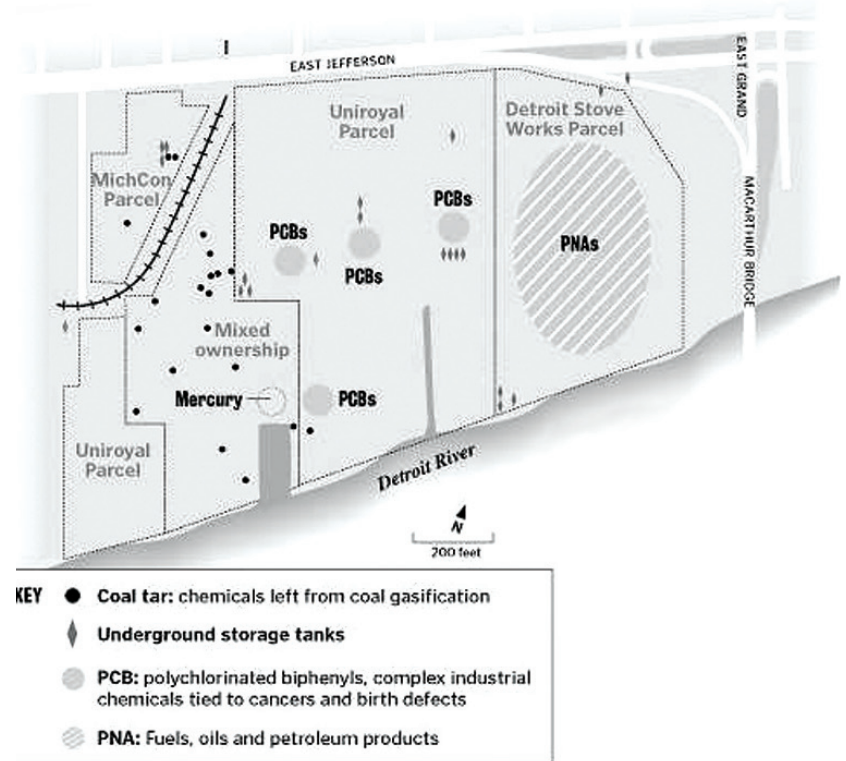
research / analysis

Site Condition

The removal of the UniRoyal plant in 1985 has left the property, a prime location along the eastern waterfront of the city, as a difficult to recover brown-field. The Great Lakes Science Center, as part of the USGS, currently has identified the conditions as follows:

- Current Land Use: brownfield, abandoned industrial site
- Habitat Quality Rating: Highly degraded
- Habitat Category: Impaired
- Assessed Value (SEV): \$4,629,400
- Vegetation and Wildlife Present: none

The 44 acre parcel of land has been recently marked for renovation by the City of Detroit, and the costs of clean-up are expected to reach \$25 million. Coal tars, underground storage tanks, and various chemicals and petroleum products currently corrupt the landscape.



rc: Michigan Department of Environmental Quality



research / analysis

Site Images

The waterfront site holds a long, ceremonial edge to the Detroit River. The framing by the MacArthur Bridge and Belle Isle will play an important role in the development of the project. The industrial-waste damaged site is currently fenced off from the public, though traffic is still allowed to pass by along the water's edge.



research / analysis

Waterfront Site

Currently Proposed and under construction for the city of Detroit is an extensive waterfront redevelopment. The two mile span from the Renaissance Center to Belle Isle Bridge is planned to become a strong center for pedestrian activity that will help spur growth and redevelopment to the troubled city.

As the project site sits at the Eastern terminus to the waterfront plan, a certain significance is required in designing for the pedestrian experience. The location and historic district make the presence of a high-profile tourist-centered project a distinct and believable option for this project.



research / analysis

Site Medium Scale Context

The site at a more immediate context reveals an area with some very attractive aspects, as well as some very undesirable ones. Working to the location's favor is the placement along the Detroit River with immediate proximity to a series of parks, including Belle Isle. These additions will bolster the design's ability to present the landscaped area as a strong, pedestrian-friendly experience. Working against the site, however, is the closeness of heavily-decayed urban neighborhoods. Figuring out how to effectively deal with this area, be it by fully integrating with them or blocking them, will be critical in evaluating the success of the project. Also problematic is Jefferson Ave., a busy street that will provide access to the center, but also cause problems with noise and possibly crime.



Adjacencies on Site

- 1 - Project Site, 44 acre brownfield site that was formerly a UniRoyal Manufacturing Plant
- 2 - Gabriel Richard Park, a terminus to the planned waterfront redevelopment
- 3 - Mt. Elliott Park, a small, recently improved park along the Detroit River
- 4 - Belle Isle, a 983 acre Olmstead designed island park

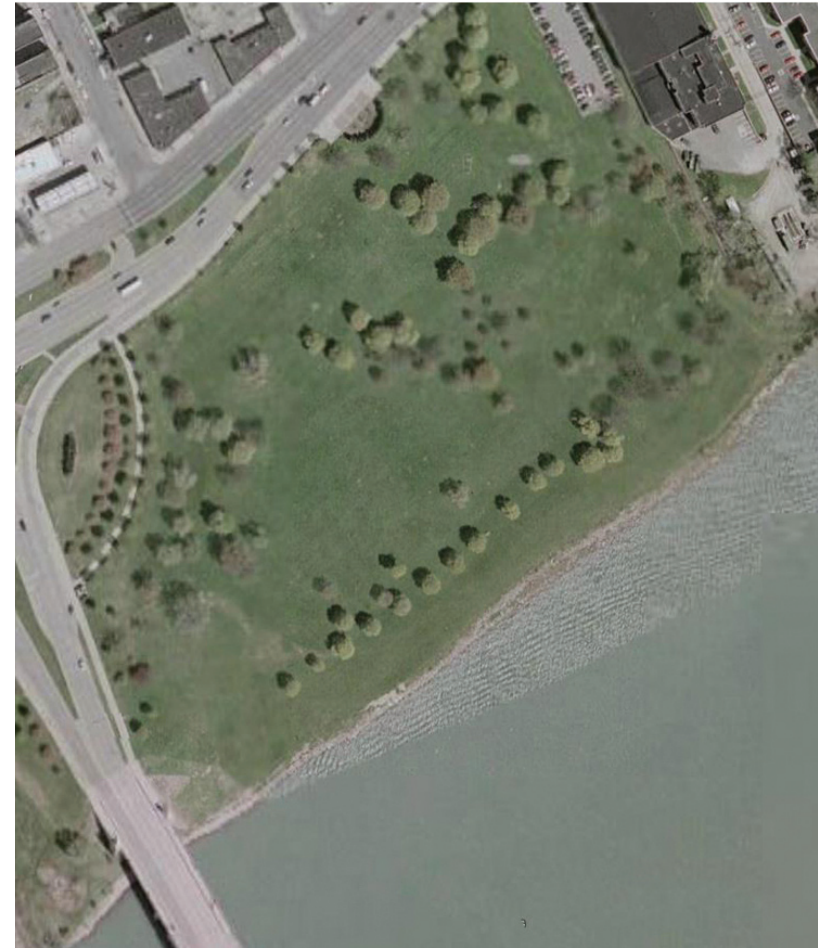
- 5 - MacArthur Bridge, the only connector to Belle Isle, an arched bridge built in 1926
- 6 - Jefferson Ave., the primary connecting Ave. along the Detroit River, sees high volumes of traffic
- 7 - Blighted neighborhood, impoverished neighborhood with over 50% vacancy of lots

research / analysis

Gabriel Richard Park

The Gabriel Richard Park was created to honor Father Gabriel Richard, a pioneering priest from the early 1800's. The Park features an open green space with a scattering of trees, and has been used in the past for amusement parks and other attractions. The majority of the park sits to the northeast of the MacArthur Bridge, and acts as the terminus to the main shoreline portion of the river walk proposal. The park was designed in the early 1900's, and renamed for Father Gabriel in 1936.

- Current Land Use: park (mowed lawn/bridge to Belle Isle)
- Wildlife Present: seagulls, Canadian geese
- Vegetation Present: Amer.ash, honey locust, Norway maple,
- Habitat Quality Rating: Good
- Habitat Category: Impaired
- Proposed Rehabilitation/Enhancement: migratory bird habitat



research / analysis

Mt. Elliott Park

Established for the nearby neighborhood, this currently stands in a well-maintained condition along the Detroit River Waterfront. The planning for the redevelopment of the waterfront has already been displayed in this portion of the park, and the park is scheduled to expand to the north as more development occurs.

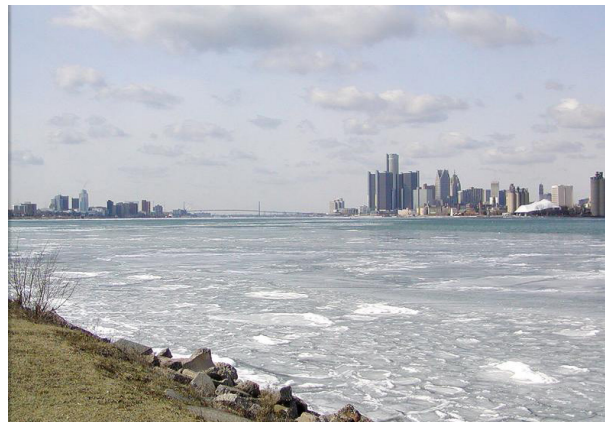
- Current Land Use: park (new, well-maintained, landscaped)
- Wildlife Present: seagulls
- Vegetation Present: grass, crab apple, honey locust, pin oak, red pine, sugar maple
- Habitat Quality Rating: Fair
- Habitat Category: Impaired
- Proposed Rehabilitation/Enhancement: create migratory bird habitat



research / analysis

Belle Isle

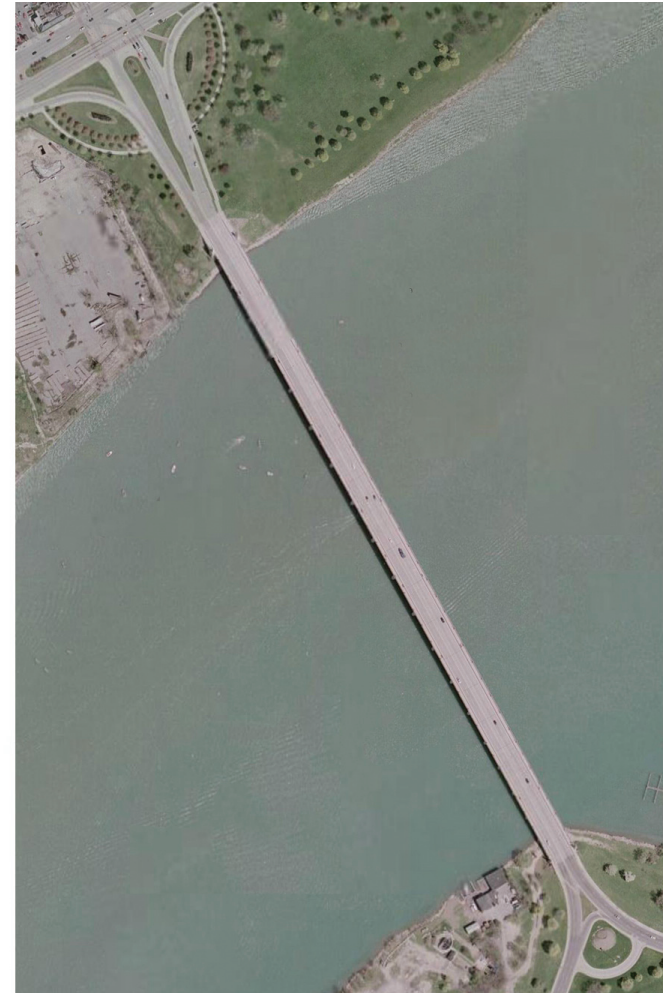
Belle Isle is a 982 acre island park designed in the 1880's by Frederick Law Olmstead. The park features nature conservatories, a half-mile long swimming beach (the only in Detroit), an aquarium, a golf course, an open-wheel race track, and other attractions. The park has suffered along with Detroit financially, but still remains a viable tourist destination for the city. The Park offers clear views to both the project site and the main skyline of downtown Detroit. Pedestrian access is limited only to the MacArthur Bridge, adjacent on the site. The island, though not exceptionally maintained, is by far the most heavily-trafficked park in Detroit.



research / analysis

MacArthur Bridge

Built in 1923, the MacArthur Bridge provides the only connection to Belle Isle from the Detroit shoreline. The bridge has width to carry 5 lanes, and has a total span of 2,193 feet. The design is a series of 19 stone arches, with no suspension or vertical supports above the pavement. The rise is thirty feet to the river water level. Pedestrian lanes are placed to the outside of the bridge, and are approximately 12 feet wide. Large stone obelisks mark the shoreline on each end of the bridge. Traffic along the waterfront is directed by bringing people beneath the bridge to the opposite side.



research / analysis

Blighted Neighborhood

The neighborhood adjacent to the north of the site is part of a heavily blighted area in Detroit, and is faced with a severe problem of decay. A large majority of the lots are vacated to the extent that the grounds resemble more a park than a neighborhood.

Zip 48214

Population (2000): 32,845

White population: 2,443

Black population: 29,757

American Indian population: 101

Asian population: 86

Some other race population: 81

Two or more races population: 377

Median age: 38.0

Average household size: 2.37

Median household income (1999): \$21,600

Median price asked for vacant for-sale houses in 2000: \$23,800

Median house value for:

White Non-Hispanic householders: \$320,100

Black or African American householders: \$31,700

Asian householders: \$65,000

Some other race householders: \$275,000

Two or more races householders: \$39,100

Hispanic or Latino householders: \$281,300



research / analysis

Major Zones on Site

1 - The waterfront portion of the site, which currently has a concrete barrier / rock shoreline. This zone will be an important location for the connection of the waterfront to Belle Isle.

2 - The zone to the northeast of the site has the more direct connection to the MacArthur Bridge, is butted up against the southwestern portion of Gabriel Richard Park.

3 - The large remaining portion of the site will need to be addressed and designed to provide interest as the pedestrian moves along the waterfront. A large site gesture is needed.



zone 1



zone 2



zone 3



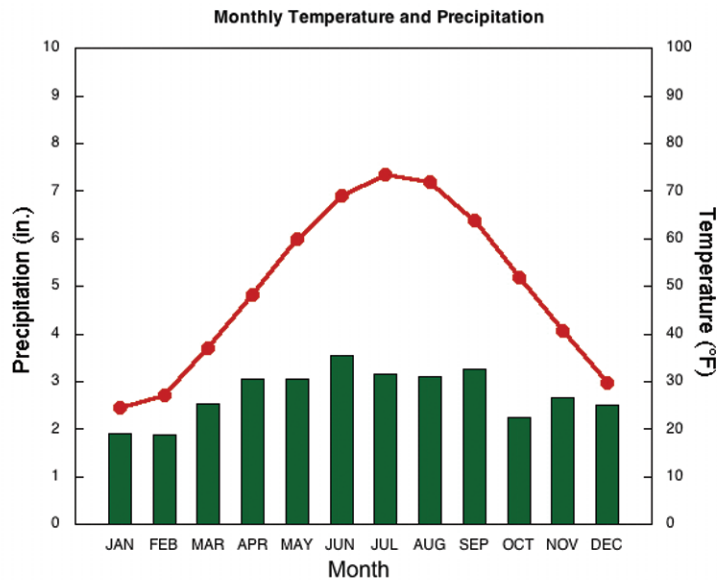
January 12:00 - 62 degrees

march 12:00 - 42 degrees

June 12:00 - 19 degrees

September 12:00 - 42 degrees

September 12:00
- 66 degrees



Temperature

Precipitation

In finding a sustainable solution for this project, both temperature and sun angles will play important roles in influencing the design. The northern location of Detroit will benefit greatly from a smartly designed building that makes use of passive solar heat gain.

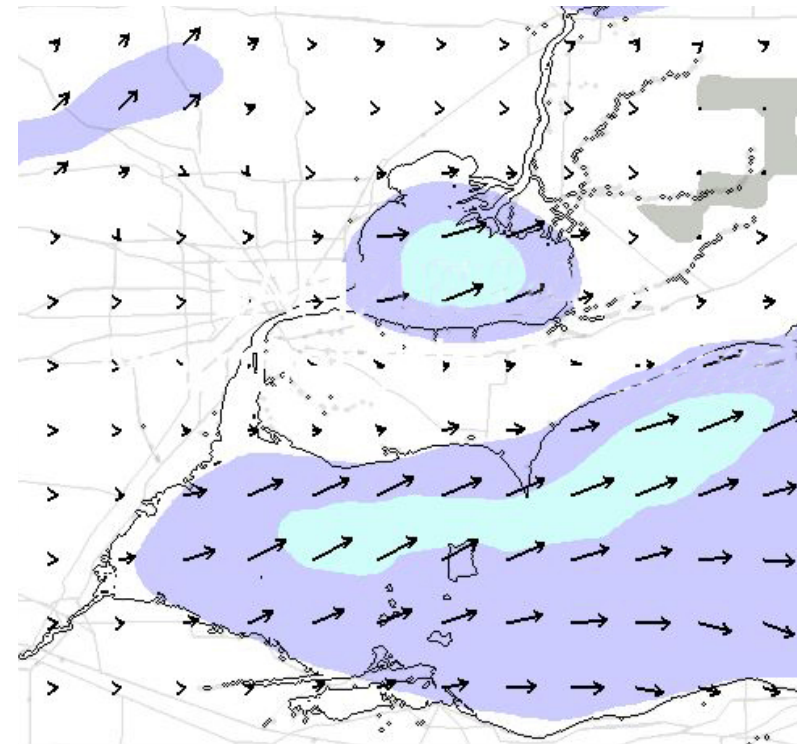
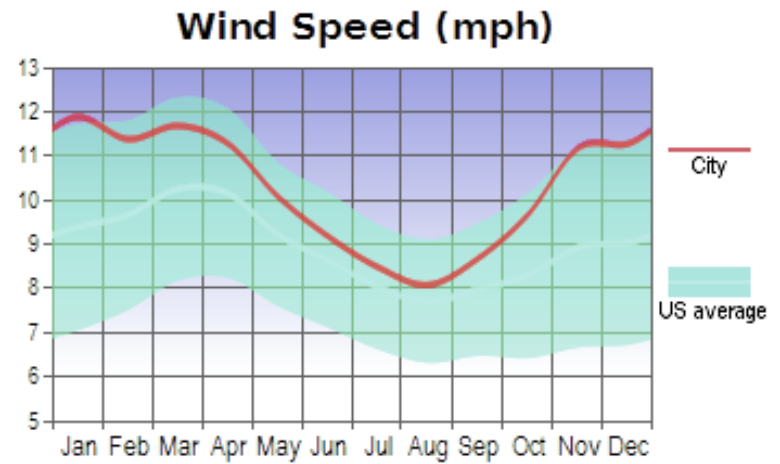
research / analysis

Wind Patterns on Site

The wind conditions for the Detroit site offer interesting considerations with regards to designing for sustainability. The average wind speed for Detroit sits well above the national US average velocity, with summer and early fall months approximately 8.5 mph, and the remaining months up around 11.5 mph. The average velocity needed for constant wind power generation is typically estimated to be about 10 mph on site.

