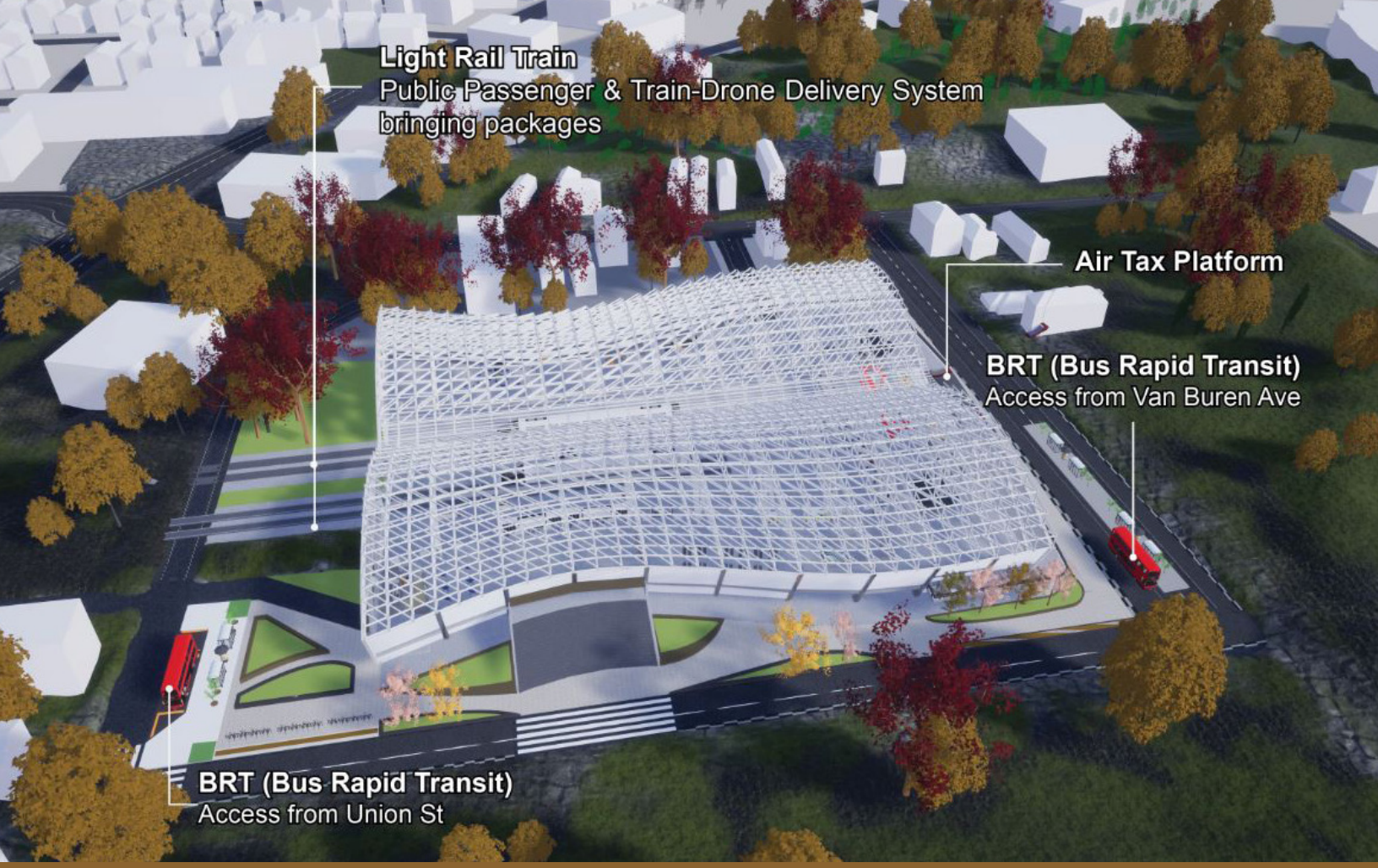


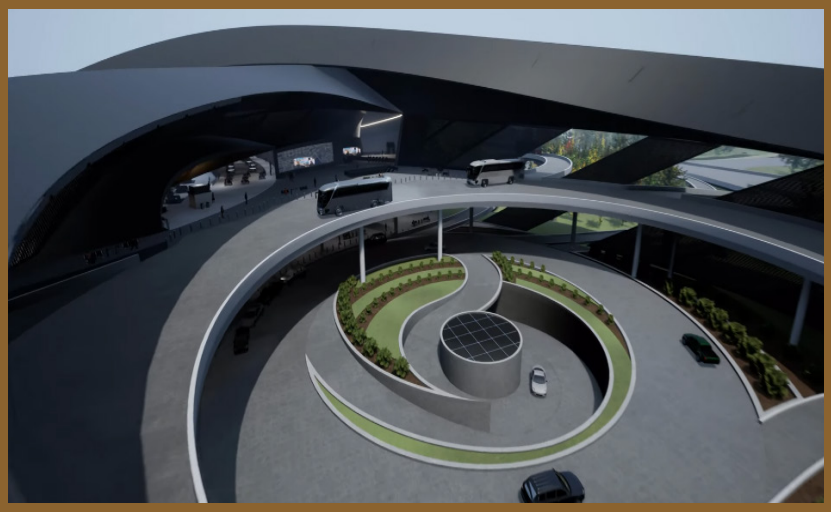
Transportatin Hub Design
Uptown Cincinnati Urban Mobility Studio

Faculty: Ming Tang, RA, LEED AP. Associate Professor
School of Architecture and Interior Design, DAAP
University of Cincinnati

ARCH 8001 Spring 2019, ARCH 4001 Fall 2018
UC Forward grant. Project-Based Collaborative Coursework for Developing Connected Transportation Network and Accessible Multimodal Hub in Uptown

Uptown Cincinnati Urban Mobility Studio Course Website: Animation. Demo walkthrough. VR Game download through links:

ARCH 8001 Spring 2019
ARCH 4001 Fall 2018



Course:

ARCH 8001 Spring 2019
Students: Alan Bossman, Shreya Jasrapuria, Grant Koniski, Jianna Lee, Josiah Ebert, Taylour Upton, Kevin Xu, Yining Fang, Ganesh Raman, Nicole Szparagowski

ARCH 4001 Fall 2018
Students: Nolan Dalman, Sam DeZarn, Nicole Powers, Jake Miller, Hang Phan, Josh Funderburk, Rugui Xie, Nick Mann, Azrien Isaac, Shiyuan li, Spencer Kuehl, Randall Morgan, Greg Ginley, Umme Habiba

Faculty: Ming Tang, RA, LEED AP. Associate Professor
School of Architecture and Interior Design, DAAP
University of Cincinnati

Office: 7215, Aronoff Center
Phone: 513 556 1856
E-mail: tangmg@ucmail.uc.edu

Using Cincinnati Uptown and proposed Smart Corridor area as the focus area, two Urban Mobility studios present a two-semester long study investigating the urban mobility with an emphasis on the simulated human behavior cues and movement information as input parameters. The research is defined as a hybrid method which seeks logical architecture/urban forms and analyzes its' performance. As one of the seven-courses-clusters supported by UC Forward, the studio project extends urban mobility study by exploring, collecting, analyzing, and visualizing geospatial information and physically representing the information through various computational technologies.

The studio investigation is intended to realize the potential of quantifying demographic, social, and behavior data into a parametric equation. In the experiments, the integration of non-geometrical parameters within the form seeking and performance evaluation process resulted in a series of a conceptual model to represent the movement and access.

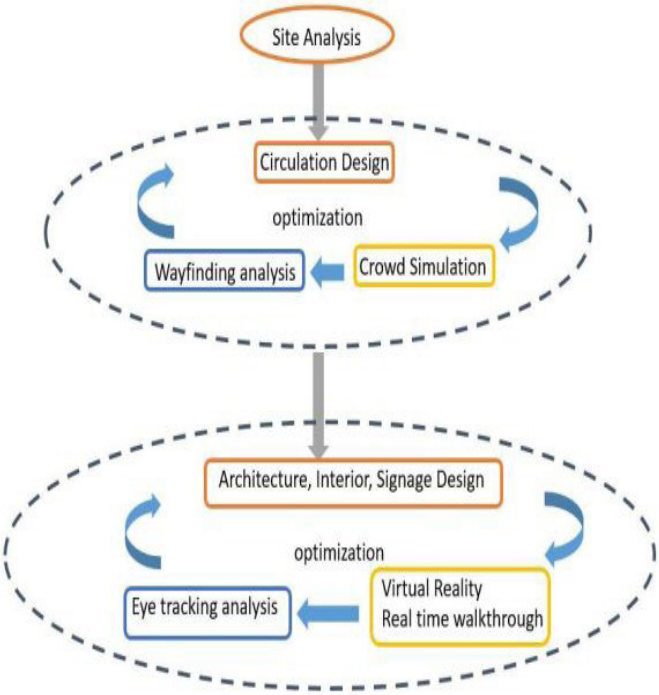


Figure: course methodology

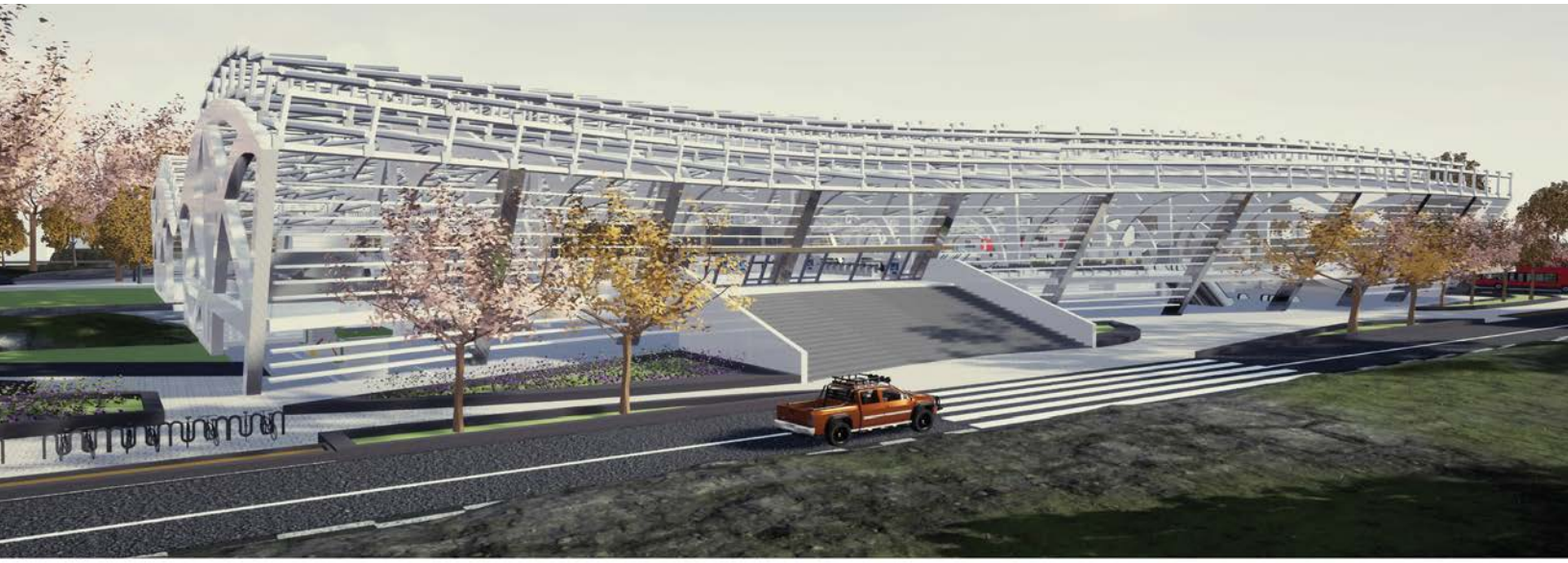
Transportation Hub Design

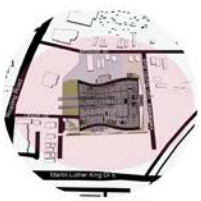
Over the two semesters, 25 student projects were developed by optimizing the transportation network, analyzing way-finding and human behavior. Ultimately, the studio looked to build upon the strengths pre-defined in the evaluation method and capture the benefits of Geographic Information System (GIS), virtual reality (VR), eye-tracking, and wayfinding simulation by seamlessly integrating vital geospatial components in the equation and altering the way people explore the possible design solutions in order to generate the ideal transportation hub in Cincinnati. Nine student projects are presented in this report.

