almost level

a pedestrian bridge

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By Zhen Wang

Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Master of Architecture

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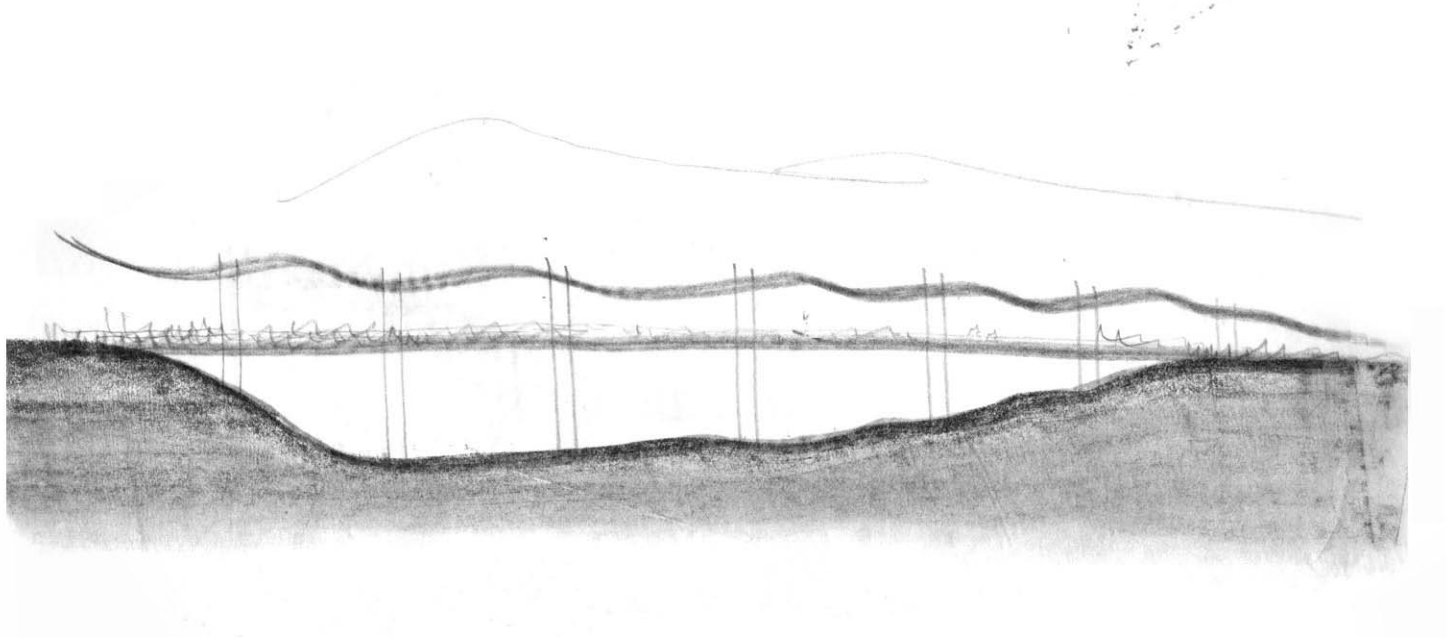

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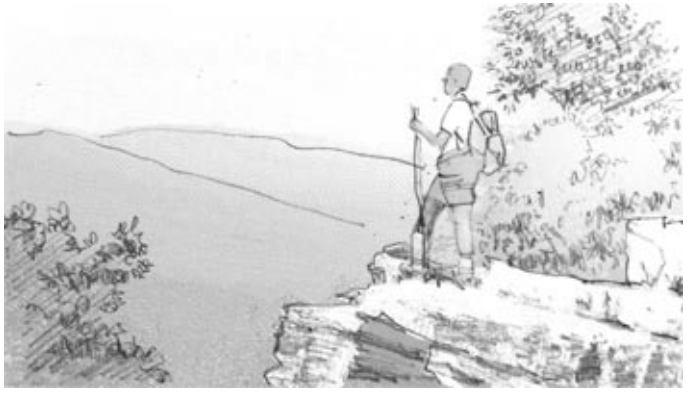
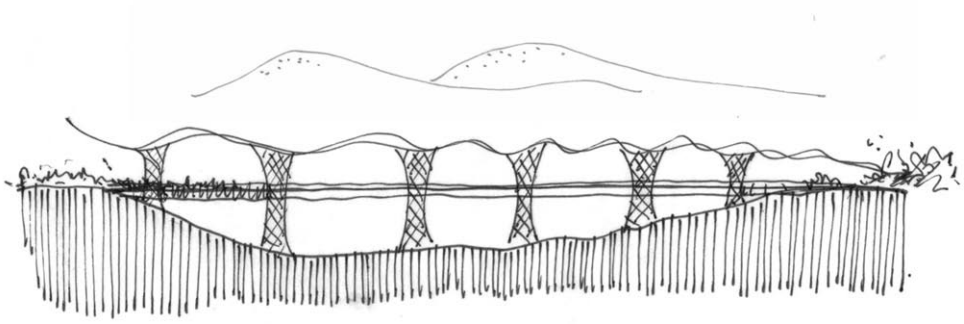


Abstract

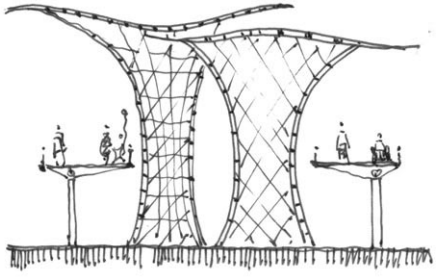
Taking the shortest possible distance and staying on a leveled surface is an intrinsic part of human nature. The bridge, a powerful invention realizes this human desire. It connects very directly otherwise separate locations and it saves time and energy while crossing the gap between them. Its elevated surface offers us different views to the world.

This project proposes a pedestrian bridge as an elevated surface. The bridge allows people to reach their cars and other destinations across topographic variations, while being sheltered from rain and sun. Its scale and location will designate it as a signature element in the campus plan.

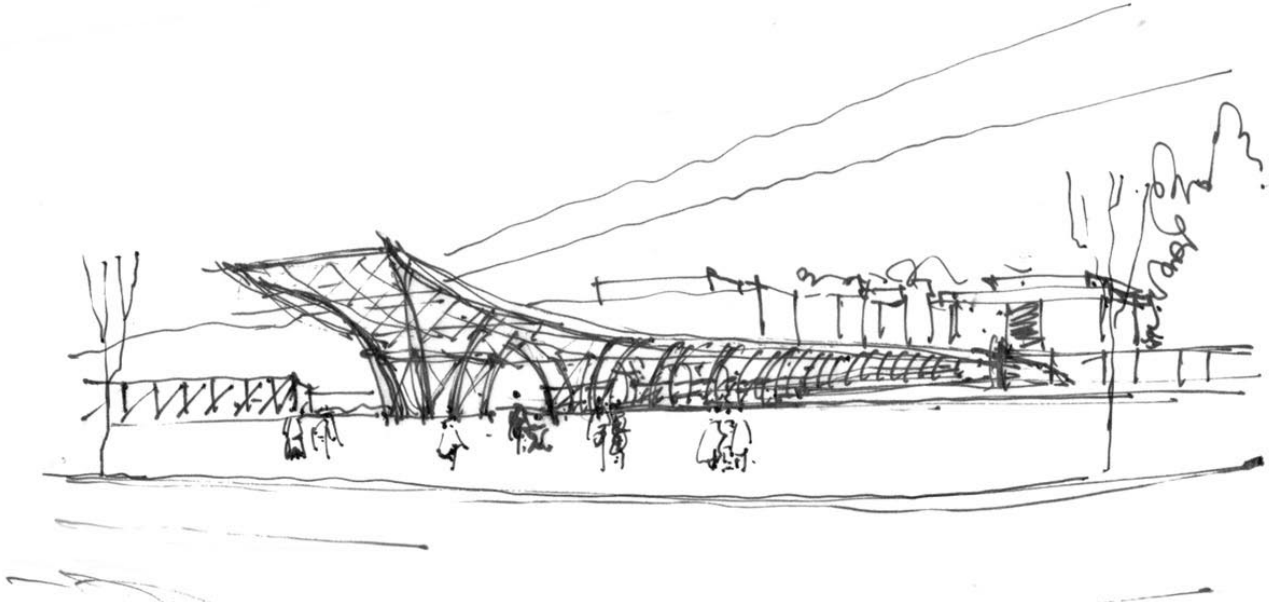
Contents



An early sketch



An early sketch of the canopy and the lifted-up walk path



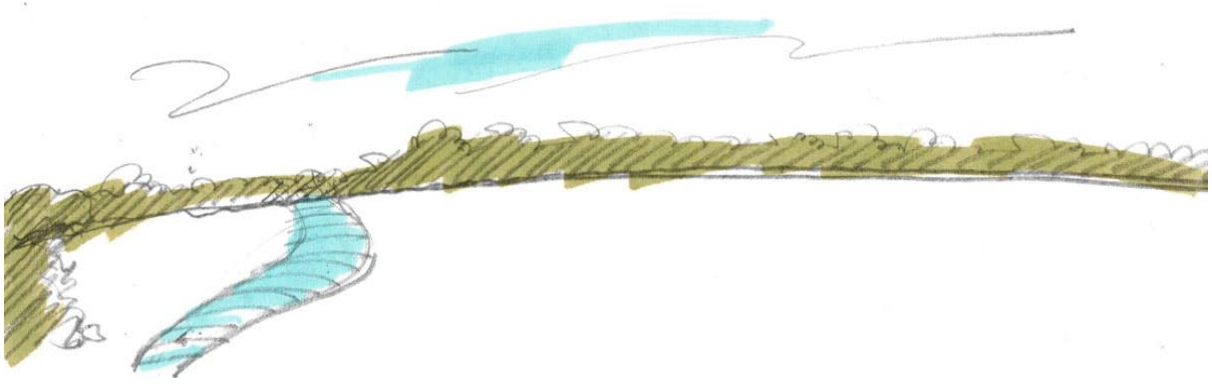
A sketch of the view from the intersection

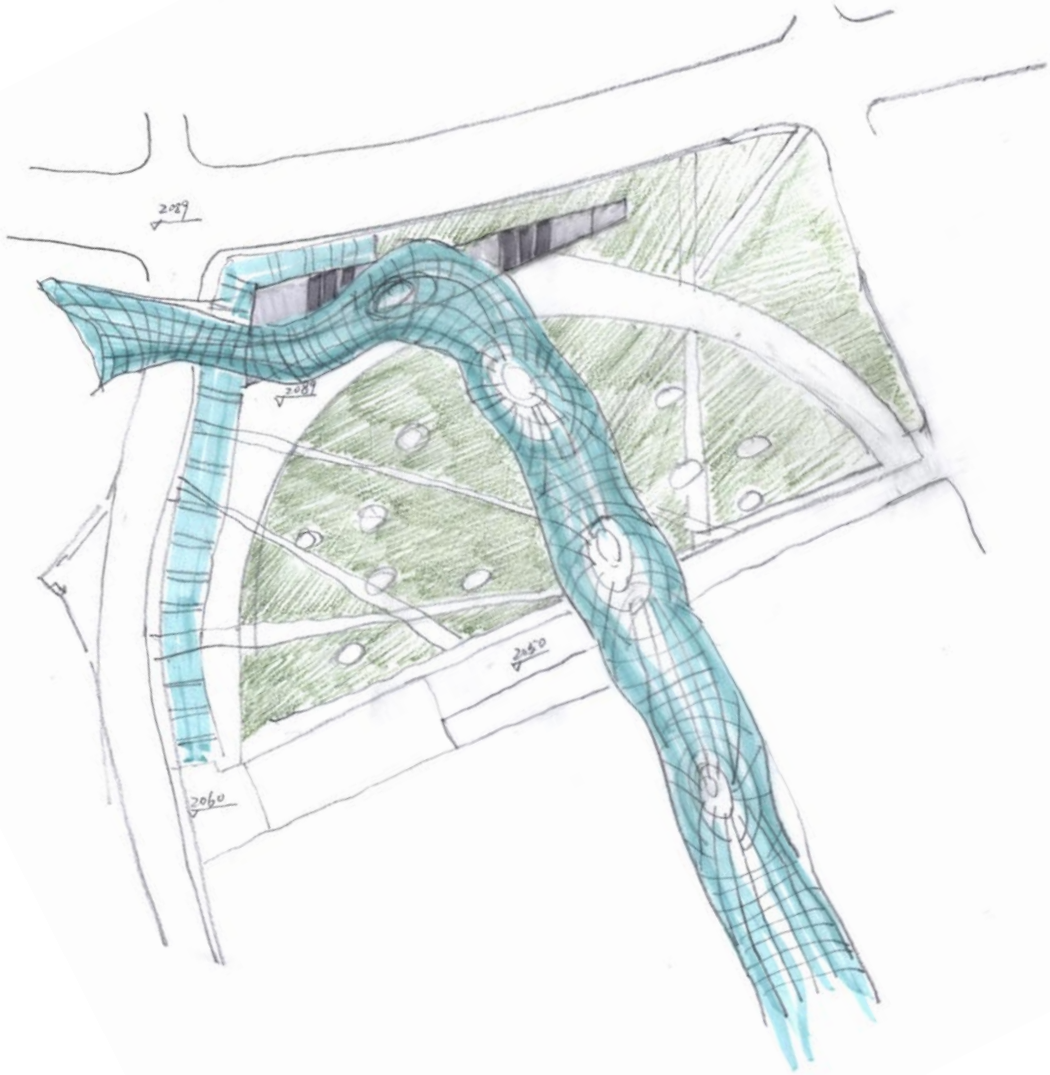
Premise:

- The bridge is an architecture of connection.
- The bridge is an elevated surface for people.
- The bridge is an identifiable landmark for the school.

Preliminary Studies

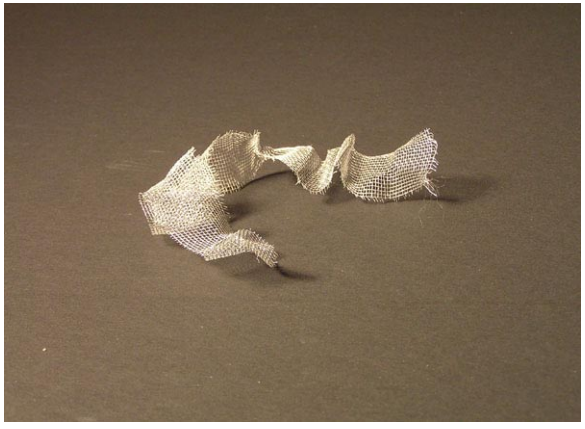
In my dream, I conceive of a beautiful scene: under a crystal clear sky, the continuous Blue Ridge Mountains become a backdrop. The canopy of a bridge begins from a green surface and extends toward the central campus.





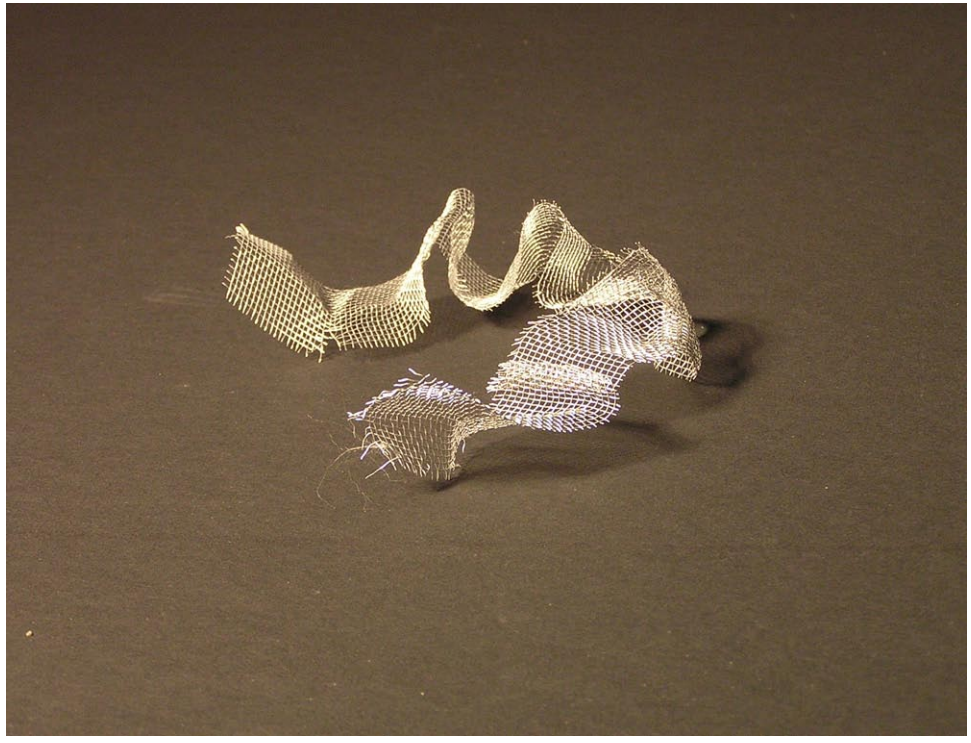
The canopy is conceived as a gently woven fabric which allows natural light to penetrate. It is a light structure and a structure for light.

The green surface is actually the roof of a parking deck. Numerous light wells conduct direct sunlight into the lower garage levels.