The direction of wind on the site comes primarily from the western direction. The site's proximity to the Detroit River, however, adds an additional southwestern bias to the direction, though the primary flow remains west to east. The river condition would also most likely add additional wind speed to the site, although that will not be factored into the design equation.

The wind on site will bring forward two important design considerations for the project. The first of these is with regards to wind generation on site. As stated before, the wind speeds on the site are sufficient to achieve satisfactory performance, and the design solution could conceivably enhance those features. The second consideration is with regards to energy loss due to winds. The winds are highest during the cold temperatures of winter, and buildings can lose significant energy as a result of contact.

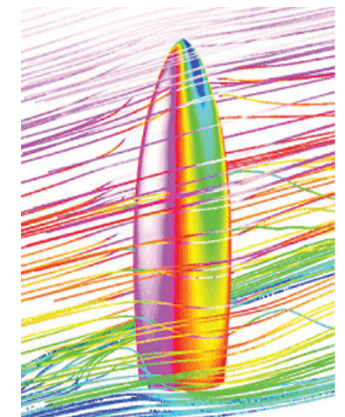
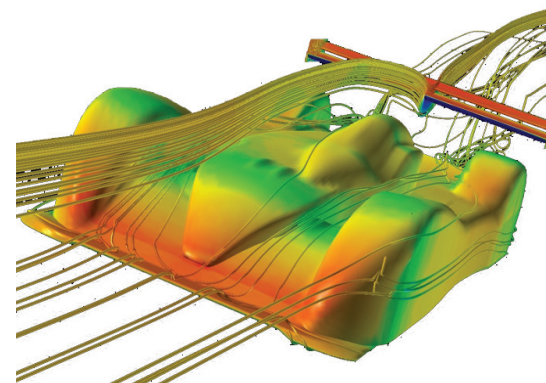
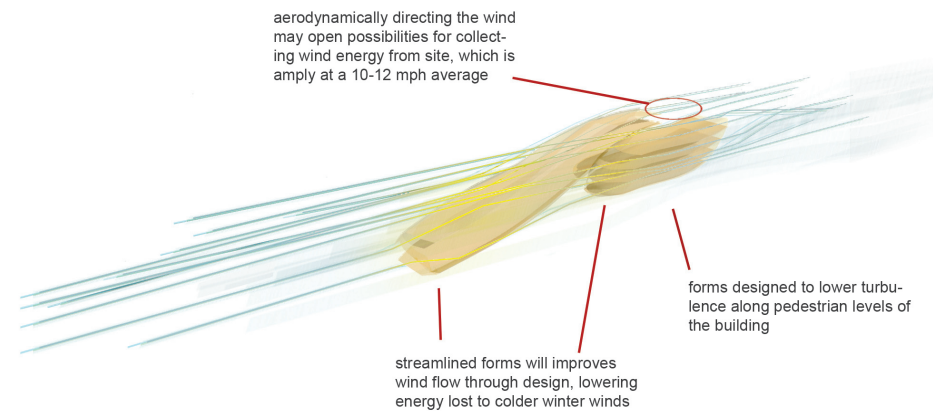
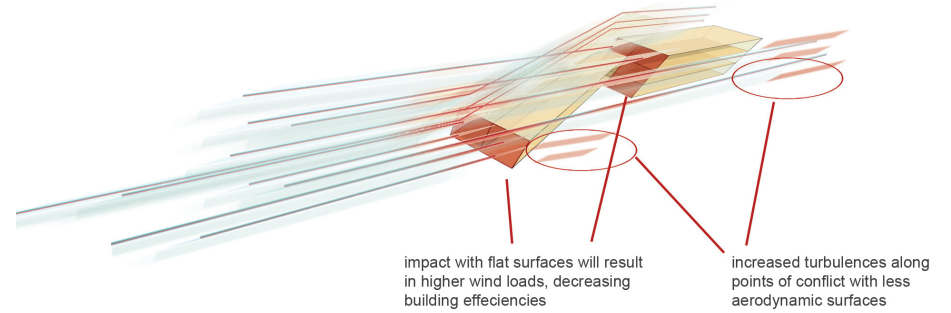


research / analysis

Wind Analysis and Research

The role aerodynamics play in vehicle design is very significant issue, and as the research has found, is one of the key components involved with the generation of vehicle form. Its role in architecture, however, has been much less explored. While some examples, such as Foster's Swiss RE building, have accounted for the effects of energy loss to wind on a large scale, most opt for consideration of other factors beforehand.

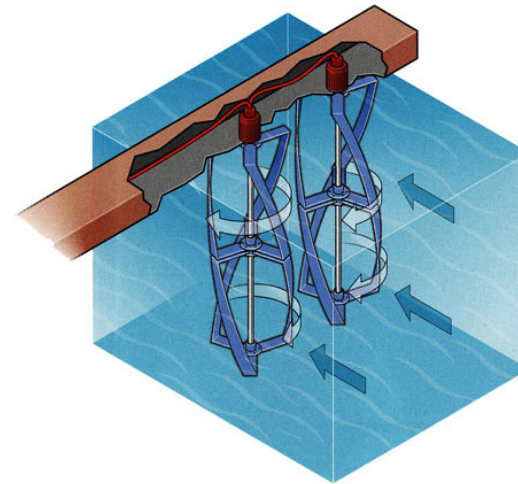
Given the high wind speeds on site and subject matter considered, the form for the research and design center should address aerodynamic concerns as one of the major guiding principles. While passive solar sustainable behavior will no doubt play a large role in the design construction, this building will argue that the effects of wind should be considered as a standard issue to be addressed in green building design.



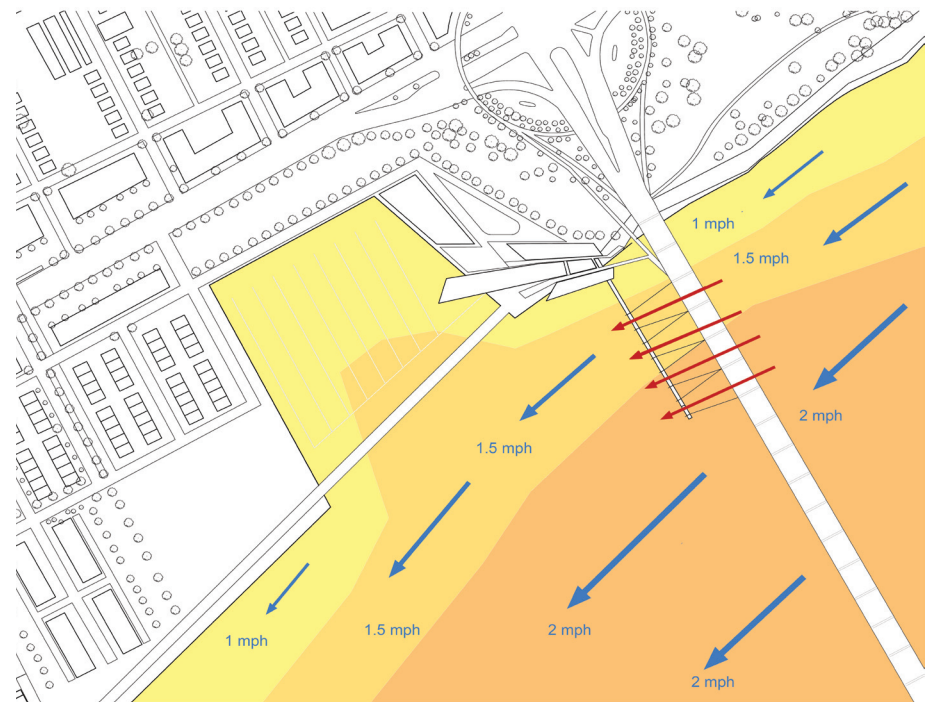
research / analysis

Water Current Technology on Site

Researched as a distinct option for sustainable technology is water current generation technology. The primary advantage when compared to traditional methods of hydro-technology is found in the lack of large-scale ecological change to a region. No dams are needed, and the technology, especially in the Gorlov Helical Design, makes little disruption to existing ecological systems. The helical design of the turbines provides a more efficient means of capturing the forces of movement from a slightly erratic source such as wind or water.



The Detroit River offers an effective site for the capture and implementation of passive water current technology. With river flow velocities of at least 1 mph needed, the observed flow speed is acceptable. While higher speeds are reached in the deeper portions of the river, the velocities could be increased. The use of the MacArthur Bridge could make for a condensed flow and naturally increased velocity in the river. While the entire span of the river and bridge should not be occupied by the infrastructure due to necessary recreational traffic that must be accommodated. Nevertheless, a significant, or at the least symbolic, portion of the bridge could be adapted towards use as a generator of hydroelectricity as a signal to the community on the project's intent as a leader in sustainable technology and advancement.



research / analysis

Precedent: Ford Motor Company Engineering Design Center

Designed for the Ford Motor Company, this design center is aimed at enhancing research and engineering at Northwestern University. The center places an emphasis on the spirit of design, though the program is not specifically concerned with automobile production. The project includes a variety of engineering and research design labs and studios for the design process. The location on campus makes use of the resources of Northwestern University.

Architect: Davis Brody Bond

Location: Evanston, Illinois

Size: 83,000 sq ft

Project Cost: \$30 Million

Sustainability: LEED Silver Rating



research / analysis

Precedent: Clemson University's International Center of Automotive Research

The Clemson University's International Center of Automotive Research is master planned project focusing on a series of buildings designed to promote research and technology in the automotive engineering fields. Included in the plan is the BMW Information Technology Research Center, designed to promote the study of advanced technology in automobiles, and the Carroll A. Campbell Jr. Graduate Engineering Center, a building designed to benefit the automotive engineering program at the University.

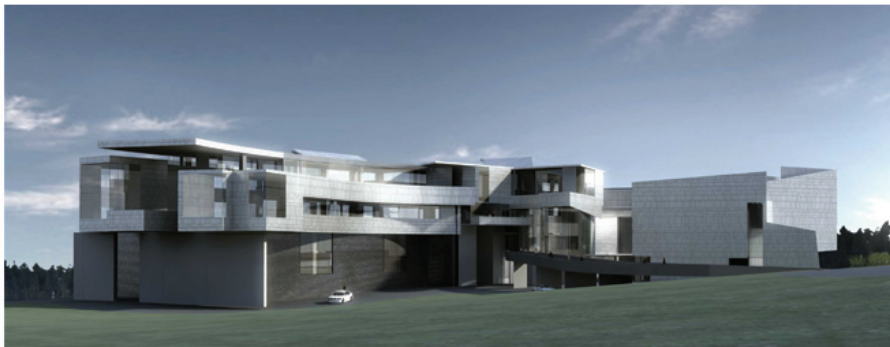
Architect: The Smith Group, Neal Prince + Partners Architects, Mack Scogin Merrill Elam Architects, and others

Location: Clemson, South Carolina

Size: 250 acre campus (BMW ITRC – 84,000 sq ft)

Project Cost: BMW ITRC - \$15 Million

Sustainability: Designed to protect natural on-site habitats



research / analysis

Vehicle Form Design and Branding

The creation of vehicle form within the automotive industry is factored around two primary considerations. The first of these is program, where the skin and form to be applied needs to accommodate for the working functions of the car, i.e. passenger space, structure, chassis, location of the engine, and so on.

The second consideration for the design is based around the idea of aerodynamics. The vehicle skin is a primary tool in improving overall vehicle efficiency and performance through design. Vehicle designers aimed at providing fuel efficient products often try to employ very low drag coefficient ratings to the vehicles' surface. The less wind impacting the car, the less energy needed to power the machine.

DaimlerChrysler

The brand of Daimlerchrysler was chosen as it has consistently shown itself to be a leader in the design and presentation of high-concept projects and vehicles. What it has been lacking, however, was a comprehensive plan for producing and distributing sustainable vehicles. This project will seek to eliminate that gap through the proposal of a new research and design center for the Chrysler side.



DAIMLERCHRYSLER



research / analysis

Design Center Program Outline

Design/Engineering Fabrication

Computer Research

Management Office

Electronic Systems and Support

Display Floor / Tourist Section

Mechanical

Core Functions

Circulation

Lobby / Atrium

Total Gross Square Footage

Parking

110 stalls @ 350 sq ft/ stall

20,950 sq ft

20,550 sq ft

2150 sq ft

5000 sq ft

25,000 sq ft

7,000 sq ft

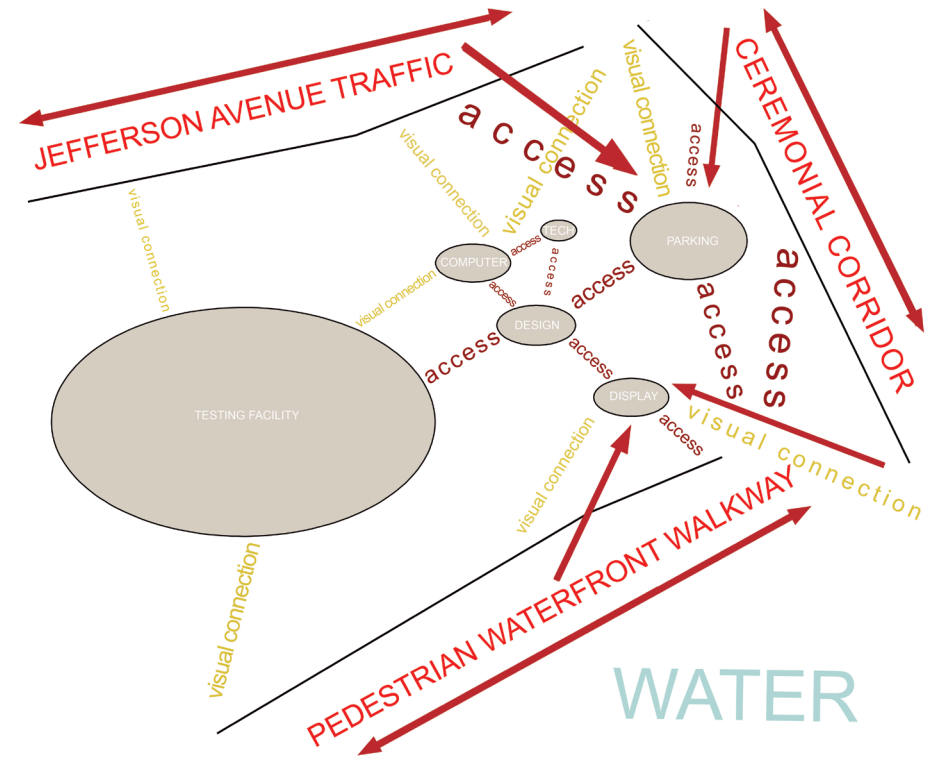
9,500 sq ft

12,000 sq ft

2,000 sq ft

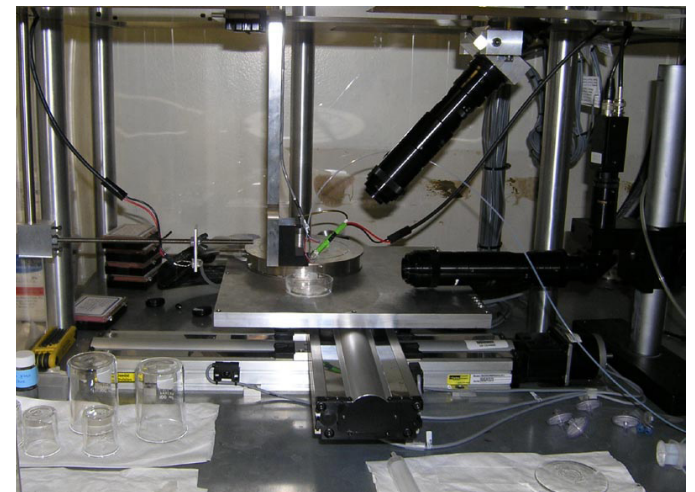
100,650 sq ft

38,500 sq ft



research / analysis

Design Center Program Outline	
Design/Engineering Fabrication	
Rapid Prototyping Lab Facility	1,250 sq ft
CAD Laboratory	1,000 sq ft
Mechatronics and Manufacturing Lab	1,550 sq ft
Design Fabrication and Prototyping	3,350 sq ft
Design Prototyping Offices	1,000 sq ft
Prototyping Lab	2,350 sq ft
Autobays / Garages	4,000 sq ft
Engineering Design Classrooms	3,350 sq ft
Multimedia Rooms and Studio Rooms	2,700 sq ft
Extra Storage and Materials	8000 sq ft
Total Net Square Footage	20,950 sq ft
Display Floor	
Showroom Floorspace	23,000 sq ft
Offices and Conference Space	2,000 sq ft
Total Net Square Footage	25,000 sq ft
Computer Design and Digital Fabrication	
Research Stations	5,550 sq ft
Research Offices	2,000 sq ft
Studio Space / Computer Lab /	13,000 sq ft
Digital Equipment	
Total Square Footage	20,550 sq ft
Electronics and Technical Support	
Offices	1,000 sq ft
Shop / Multi-use Space	2,700 sq ft
Multi-Media	1,000 sq ft
Total Square Footage	4,700 sq ft
Management Offices	
Offices	2,150 sq ft
Conference Space	1,000 sq ft
Total Square Footage	3,150 sq ft



research / analysis

Site Redevelopment

The focus and scale for the masterplanning portion of the design fell primarily to the immediate and adjacent site conditions. While the project site will certainly be addressed, as will nearby abandoned industrial zones

Of primary importance was the redevelopment of the blighted neighborhoods. In order to present the project as a working site improvement to the region, the heavily blighted area must be addressed in a plausible and beneficial manner. Focusing on East Grand Boulevard as the primary point of interest in this area will aid the design, as the regrowth could spread from that area and begin to infill many of the vacant and abandoned lots currently present.