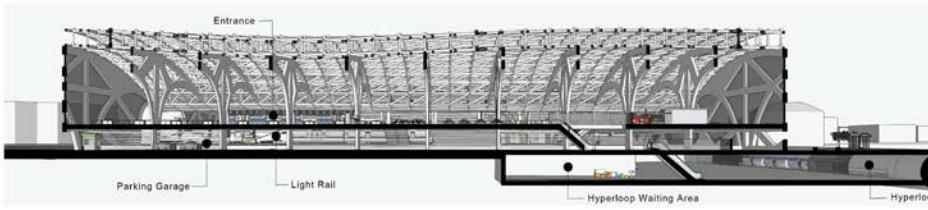
Jianna Lee

Cincinnati Uptown Transportation Hub Center (CUTHC) project aims to create a brand-new interchange that connects communities, cities, and states by consolidating public transportation from small scale to large scale. It is designed to provide a seamless linkage between light rail train and other modes of transportation such as hyper-loop, BRT (Bus Rapid Transit), air taxi, passenger car, bicycle or scooter, which facilitate the connection between transportations that are integrated and gathered in one single place. In contrast that most of the existing development of transportation facilities have been carried out individually to single transportation, resulting in less efficiency and connectivity in terms of the overall transportation network, CUTHC is a concept of a 'Complex Transfer Center' concentrated in one stop solution. The cultural, commercial, and business facilities are also provided to accommodate the high-density floating population. Here, the Hyperloop, which is a high-speed railway, runs interstate underground with rapid speed and economic cost compared to an airplane. It is possible that all the transfer between transportation from the city railroad, metropolitan bus, to even future-oriented air taxi take place within 10 minutes. As the complex transfer channel, CUTHC accommodates a large number of floating populations, which is also suitable for attracting cultural shopping malls armed with diverse contents in the vicinity of the transportation hub. That is why the complex transit center will have a big ripple effect on the local economy. With the creation of a complex transit center, it will not only improve the traffic environment in the region but will also contribute to economic benefits such as job creation and leading the tourism industry.

Figure: project by Jianna Lee



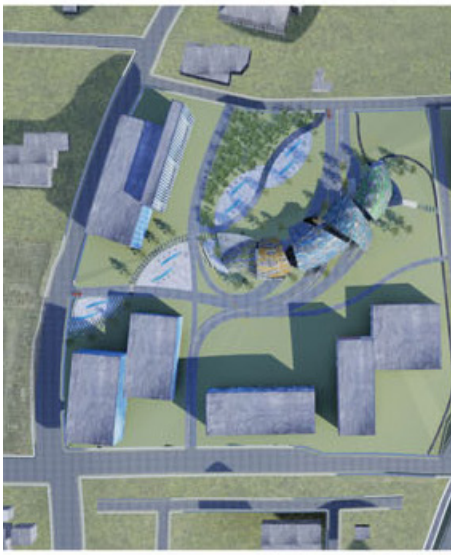


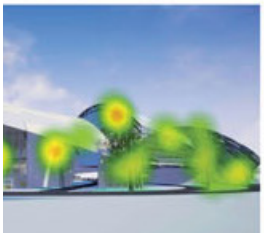


Josiah Ebert

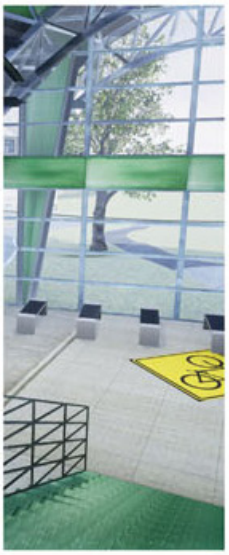
The major problem of the project was creating a series of interconnected pathways for the transit of different types such as cars, buses, bicycles, and pedestrians, while at the same time holding these pathways separate to increase the efficiency of movement and safety of different user groups within the space. To accomplish this, the designer created a central pedestrian promenade that ramps above and over a set of intersecting paths for vehicle transit. The vehicles are allowed to pass under the promenade, while a series of loading and unloading platforms both divide the vehicle lanes and become the link between them and the pedestrian pathway overhead. Finally, because of the simple method of pedestrian circulation, additional programmatic elements such as lounges, restaurants, and customer service are able to be slotted along the promenade path without interrupting the previously established efficiency of the circulation. These additional programs create alcoves and outcroppings from the path that offer points of repose for people without delaying their movement if they are in a hurry.