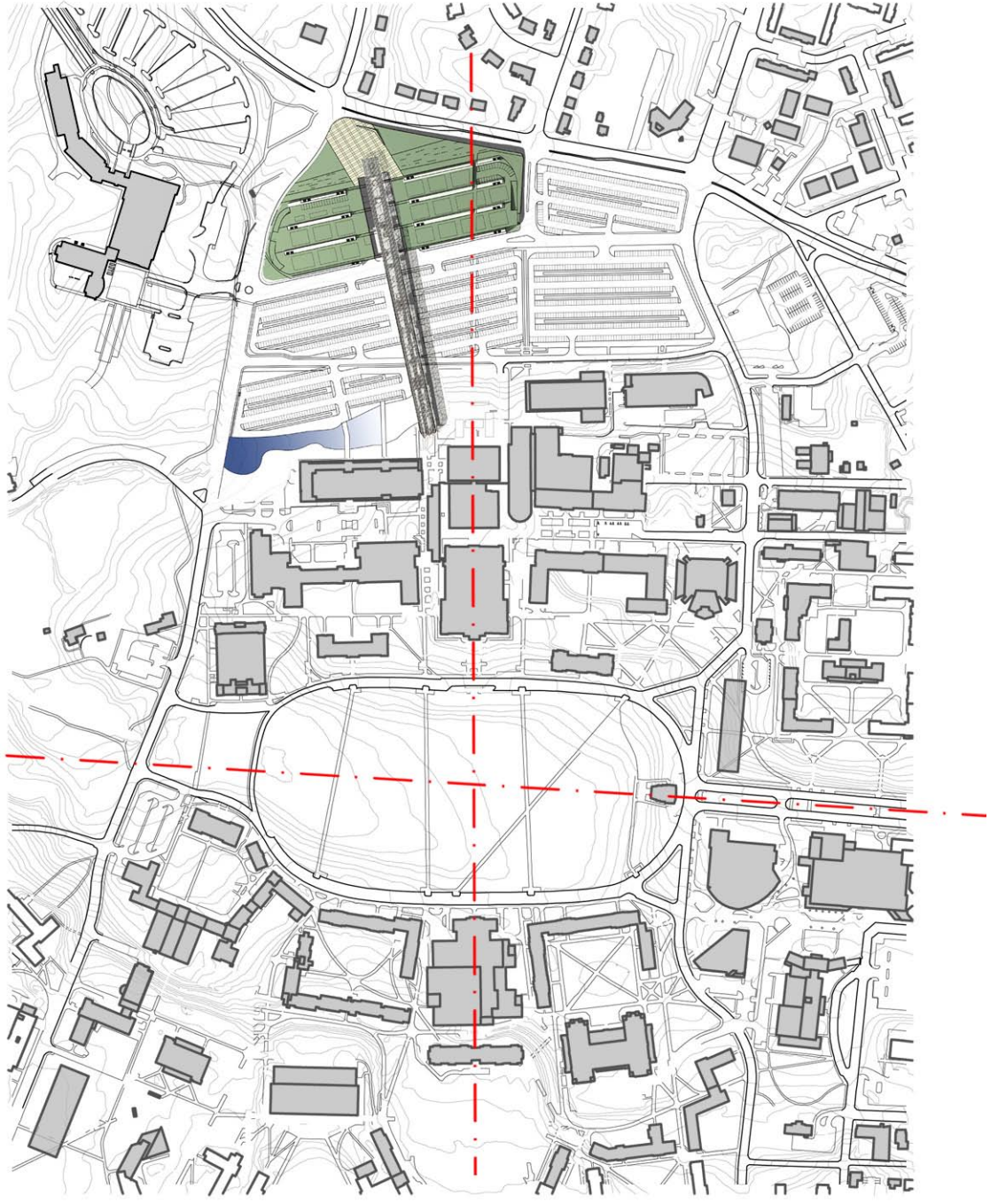
An early conceptual model of the canopy:

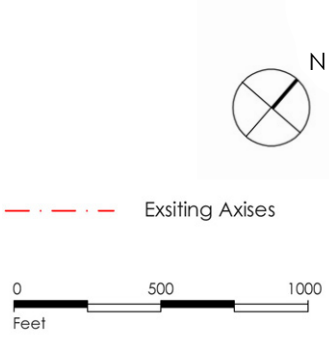
A fabricated surface to be continuous and dynamic;
A structure with lightness;
A structure to play with light;
A new element for landscape;
.....



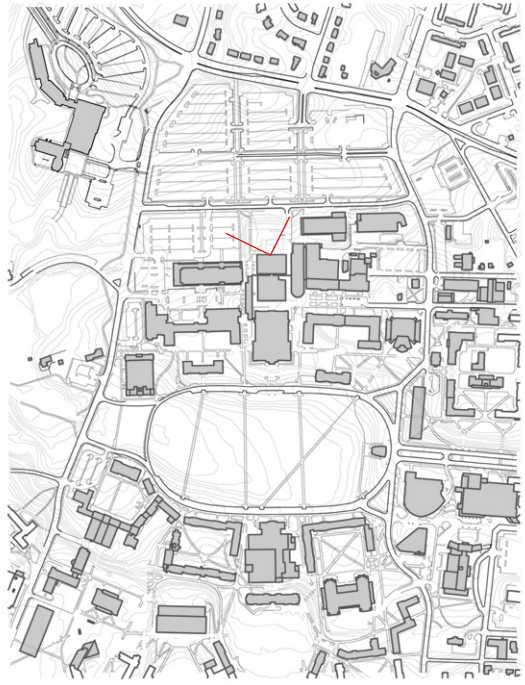
The Terrain

In the design proposal, a 900 hundred feet long pedestrian bridge is placed over the Price's Fork parking lot on the Virginia Tech campus. It begins at the intersection of Price's Fork Road and West Campus Drive, a possible location for a visitor center for the university because of its exposed setting. The linear structure directly leads from the edge of the university to the central campus. Everyday, a large number of students walk through it from the parking spaces to academic buildings. It is both the start and the end of their daily school journey.

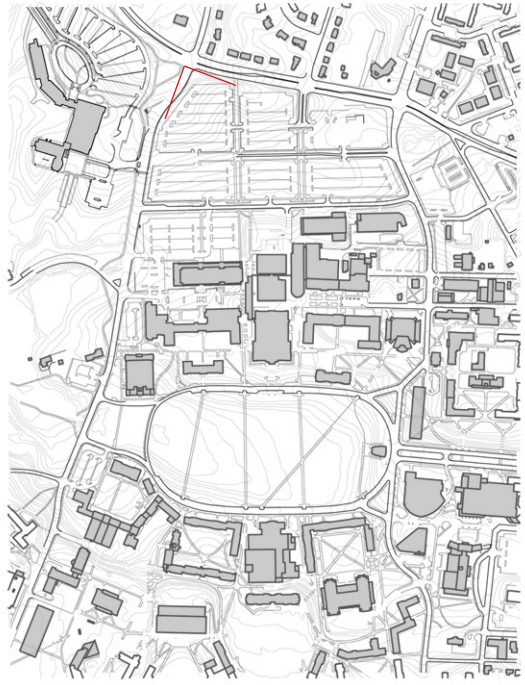




Corner view from Cowgill Hall for the proposed bridge and green roof parking garage

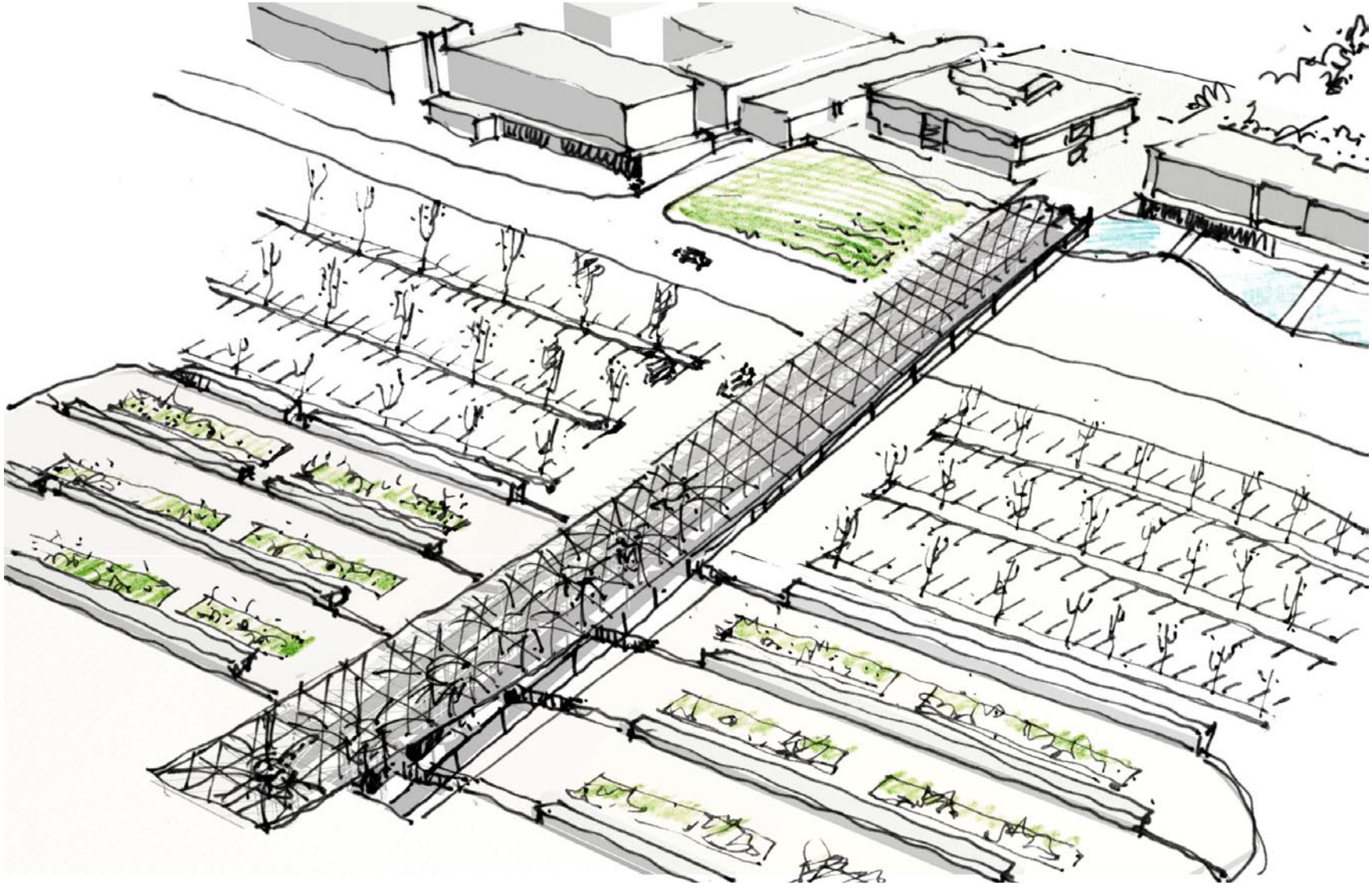


Existing corner view from Cowgill Hall

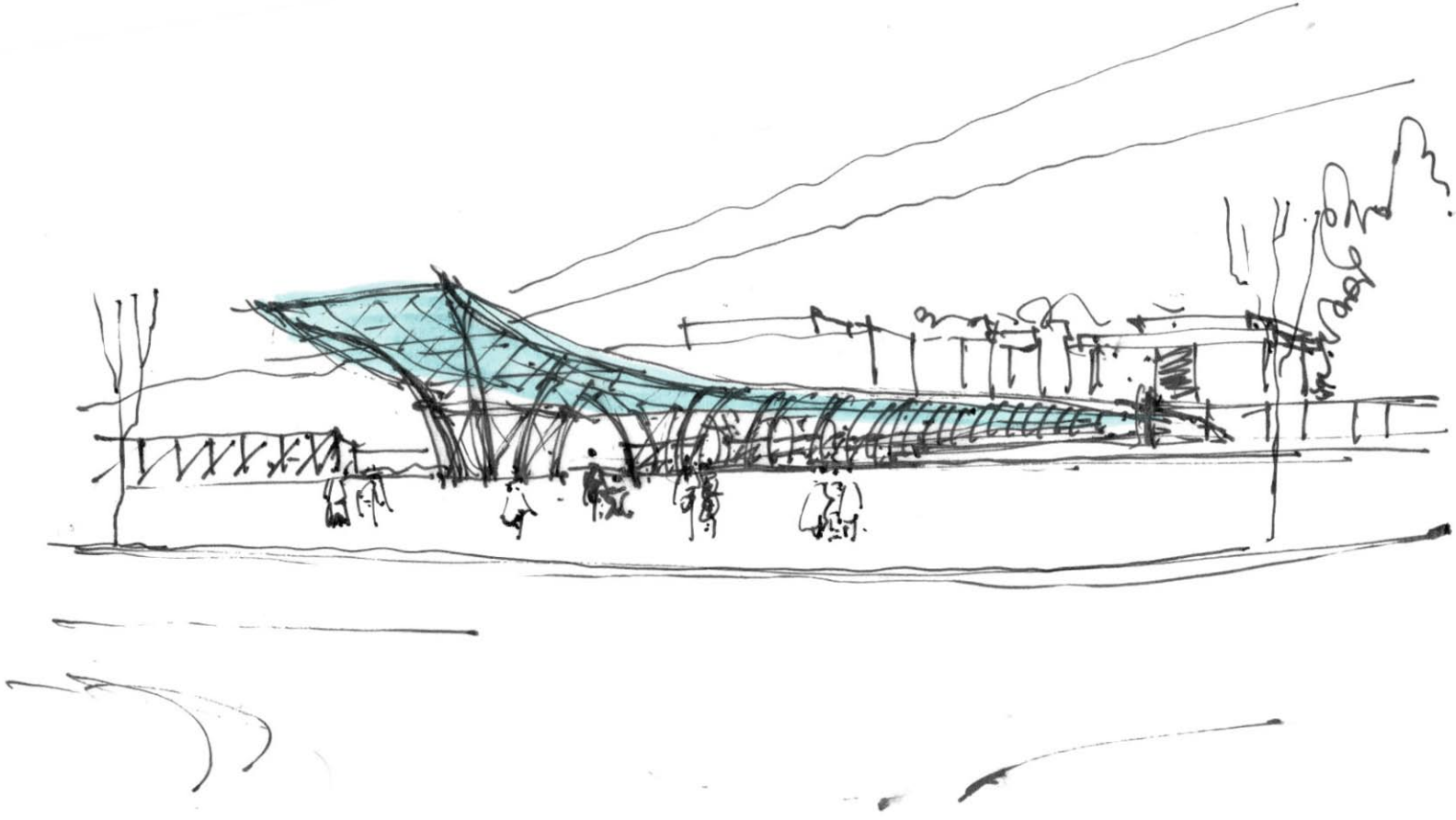


Existing condition from the intersection of Price's Fork Road and West Campus Drive

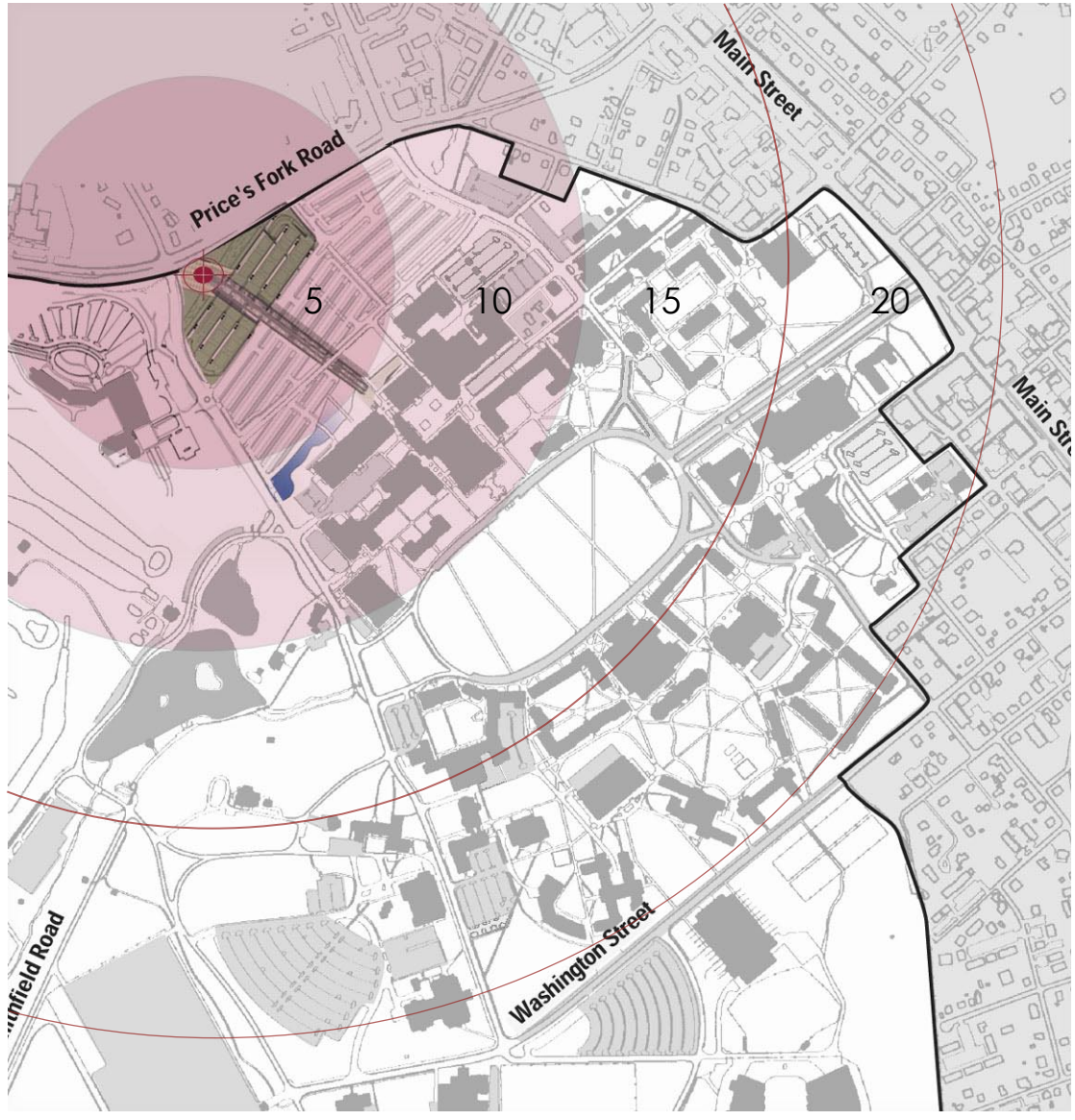
Aerial view of the proposed bridge



Sketch shows the view from the intersection of
Price's Fork Road and West Campus Drive