Also significant will be addressing the waterfront condition, looking at where optimal locations reside for new development and design.

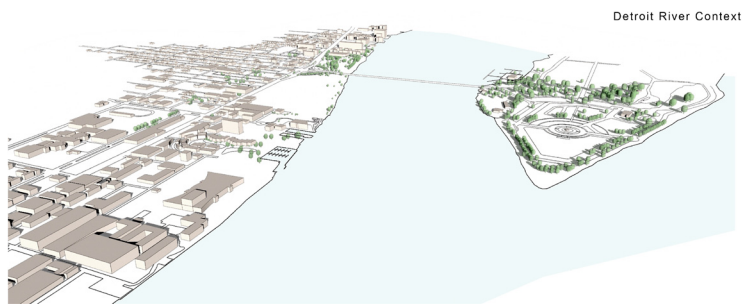
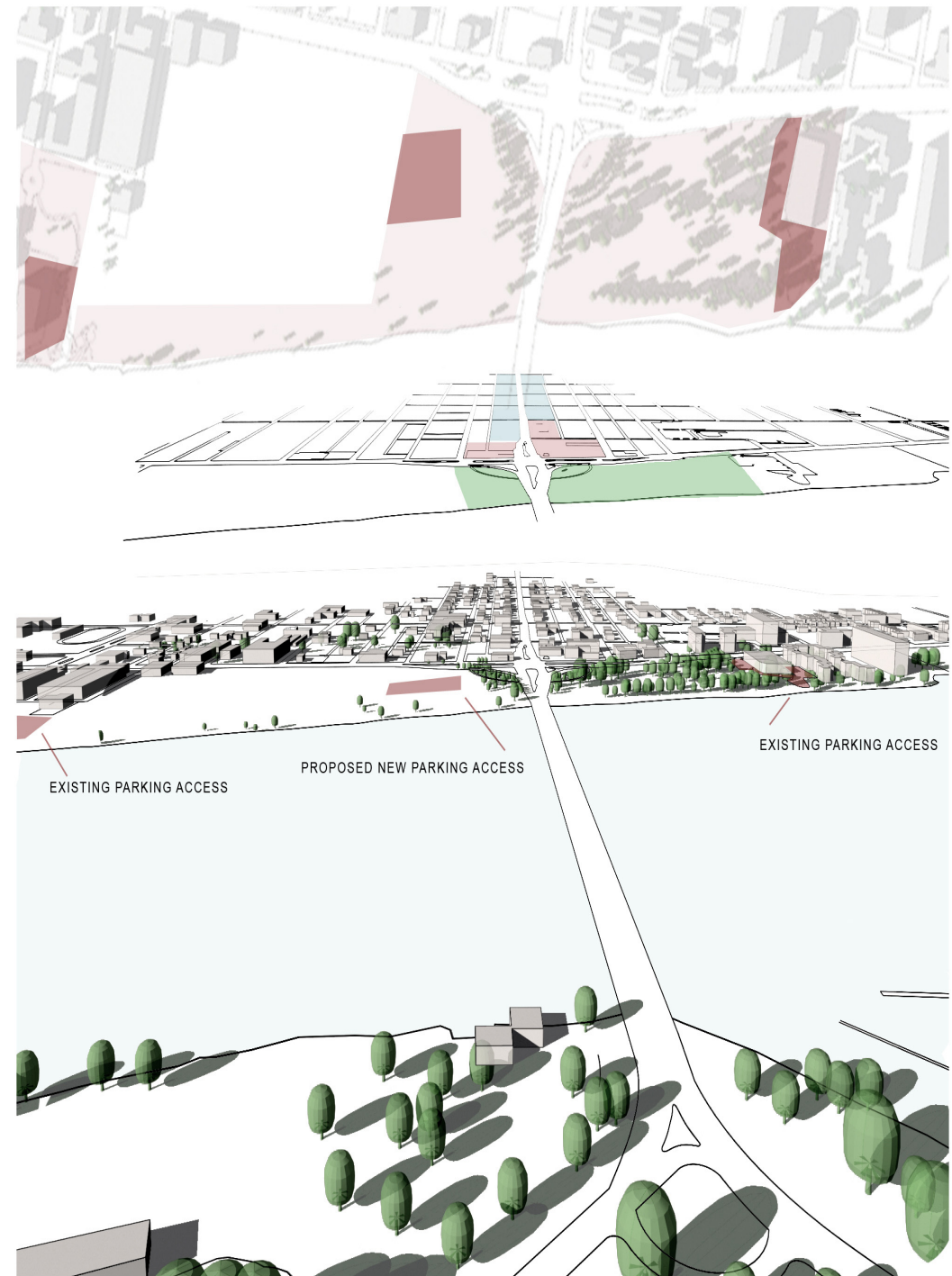


research / analysis

Site Scale

As Part of the analysis process, a model was generated of the site to better understand the size and scale relationships for this waterfront site. The model was created by estimating the heights of the present, existing structures based off of photo research, precedent studies, and analysis of shadow patterns from overhead maps.

The models were used to begin to generate analysis findings on the site, including looking at scale issues and how to increase the presence along the waterfront through redevelopment patterns. The zoning and axial conditions on site were also on prominent display to the design, allowing the furthering of design goals along that conditional front.



research / analysis



- PUBLIC ZONE
- PRIVATE COMMERCIAL
- PRIVATE RESIDENTIAL

Zone Analysis

Adjacent to the project site are two parks (three if Belle Isle is accounted for). Further up and down river are high density residential zones, and beyond them, commercial districts. The location for the site allows for a high-profile project to act as a centerpiece to the developed park system situated on site. A fully-functioning mixed-use district is able to be reached if the neighborhoods are properly redeveloped.



- 3000-5000 VPH
- 2000-3000 VPH
- 1000-2000 VPH
- 500-1000 VPH
- <500 VPH

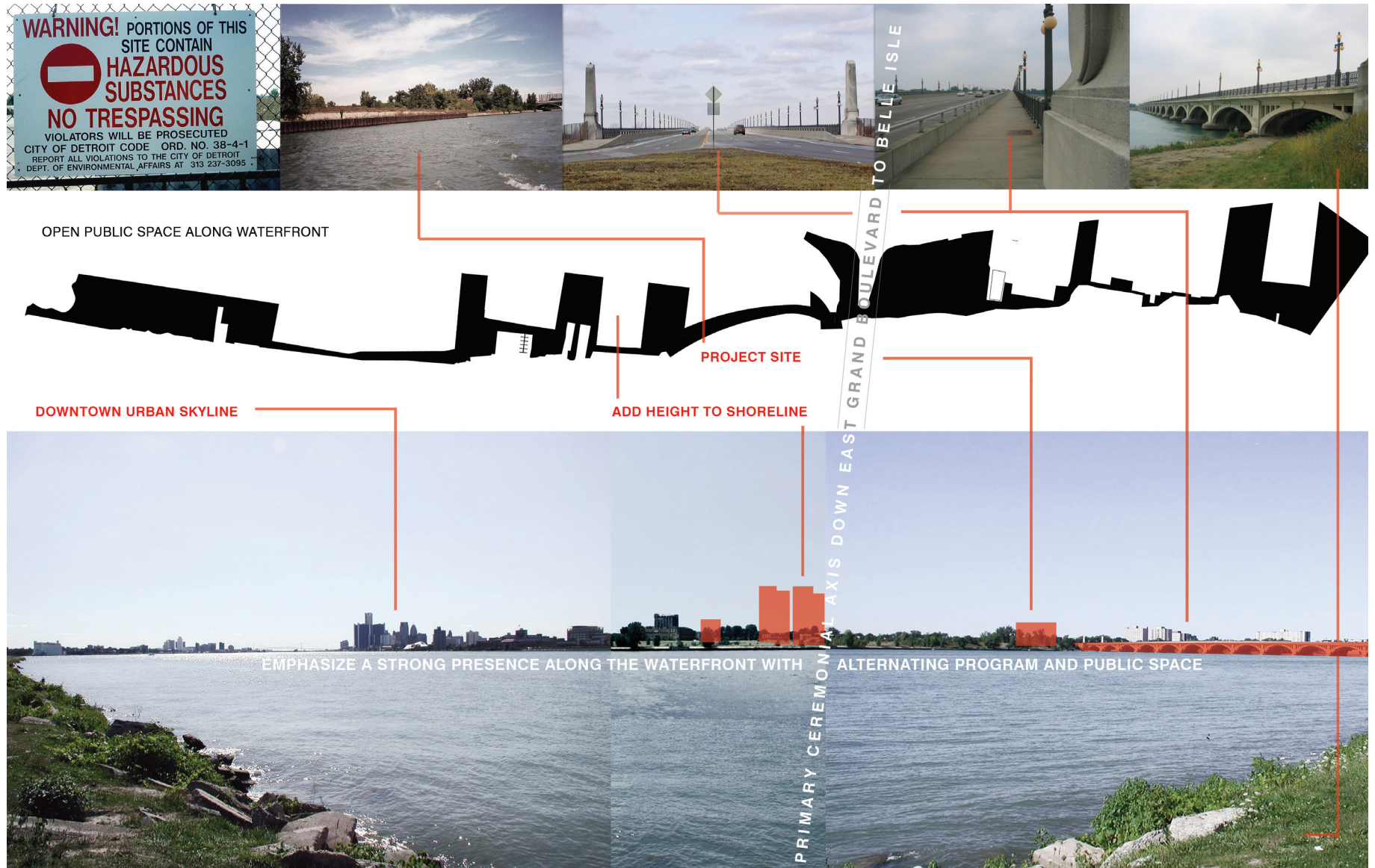
Traffic Analysis

The major traffic arteries from the site come from Jefferson Avenue and East Grand Boulevard. Jefferson Avenue, a six-lane major road, can be expected to hold traffic volumes up to 5000 vph. E. Grand Blvd. features less heavy volume, and also holds additional pedestrian traffic. Waterfront traffic moves closely along the shoreline, sourced primarily from residential zones to the north and south of the site

conceptual design

Fall 06 - Semester Break

conceptual design



conceptual design

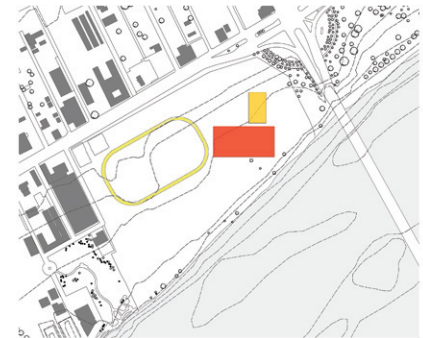
Building Footprint Analysis

The footprint and alignment of the Design Center will play a critical role in both tying the design to the site and offering an energy efficient solution. This study looks at three different options on-site for 1, 2, and 3 story designs. The footprints are all design with a 2-1 rectangular ratio with a south-facing solar orientation to maximize efficiency. The parking will occur on-site and occupy approximately 30,000 sq ft of area.

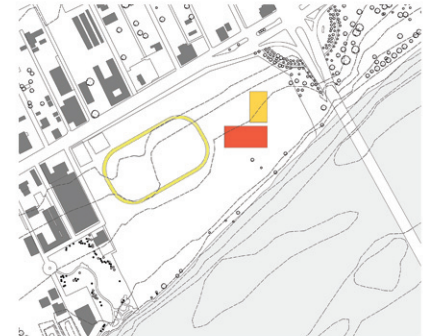
The two story design seems preferable for performance and site design issues. It fills the site more strongly than the 3 story design, which may help in establishing a connection along the waterfront. The multiple stories will also be preferable from energy efficiency issues. The 3 story option is likely still viable, and might be important to hold offices at certain points, while more visitor and production friendly elements like the display floor and manufacturing labs can spread on the ground floor.

The orientation for all examples is one that is directly facing the South sun for optimal energy performance in both Summer and Winter Conditions.

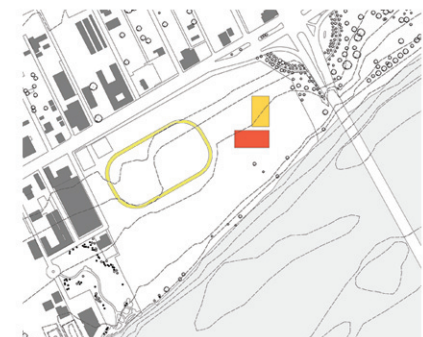
1 Story Design featuring a footprint of approximately 105,000 sq ft.



2 Story Design featuring a footprint of approximately 52,500 sq ft.



3 Story Design featuring a footprint of approximately 34,500 sq ft.

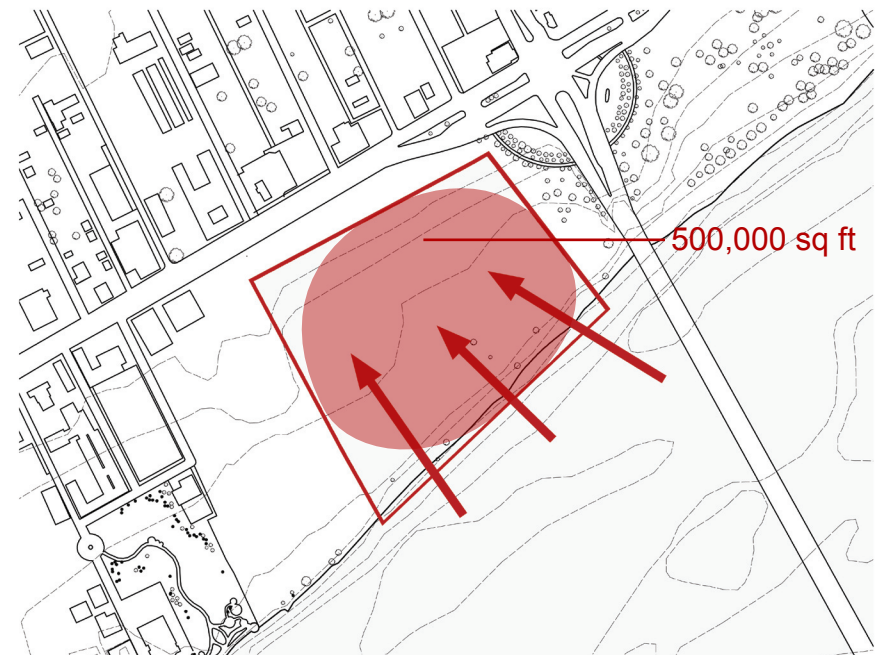


conceptual design

Site Reclamation

An important step in the recovery of the Brownfield conditions is understanding the location and severity of the site damage. At the old UniRoyal site, by far the greatest hazard comes from the location of pcb's on the site. These industrial compound wastes are known to cause cancer and other defects, and as such, need to be removed from the site. Excavation is the only viable means due to the buried condition present. Also significantly degraded is the northeastern portion of the site that has, over-time, become saturated with petroleum products. Again, excavation would be the most likely option, however, bio-remediation procedures would likely be successful given enough time. Also on the site are various left-over storage facilities and other remnants of a once-sprawling industrial complex. The expected total cost of such a cleanup has been estimated at 25 million dollars.

As mentioned above, excavation is likely the most reasonable solution for site cleanup. The approximate area needed to be removed to lessen the dangerous potential of the site would be nearly 500,000 sq ft of land. Yet rather than pay to have replacement soil brought in to refill, this project suggests the excavation be left as a permanent marker to the land, perhaps even expanded to create a deep, signature inlet along the waterfront experience. Letting the water reclaim back some of the city would suggest a new vision in dealing with environmental issues, and would honor the river's historic role in bringing great prosperity to the city.



conceptual design

Masterplan Proposal

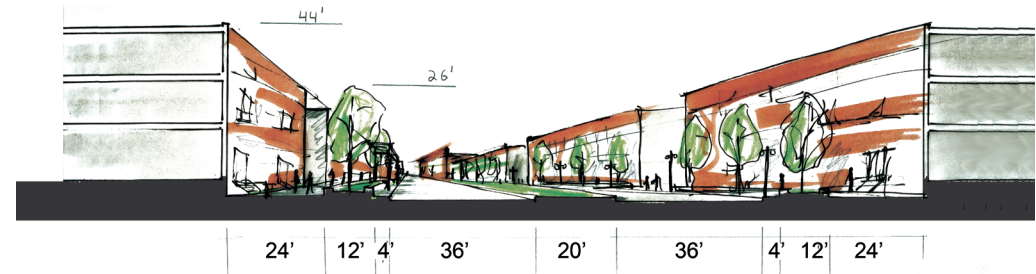
The site was redeveloped as a means of providing a projection as to how the design center could serve as a catalyst to the redevelopment of the area. The infusion of a large scale development to the area could spur additional revenue being placed into the blighted area of the city.

Jefferson Avenue Corridor - The commercial corridor of Jefferson Ave. is a busy, six-lane road that provides the primary E and W connection for downtown Detroit, with developments to the East along the river and lake. The proposal continues the commercial and retail centers along the drive, adding enhanced infrastructure to the site.

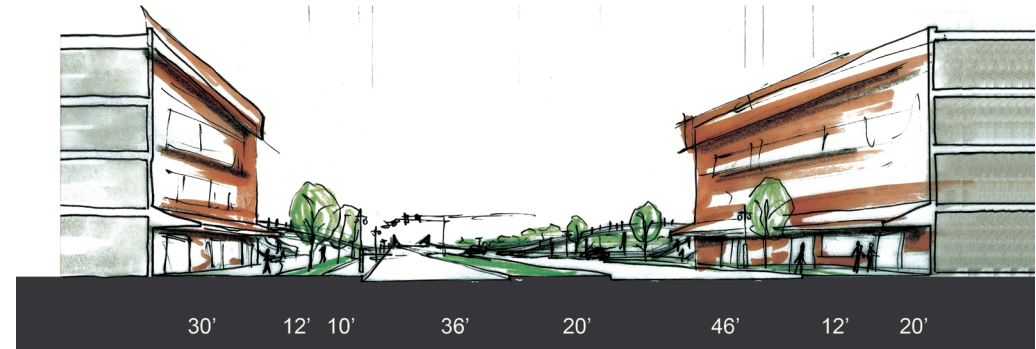
East Grand Boulevard - Redeveloped to give a greater presence to the ceremonial corridor, large townhouses now line the path to Belle Isle, with single home residential still behind. Pedestrian access is granted over Jefferson Avenue through the use of pedestrian bridges.