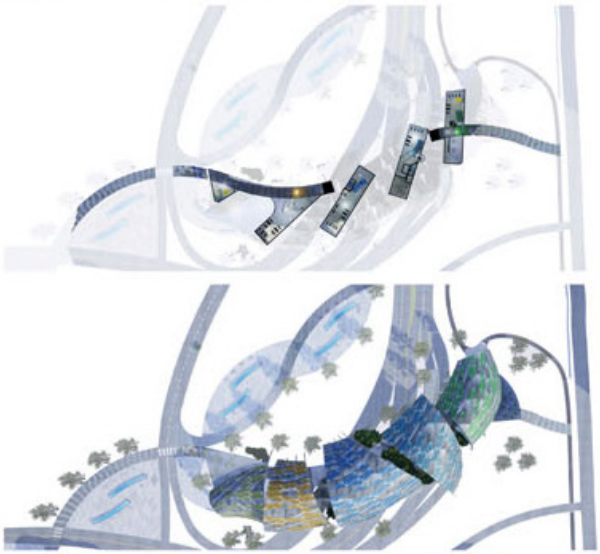
Figure: project by Josiah Ebert

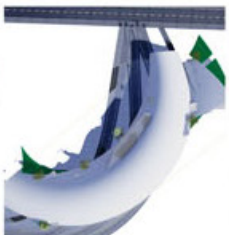


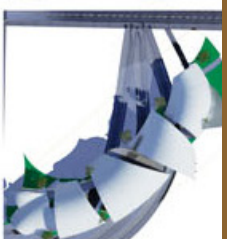


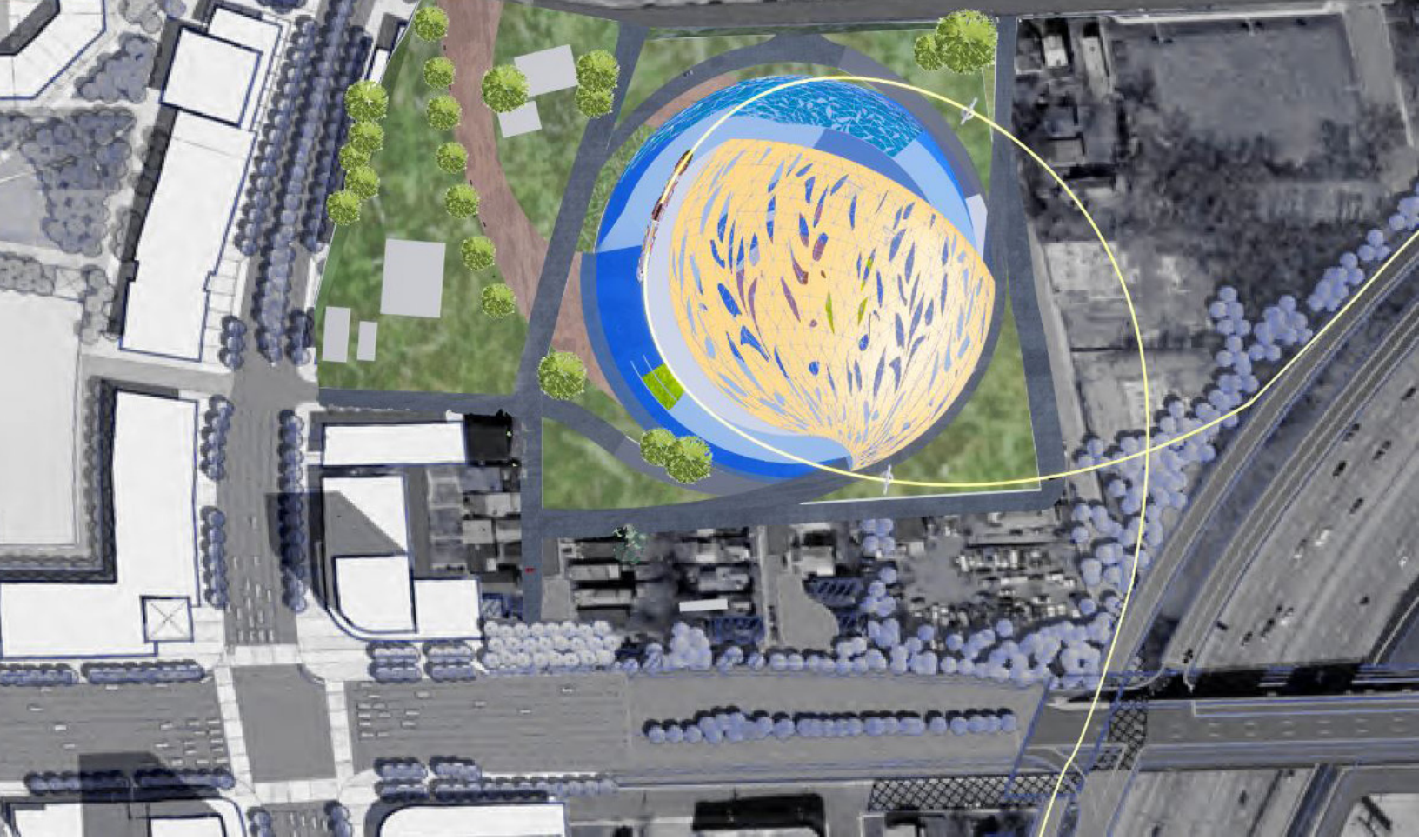

BUS - BLUE







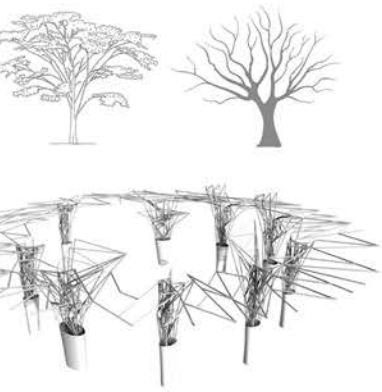


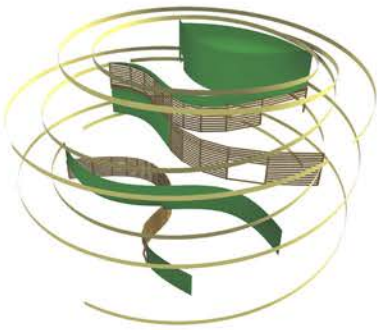


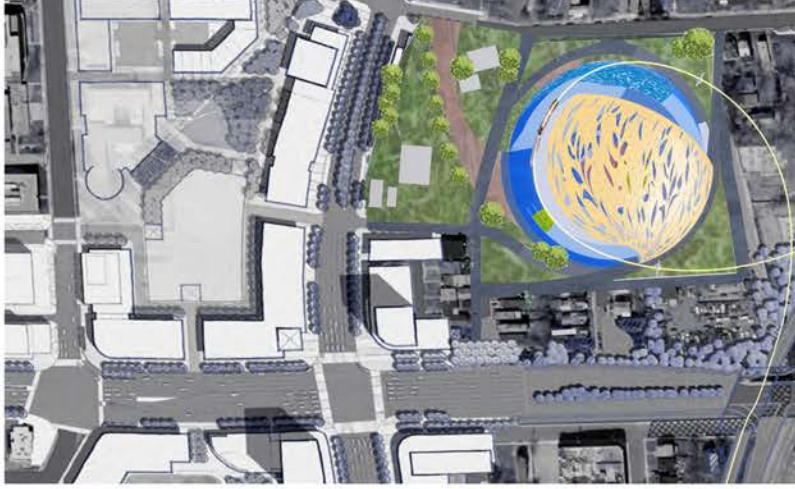
Shreya Jasrapuria

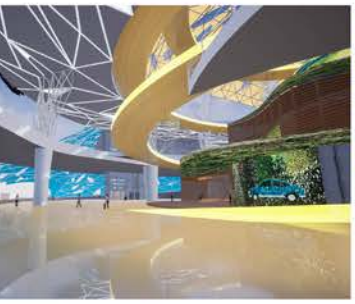
INTRANSIT is designed for three modes of transport within Cincinnati: self-driven cars, buses, and monorail. Each mode of transport is connected to MLK and branches out into 3 levels within the hub, the pedestrian entry being at the intersection of Reading and Whittier. The design of the transport hub is inspired by the lush greenery on site and the idea is to recreate this within the hub. The structural system is designed as an abstracted version of the branching of trees while the trunks form columns holding the intermediate level. The long span roof covering the entire structured has perforated panels with an abstracted pattern of foliage which creates a dramatic play of light and shadow within the space. The central space is created to form an interior garden with terraced levels that house restaurants and retail spaces which serve as recreational and waiting areas for the users. These spaces are connected to the transport stations using a ramp that forms a sculptural pivot point in the atrium. The interior space is further covered with accessible green walls and roofs that becomes the breathing center within the hub. The use of biophilic design elements acts as a de-stressing element which allows the users to connect with nature, thereby creating a healthier built environment. This has been confirmed using eye tracking and stress level analysis study using VR tests within the designed hub. The aim is to provide a stress-free, closer to nature experience for the everyday traveler.

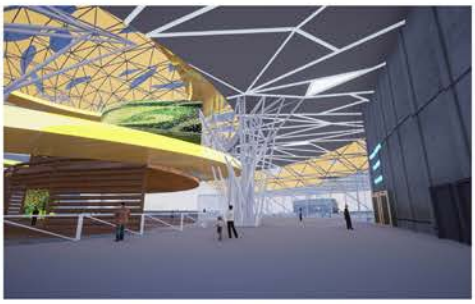
Figure: project by Shreya Jasrapuria

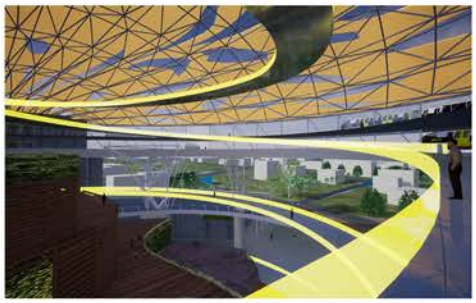


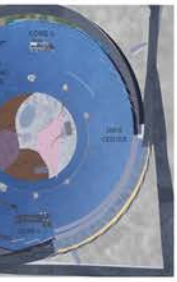




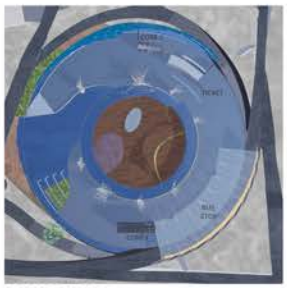








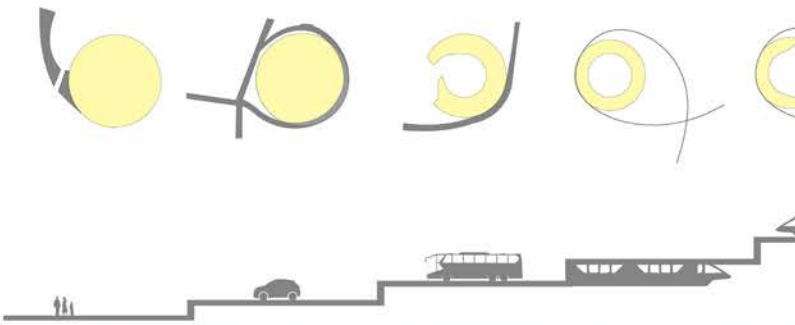
F DRIVEN CARS WITH BASEMENT PARKING

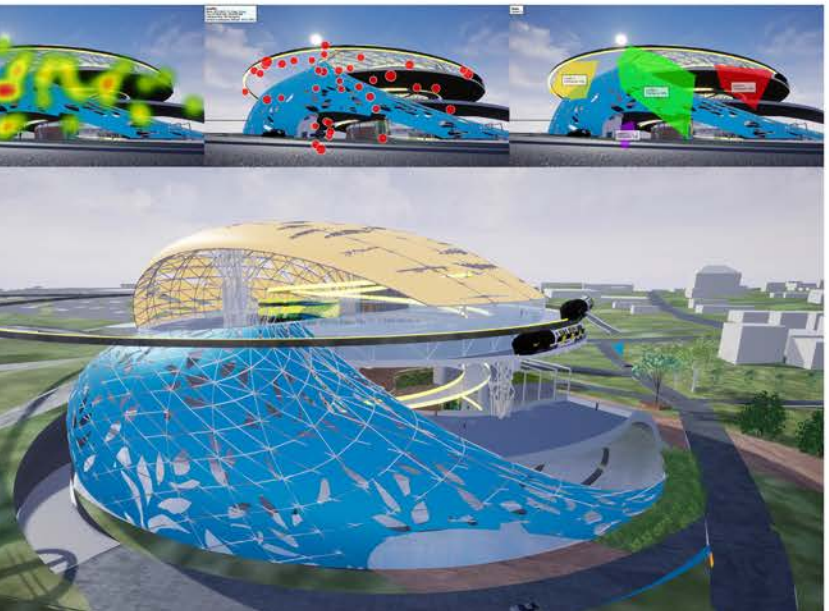


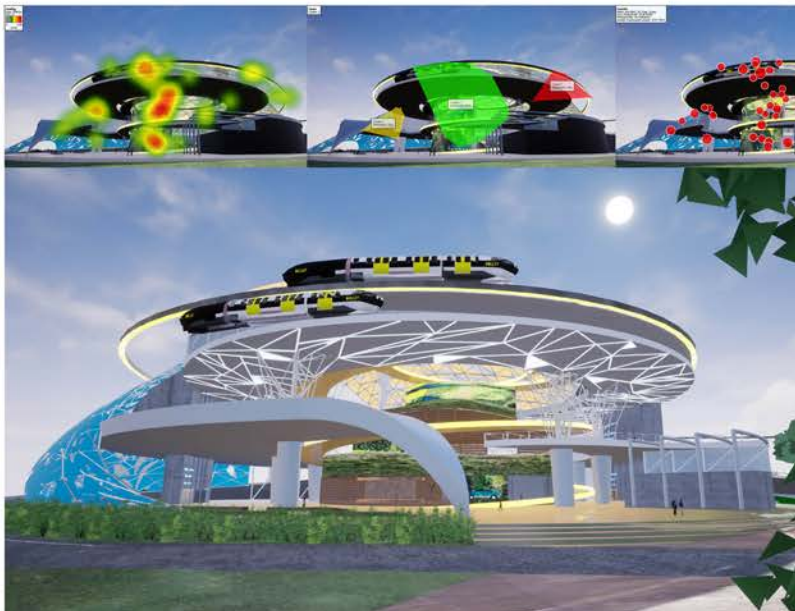
SECOND FLOOR: BUS STOP

THIRD FLOOR LEVEL 1: NORTH BOUND TRAIN STATION

THIRD FLOOR LEVEL 2







Taylour Upton

Inspired by Tschumi's follies at Parc de la Villette, Parc expresses and emphasizes, the deconstructing of architectural presence and presumption. Located at Cincinnati's Innovation Corridor, it serves to highlight the physical reconfiguration of the city, while also embracing its long-standing history and representing an idealistic vision of what it can become. Parc, situated 20 years into the future, features magnetic levitation (maglev) railways as its primary mode of transportation. Two main guideways service commuters in all four cardinal directions, one guideway spanning north to south, and the other east to west. These maglev transporters travel at very high speeds, and thus span throughout the Midwest United States, reaching other major cities such as Detroit, Chicago, Indianapolis, and even Louisville.

The color red is a primary feature hue that exists throughout the Parc, as it not only emulates the follies in Paris; it serves as an essential eye-tracking tool in the wayfinding experience. This color is naturally, readily detected by the human eye, and highlights various architectural elements at the Parc. From a bird's eye view of the Parc, the red features that exist cause the complex to stand out from afar. Additionally, bright red lights infiltrate the translucent diaphragm roof structures and showcase each programmatic pavilion in an individualistic and integrated fashion. From such heights, one can catch glimpses of what lies beneath the roofs.

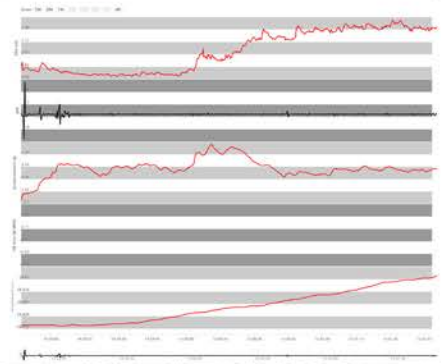
The burnished maglev guideways are supported by red steel structures, which denote the extents of their spans (the guideway in Chicago, for example, can be easily spotted as a part of the Parc's system via its unique track structure). To take part in the Parc's structural re-de-construction, the east-west guideway runs over the north-south, creating variability with height and circulation. This strategic play with elevation and routes throughout the facility creates dynamic vintage points whilst showcasing the long span structures that shelter the various programmatic elements.