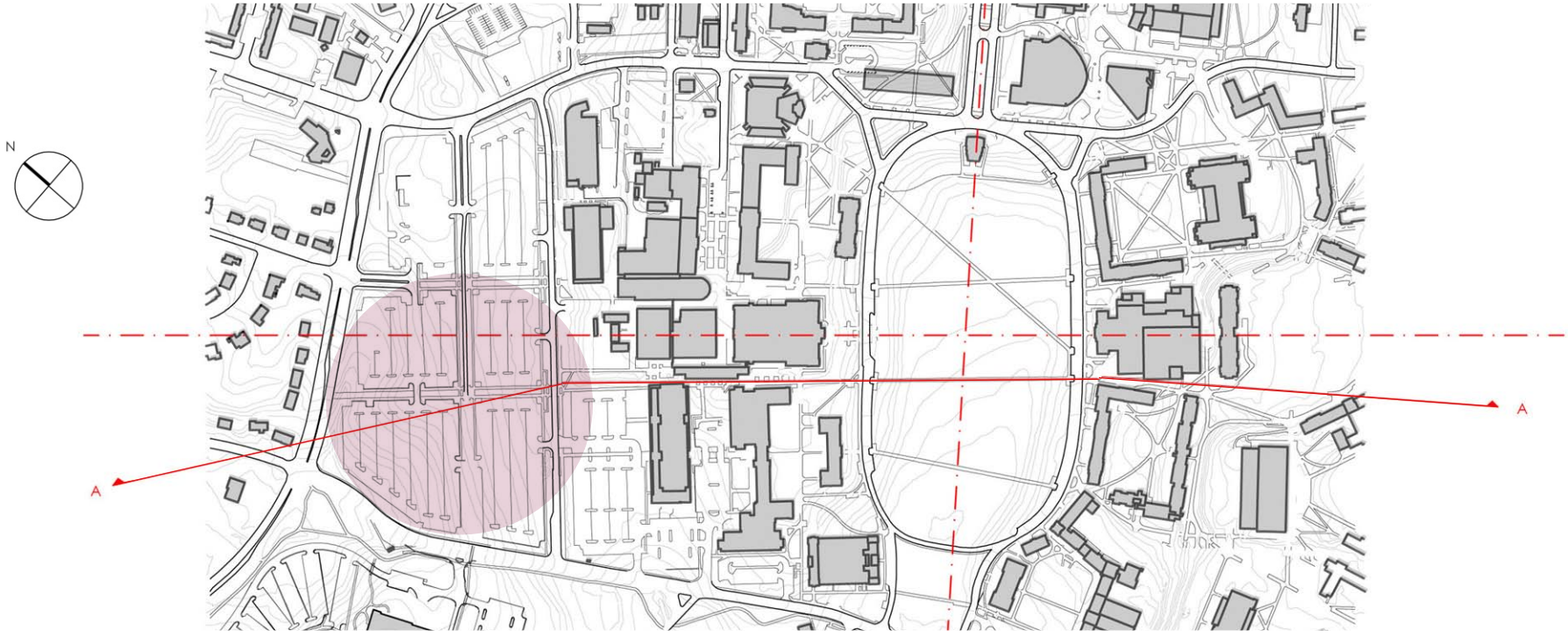
The bridge and the existing pedestrian network:



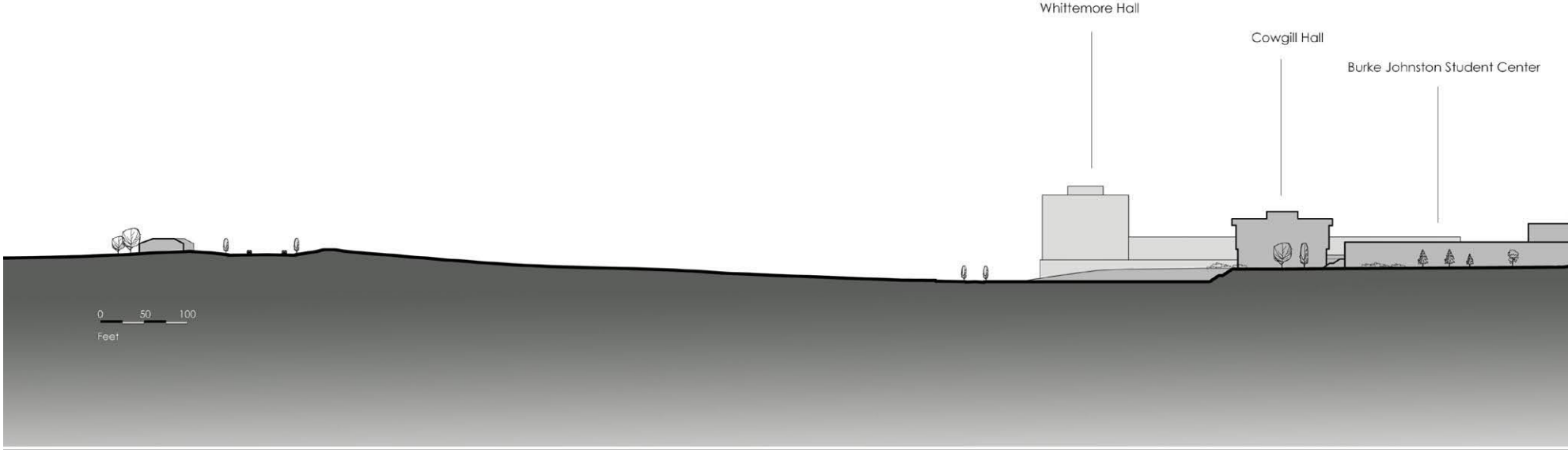
5 minutes walking time zones:

5 minutes walking distance

The starting point of the bridge



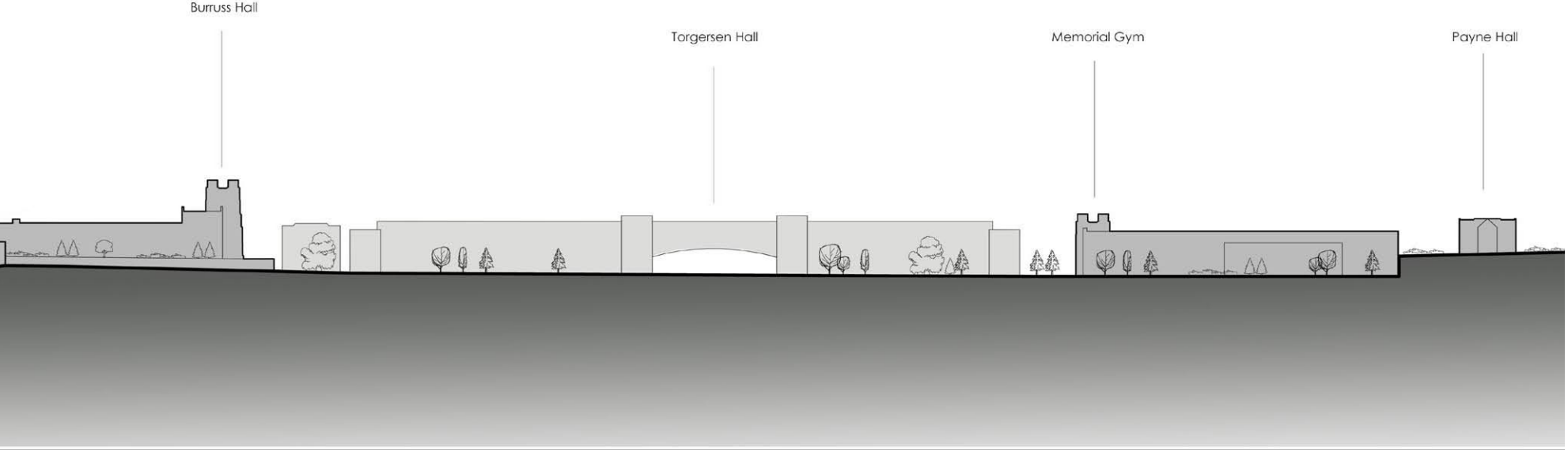
Proposed site


Whittemore Hall
Cowgill Hall
Burke Johnston Student Center
0 50 100
Feet

Section through the central part of the campus:

____ the topographic variation of the existing site provides the opportunity to forge an elevated surface

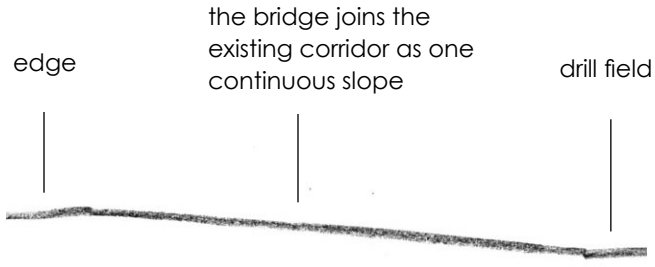
____ a pedestrian bridge can span the topographic differences and tie directly into the campus pedestrian network.



A-A

Two possibilities to connect to the existing pedestrian network:

1. The bridge is slightly inclined and ends at the level of Cowgill ground floor. In this way, the bridge directly joins the existing pedestrian corridor along the Burke Johnston Student Center smoothly as one continuous slope.

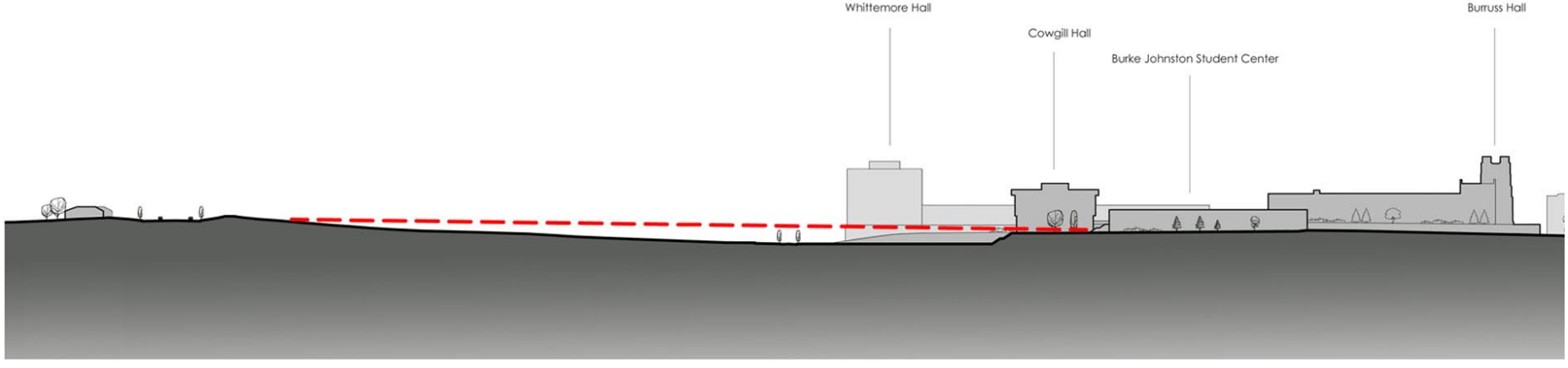


The bridge joins the existing pedestrian network at the platform between Derring Hall and Cowgill Hall:

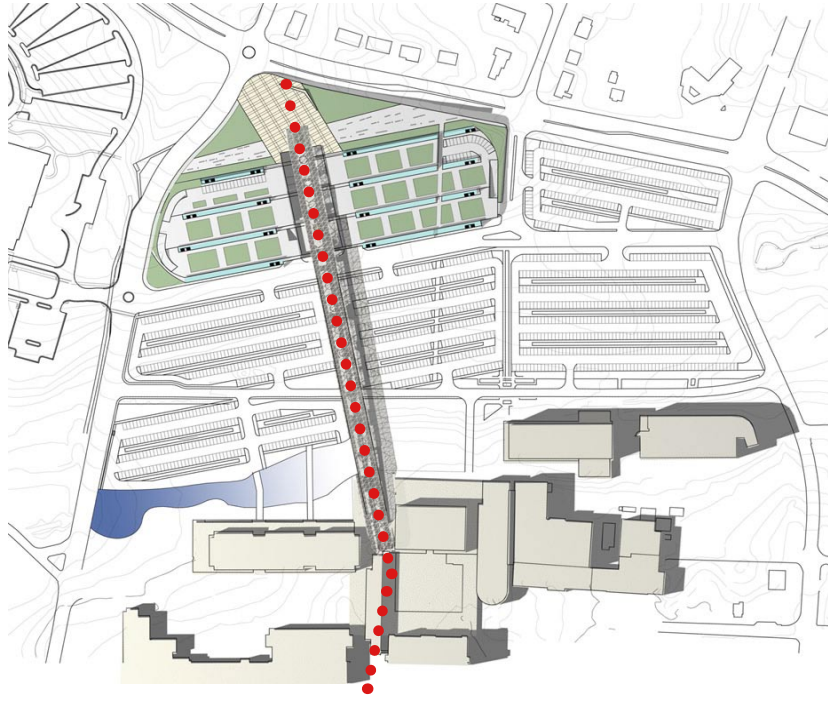
Heavy pedestrian use

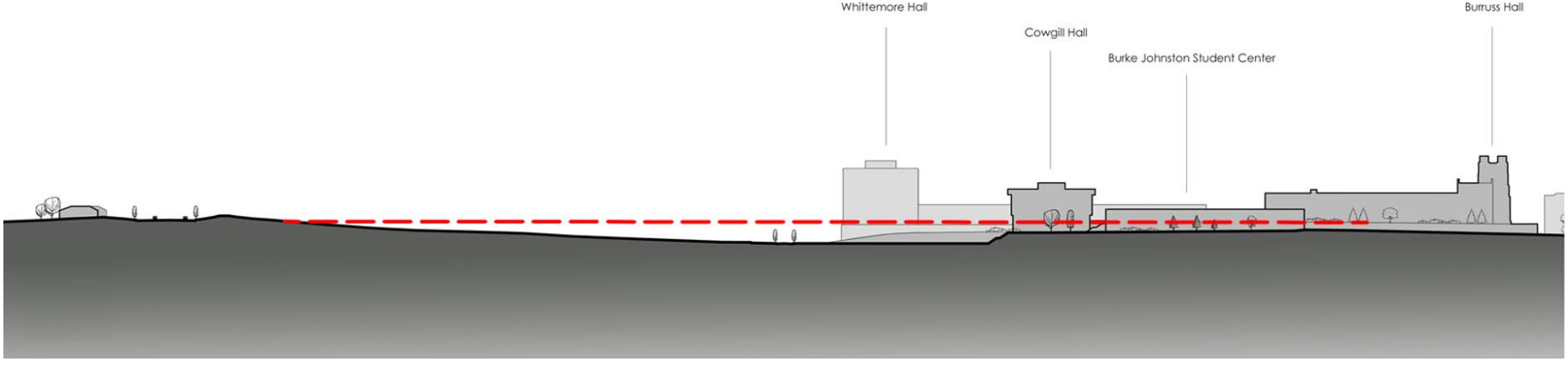
Light pedestrian use

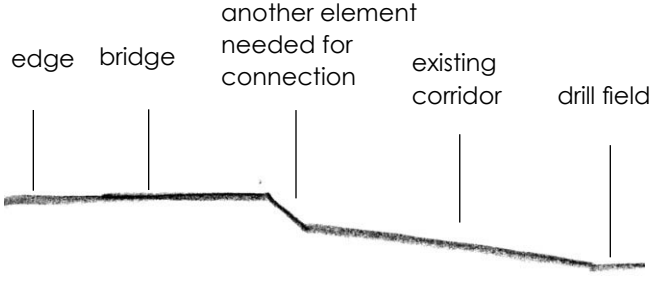
The existing pedestrian corridor along the Burke Johnston Student Center.


Whittemore Hall
Cowgill Hall
Burke Johnston Student Center
Burruss Hall

2. The truly level bridge ends at Cowgill Plaza. The 15 feet elevation difference between the plaza and existing corridor along the Burke Johnston Student Center would require a longer and taller bridge construction. An additional element may be needed to connect the bridge to the existing corridor.