Waterfront Redevelopment - This proposal looks to continue the high land values along the waterfront by providing upscale residential units along the water. One of the existing problems with the land use is the lack of presence along the shoreline. This proposal introduces high-rise residential towers to this section of the waterfront, providing a greater population base for the mixed-use region.

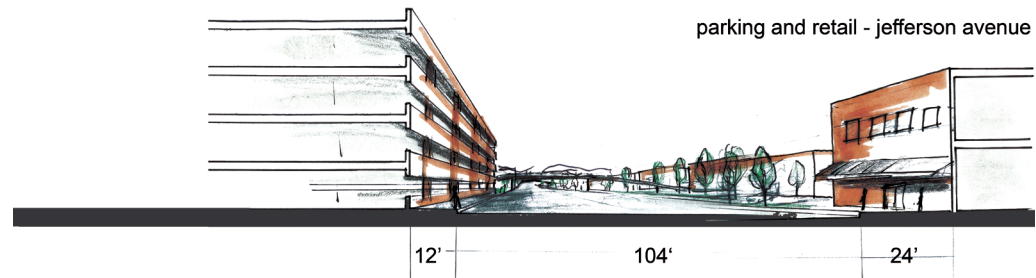
townhouses - east grand boulevard



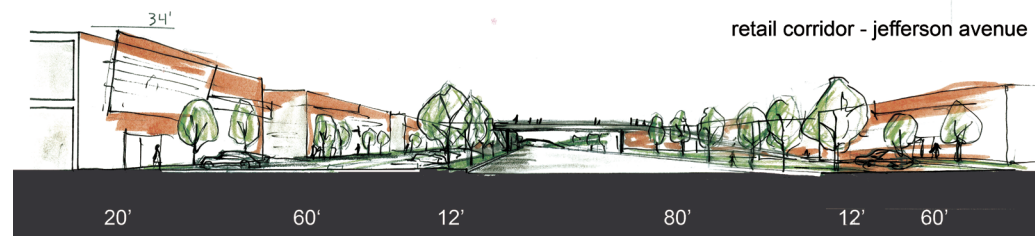
mixed use - intersection



parking and retail - jefferson avenue



retail corridor - jefferson avenue

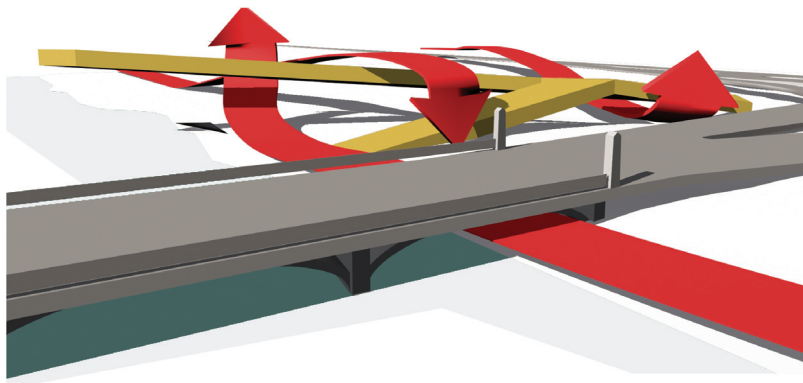


conceptual design

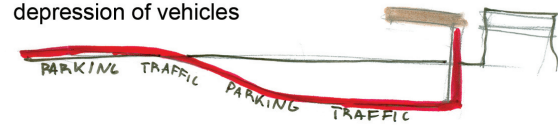
Site Planning and Design

A primary strategy for designing the site involves understanding and directing the flows of traffic through the project space. The primary vehicle traffic flows will be drawn in from Jefferson Avenue, and will be taken across the site to the design center. A more immediate access is prevented due to the access lanes and ramps necessary to shift from traffic from Jefferson Avenue to East Grand Boulevard and the MacArthur Bridge.

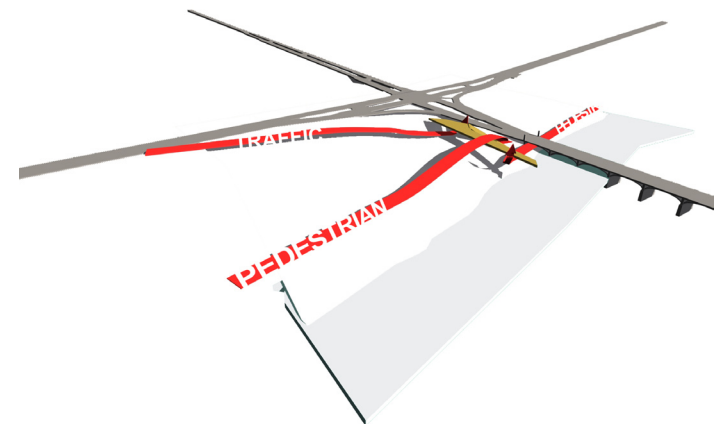
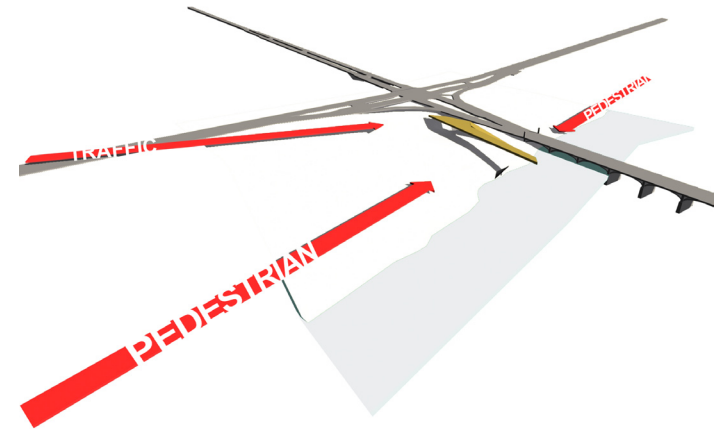
The design involves the creation of hierarchies through the elevation and submergence of the pathways in relation to the design center. Given significance is the pedestrian path from the waterfront, which must offer continual connection along the shoreline, and still be allowed to rise up to meet the bridge and over Jefferson Avenue.



depression of vehicles

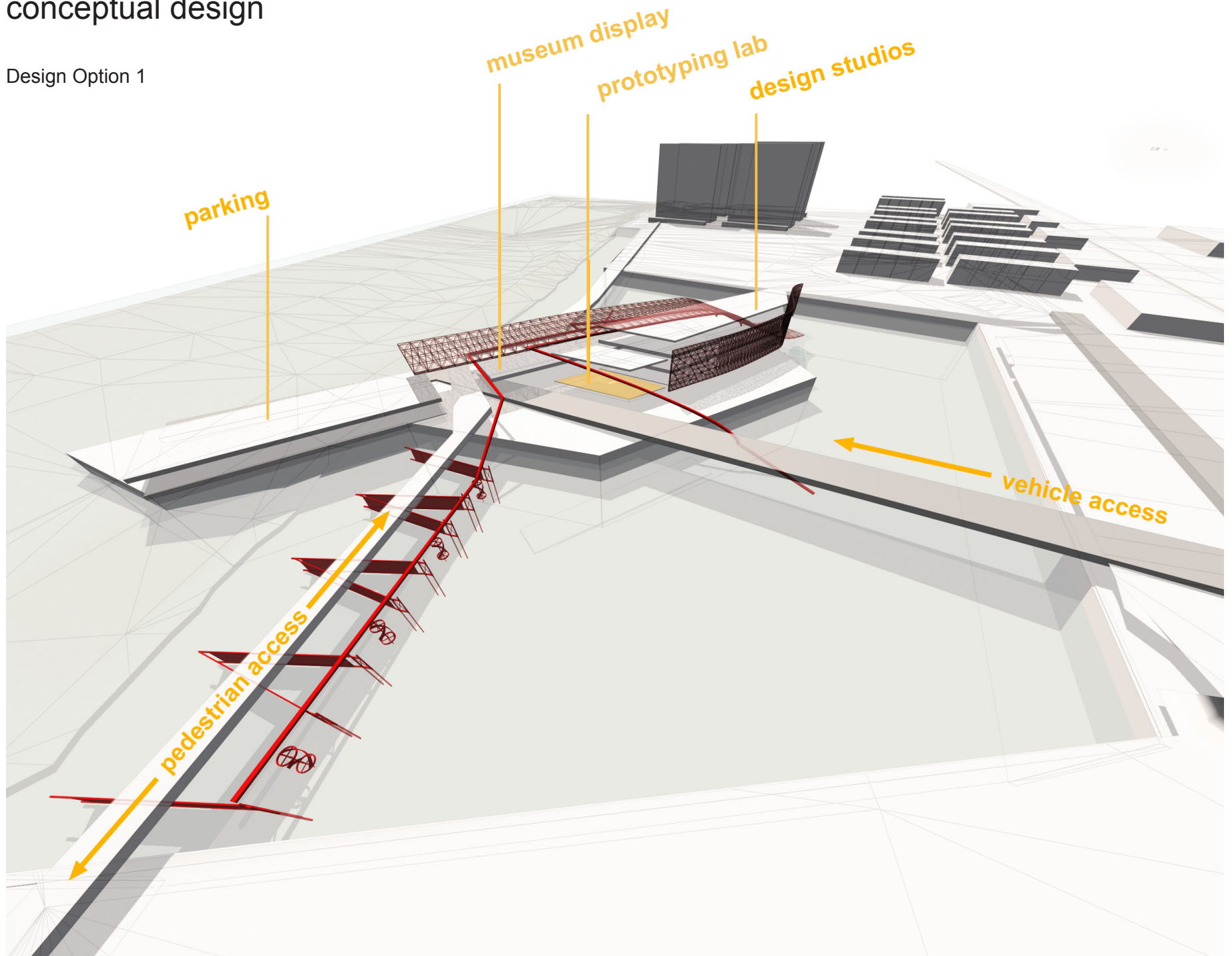


elevation of pedestrians



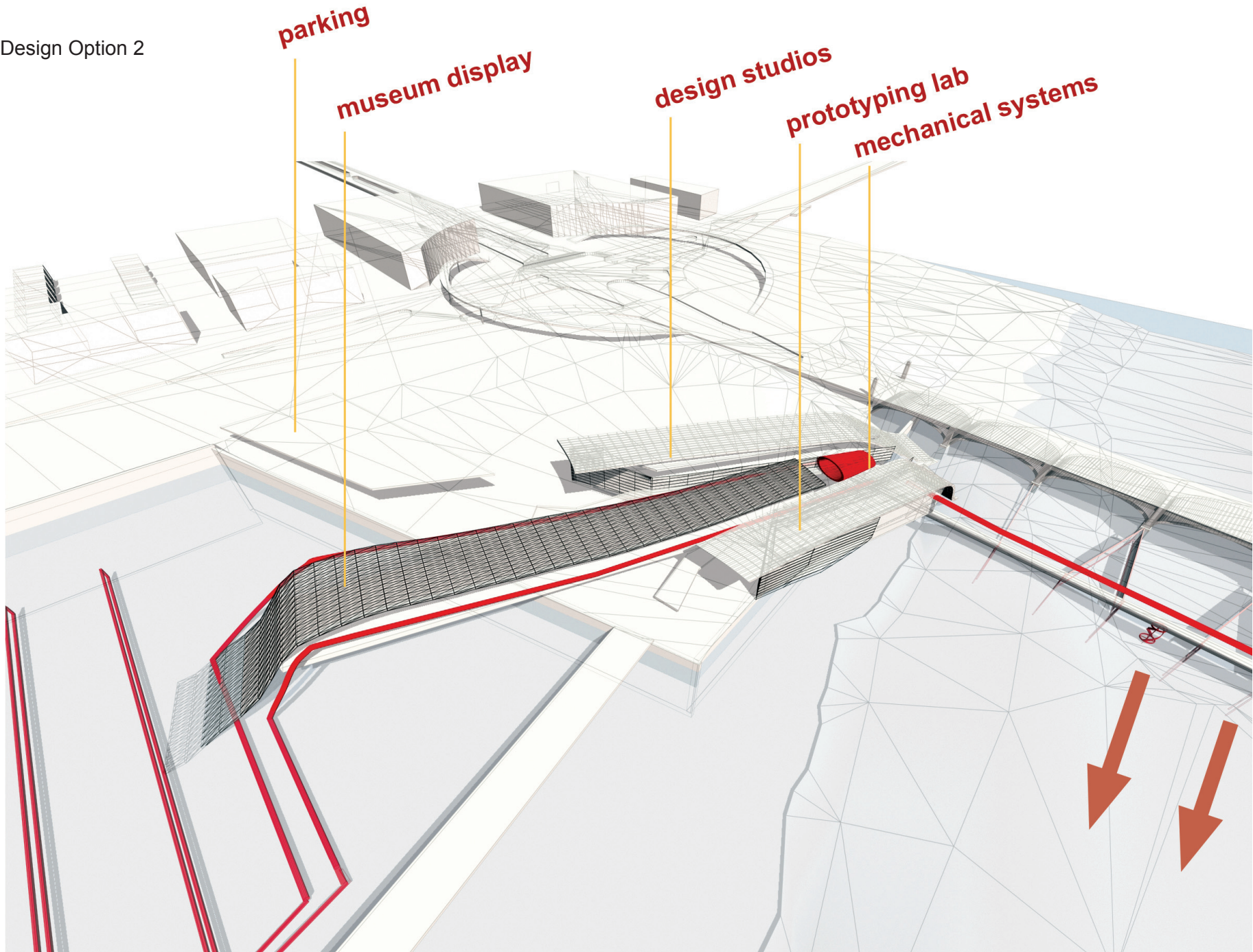
conceptual design

Design Option 1



conceptual design

Design Option 2



process documentation

Semester Break - February 07

process documentation

Vehicle Aerodynamic Form

Vehicle form functions to divert wind energy around the structure, improving energy lost to friction. Highly efficient vehicles typically have a greatly reduced coefficient of drag in the form design. Wind energy is also harnessed through scoops and other features to take advantage of the free energy as a means of cooling, generating downforce, and other benefits.



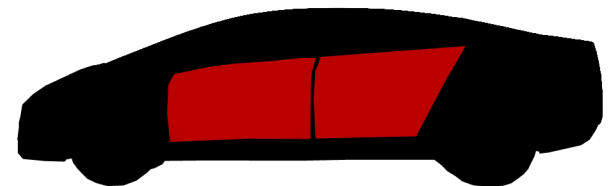
Vehicle Mechanical Systems

Sustainable vehicle systems often take advantage of hybrid systems that weld various types of technologies into a single cohesive and efficient system. This can mean the combination of gas engine with electric motor, or even hydrogen power with a regular combustion engine.



Vehicle Material Efficiency

Energy efficient vehicle design capitalizes on efficient use of highly advanced materials. Carbon fiber technologies allow for body panels stronger than metalwork, yet half the weight. Of great importance is the multi-functionality of materials that can provide the most benefits within the relatively small area they have to work with.



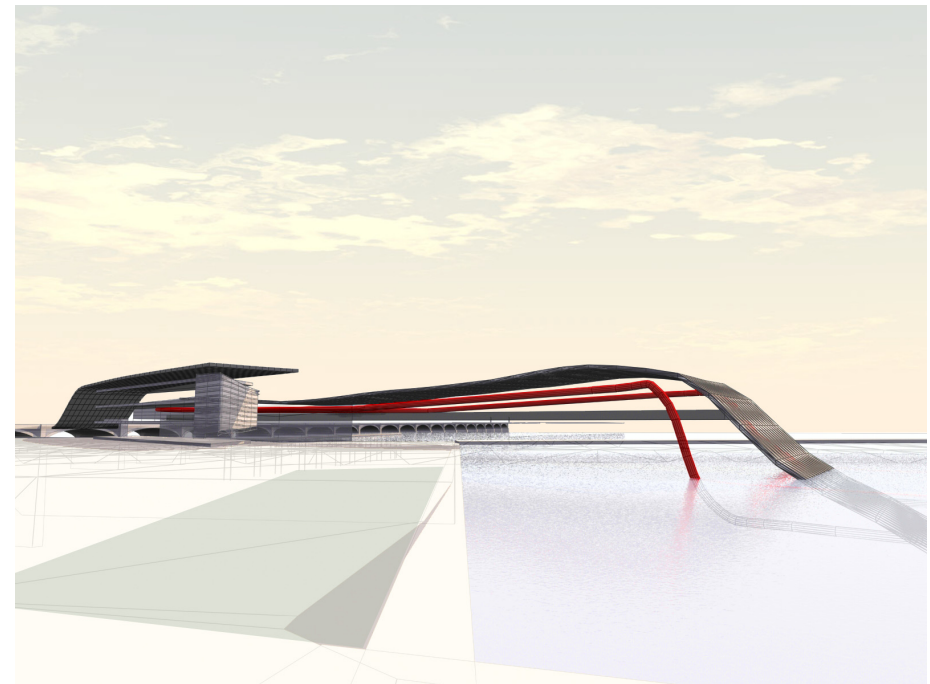
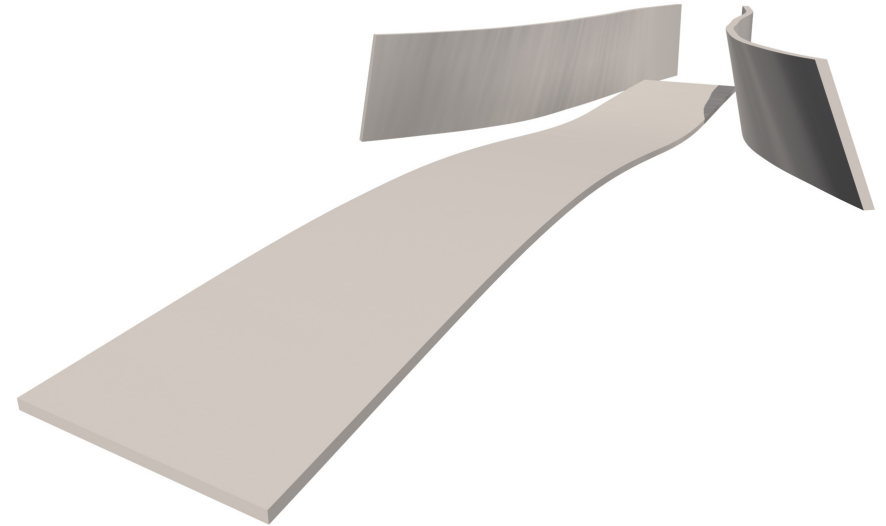
process documentation



Aerodynamic Form

The design center will be aerodynamically shaped in such a manner that energy is not lost due to the cold winter winds. The design of the form will therefore carry a distinct importance in minimizing the energy performance of the project. The avoidance of orthogonal surfaces enduring direct impact from the wind is of critical importance, and much like an efficiently skinned vehicle.