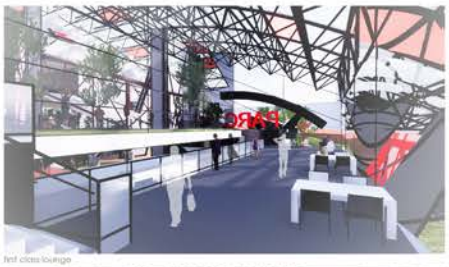
Upon entering the complex via the north end of the site, visitors can park their vehicles in the landscaped surface lot that is complimented with foliage. Leaving the lot, and just before entering the primary ticket station, occupants come across the one-way bus route which essentially circles the entire site before exiting outward to the Greater Cincinnati region, and takes place as the Parc's secondary mode of transportation. At this end also exists an information and reception area, as well as a lofty lounge space to welcome transporters and non-transporters alike by housing a roof garden and allowing views of the surrounding context. As with architectural follies, nature and green space are also highlighted and enjoyed by visitors. They serve as equally occupiable spaces, often more than the actual buildings.

When entering the Parc's central courtyard, one is greeted by a vast and open garden space with water features that complement the prominent diagonal path that spans through most of the site. Additionally, one is confronted by the complex's feature circulation connectors, which are present throughout and highlighted with metallic red bracing, interlocking all main programmatic spaces. The structural brutalist architecture blurs the boundary between utopian and dystopic space, as it clashes and harmonizes with the landscape. A circulatory system is established at differing elevations, adding to the Parc's unification of its separate zones, and allowing occupants access to other areas of the complex.

The VR experience comprises of wayfinding oneself through the series of pavilions, circulation paths, green terraces, and ground level spaces. Devices such as custom light fixtures and furniture pieces provide clarification, as this involvement can prove slightly sporadic, but concludes to form a cohesiveness with the architecture, landscape, and overall context of the city. Although there exist more succinct paths toward both guideways, these routes beg to be occupied and experienced, emphasizing the immersive experience with the re-de-constructed Parc.

The interior environments at this complex integrate with the aesthetic and atmosphere of the overall site. Housed under the aforementioned long span space framed roof structures, these spaces correlate with each other and the rest of the complex via their connection with outdoor spaces and the feature circulation routes. The south end entrance and lobby space include more ticket booths and lead to a gift shop where Parc souvenirs can be purchased. This pavilion is connected with the innovation offices above and to the café via an intermediate roof garden and engrosses visitors to the external spaces via vast thresholds, translucent facades, additional balconies, and terraced green spaces. The café comprises of two levels and a mezzanine, and access to yet another roof garden which is utilized more so for growing food cooked in the kitchen below, rather than for recreational purposes. These spaces still maintain a connection with the central courtyard and its impression on the entire facility, again bringing various zones of the project together.





first class lounge

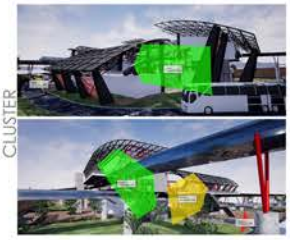
north-south track

café

tower towards E-W track

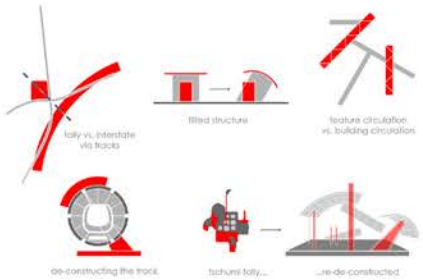
BEESWAX

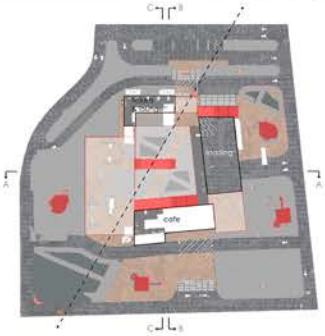
CLUSTER

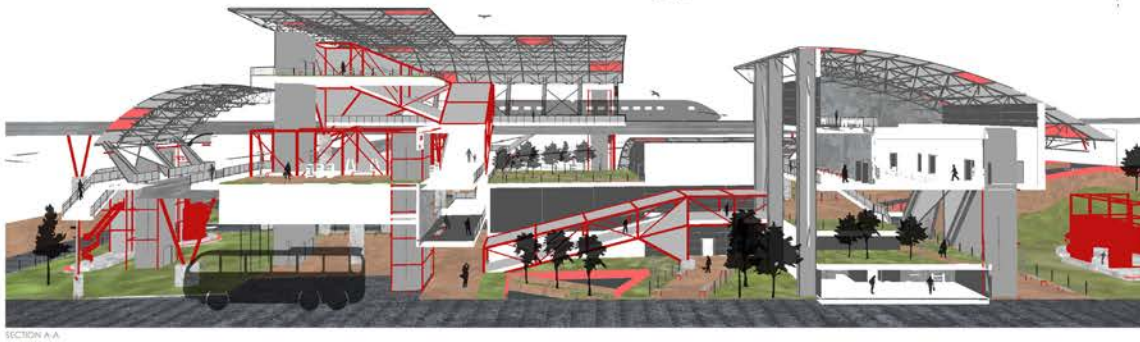


central courtyard

toward innovative office suite



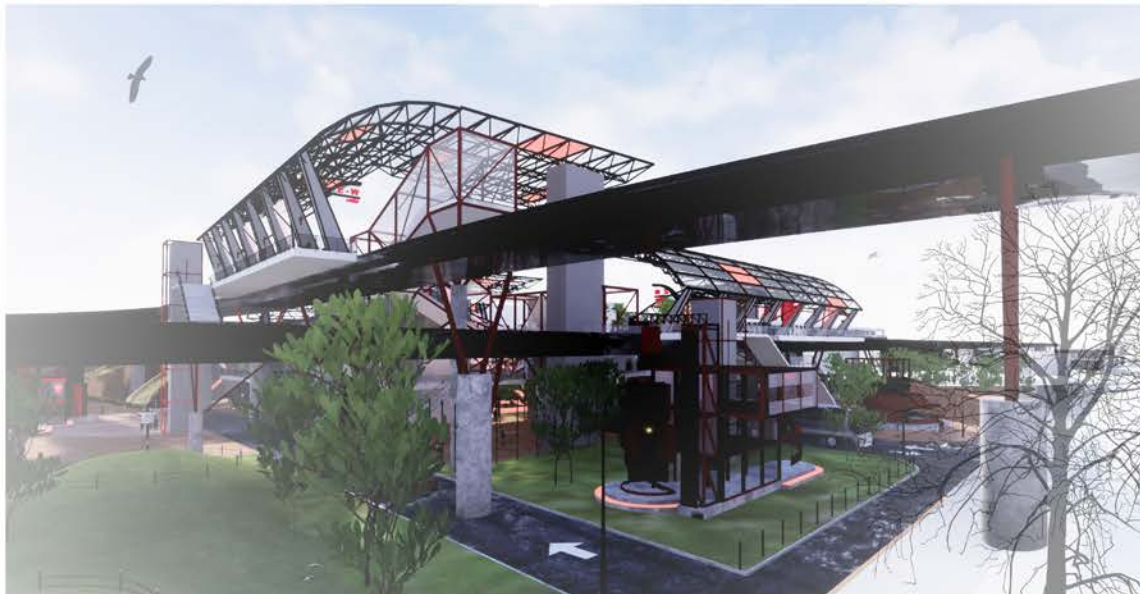




SECTION A-A

SECTION B-B

SECTION C-C



Commuters also enjoy the Parc as they lounge about the elevated platforms that provide natural elements and prized views of the city. Amidst the wayfinding elements such as directional signs and video walls which inform about Hyperloop technology and the Tschumi folly, visitors are led to the north-south guideway platform. As they wait for the board the train, they can purchase their tickets and enjoy and greenery that awaits. From this point, the feature circulation leads one up to the east-west guideway. At the intersection of the two guideways, the "tower" structure situates itself. This structure leads to the Parc's highest terrace which allows visitors to capture the essence of the entire complex and brings the disparaging components of the complex into ultimate cohesion.

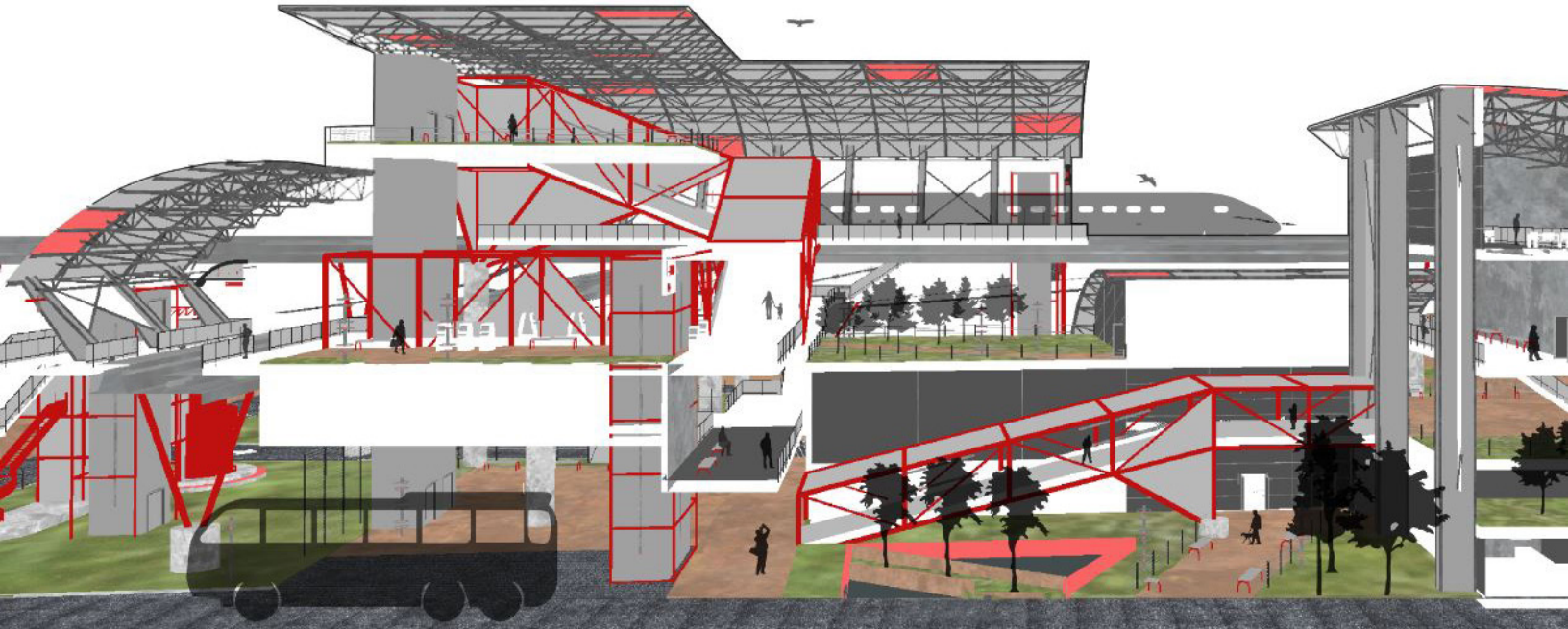
The site which surrounds the structure manipulates the existing, hilly terrain and replaces existing buildings. However, from the west end, much of the current topography is maintained and integrated with the proposed Uptown site and buildings and the Parc's streetways and greenways. This subtly transitions to a more flattened terrain toward the east side, end with a retaining wall boundary that separates the Parc from the adjacent lot for future development.