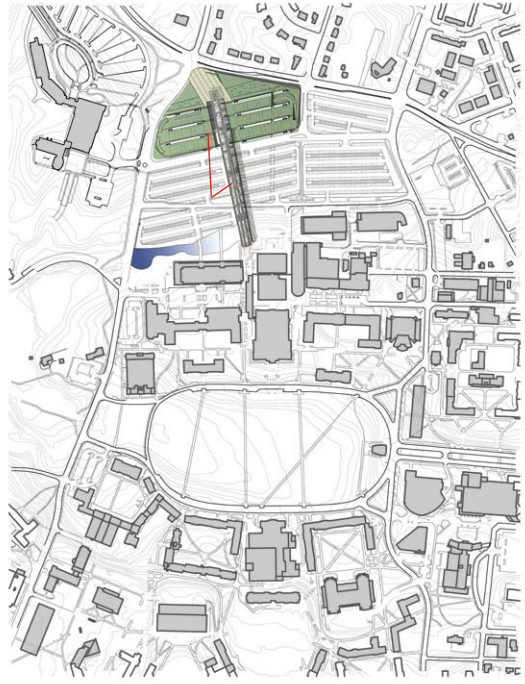






Cowgill Plaza

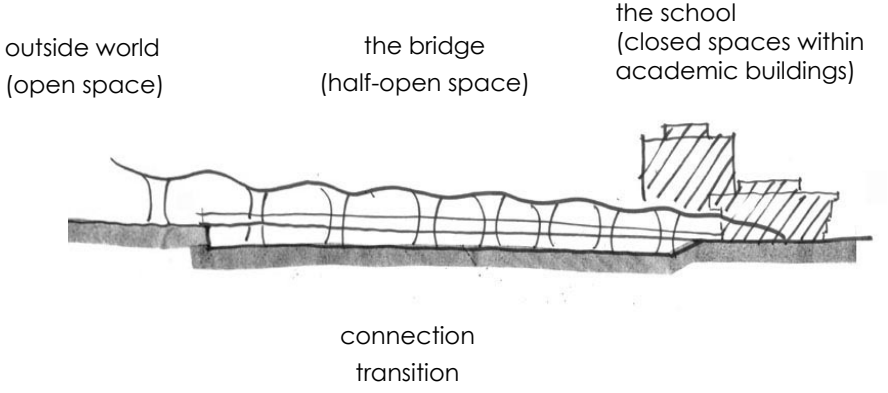
The Bridge

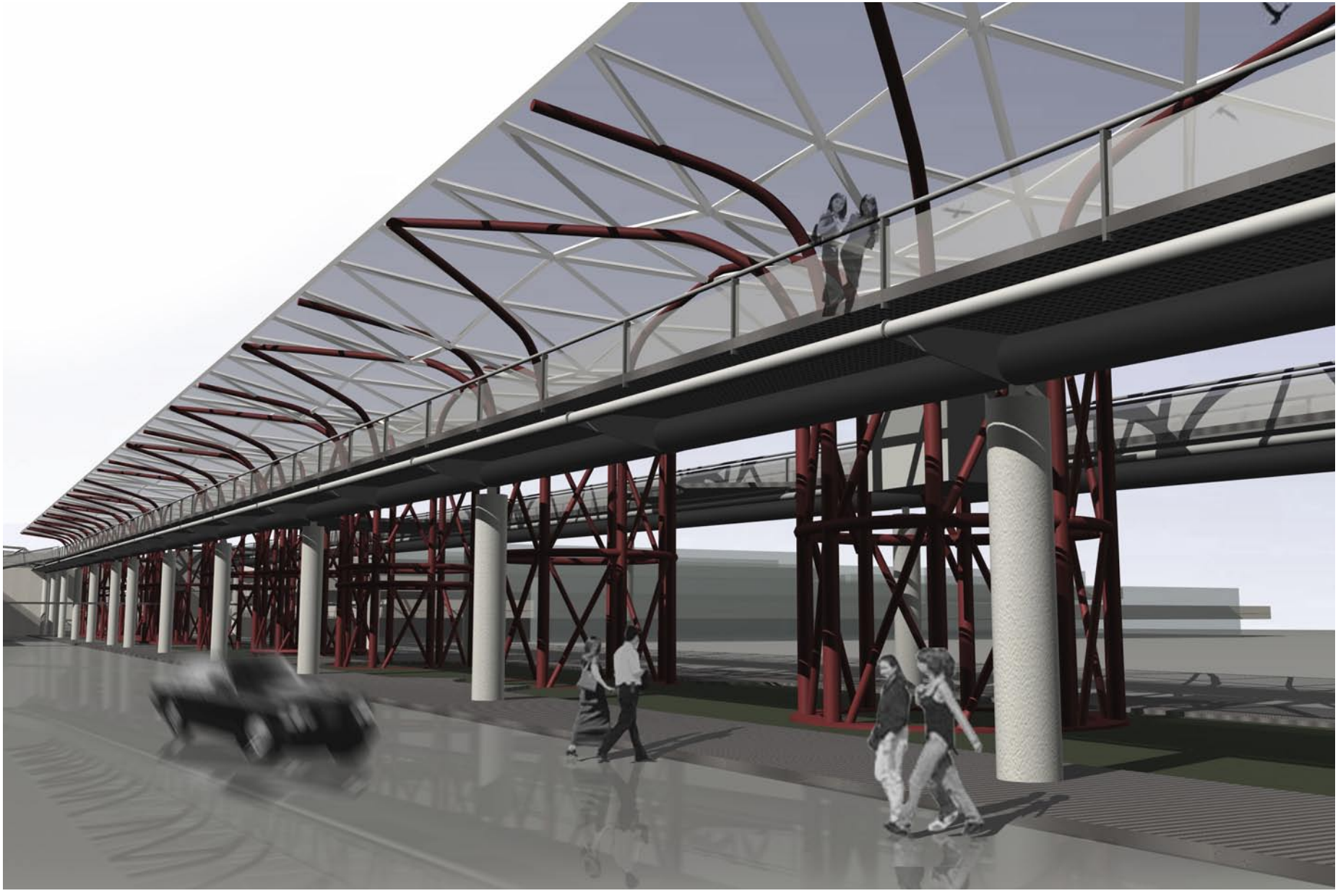


The structure is a direct answer for the purpose of connection. This simple linear geometry represents the continuity of vision. In three-dimension, the waving, undulating roof defines a half-open dynamic space.

This space is for transition and full of wonder. It is a space between the world of school and the world outside, where students would get ready and anticipate an exciting school day as they arrive.

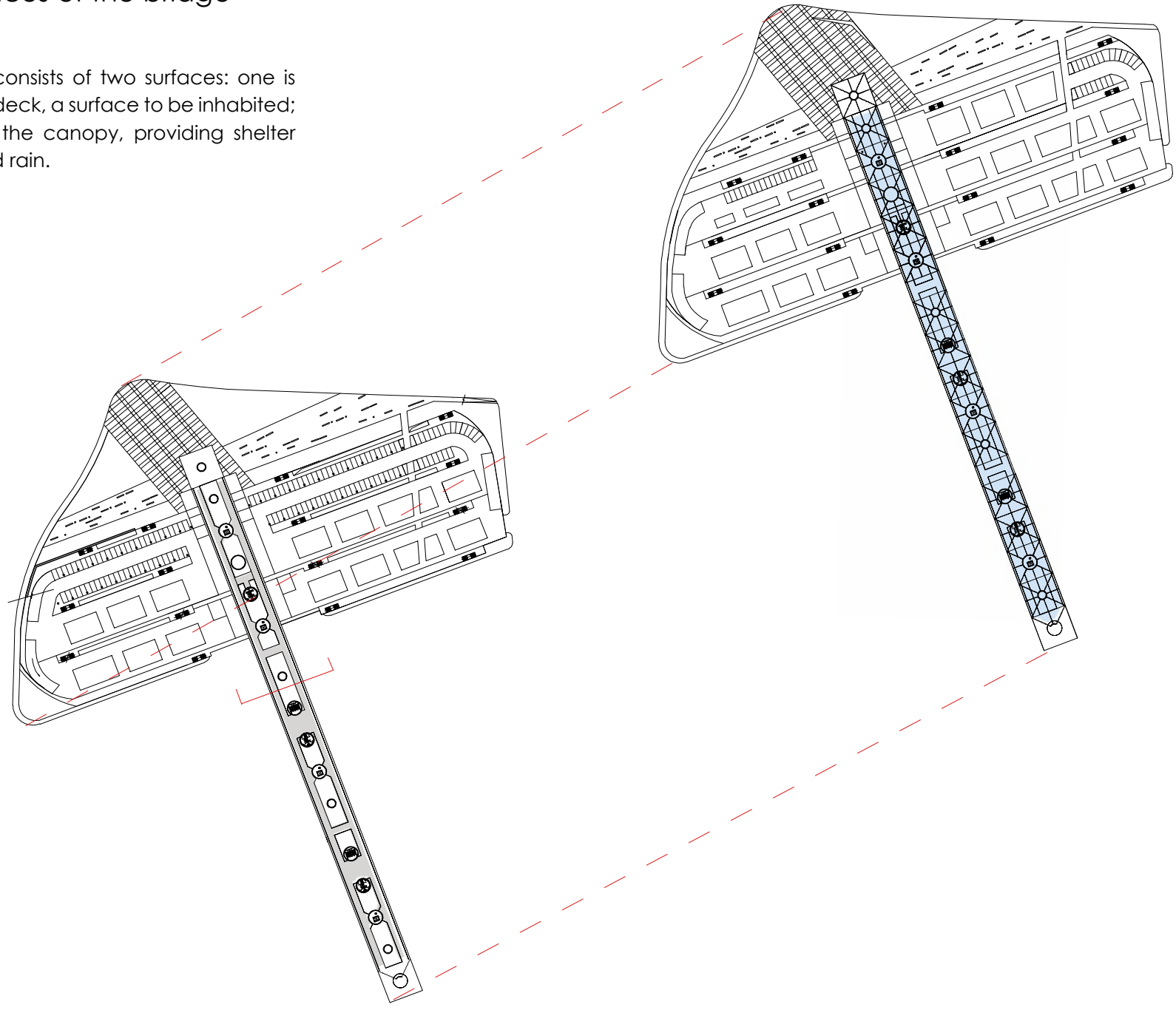
Contrasting with the heavy appearance of existing buildings, a structure with steel and glass is selected to provide an elegant transition. Like other glass buildings, the glazing roof reflects and refracts light and therefore the space under the canopy is luminous, even at the ground floor. Grass is planted between the walkways at the ground floor.

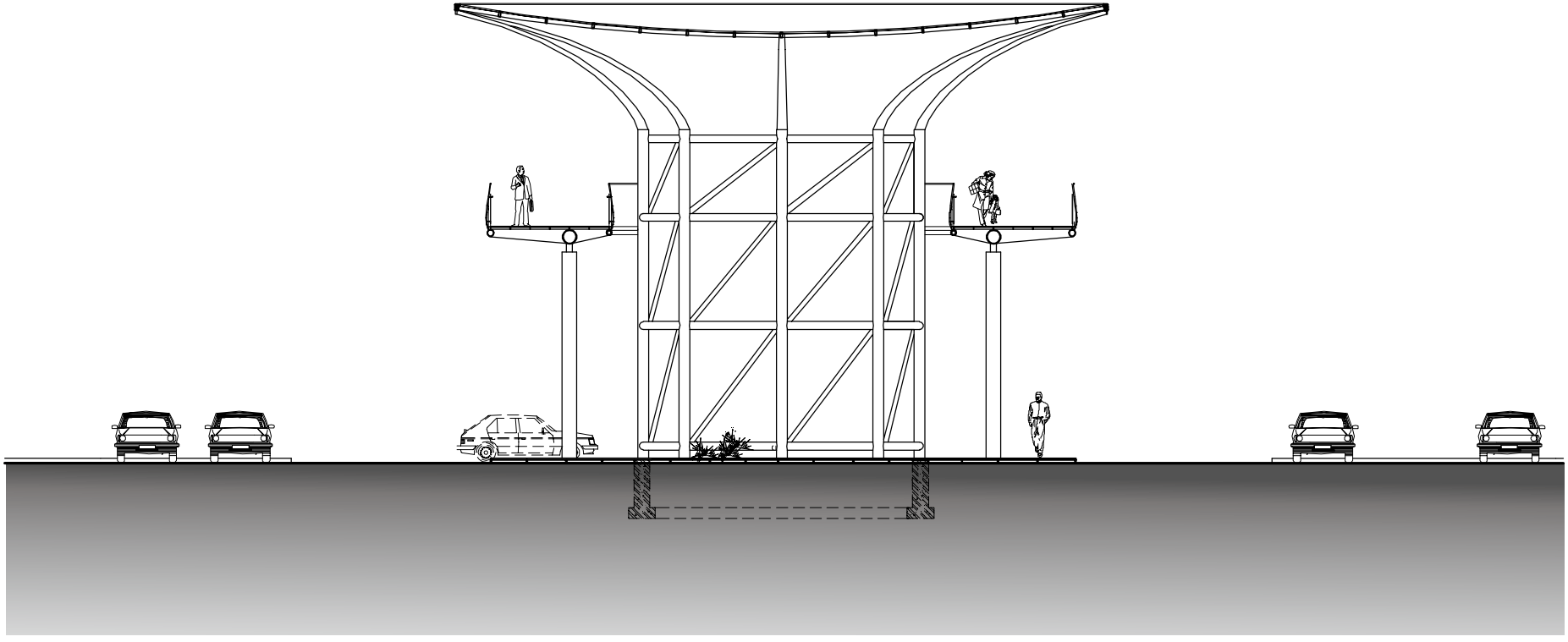




Two surfaces of the bridge

The bridge consists of two surfaces: one is the walking deck, a surface to be inhabited; the other is the canopy, providing shelter from sun and rain.