The skin will also seek to make effective use of the site's wind velocities as a naturally renewable resource. The high speeds present should be able to offer a consistently strong source of power to the project. In order to enhance the potency of the resource, however, the diversion and concentration of the wind energy through formal gestures will become paramount in securing the resource properly.



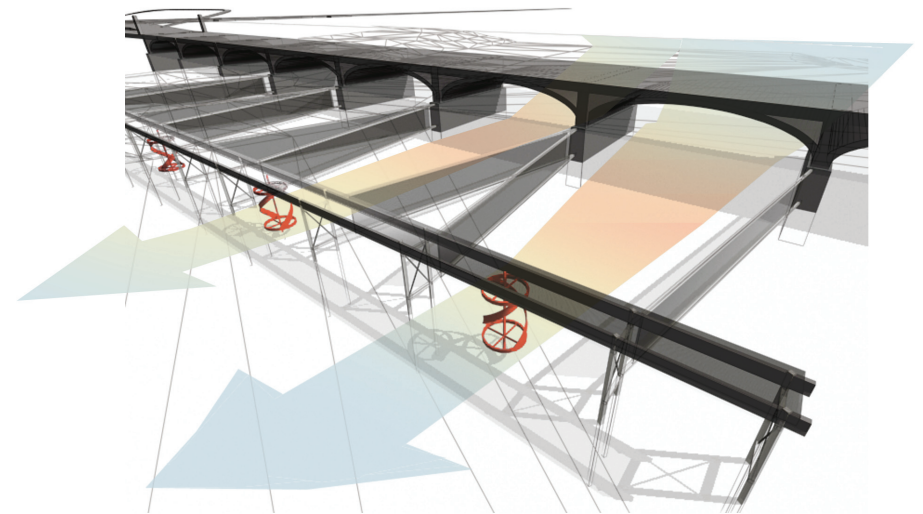
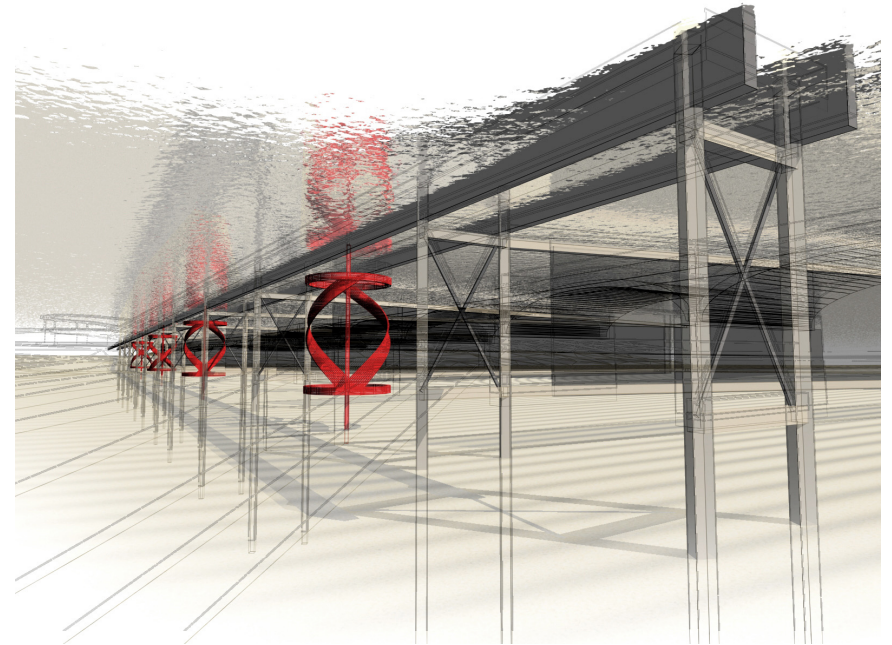
process documentation



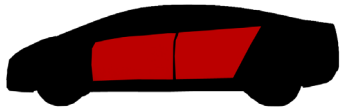
Mechanical Systems

The design center will make use of several on-site means of energy production. Primary among them will be the use of helical turbines in the Detroit River. The environmentally safe structures are capable of generating hydrogen through electrolysis, which can be studied and applied to vehicle technology. Wind, solar, and heat pump systems are used as well.

The MacArthur Bridge will play an important role in aiding the generation of water power on the site. The naturally increased velocities of river flow speed through the structural supports can be coupled with a venturi hood of carbon fiber mesh to give the river velocities a more consistent base for energy production.



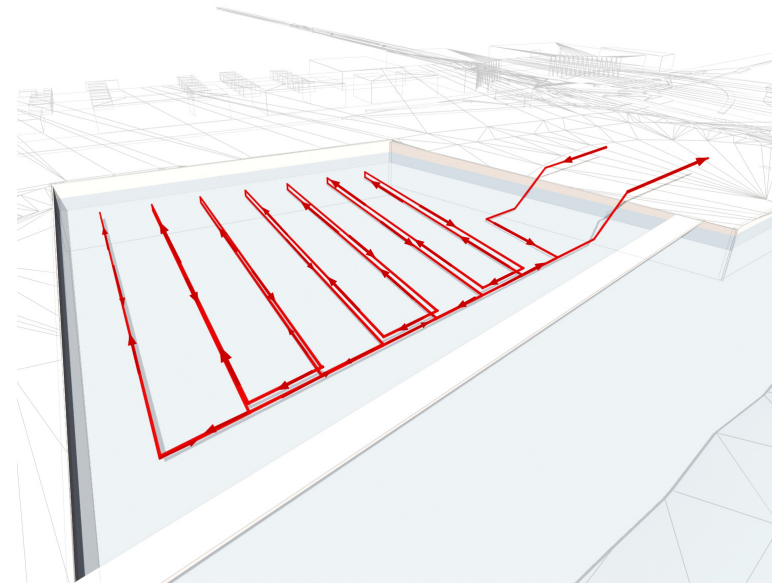
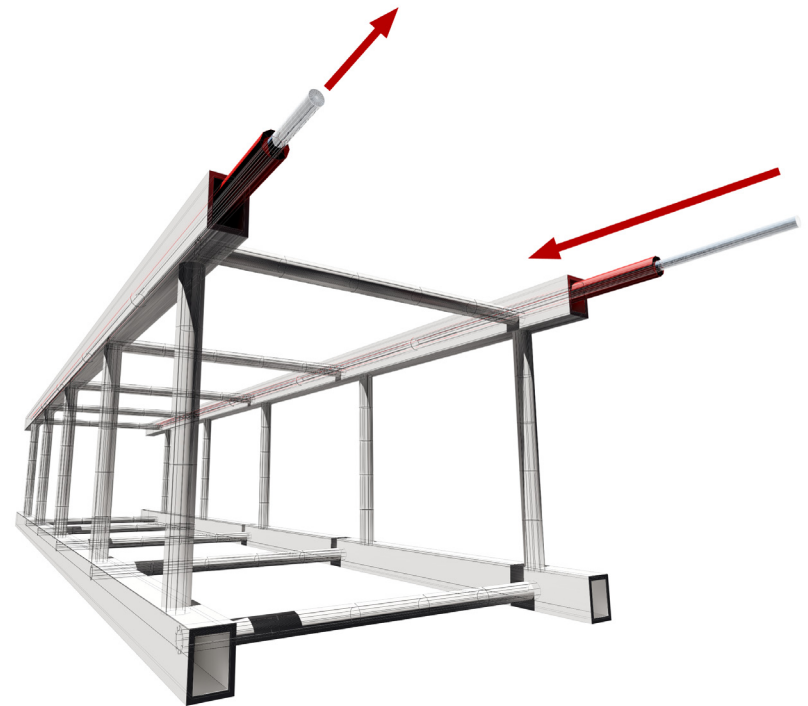
process documentation



Material Efficiency

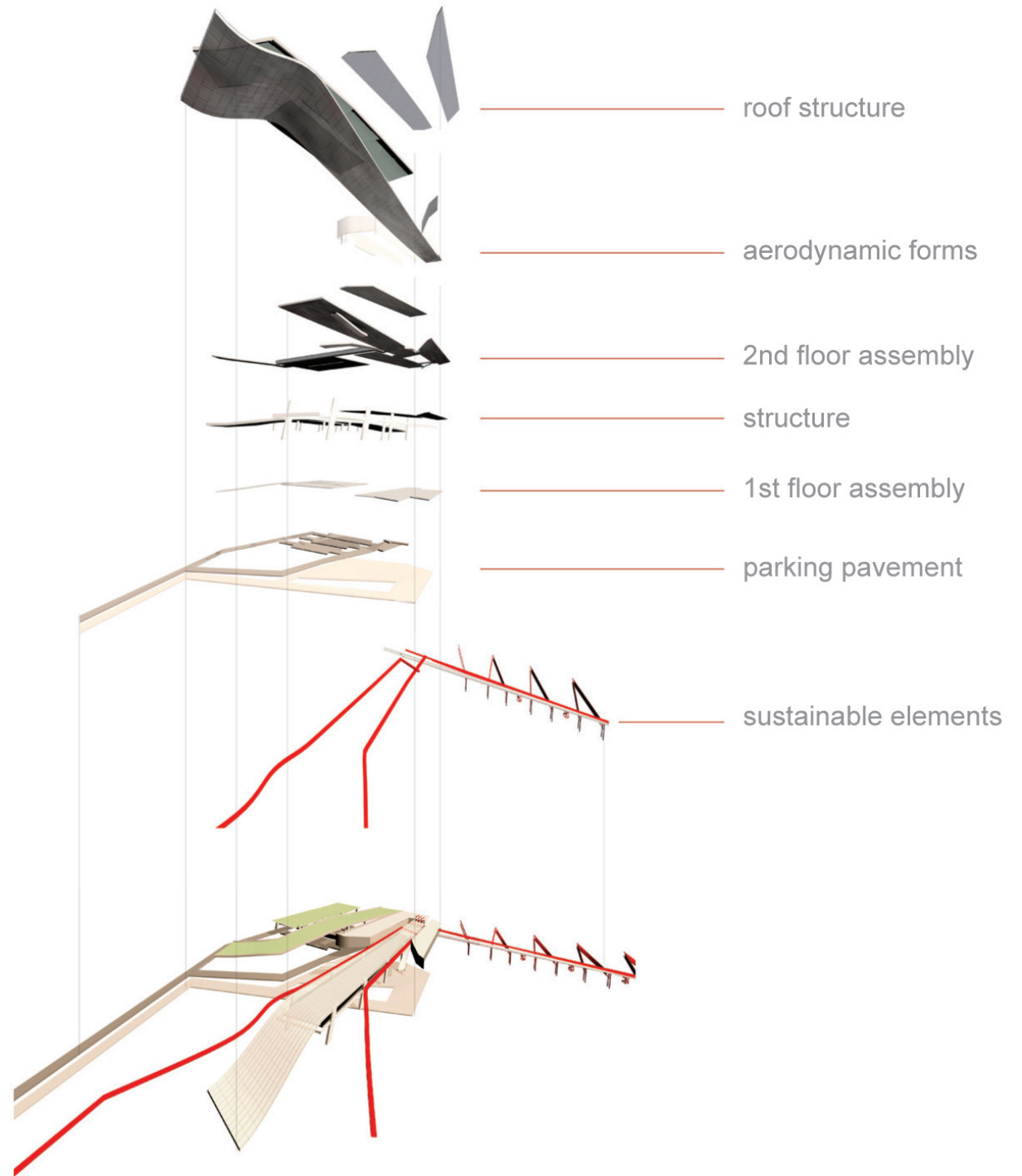
The center shall focus on highly technological solutions that maximize efficiency. Truss systems that transfer water to and from the river source and mechanical room and skins that deflect wind while naturally lighting a room are some examples. The truss system would operate much as any structural truss would. The interior of the truss would be fitted to hold a water pipe that would circulate the water to and from the water source heat pump system. The expression and integration of the materials and mechanical systems will play an important role in educating the visitors on the technology's employed in the design.

The combined system will make use of the excavated inlet on site and become a prominent design feature. Working with the adapted use of the carbon fiber meshing and other material technologies, the architecture will become a display to the beauty of technology advancement in design.



process documentation

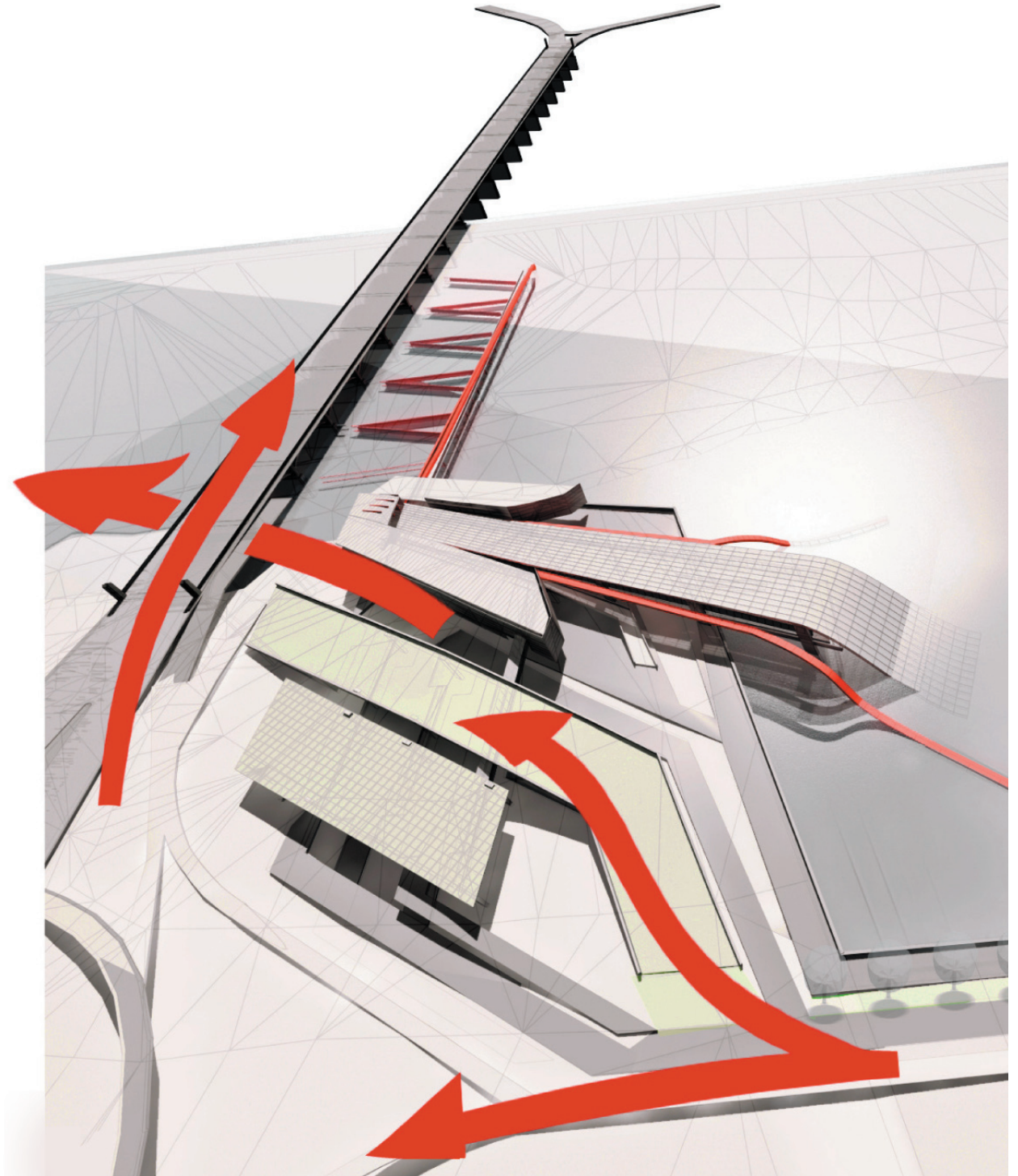
Exploded Perspective Drawing



process documentation

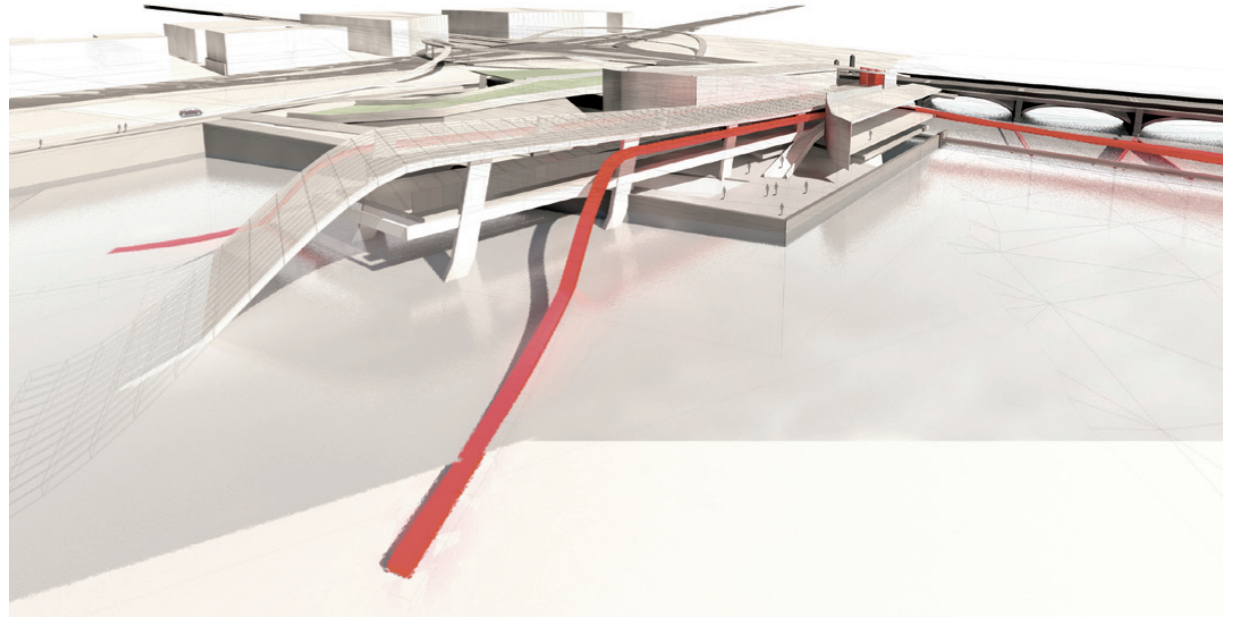
Path Diagram of Site

Diagram of the various path networks that exist on the site. How the site connects the waterfront pathway to the MacArthur Bridge and East Grand Boulevard is of significant importance.