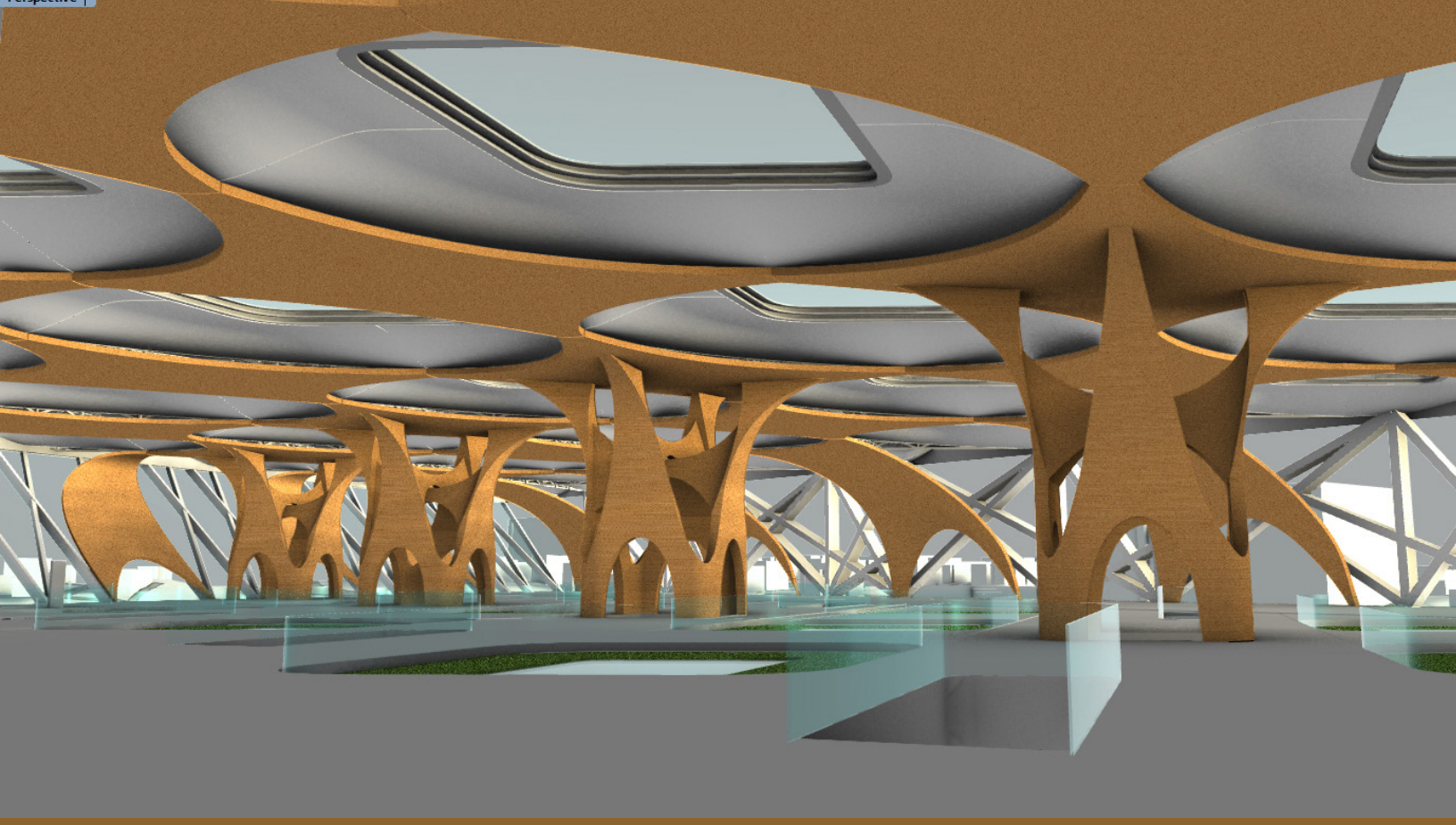
Additional site elements are positioned on hardscapes and turfed grass. Renditions of the original follies of Parc de la Villette are scattered about as both objects to be admired and contemplated and as spaces to be experienced, just as the Parc proposes. To further break the ground plane, elevated infographic videos of follies are located atop small, grassy mounds surrounded by lights. When visitors pass the thresholds towards the folly videos, the folly exclusively becomes an objected figure of commemoration. As a result, Parc showcases the folly at various scales and experiences.

When navigating through this complex via VR, a strong sense of scale is at focus, and at times can be overwhelming to those to experience it. With occupying the spaces intertwined with the forty to sixty-foot tall guideways, finding one's way through the site is synonymous with going on an expedition. One can explore the architectural phenomena and how it relates to the surrounding outdoor spaces and complementary site elements. The Parc prompts visitors to marvel at where they are within the complex at any given time but also can cause them to desire to explore its many other spaces. VR automatically calls for an immersive and surreal experience, but with this project, such an experience is amplified.

The Parc is more than a mere transportation station. It pretenses as a park of architectural and historical wonders and exploration for anyone who seeks adventure. In 2040 Cincinnati, where technological advancement continues to dictate the world's well-being, structural brutalism and capacity prevail, and architectural works form a revitalized meaning of what de-constructivism is. It does not intend to capture a space-age presence but certainly makes a statement to all who visit, and foreshadows for a futuristic society.

Figure: Project by Taylour Upton





Kevin Xu

The focus of this transportation hub is the implementation and accessibility of a multi-lane bus terminal system. The buses are to enter from one side of the site and exit out the other, utilizing a one-way circulation system that intersects 4 platforms where boarding can occur. This system is large enough for 8 simultaneous boarding and always wide enough to have two parallel lanes so that traffic can remain fluid even when one lane is occupied by parked buses. The one-way circulation has several routes to resolve any congestion issues that might occur. For example, under circumstances where the terminals are problematic, buses can simply take an alternative route to bypass the terminal lanes and directly exit the site. Precautions have been taken to ensure that the bus system is realistic and efficient and flexible under precarious circumstances. The model is not quite detailed in terms of defining exactly what kind of buses. However, the height of the vehicular lane can be adjusted and is currently high enough for most bus and coach vehicles in operation.

Efficiency and ease of access are complementary to the layout of the main program. As such, pedestrian circulation is also at the forefront of the design scheme. Pedestrian traffic is regulated to a level above the vehicular traffic in order to both maximize leveled space for both and minimize contamination of either. This allows visuals, smells, and sounds of the parked buses to be separated from the main waiting area for the building occupants, which helps elevate the quality of space and experience of the pedestrian level. Simultaneously, by reducing pedestrian presence to the platforms on the vehicular level, it can decrease the chances of vehicular accidents and boost safety measures for pedestrians.

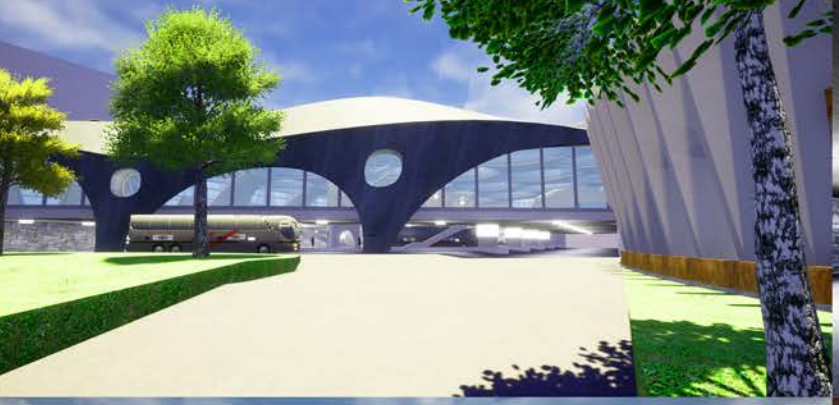
It would be unsurprising that similar layouts were applied to the train terminal, which although was a later add-on to the site, better represented the traditional two-story terminal system. The terminal features a single platform with two tracks that can be for a plethora types of trains. Its access is not dependent on the immediate site as it is underground.

For the consumer vehicle circulation, an integrated scheme was applied to allow for seamless access to the multi-level garage and carpool lanes from various points of the pedestrian space. There are several ways for non-bus automobiles to enter the site including the main bus entrances. However, consumer vehicles are recommended to enter via the parking garage entrance, which immediately allows them to either pickup/drop-off at the ground level of the northern entrance beside the bike storage, or go up to the vehicle level and access the carpool spots, the rest of the parking garage, or a secondary pickup/drop-off. The main idea was to streamline the car-related programs into a simple route that was regulated to its own area adjacent to (but also connected to) the bus lanes. Henceforth, whether it is a bus, train, or car, the circulation path is straight forward, one-way, accessible, and flexible.

For the occupants of the building, there are two main pedestrian entrances. They are separated primarily by the change in grade on the site as well as location. Originally, the primary entrance was located near the northeastern corner of the site due to it having the lowest graded terrain that allowed for a larger clearing in front. This entrance was to primarily serve the adjacent sites and allow for better access for more of the site including the lower levels of the building that ultimately lies below the main vehicular level. Having this entrance defined the main programmatic blocks of my building. A secondary entrance was then added to the eastern side of the building to better serve pedestrians arriving from Martin Luther King Dr. It includes a small ascent that leads to the pedestrian level of the building, which is two stories above the primary entrance. This entrance allowed for faster access to the terminal areas and in combination with the primary entrance allowed for better pedestrian circulation overall. In addition, the heights of different spaces were adjusted to minimize travel distance such as how many stairs it would take for a passenger to descend from the terminal area down to the bus platform.

The aesthetics of the building is both the most alluring aspect of the project as well as the biggest complaint. Each portion is meticulously designed and redesigned to be unique among the members yet share a similar curvature theme that highlights the use of wood accents. The building was very much designed in stages, beginning with the bus lanes and terminal and primary entrance, followed by the balcony area and parking garage, and lastly the train terminal and secondary entrance. This is because of the nature of the project. The emphasis on using modeling software and techniques (Rhino and Grasshopper) directed the extent of the irregular geometries that scatter the building. The transition into Unreal directed the simplification and repetition of forms and program blocks for streamlined productivity and material application. And the requirements of the project directed the measurements, placement, program features, and realism of the space.