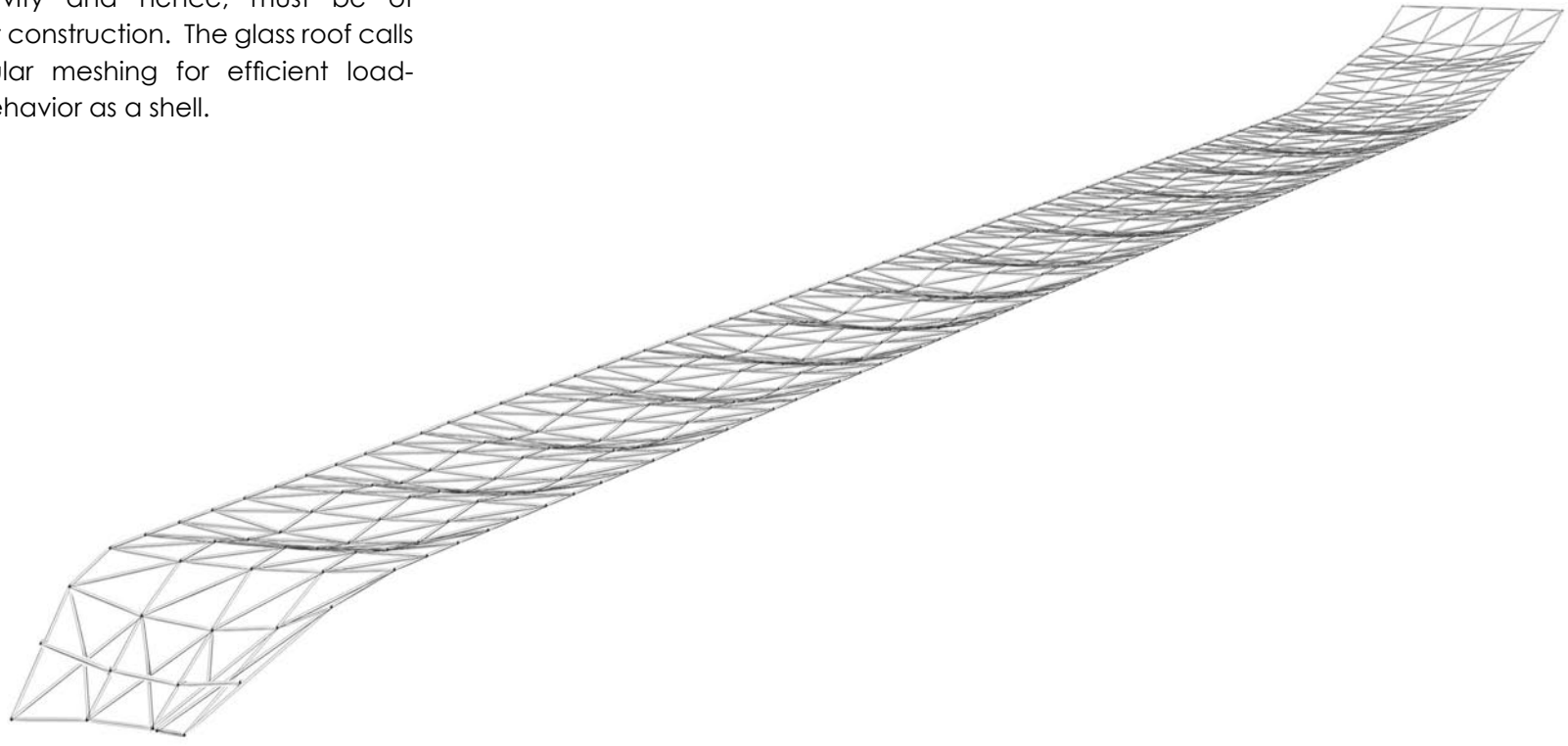


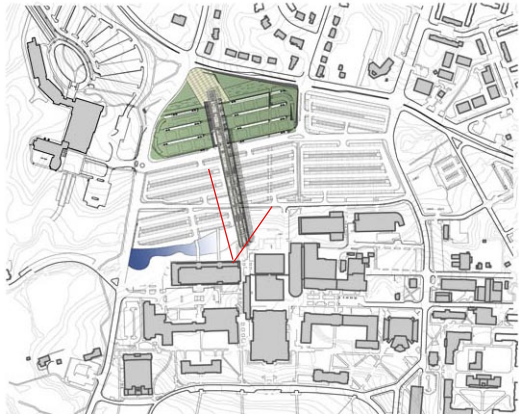


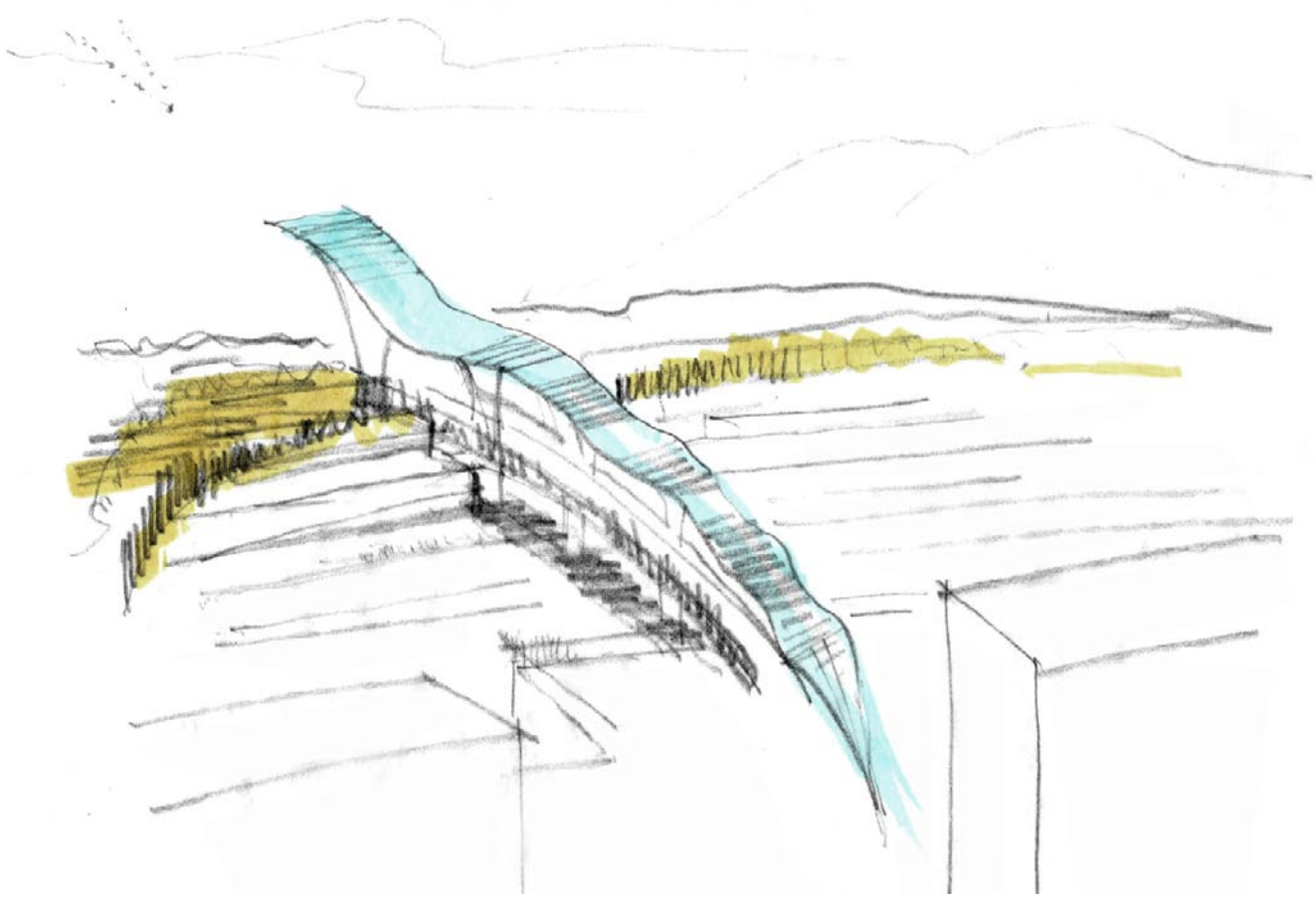
The canopy

The canopy is about 910 feet long and 60 feet wide. It is a continuous fabricated surface which serves as an enclosure. It defines a half open space from the outdoor environment, keeping out rain, reflecting sun's heat, and transmitting natural light.

The diagram shows the form and structure of the canopy. The canopy is an undulating metal mesh filled with glass panels. The curved form is generated from the material under gravity and hence, must be of lightweight construction. The glass roof calls for triangular meshing for efficient load-bearing behavior as a shell.







Early sketch shows the canopy is curved and is of a lightweight structure.

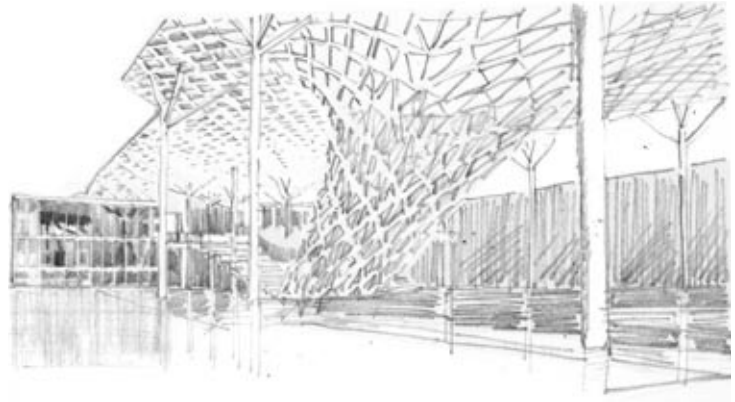
This fabric-like surface is also an integral part of the structure. The lattice shell serves as both primary structure of the canopy and as framing for the tinted glazing, which eliminates the need for a secondary structure. This canopy is composed of a triangulated steel-mesh armature holding triangular glass panes. The steel structure members are fabricated by plates and Structural Tees.

The glass roof is supported by hollow steel columns. The repetitive structure under the long undulating roof provides for multiple functions below. They are containers for stairs, elevators and restrooms. The longitudinal section (p.56) shows these columns as containers.

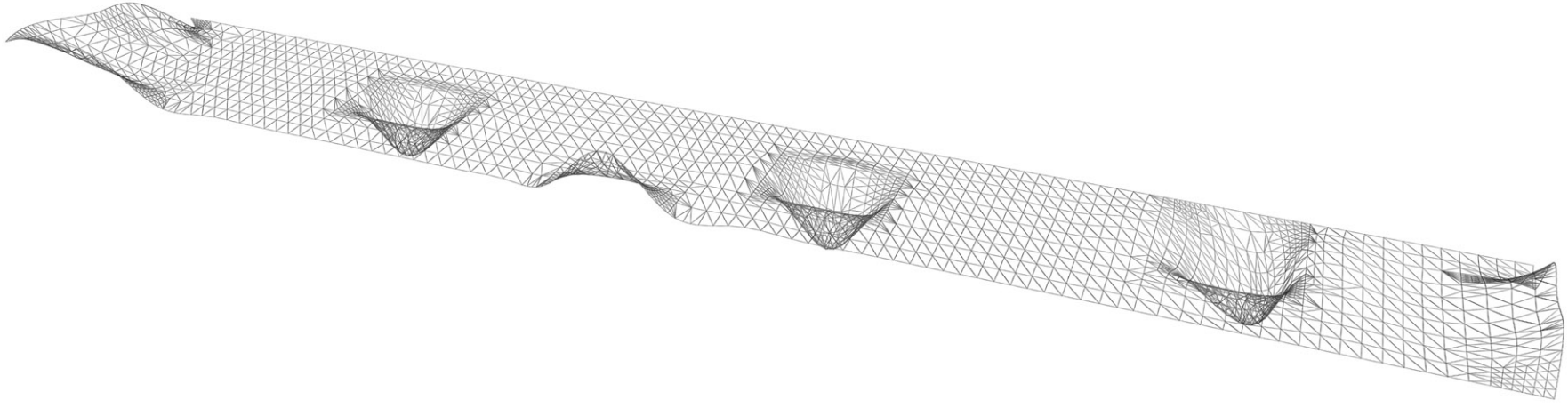
The view of the canopy from the ground level.

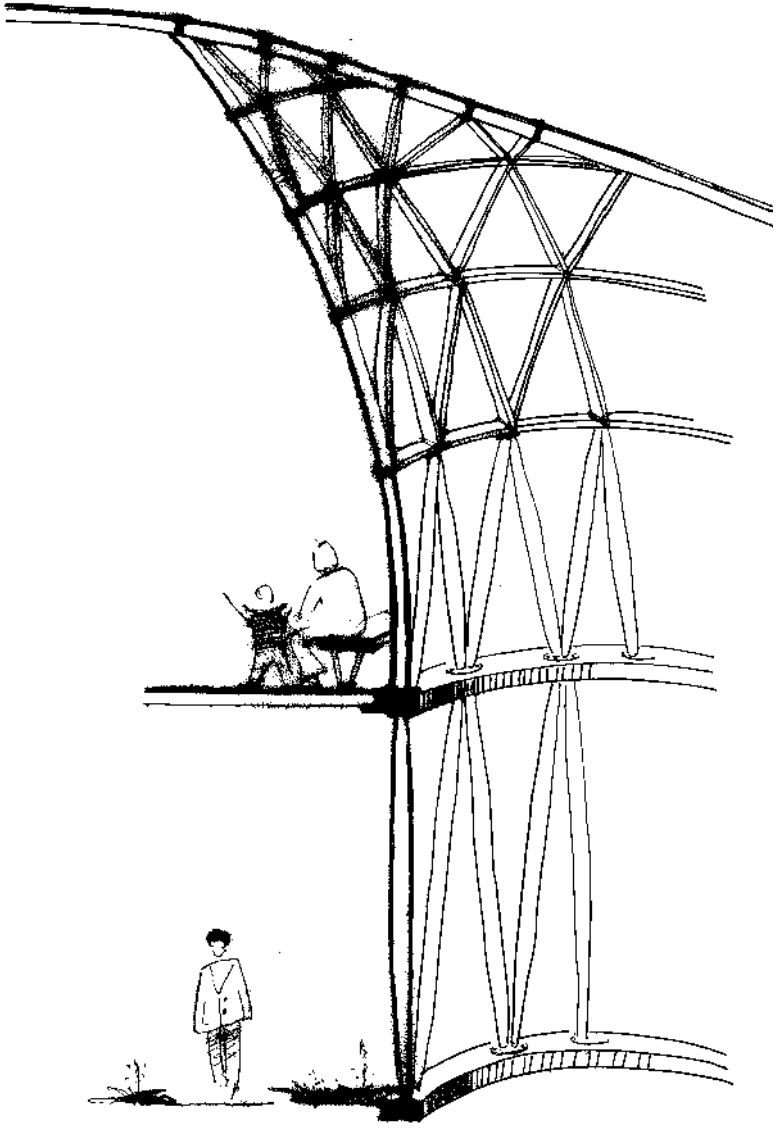
Early studies of the form and structure of the canopy

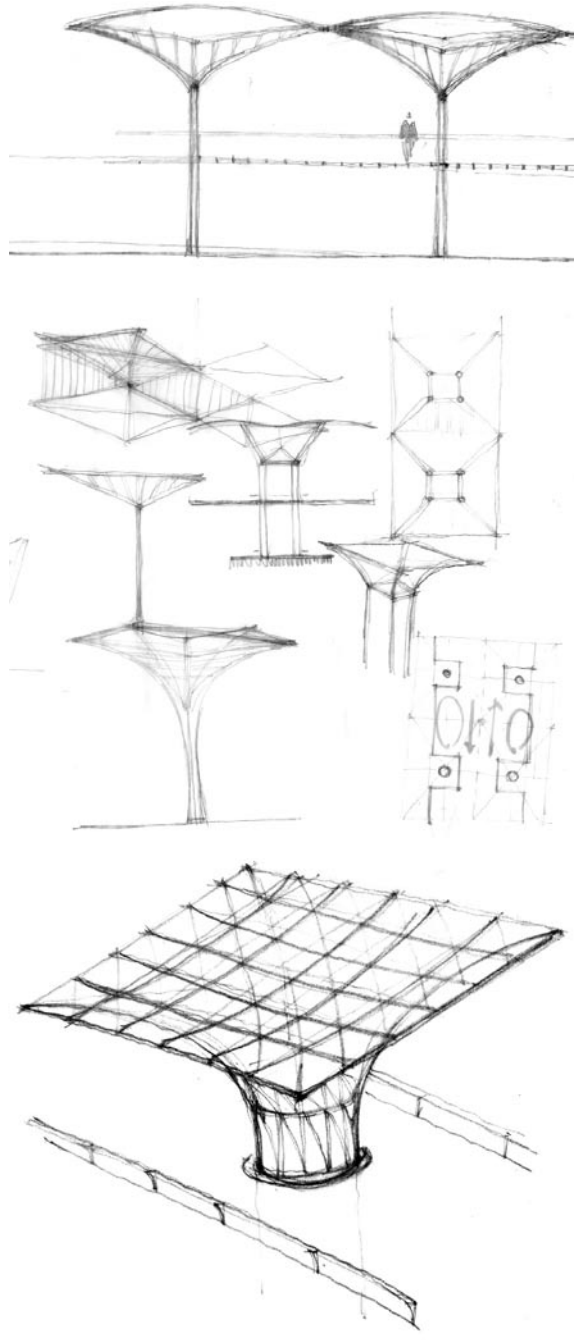
Shown in the lower computer generated model, the roof is originally conceived as a free-form fabric, like the canopy of the Milan Trade Center. Supported by vortex-like parabolas of glass and steel, the canopy of the Milan Trade Center touches the earth here and there, which looks like floating. However, the roof cannot be absolutely self-supported - it requires additional support, such as steel pillars.