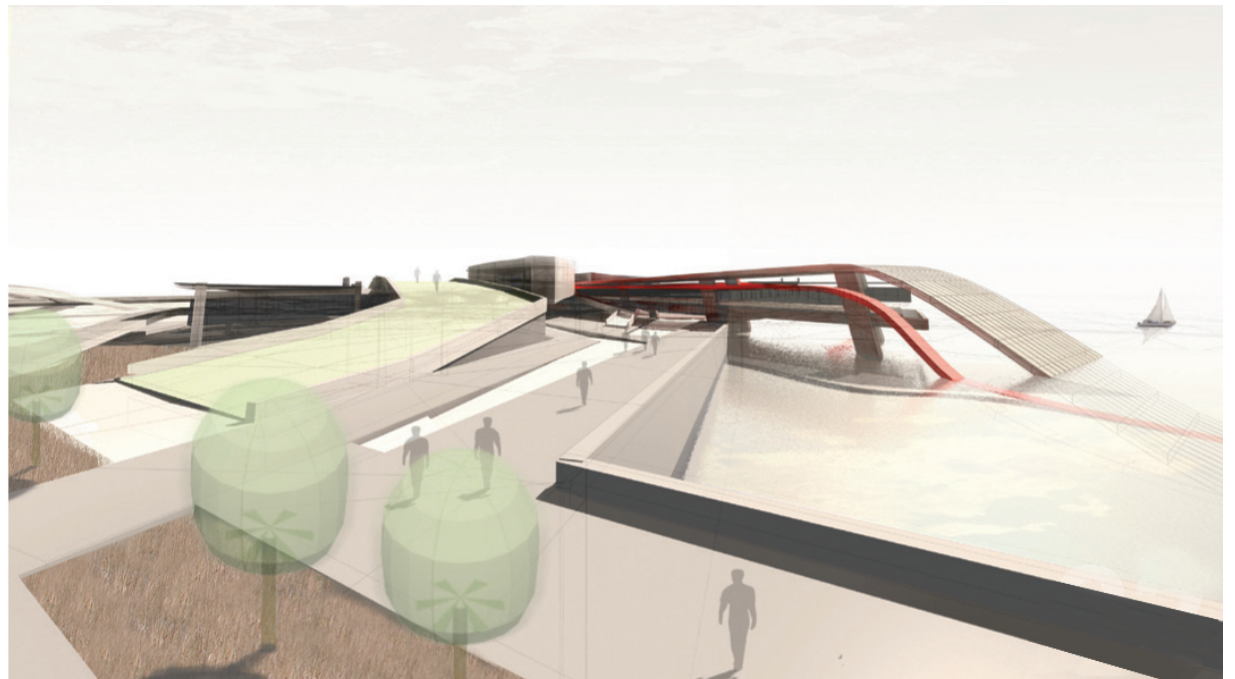


process documentation

Aerial of Site

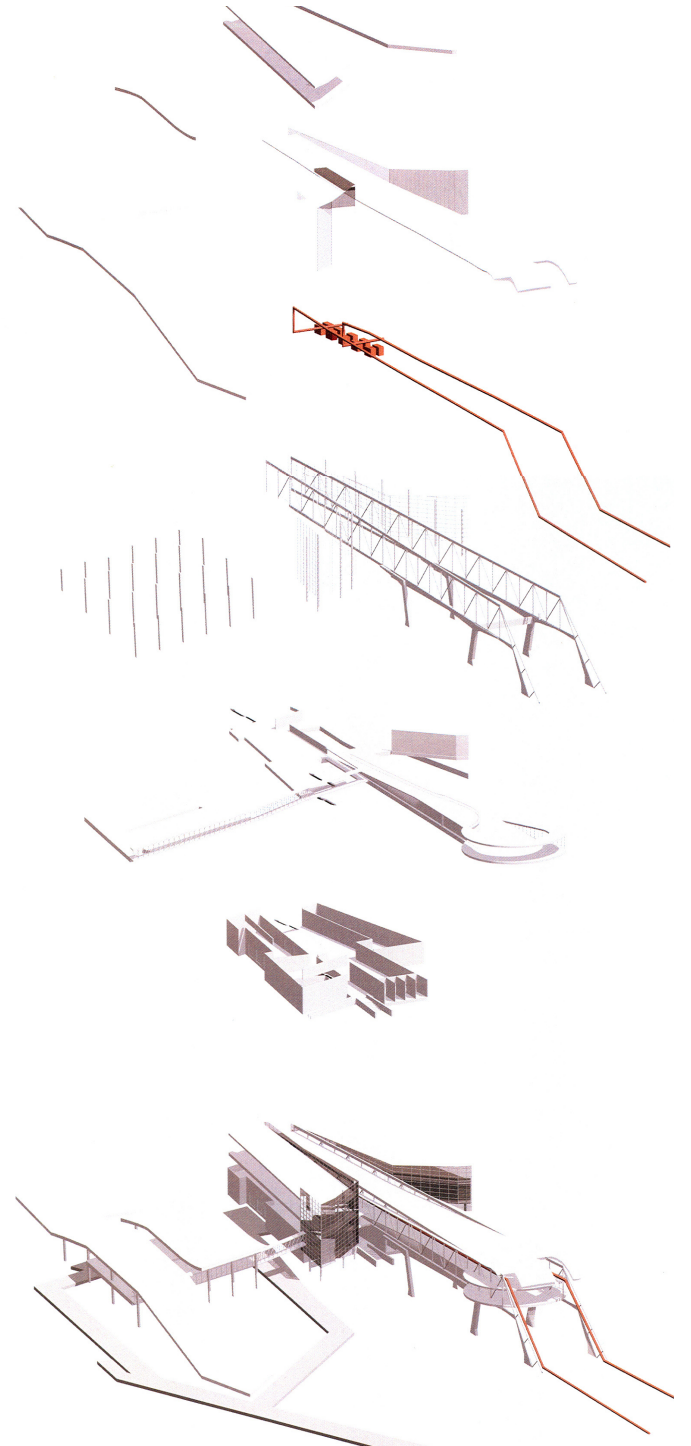


Approach from the Waterfront



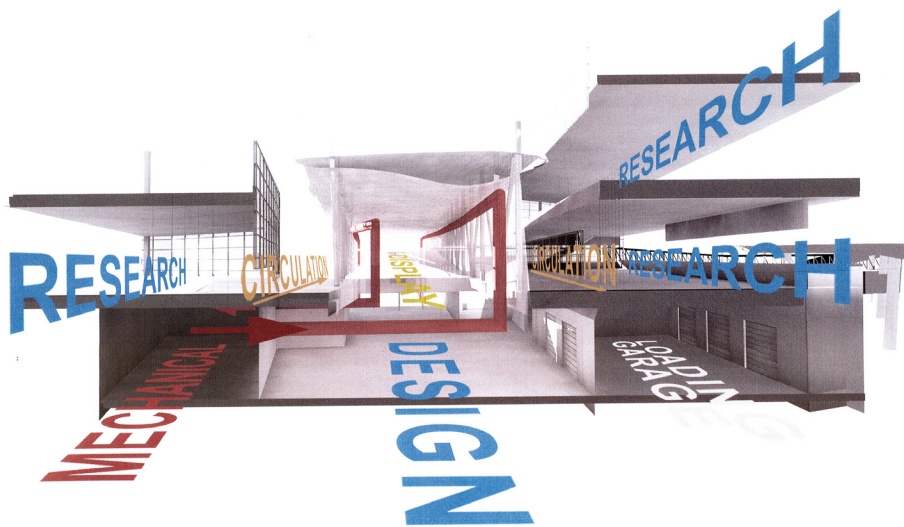
process documentation

Exploded Diagram



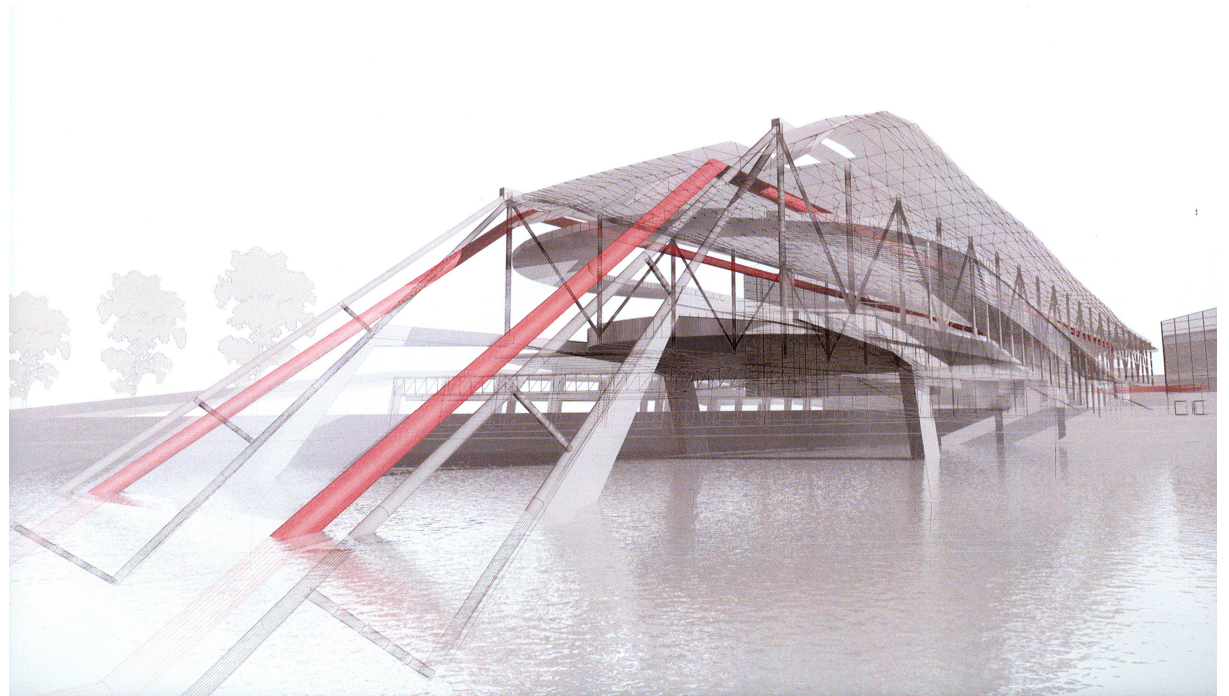
Exploded Section

Designed to emphasize the aspect of design, the center features at its core the main prototyping design lab. Linked around the lab in various levels are the pedestrian traffic flows and research design stations.



process documentation

Exterior Perspective



Interior Rendering



final design documentation

February 07 - March 07

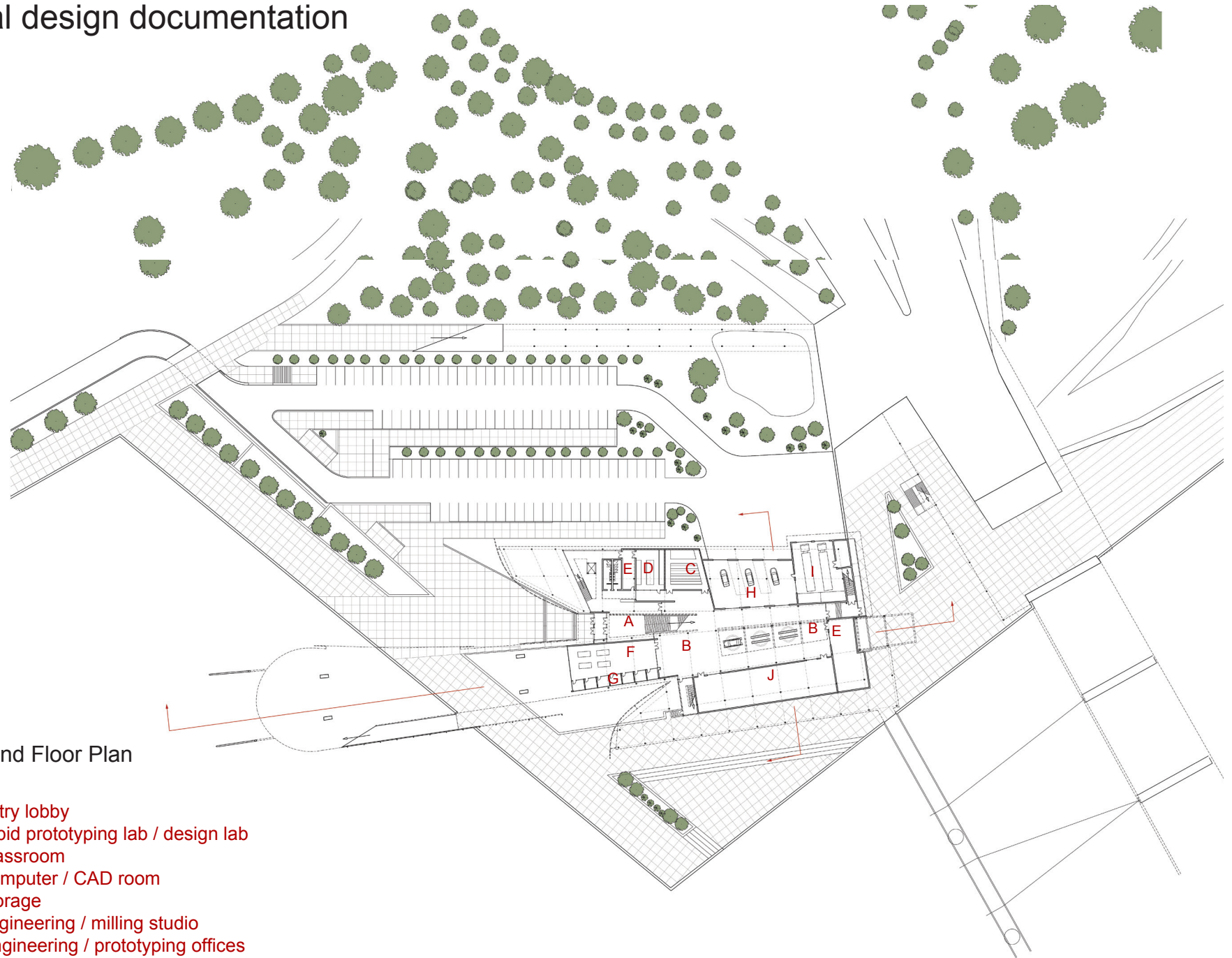
final design documentation

- public park space
- light residential
- med. - high density residential
- retail
- mixed use
- parking