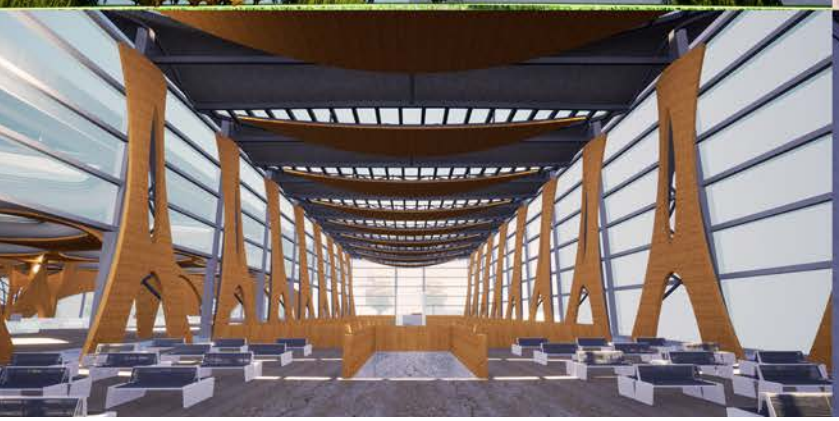
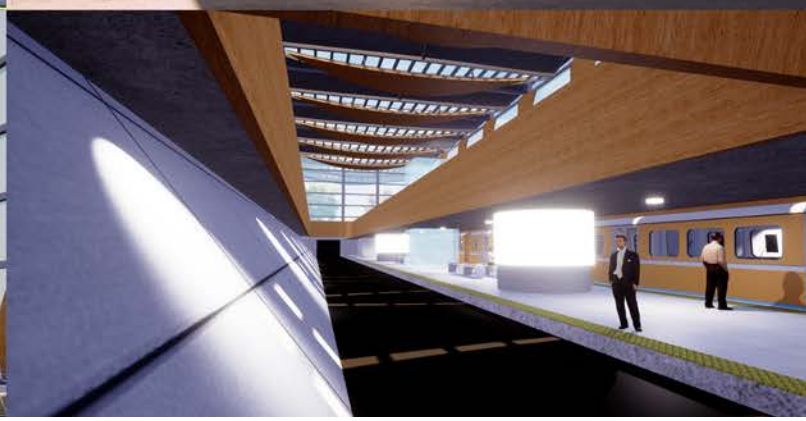
Figure: Project by Kevin Xu









Alan Bossman

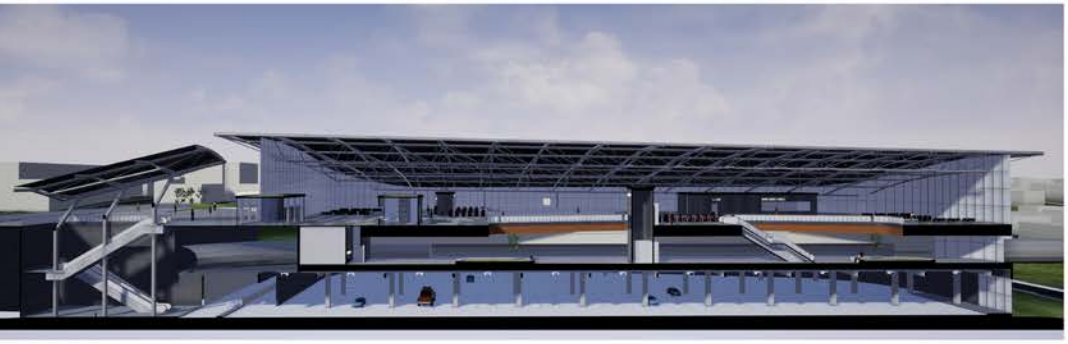
The task of this project was to explore a transportation hub that would be useable for the near future and beyond for a developing area of Uptown Cincinnati. This area looks to become the innovation corridor of the area, a region designed to attract technology-related jobs and become a center for development in Cincinnati. The Uptown Transit Center is designed to allow a multimodal approach to transportation and perhaps allow the modes to change over the station's history. The transit center incorporates pedestrians, personal vehicles, local shuttles, Metro buses or bus rapid transit, light rail or streetcar, and Hyperloop or other long-distance trains. This multimodal approach allows the transit center to adapt as future technologies to develop and as the needs of the city change.

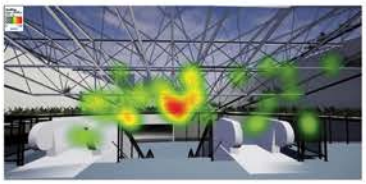
The pedestrian connection from the south end of the building allows for the closest pedestrian access to the future development of the innovation corridor to the south of Martin Luther King Drive along Reading Road. The personal vehicle and local shuttle (i.e. University of Cincinnati, Cincinnati Children's Hospital, UC Health, etc.) have access from Whittier Street to the north, which sits roughly a full story lower than MLK Drive. This allows the vehicle traffic to enter at grade but still be on the lowest level of the building. There is a parking garage at this level and a set of stairs, escalators, and elevators to allow vertical access to the transit center above. This access takes potential passengers to the main entry plaza at the south of the building and allows them to enter the same way a pedestrian does from the innovation corridor.

Upon entering the Uptown Transit Center, there is a large open space under one space framed roof. The roof has a geometric pattern of light and dark translucent gray panels that allow the grand space to be heavily day lit. Space is organized with three terminals: The Metro Bus or BRT to the left, Hyperloop in the center, and light rail to the right. Each space is marked by an elevator core that rises, yet not touching the roof span, and labels the station. The stations exist on the level below and are accessed by stair, escalator, or elevator. Each platform is independent of the other. If one arrives via any of these transit modes, they must ascend into the main space above before exiting the hub or descending to another transit mode. The main circulation of the space implies that one must ascend into the main space before descending to leave. This becomes an experiential moment in the design.

Figure: Project by Alan Bossman


METRO PLUS

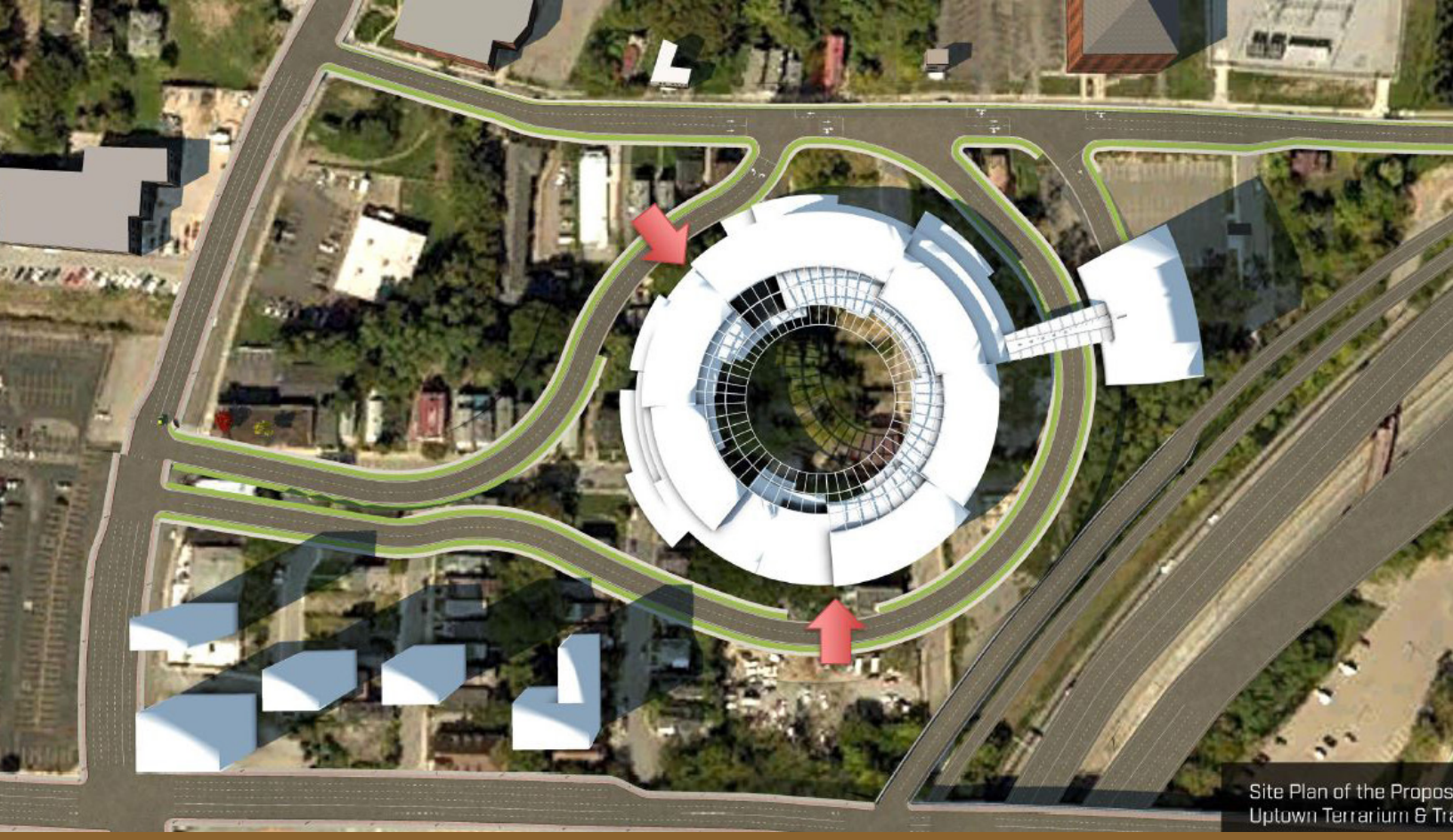





WHITTIER STREET
READING ROAD
MARTIN LUTHER KING JR DRIVE


EXIT


U
UPTOWN



Ganesh Raman

It is known that the perception of forms is directly related to emotion. A major aspect of design for the current studio is the navigation through a transport hub where people coming to the hub and make decisions on where to go to transport them from the hub to their destination. Thus, the objectives of the people visiting the space are clear, the form of the building introduces the perception of being in a constant flux of motion within the building through the typology of the architectural form, geometry of the spaces intended for circulation and therefore the emotion of the people navigating through the building. The author's design vision for the design of the transport hub is to translate the physics of dissemination of kinetic energy in motion as a static representation of architecture for the premise of design of the transport hub that attracts and moves people from/to the focal point of its location – similar to the formation of a hurricane, centriole motion of an ice-skater. The organization is similar to the arrangement of iron filings around a magnet, with movement in repeating split-offset helical paths, similar to the formation of stars.

Figure: Project by Ganesh Raman

Grant Koniski

2035 Transportation Station Description

It's the year 2035, autonomous cars dominate the market, 60% of people in urban areas use an autonomous car daily. A Hyperloop has been introduced on the East and West Coast, coming as far inland as Chicago. Cincinnati has been chosen as a mid-point for this Hyperloop. Many people rent autonomous cars daily; the cars come from a dispatch center and roam the streets taking rides and switching users efficiently. Once the cars are spent, they make their way back to the station. When the autonomous cars arrive, they drive up onto a hydraulic lift and are lifted into the vault where they can be charged and maintained if need be. From the vault, the cars are queued up onto the upper ring of the station by users and the programmed expected need. The cars are then on a rotating queue around the exterior of the building; the ring has lights under the car to tell you if it has been officially reserved or not; if not then you can rent the car straight out of the queue and pick it up on the ground floor. This allows the users to see their choice of cars while they experience the dining, exercise and green spaces.