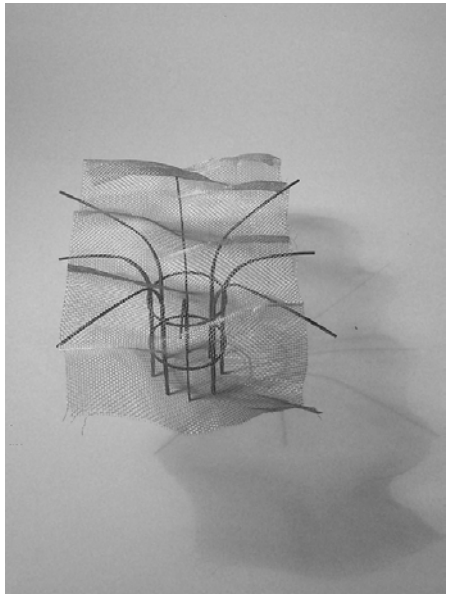
The canopy of the Milan Trade Center

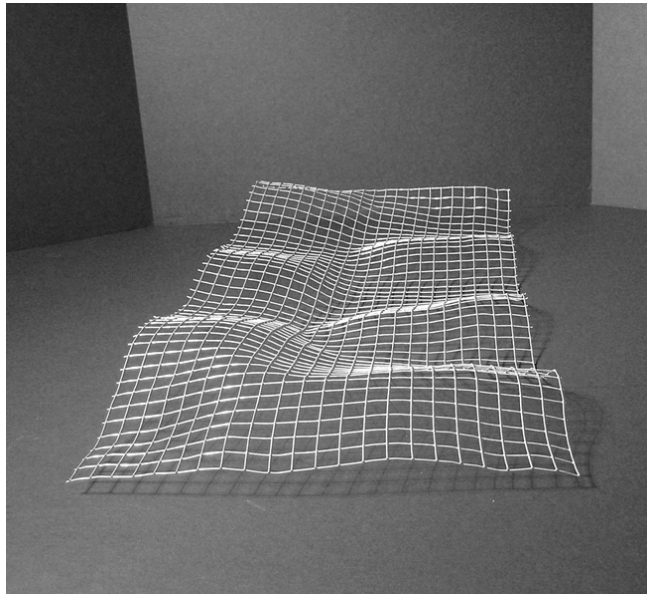




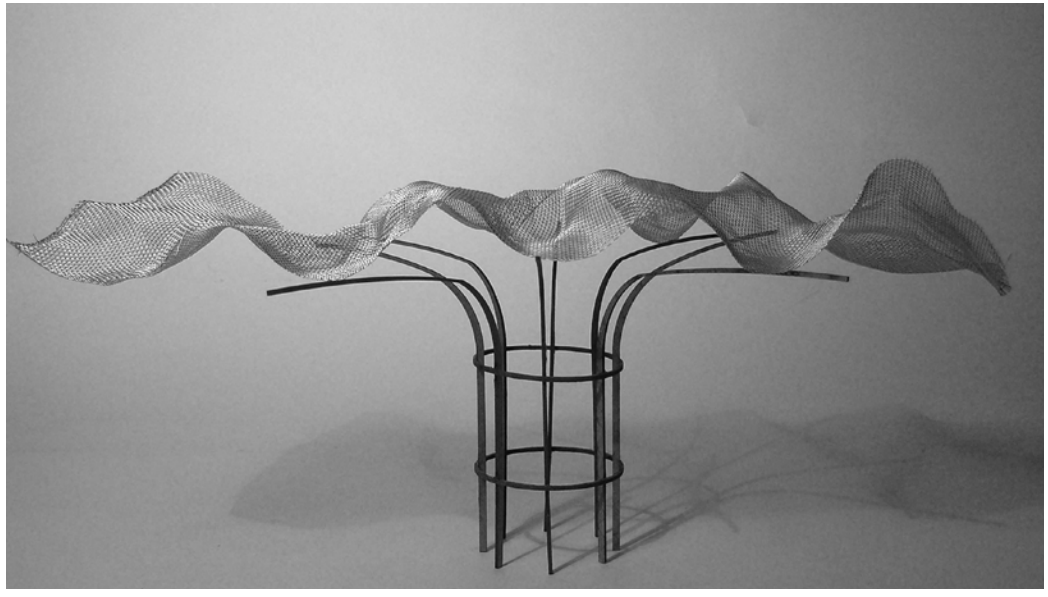


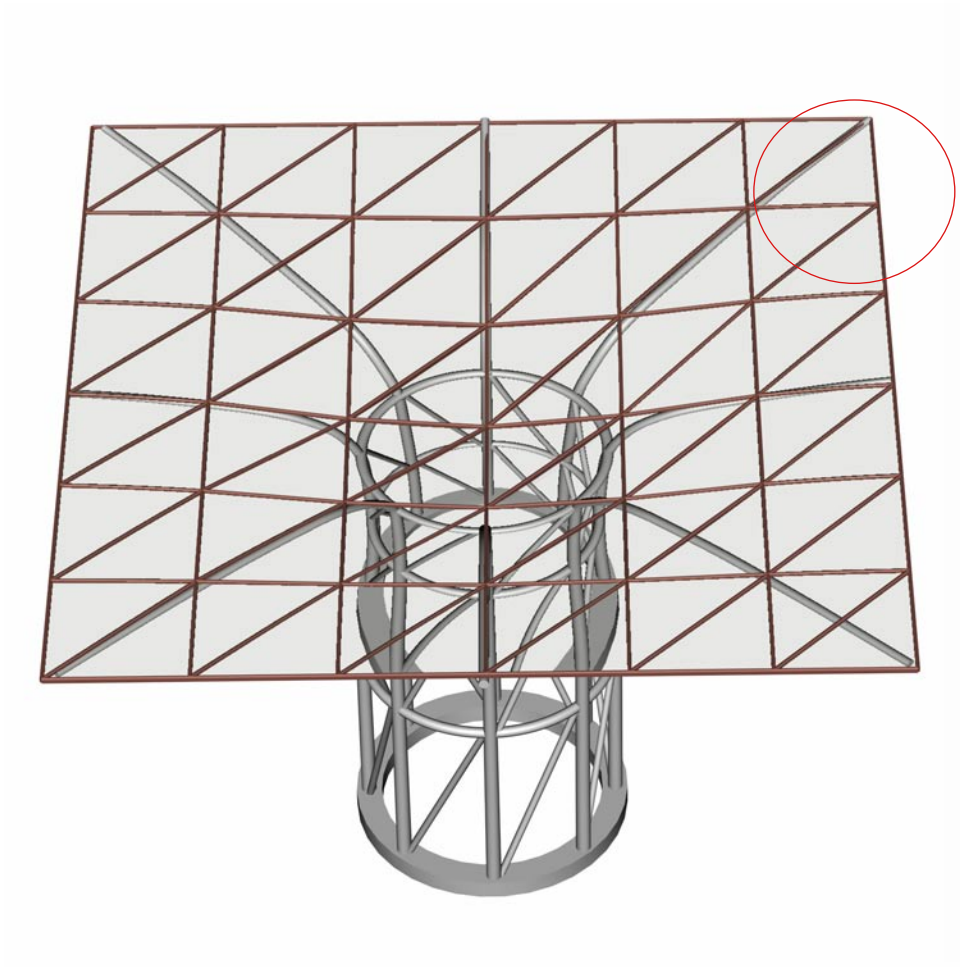
Early sketches of the structure study





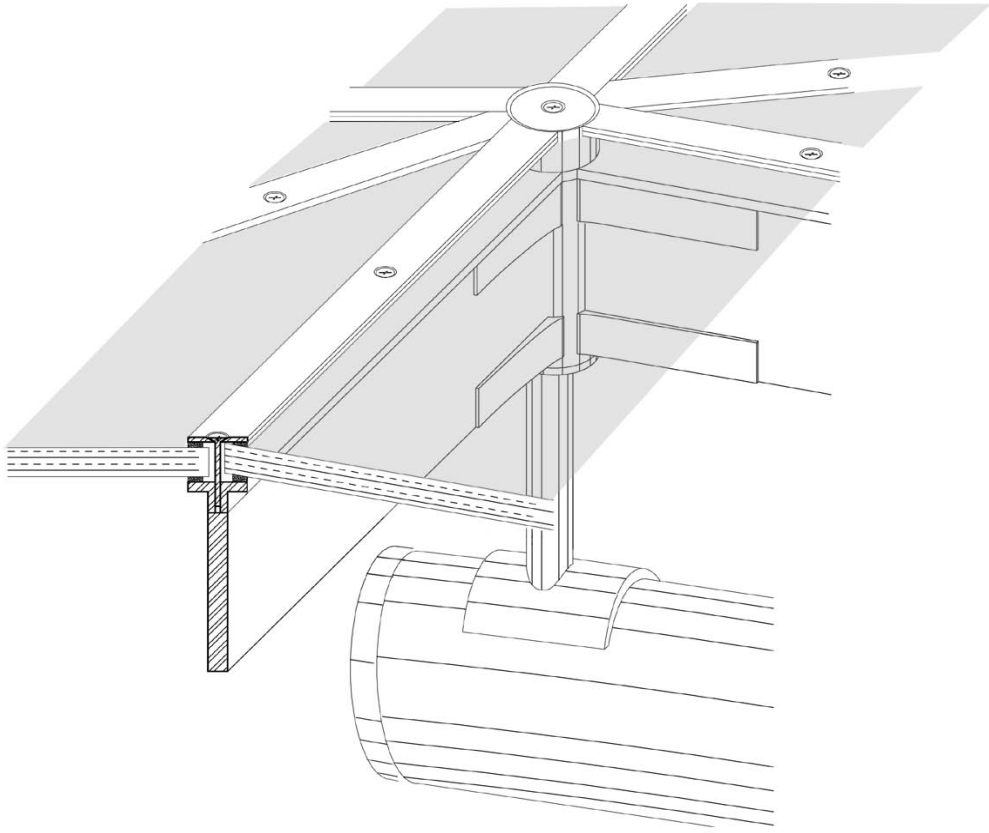
The canopy as a double-curved surface. The difficulty with the mesh is the connection to the column below.

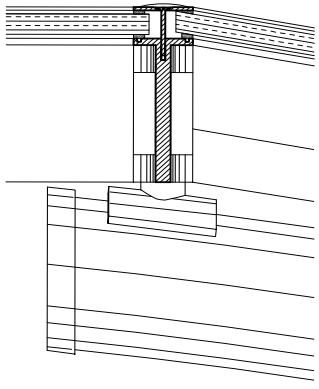


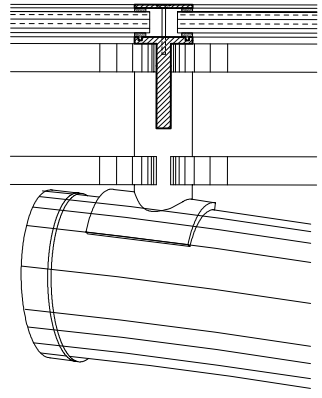


A web like distribution of eight curved beams receive the load of canopy mesh.

As mentioned before, the steel structure members are fabricated by plates and Structural Tees. The details are shown as the drawings at right.

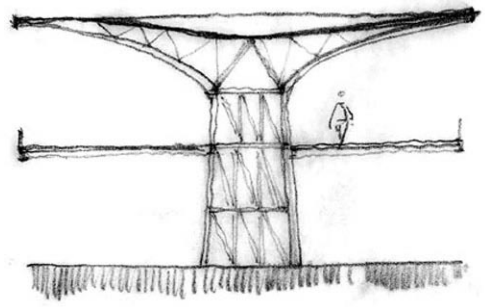


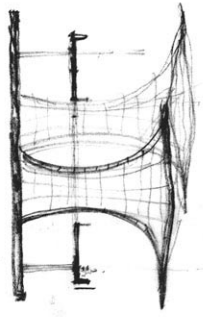


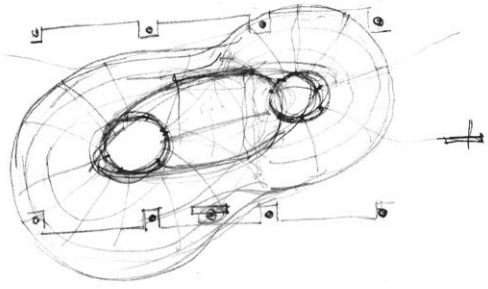


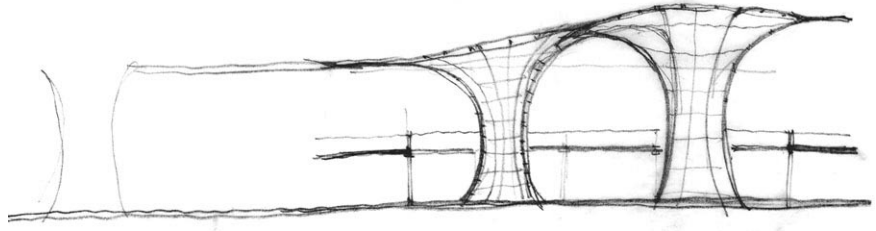
The walking deck

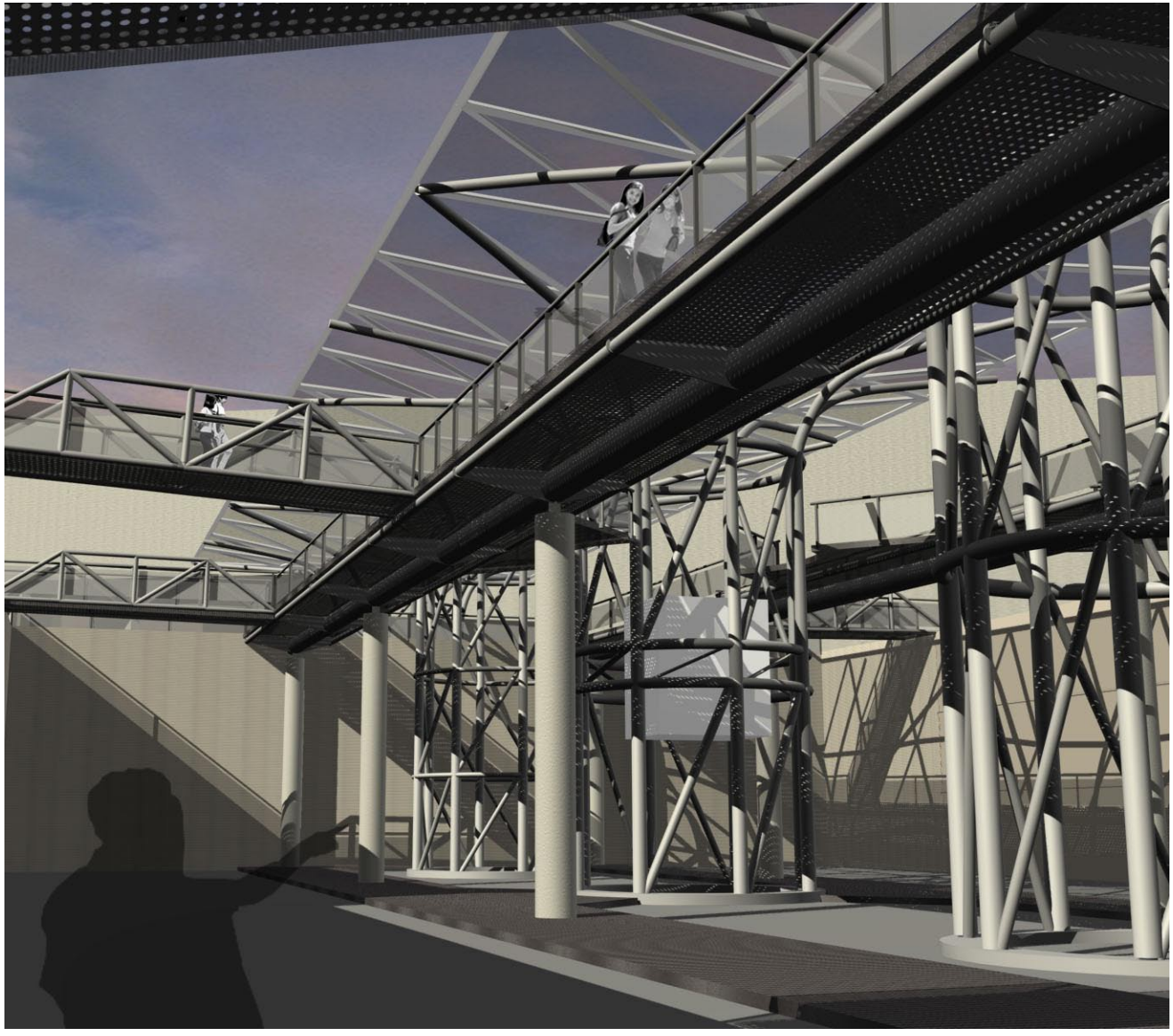
The walking deck is elevated and runs under the full length of the canopy. Flooded in intense light and covered by waving glass, it feels ethereal. Perforated steel mesh is used for walking deck to allow the natural light penetrate. Looking up from the ground floor, it looks like stars are sparkling in the sky. Together with the woven canopy, it casts beautiful shadow on the ground.