site plan 1:300 n ↑

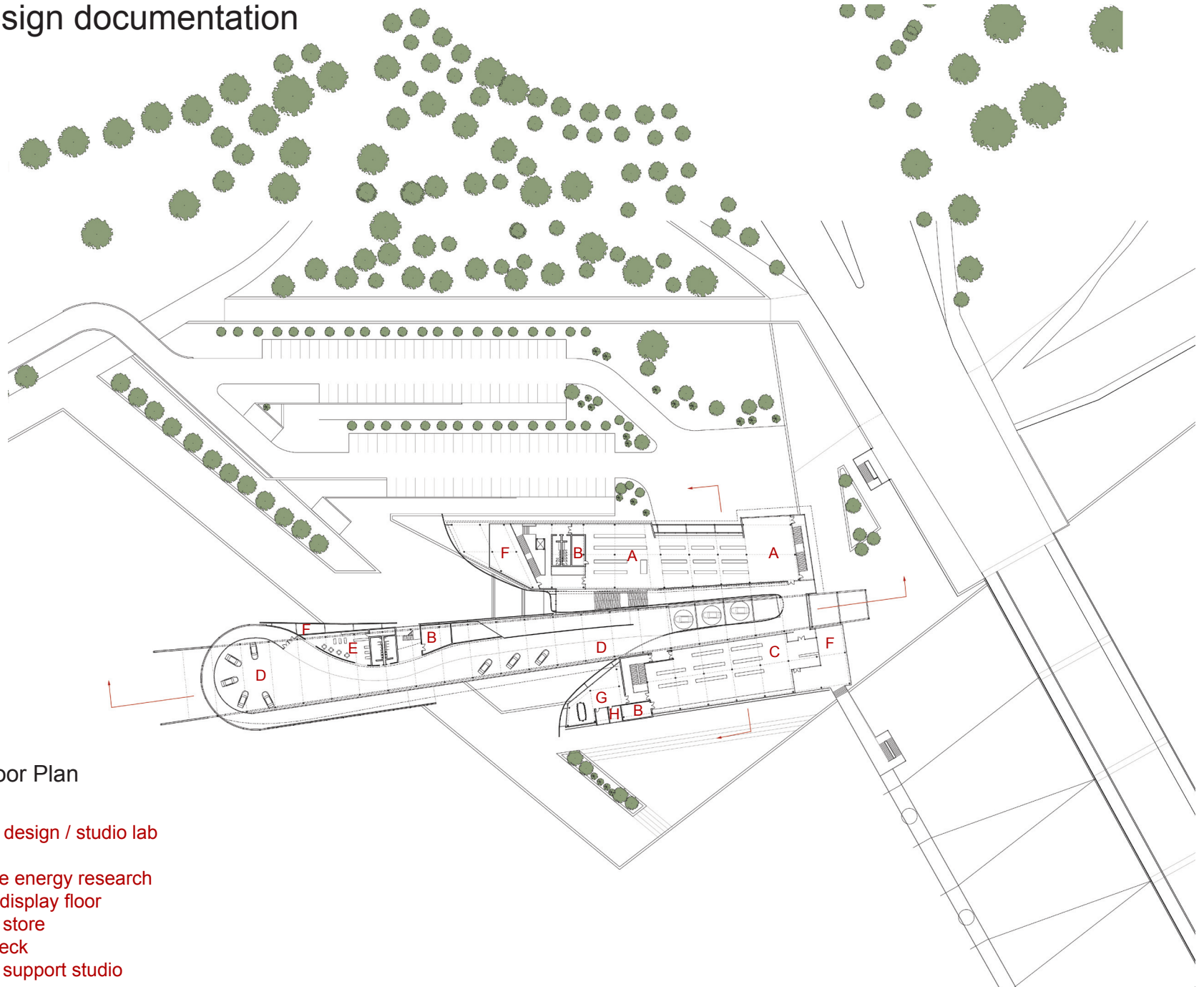
final design documentation



Ground Floor Plan

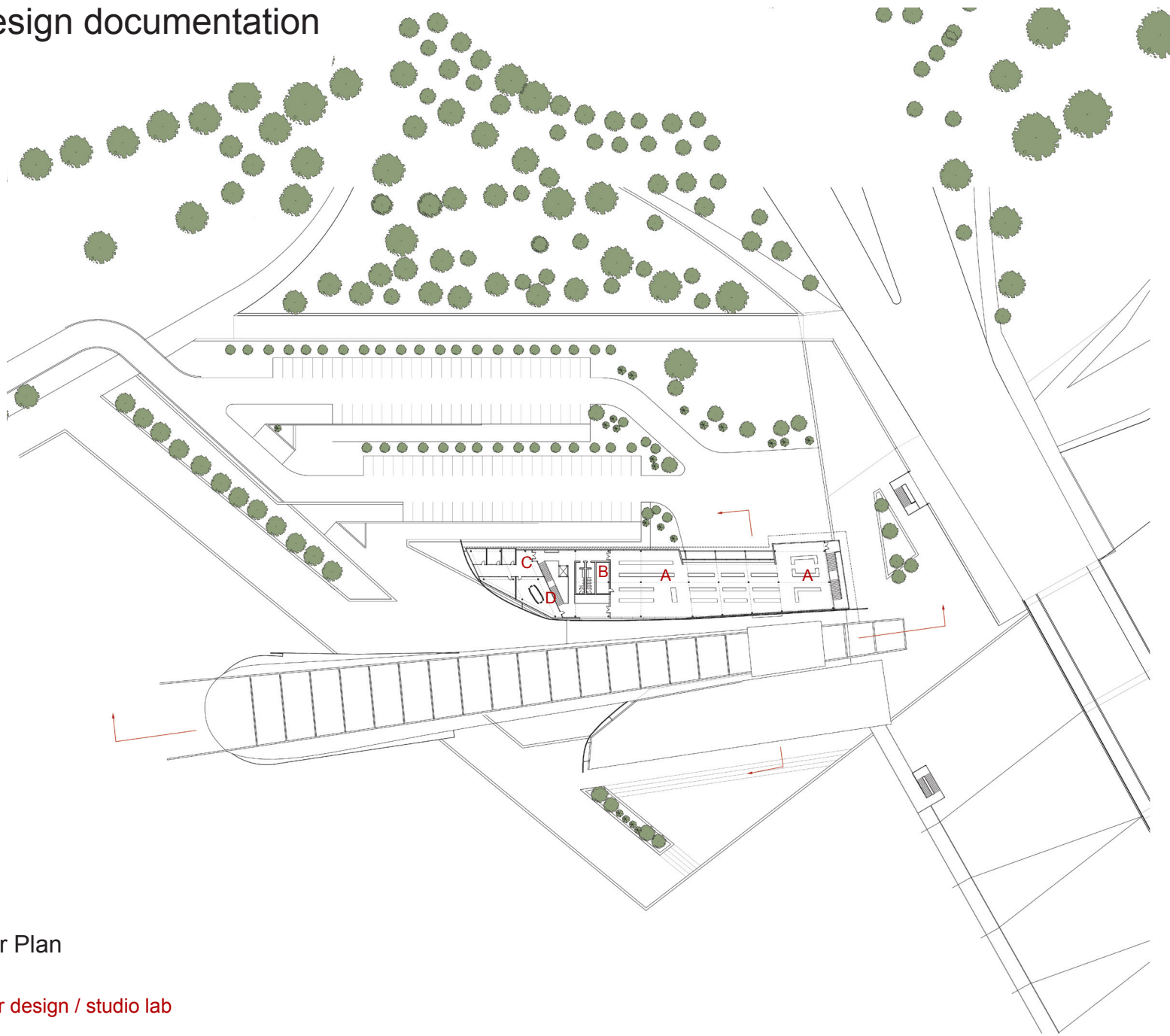
- A - entry lobby
- B - rapid prototyping lab / design lab
- C - classroom
- D - computer / CAD room
- E - storage
- F - engineering / milling studio
- G - engineering / prototyping offices
- H - garage bays
- I - loading dock
- J - mechanical room

final design documentation



Second Floor Plan

- A - computer design / studio lab
- B - storage
- C - alternative energy research
- D - museum display floor
- E - cafe / gift store
- F - exterior deck
- G - technical support studio
- H - offices
- I - lift from lower floor



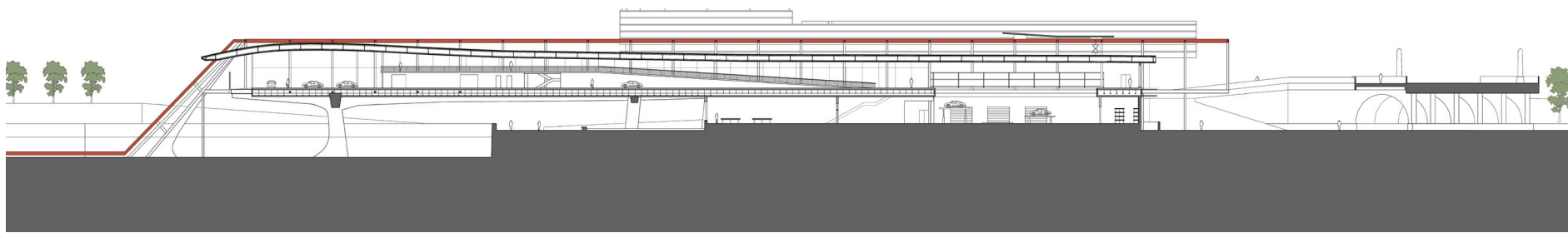
Third Floor Plan

- A - computer design / studio lab
- B - storage
- C - offices
- D - conference room

final design documentation



Transverse Section



Longitudinal Section



final design documentation

Environmental performance Section

Passive solar ability is a primary factor in determining the project's success. Just as it should exemplify the active process of energy generation, so too should it manifest the leading technologies and strategies of a passive site-specific design solution

pervious paving materials mimic a soft-engineered shoreline, allowing a normal pattern of drainage to occur along the Detroit River Waterfront.

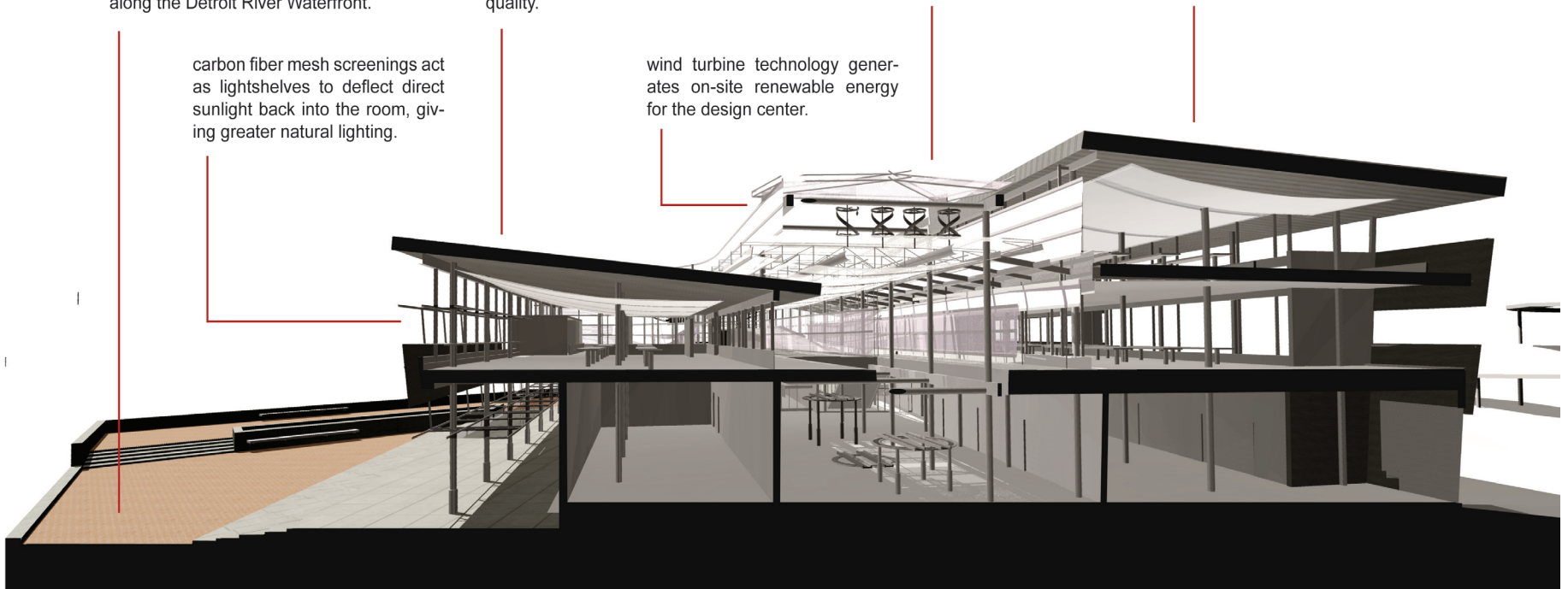
carbon fiber mesh screenings act as lightshelves to deflect direct sunlight back into the room, giving greater natural lighting.

carbon fiber mesh baffles further deflect light into the interior of the space, providing an even lighting quality.

wind turbine technology generates on-site renewable energy for the design center.

open atrium to design studio allows a natural stack effect to take place.

staggered form allows all primary occupied zones to receive natural lighting from multiple directions



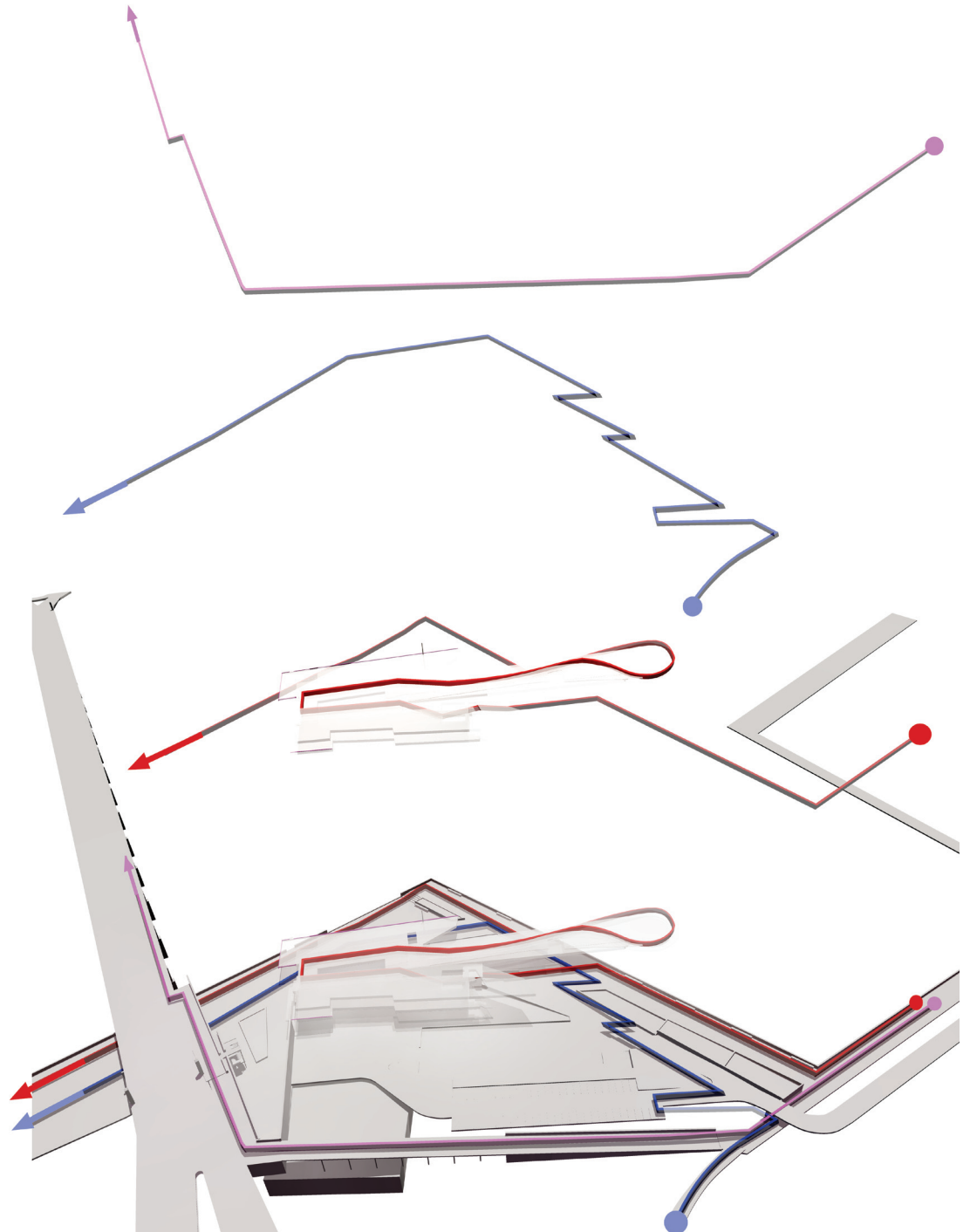
final design documentation

Site Pathway Analysis

The consideration for the bike paths and pedestrian joggers looking to reach Belle Isle with minimal interference is demonstrated through this solution. A ramp extends directly from the pedestrian path along the inlet and rises up to the Belle Isle Bridge pedestrian path with little harsh edges or forced stairs.

Connection with East Grand Boulevard is also of significance, as the proposed redevelopment would establish a strong and active community along the corridor. The bridging of Jefferson Avenue is an important first step, as are the other connections down to the waterfront, either by the stairs at the bridge or the ramps down the parking lot or bike path.

The last path to consider involves the direct connection with the research center. The pathways from the waterfront to the visitor programmed elements of the building is designed to offer itself as a seamless side excursion for the pedestrian. The pathway through the center removes the need for any backtracking and places the visitor back on the waterfront, where they can continue along the water or diverge to Belle Isle.



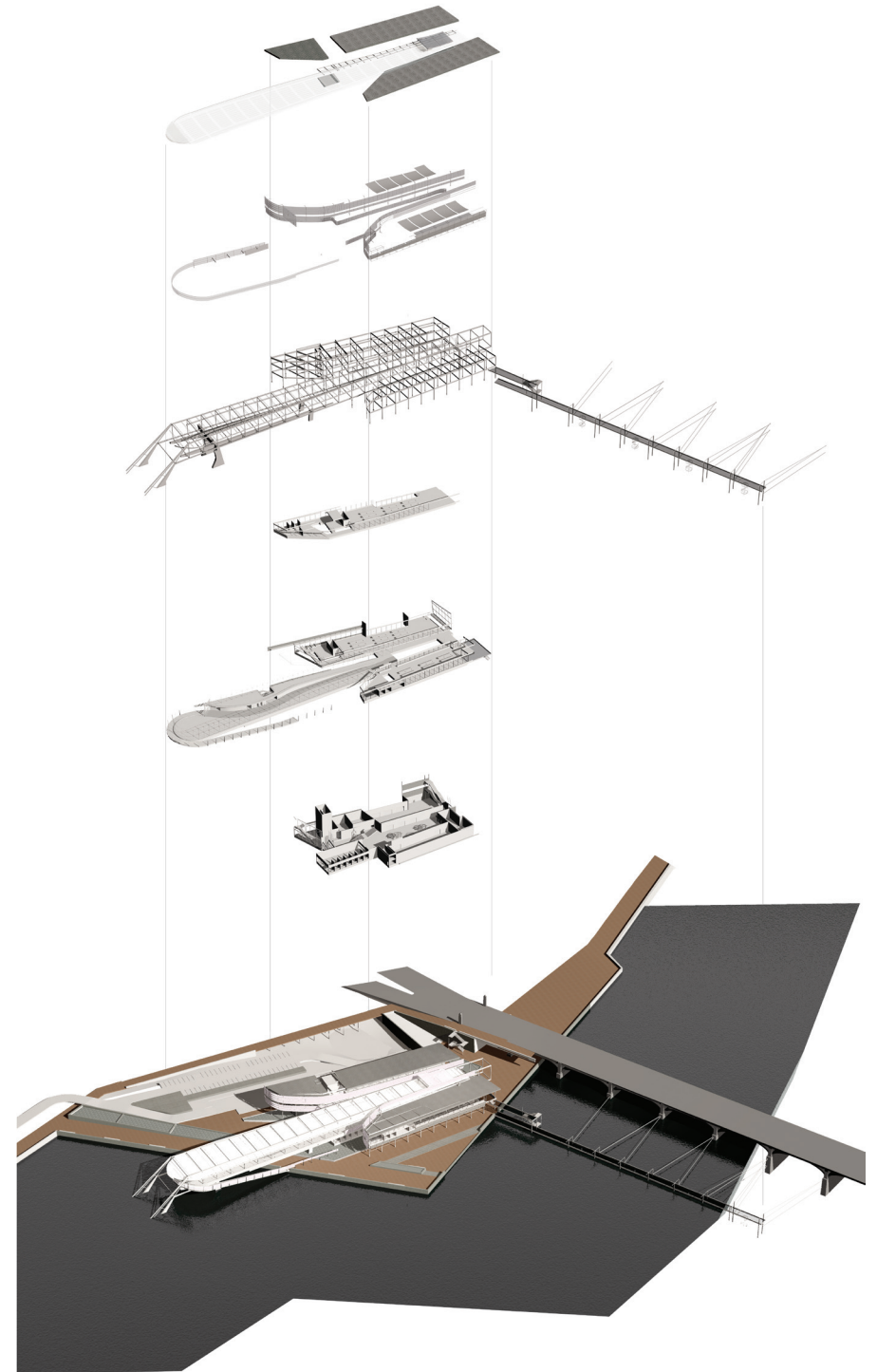
final design documentation

Building Component Analysis

Acting as a cloud-like cover to the museum display floor is a lightly constructed curving roof structure. The form pulls upwards from the newly created inlet in the Detroit River and directs the flow of wind back towards the base of the building to be harvested for energy.