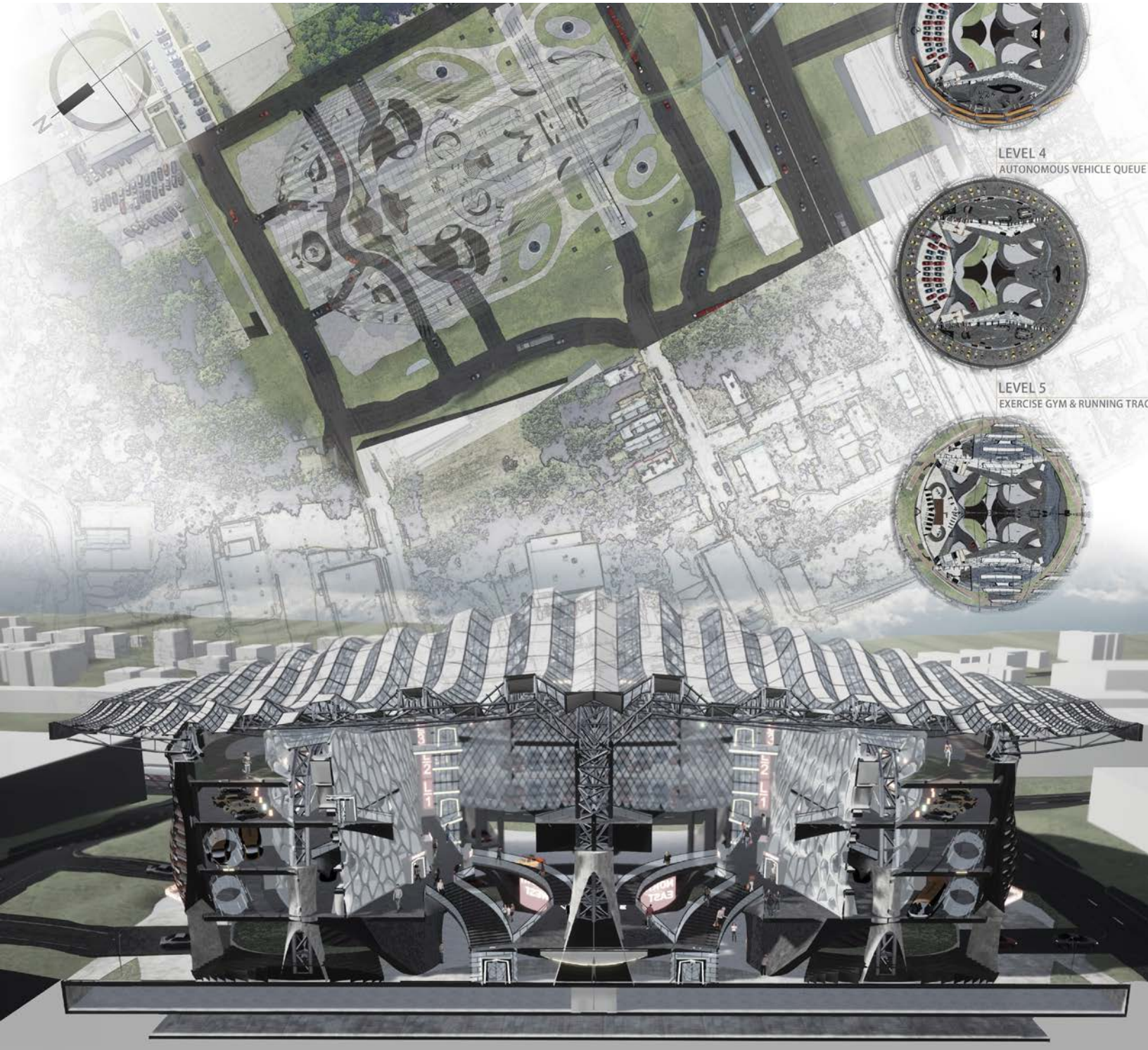
The Hyperloop is brought into the building on the second and third floors. The Hyperloop loops around the building and can switch tracks between the two tracks per level. That allows the North-South trains to function on the second level and the East-West trains to function on the third level. The Hyperloop terminals have staggered open floor plates that allow light and sound to travel between levels. This creates a space that invites exploration vertically; eventually bringing the user to the top cafe, and then green space and track.

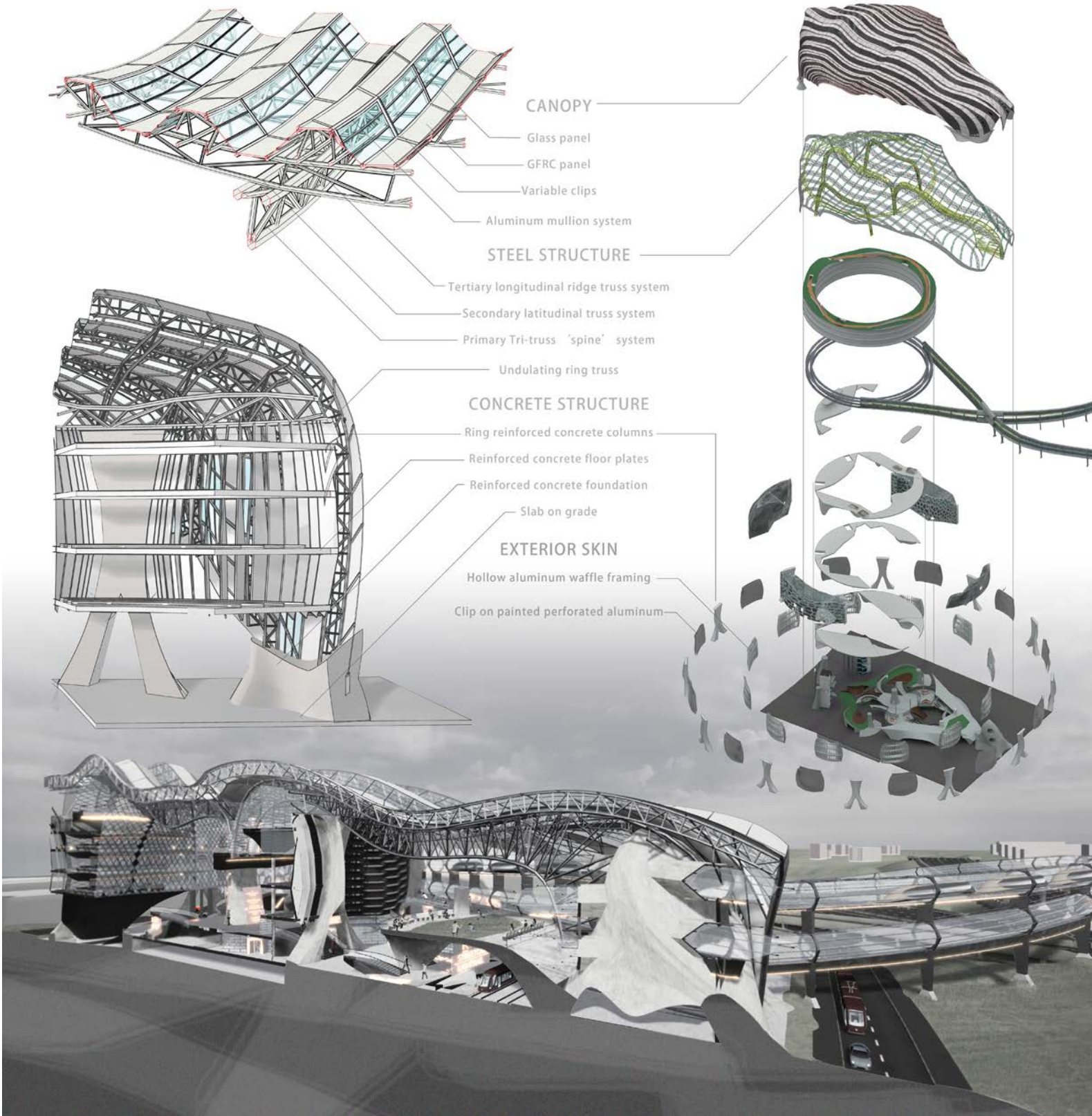
Below the Hyperloop runs an interchangeable streetcar and light rail. The rails turn around and run up reading until it splits down MLK. The streetcar creates an accessible and easy mode of transportation to take people from the innovation corridor to downtown Cincinnati. The lower level also consists of a dispatch center for scooters, and bikes; this allows the users of the space to choose any degree of transportation. Above the scooter and bike dispatch, there are ticket areas and a lounge on the 1.5 level that provide refreshments for the casual seating and un-programmed green space above

on the second level. This creates a space to sit back and watch the trains depart as the quietly move through the concrete foundation intersection of them. On the upper level, there is a south-facing greenhouse that produces most of the fresh produce for the adjacent kitchens on the upper level of the terminals.

On the opposite side of the greenhouse there is a traditional gym with equipment. Around the ring on the upper level is a green roof surface that undulates with the structure; this undulating green surface is intersected and tunneled out to create a running track that continuously connects the circulation of the uppermost ring. The local health professional workforce values exercise and healthy eating; this station is bringing the non-traveler in as well.

Figure: Project by Grant Koniski




CANOPY
Glass panel
GFRC panel
Variable clips
Aluminum mullion system
STEEL STRUCTURE
Tertiary longitudinal ridge truss system
Secondary latitudinal truss system
Primary Tri-truss 'spine' system
Undulating ring truss
CONCRETE STRUCTURE
Ring reinforced concrete columns
Reinforced concrete floor plates
Reinforced concrete foundation
Slab on grade
EXTERIOR SKIN
Hollow aluminum waffle framing
Clip on painted perforated aluminum

Reflection

Eye Tracking

The use of Eye-tracking (ET) for way-finding design has received positive feedback from students. As Josiah Ebert described in his report. "Simplicity and direction of movement are two categories that can be accessed through ET first by observing where a person's gaze is drawn, then by analyzing if their gaze is drawn down the desired pathways or to entry points, and finally, enhancing those points through design to amplify the clarity of direction. The first test of this in my design was, of course, along the pedestrian promenade. As seen in the image below, although the typical gaze does proceed along the path, it also heavily focuses on the seating to the left side and on the view out of the building to the left of the pathway. These are both locations of interest but distract from the actual circulation path which is directing the pedestrian to their desired platform or out of the building. In contrast, the second image, taken from an ET video shows a similar location after further design development. While the person being recorded did eventually look toward the periphery areas of interest, their initial gaze was consistently drawn to the high contrasted gray floor with bright arrows as well as the, again highly contrasted, signage hanging from the ceiling. The washed-out nature of the original space meant that activity claimed the viewers' attention, but by increasing the contrast in desired areas, namely the circulation path, the users' attention was held by the path itself, with the additional areas taking a subservient role."