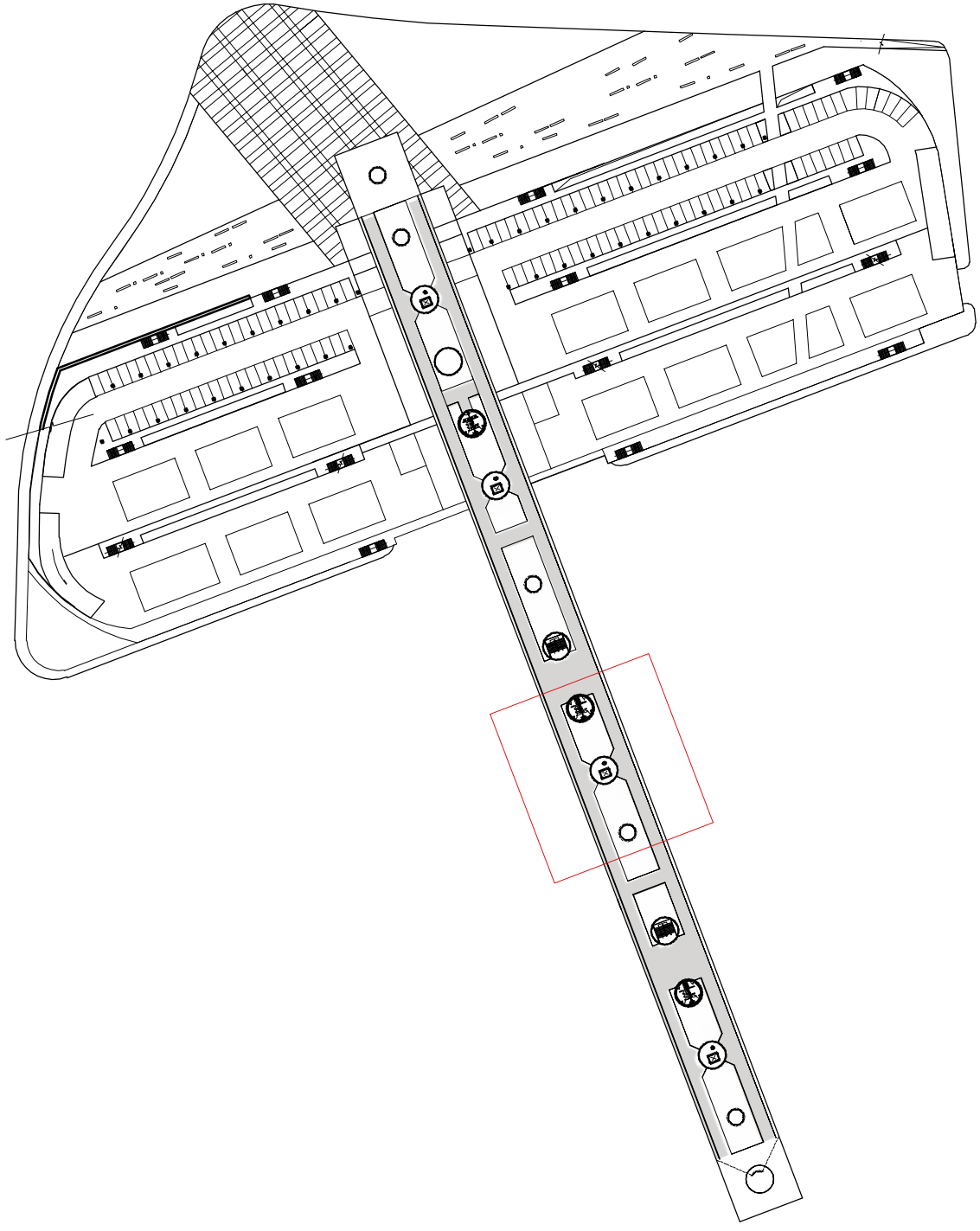




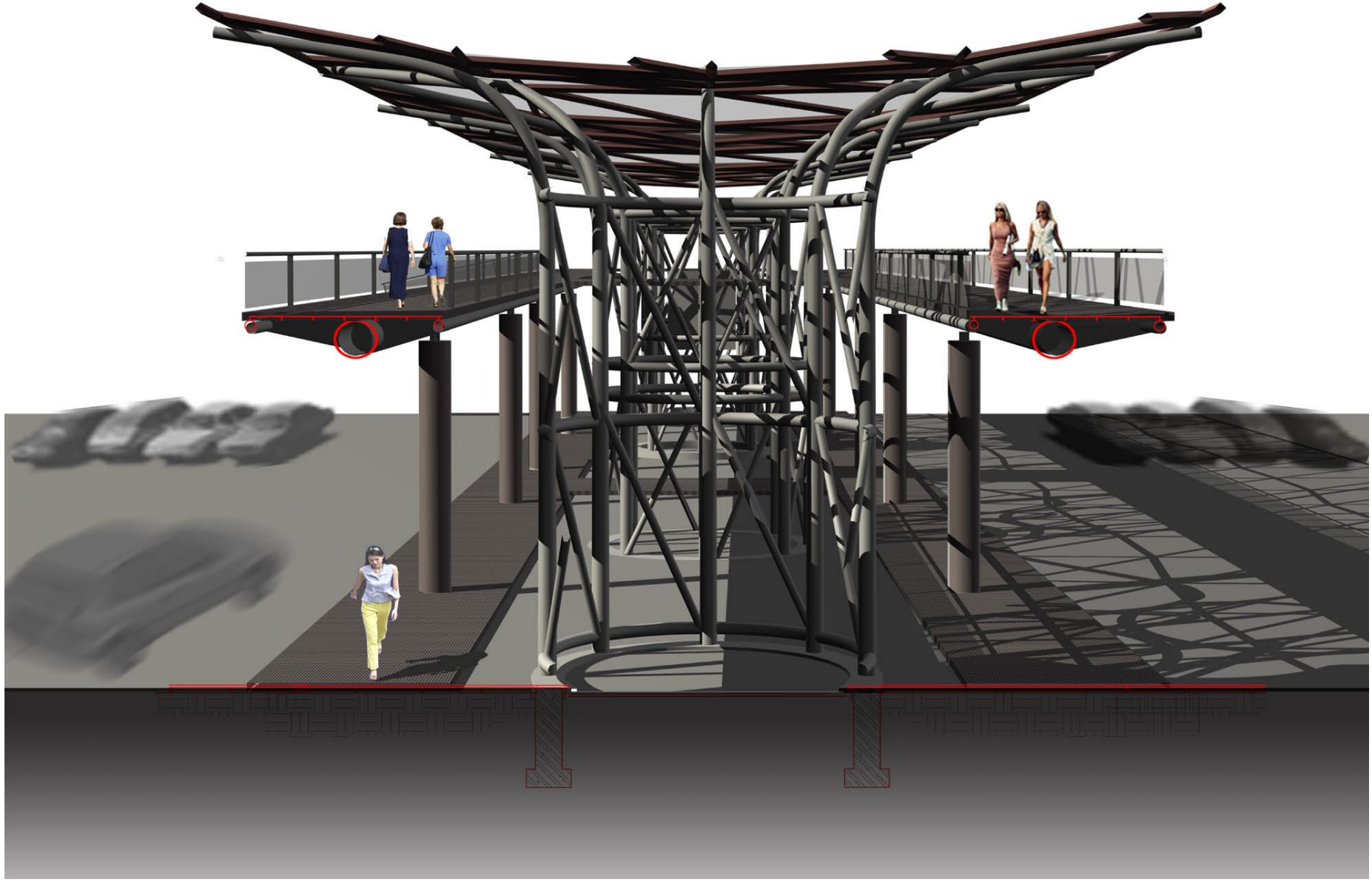








The elevated walking deck consists of two parallel decks, each of which is 12 feet wide. Several cross bridges join the two parts together. This constellation promotes the independence of both roof and deck. The openings in the deck allow the roof and its columns to be understood from virtually every perspective.



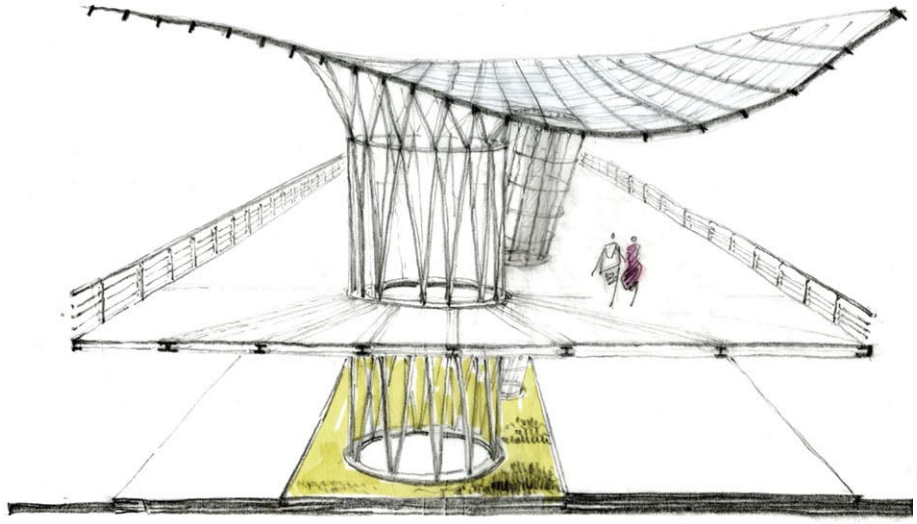
Structure study of the walking deck

Early sketches of the structure study:

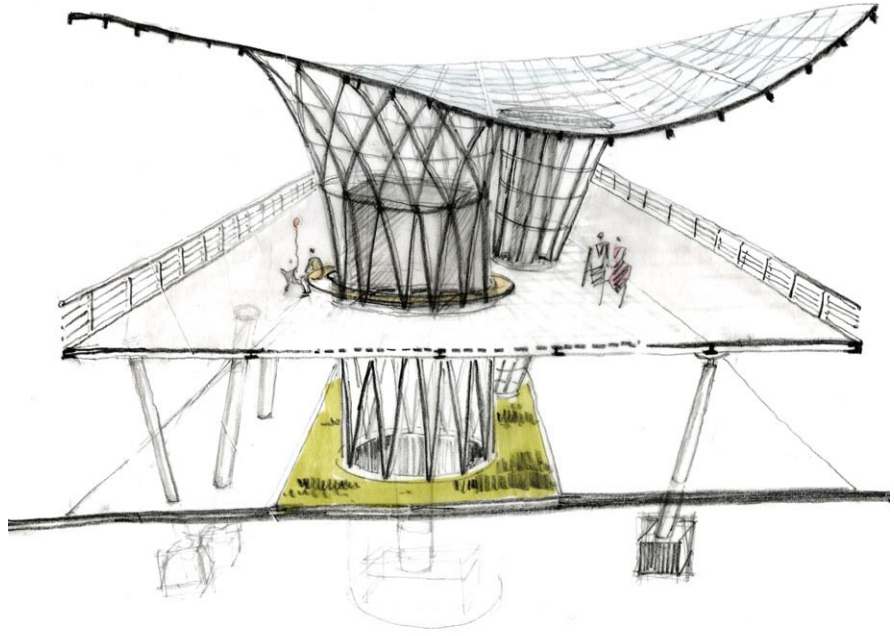
1. A single walking deck is supported by central columns.

2. A single walking deck is supported both by central columns and side columns underneath.

1.

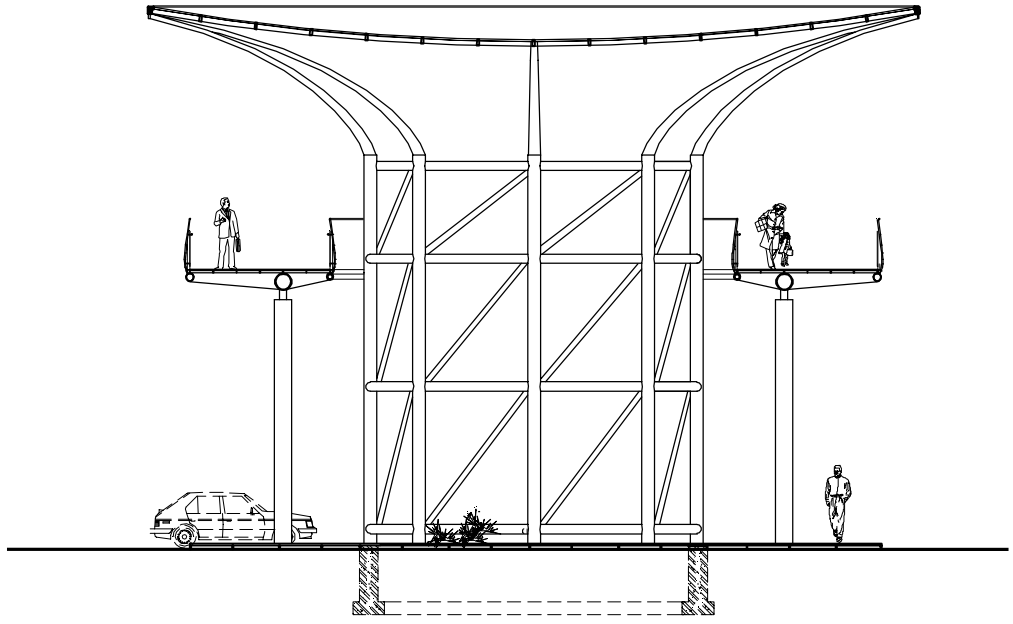


2.



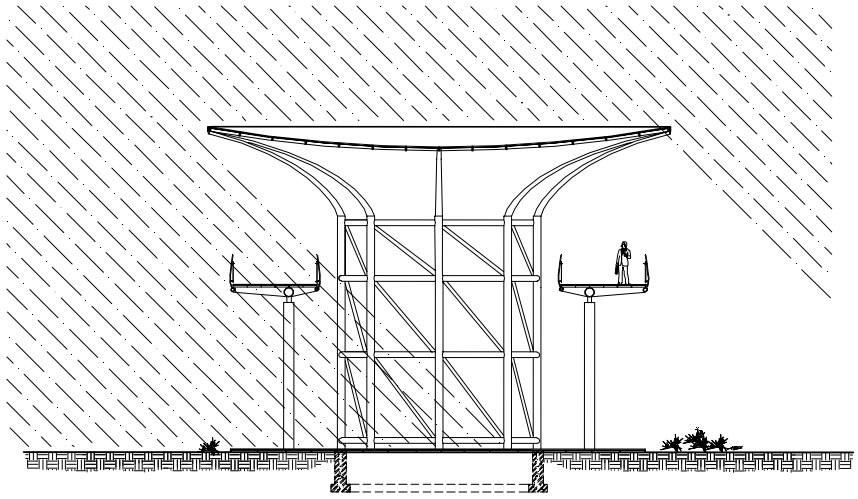
The decision:

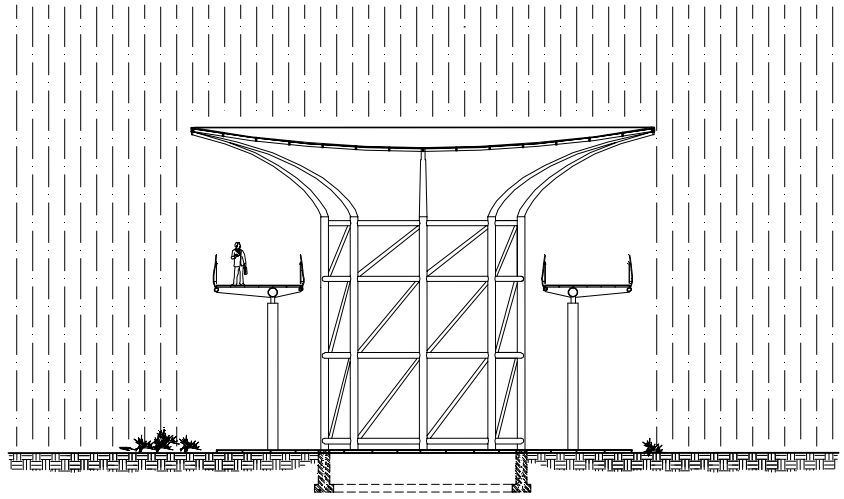
The walking deck is divided into two pieces, separated by the canopy.

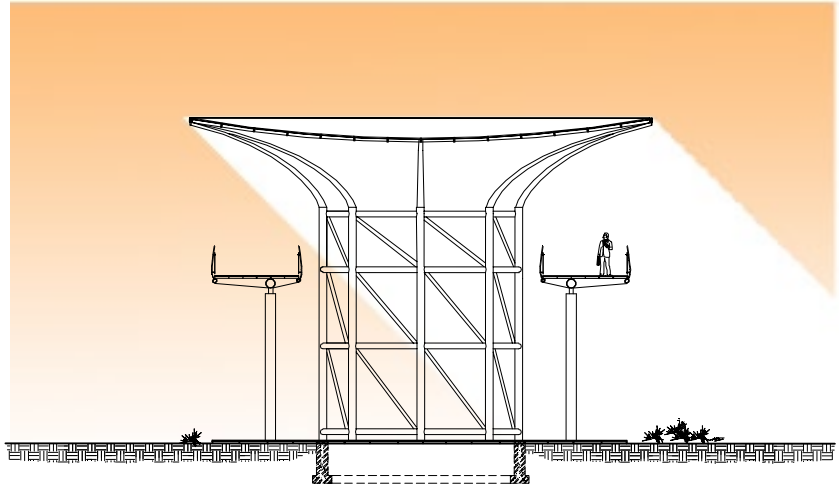


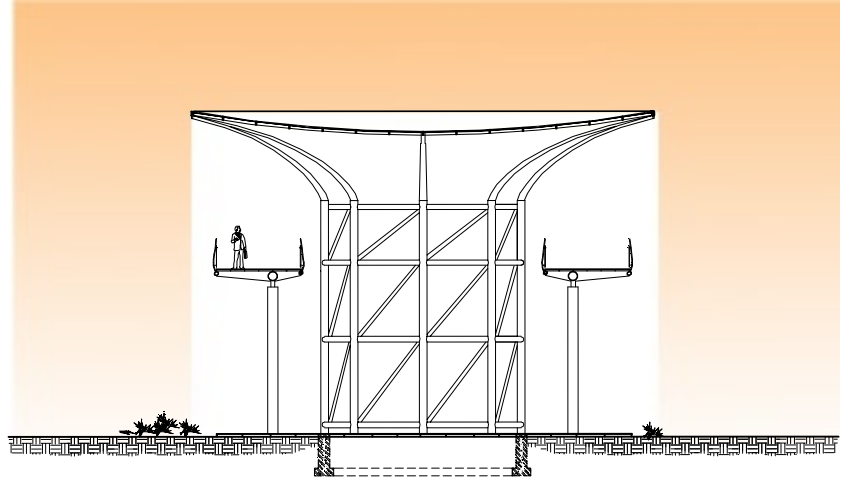
Shelter of walking

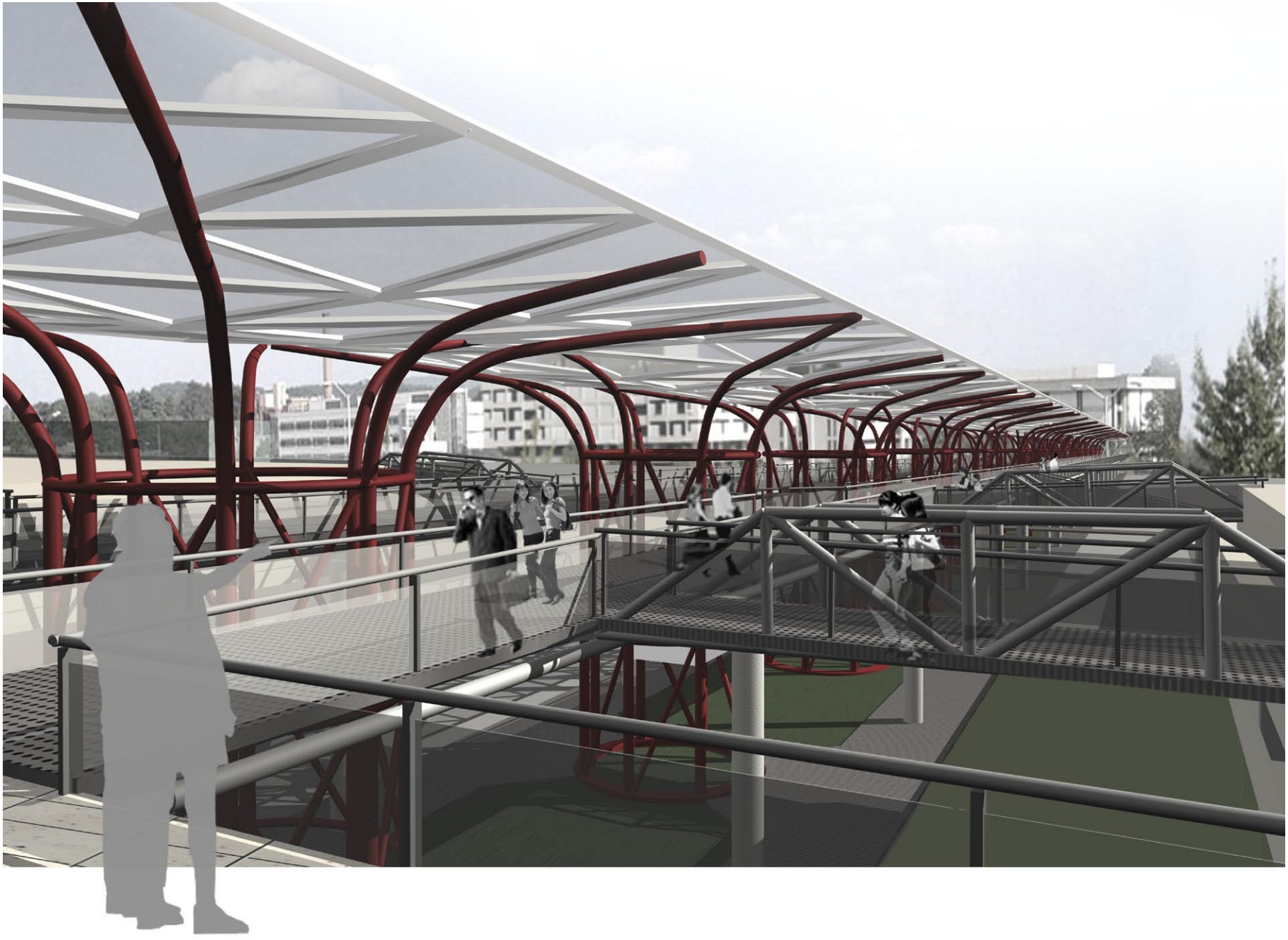
Although the canopy does not extend far beyond the walking deck, it provides various possibilities for shelter from rain or sun.