Serving as a secondary form of cladding to the structure is a system of carbon fiber skins designed to benefit the building in a variety of ways. The prominent panels to the north and south of the museum form are sculpted in such a manner as to divert the strong winds down the center form of the design. The carbon fiber mesh is also diverted inside the structure where it acts as a privacy screening for the office research space. Southern screens block direct summer light and reflect it up towards mesh baffles that illuminate the work stations with natural lighting.

The structural systems for the museum allow its form to soar above the pedestrian path, leaving the space free of obstructions for the waterfront visitors. This is accomplished through the use of 30 foot tall truss system to give the museum floor an appropriately dramatic scale.



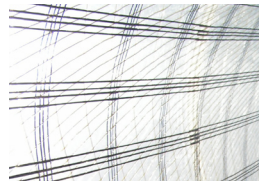
final design documentation

Carbon Fiber Mesh, used prominently in the body panel design of automobiles and interior detail work, is a material of exceptional strength and lightness in weight. carbon fiber as a mesh involves weaving material strands into a translucent fabric with greater strength than cloth and less density than steel meshes.

Vacuum insulated panels make use of commonly applied vacuum technology as seen in thermoses and automobiles and applies it as an insulation building material. The high thermal resistance and slim profile allow architectural forms to be increasingly exposed to harsh climates and elements without great losses in energy efficiency.

Passive Cooling Materials allow the interior of the roof allows for the construction of lightweight structures in harsh environments. the pcm can be applied to a variety of surfaces, and generate an increased thermal mass in the material's properties, allowing a lightly constructed roof such as in the design center to behave energy wise as it were much greater in mass.

translucent solar cells can be applied to the surfaces of the roof structures to generate and supply renewable energy to the design center. the cells have been designed to fit over curving surfaces, and still allow through over fifty percent light transmittance, while being as thin and light as sheets of plastic.



A



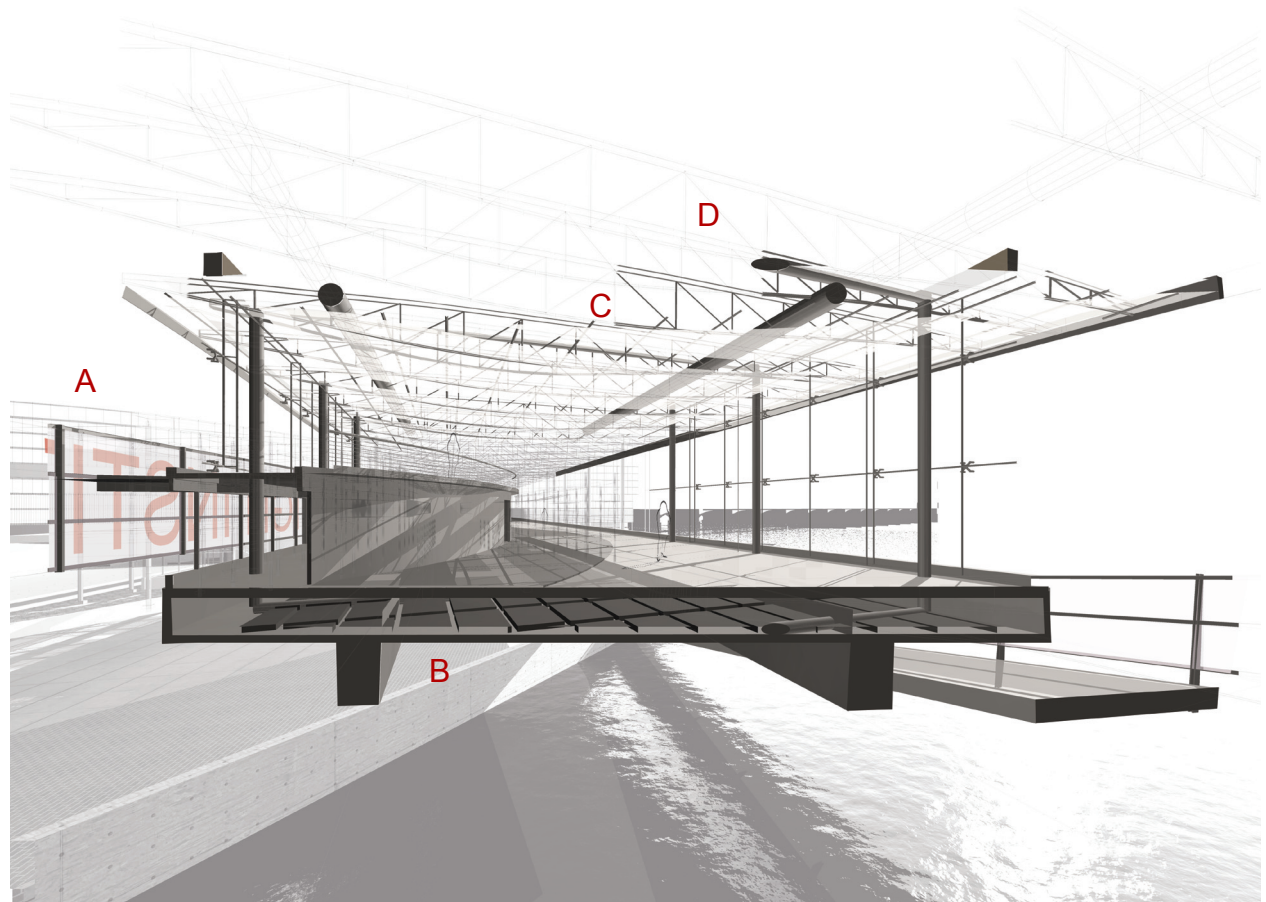
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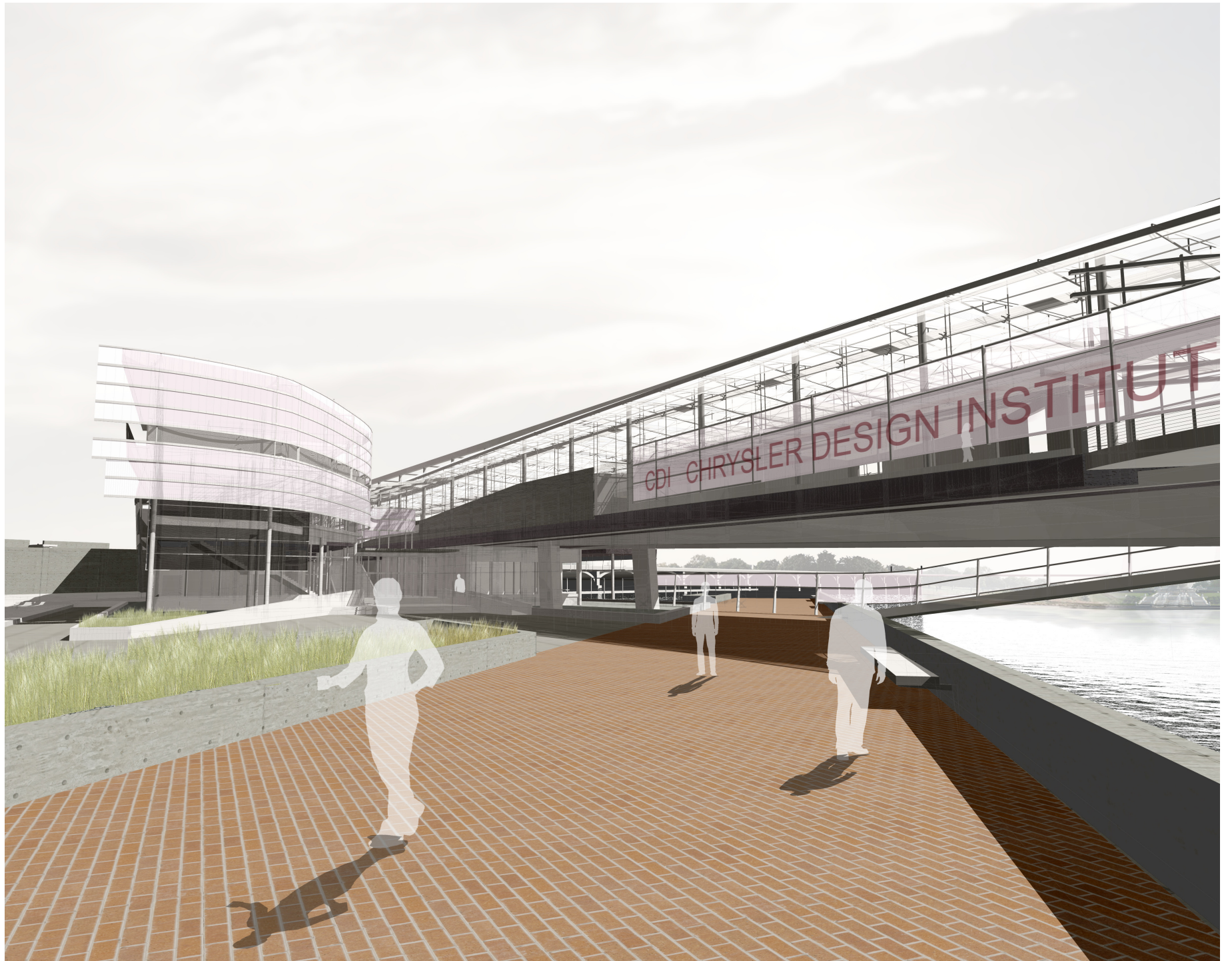
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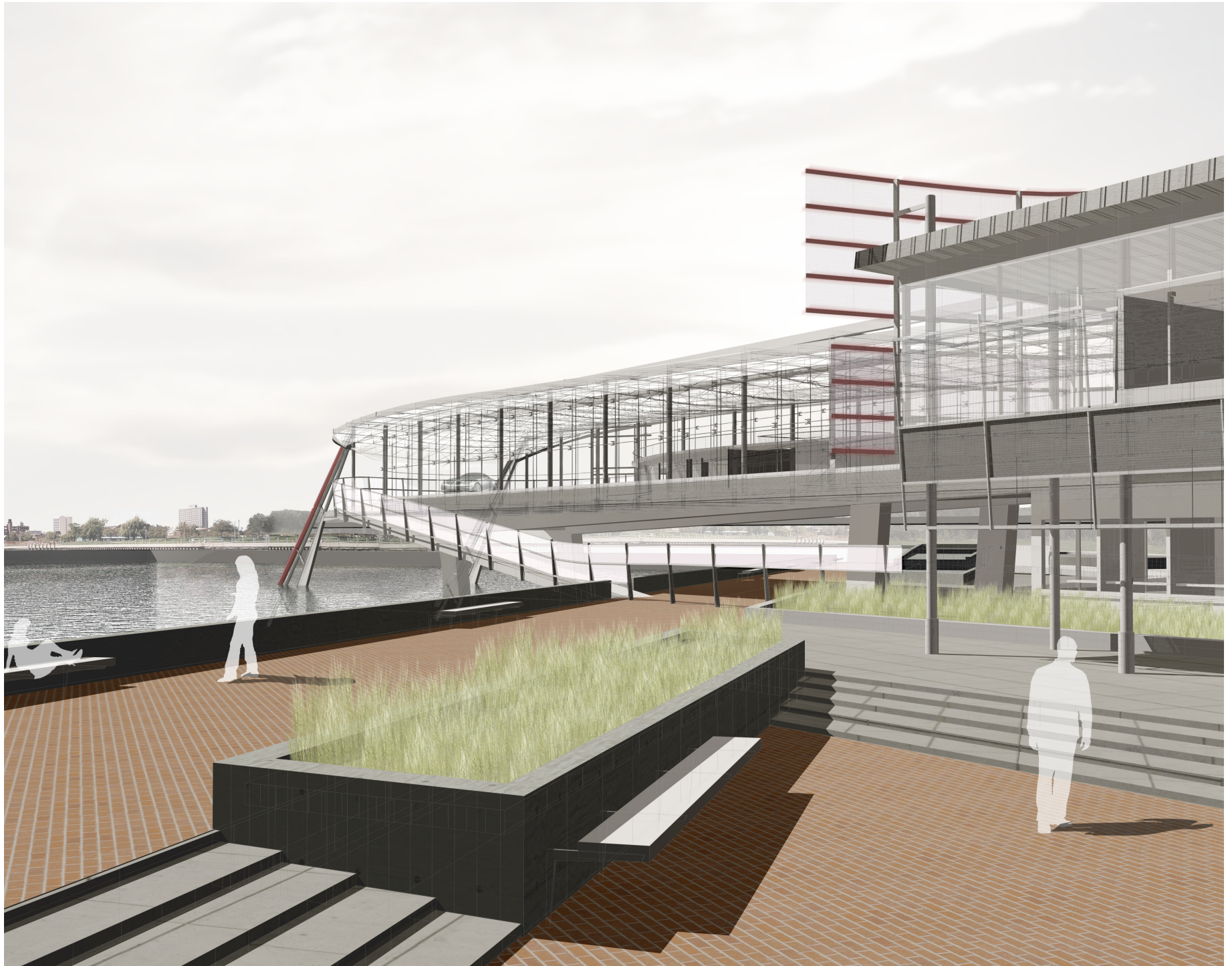


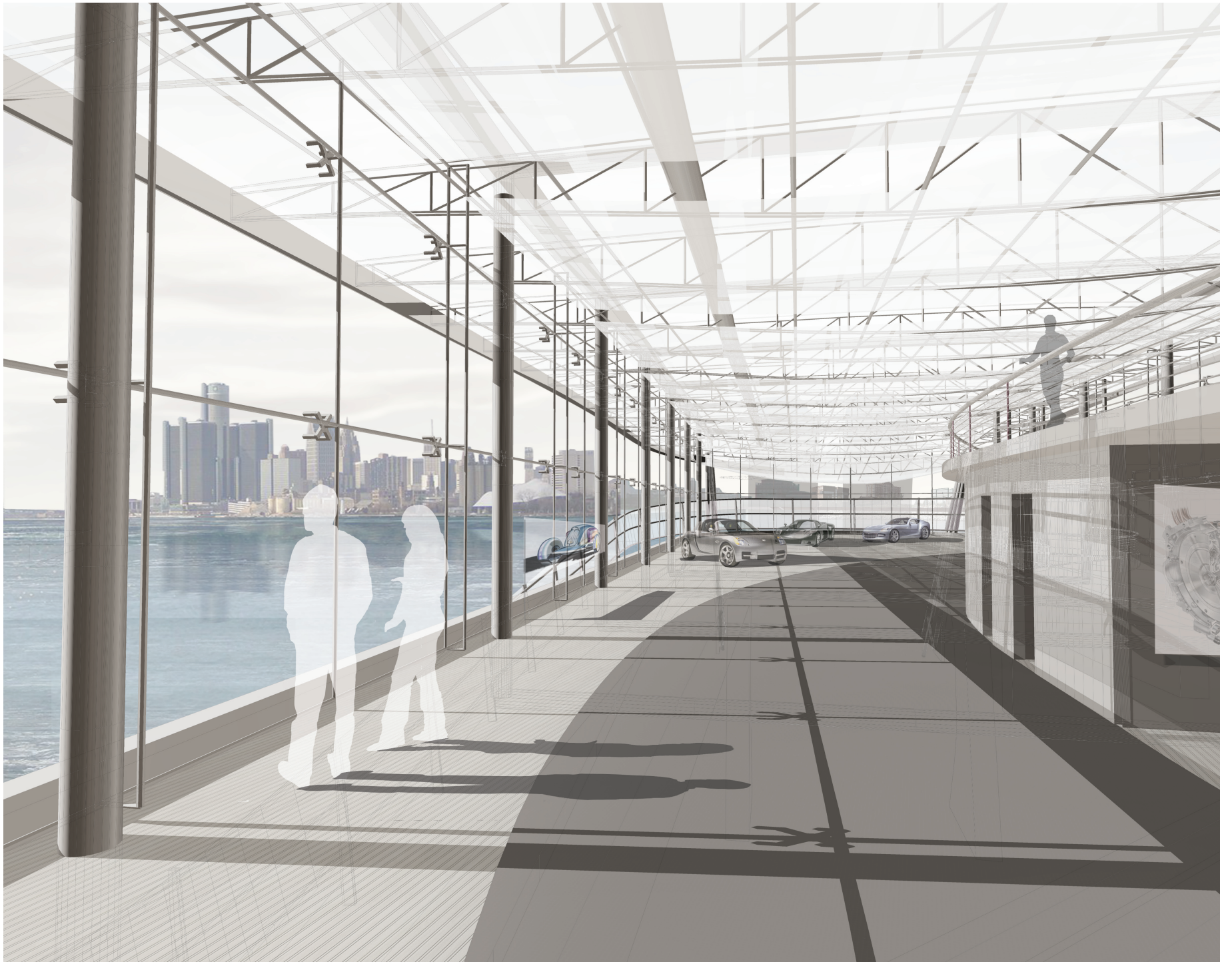
D











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