Figure: Eye tracking result by Josiah Ebert.

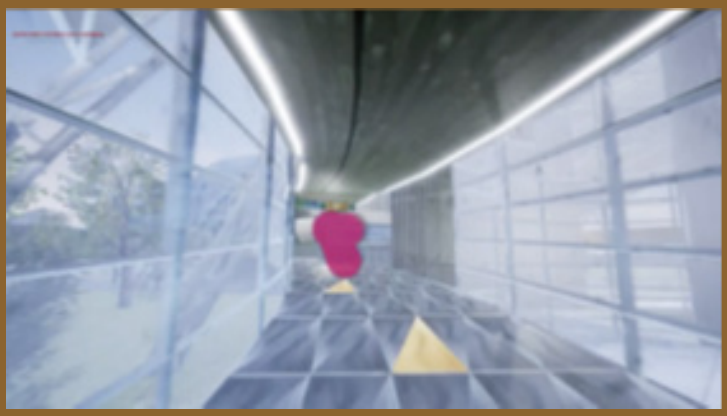
Virtual Reality

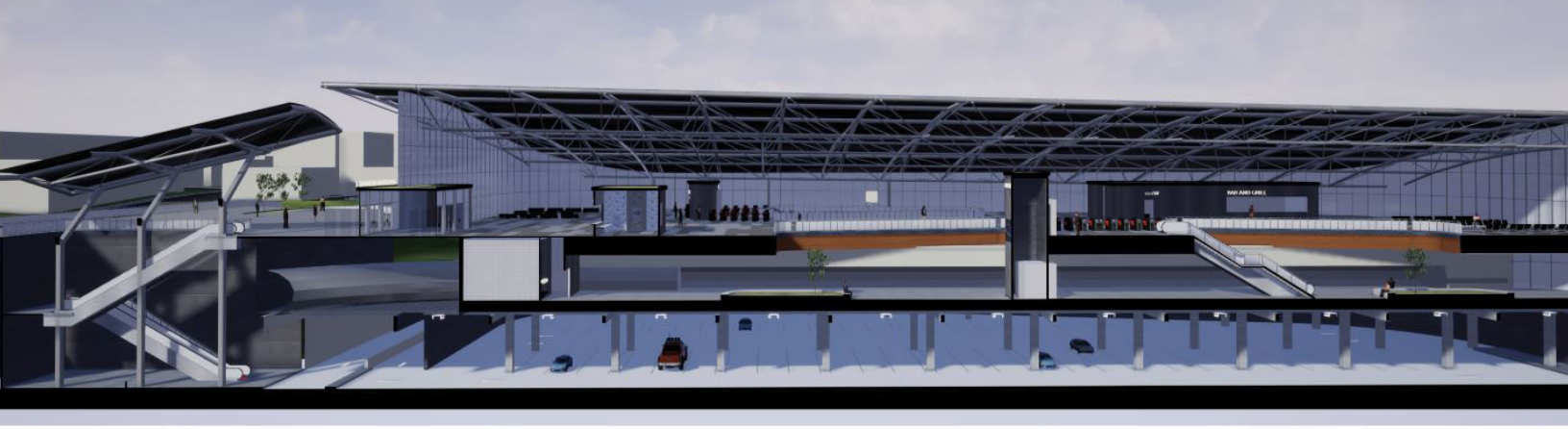
Students also discussed the pros and cons of applying virtual reality as a communication tool in this studio.

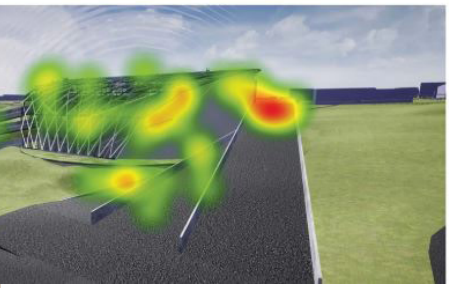
Figure: VR applications in studio.

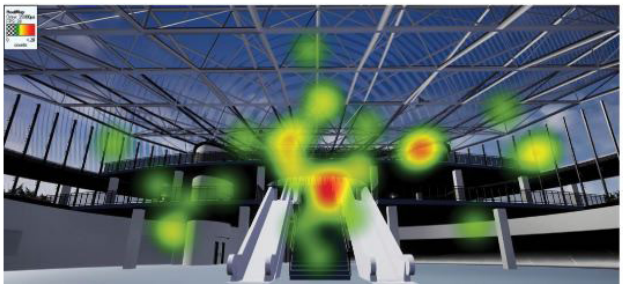
Benefit of VR

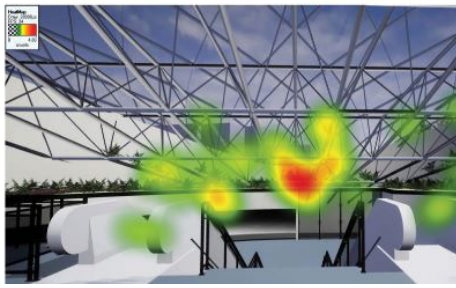
As student Shreya Jasrapuria described. "VR in Architecture is a significant innovation that has been helping designers visualize and design in a more immersive way. It allows the designer to visualize how the built space would look in reality once constructed. In this project, VR was used to understand the scale of the building. Being a transportation hub involving many different modes of transport it becomes important to understand the scale of the space and how each mode works in tandem with the other and how the travelers









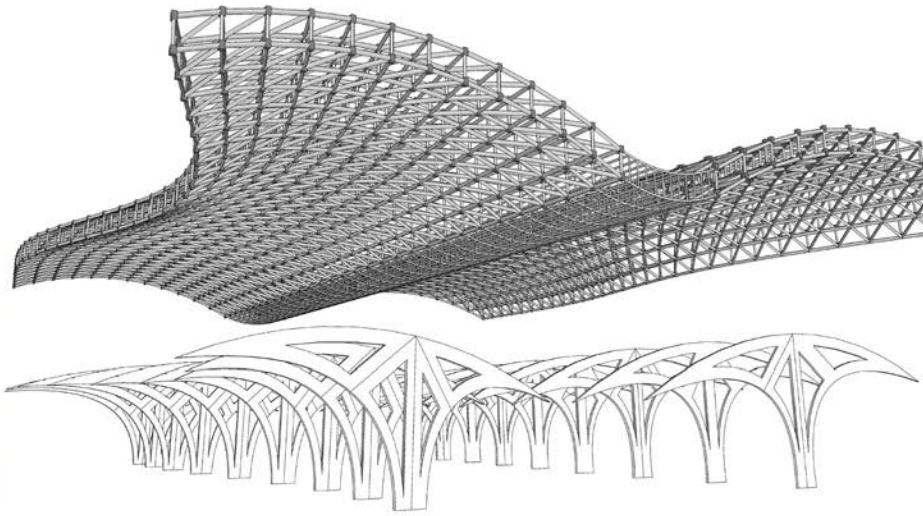


navigate through each one of them or independently to reach them. In this project, the three modes of transport are branched into three different levels and the user uses the central ramp to spiral up to each level. The levels are also connected through two cores at the end two ends of the building for faster vertical transportation across the hub. VR experiment through space helped understand the time it would take for a traveler to reach from one point in the hub to the other depending on which path they take. Depending on the time taken, proximity to the cores was decided and other elements of interest were introduced in the path to keep the journey eventful. VR also helps understand the view of a place from different angles as opposed to a single rendered image developed to understand the space. This helped me in this project to create spaces while experiencing them from different angles allowing for a more detailed approach to design and considering every small element in the whole design. It helped me develop how the traveler would approach the video information walls and interact with the same to generate tickets for the modes of transport they intended to use. It also helped me understand how different levels within the hub interacted with one another both visually and physically."

Student Kevin described applying VR to evaluate his design. "My VR experience combined with the gamepad controls revealed a new aspect of architectural representation: the passage of time that occurs when exploring space. Being in a VR space better attenuates the perception of the design towards the natural human physiology, requiring the effort to move one's gaze, the limiting of one's field of view, and the patience required for traversing through the building. As such, VR is, on one hand, expansion of the capabilities of digital representation by incorporating human-like conditions, and on the other hand, is a limiting factor to how one can move around. This affected the sequential nature of my buildings programs and the positioning of its various programmatic blocks to be better suited to the natural expectations a visitor would gradually develop as they traverse through the building. This also highlighted several shortcomings, such as the relatively isolated balcony space above the primary entrance, and the somewhat confusion transition between the two terminals. Meanwhile, more monumental aspects of the aesthetics such as the building facade and accented columns stood out more when experienced ground-level in VR."

As student Grant Koniski described in his final report. "Designing a smooth promenade in a building is often a mental task that takes a lot of hours looking at drawings, 3d models, physical models, and mental visualization. That is the typical architectural workflow but through the use of Unreal Engine's VR blueprints and the oculus rift headset we were able to walk through the building in first person VR. This allowed me to better understand

Underground Tunnel Hyperloop



Longspan Truss

the visibility of the wayfinding. Using the drivable car blueprint in tandem with the walking character with video game controls allow me to easily navigate my building to understand what circulating through the building would actually be like. After each progress export in the unreal engine, I would walk around in VR and give myself a design critique as I moved through space sequentially. These design critiques allowed me to take the ideas I had out of my head, onto the sketchbook and then eventually into rhino and unreal. VR was also a great help when it came to checking the scale of spaces and understanding the bodies relationship with the architecture. "

Constraints of VR

As student Josiah Ebert described in his report. "In experiencing an architectural project in the context of a VR environment it is important to first note the changes in design approach and limitations that VR entails. One of the most obvious, but also most drastic of the changes is that in a VR environment, every connection and surface of the building must be developed in connection to the other spaces because all views are accessible to people interacting with the project. Whereas typically a meticulous set of very developed views is used to portray a project, in VR the entire space must tell the story of the project. While it has drawbacks, this approach is an advantage in that anyone who experiences a building in real life does so by walking through it and observing the spaces in real time. Although snapshots may have more clarity in the purpose or reason behind the design, that clarity is a false clarity – nowhere in real space does it exist. Thus, although it is much more difficult to tell a story in real time 3d space, the story told through this mechanism is much closer to the experiential story of the potential building's users. The disconnection between visual and physical movement and interaction with a space that is innate to VR holds some design implications as well. For instance, there is almost always innate mental disorientation during a VR experience especially as the experience appears to approach closer and closer to reality. Because of this, presentable scenes actually encouraged in some cases to maintain a certain level of abstraction because of the mental disconnect between seeing, but not physically moving or experiencing a space. While it would take more study to take solid design conclusions from these experiences, it is quite possible that this abstraction is impactful in the kinds of spaces that are built using VR during the design process. "

Reference:

Uptown Cincinnati Urban Mobility Studio Course Website: Animation. Demo walkthrough. VR Game download at

ARCH 8001 Spring 2019
ARCH 4001 Fall 2018

UC Forward grant. Project-Based Collaborative Coursework for Developing Connected Transportation Network and Accessible Multimodal Hub in Uptown.

Co-PI: Heng Wei, Na Chen, Xinhao Wang, Jiaqi Ma, and Ming Tang.