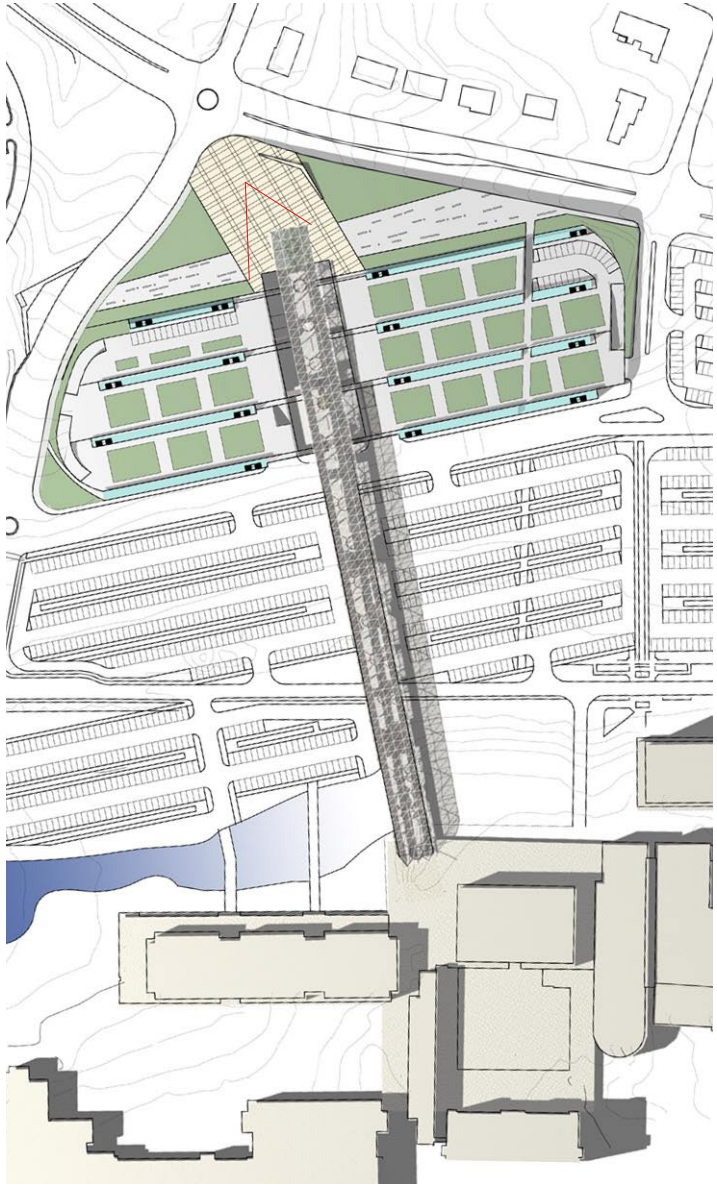








Arriving

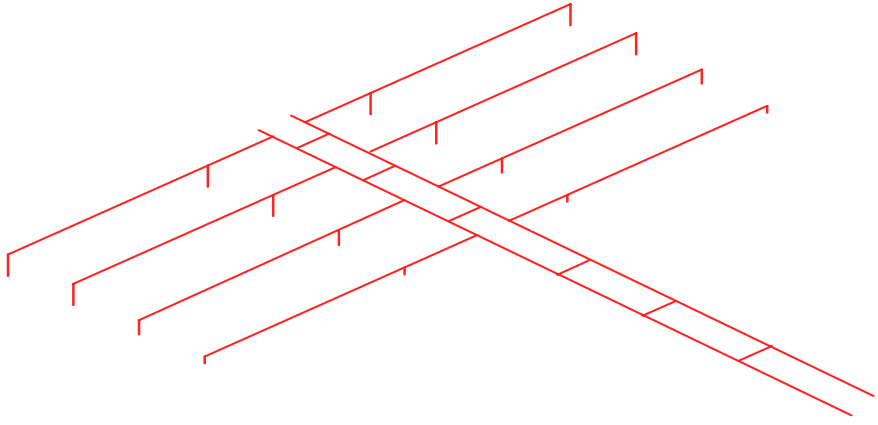


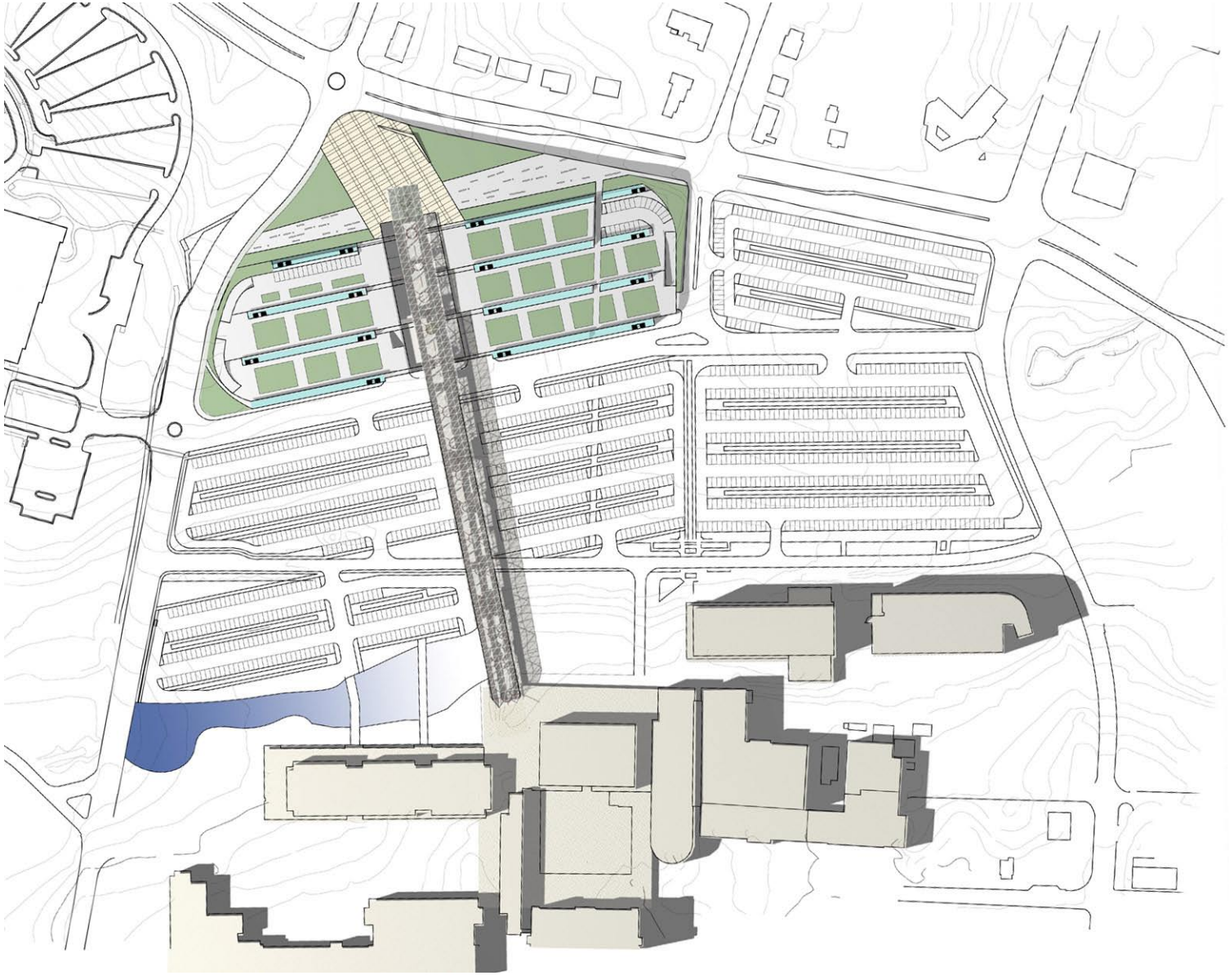
The bridge has two arrival points: one is the parking garage at the corner of intersection of Price's Fork Road and West Campus Drive; the other is the platform between Derring Hall and Cowgill Hall.

The relationship with the parking garage

The diagram below shows how the bridge serves as a collector to gather people from the parking spaces and bring them to the central campus. The access paths within the garage run parallel. Light wells conduct natural light into the lower garage levels.

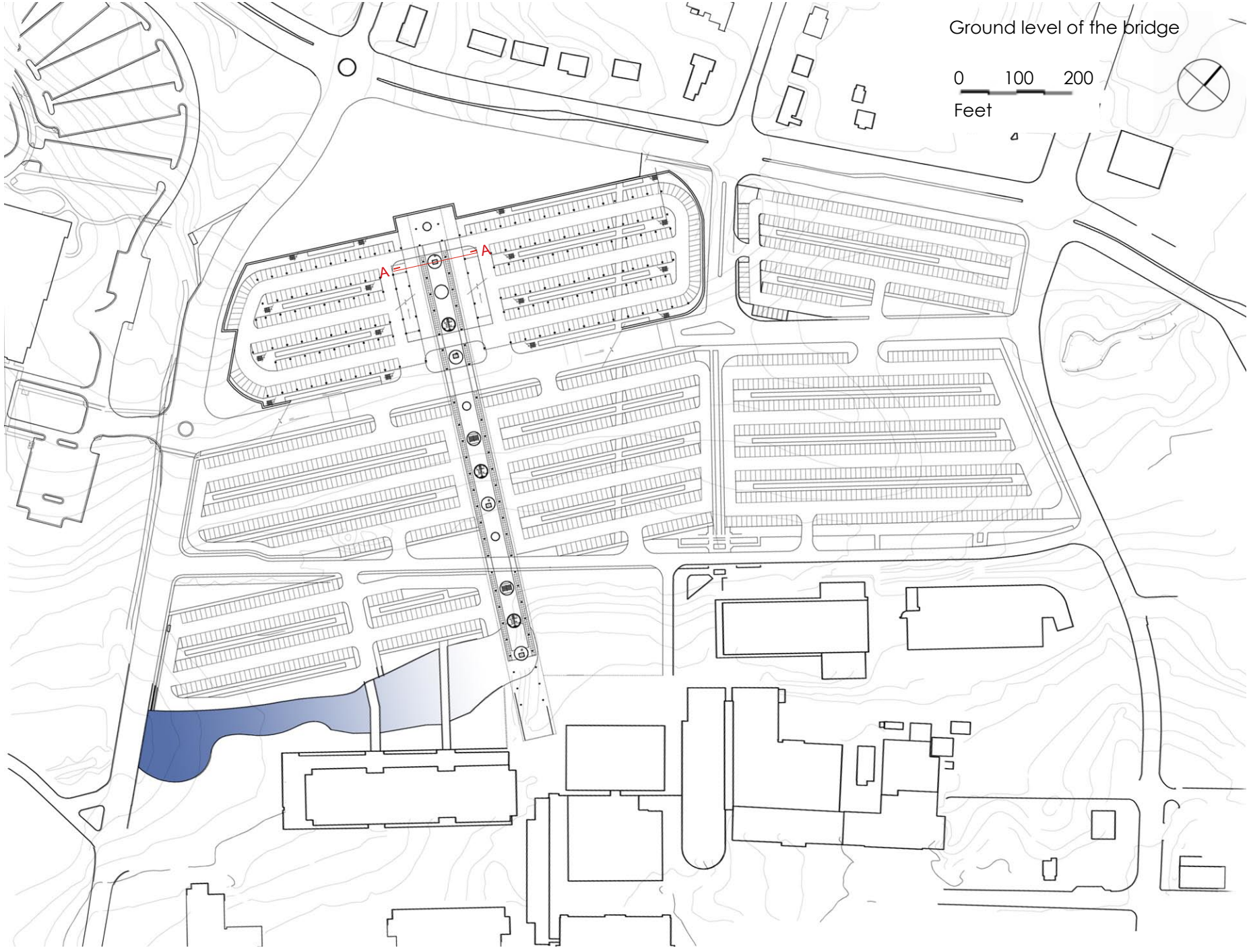
The roof of the parking garage is a new surface for people which combines greens and landscape. Together with the bridge, it will give a new appearance to the existing parking lot.

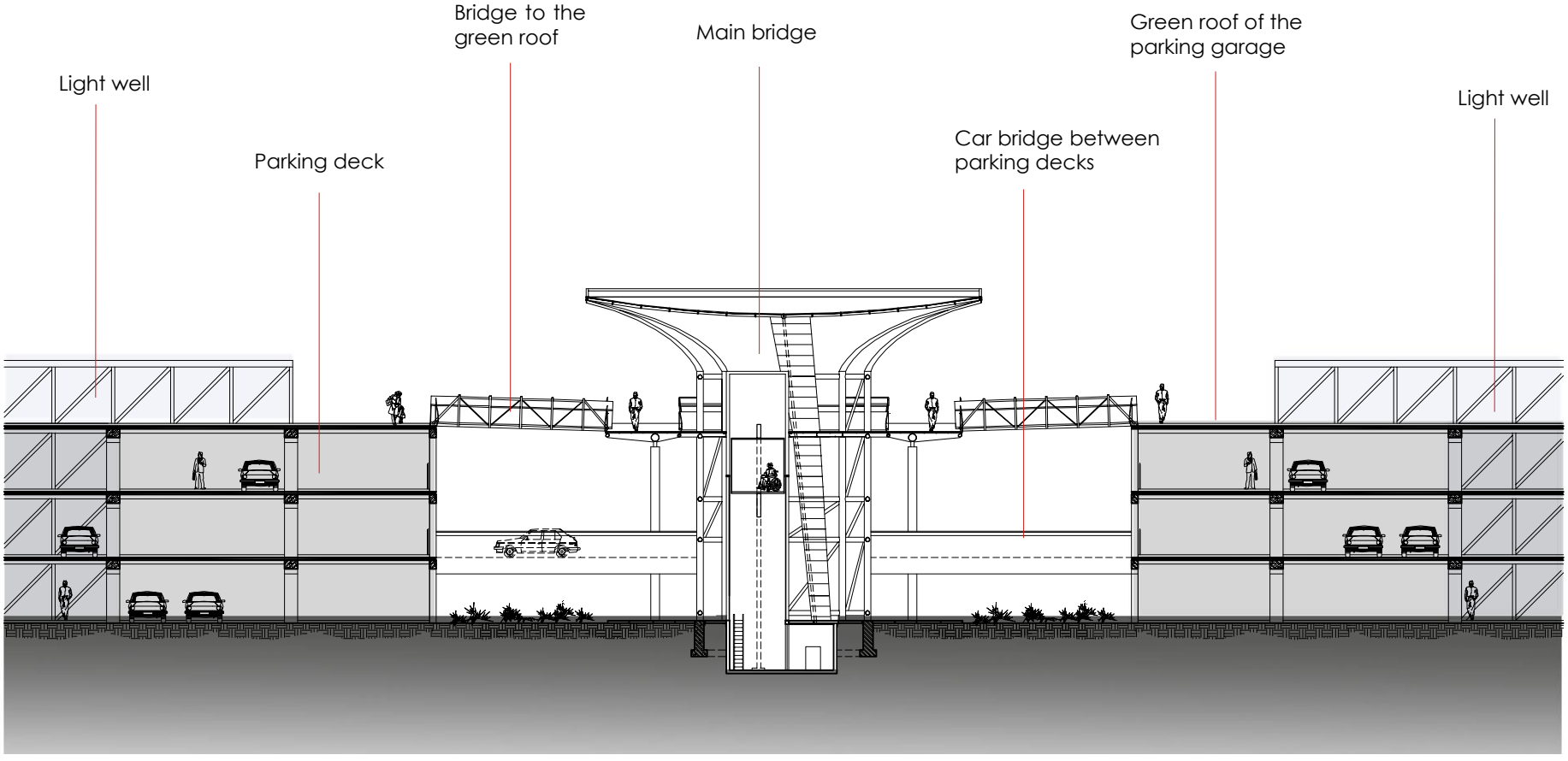




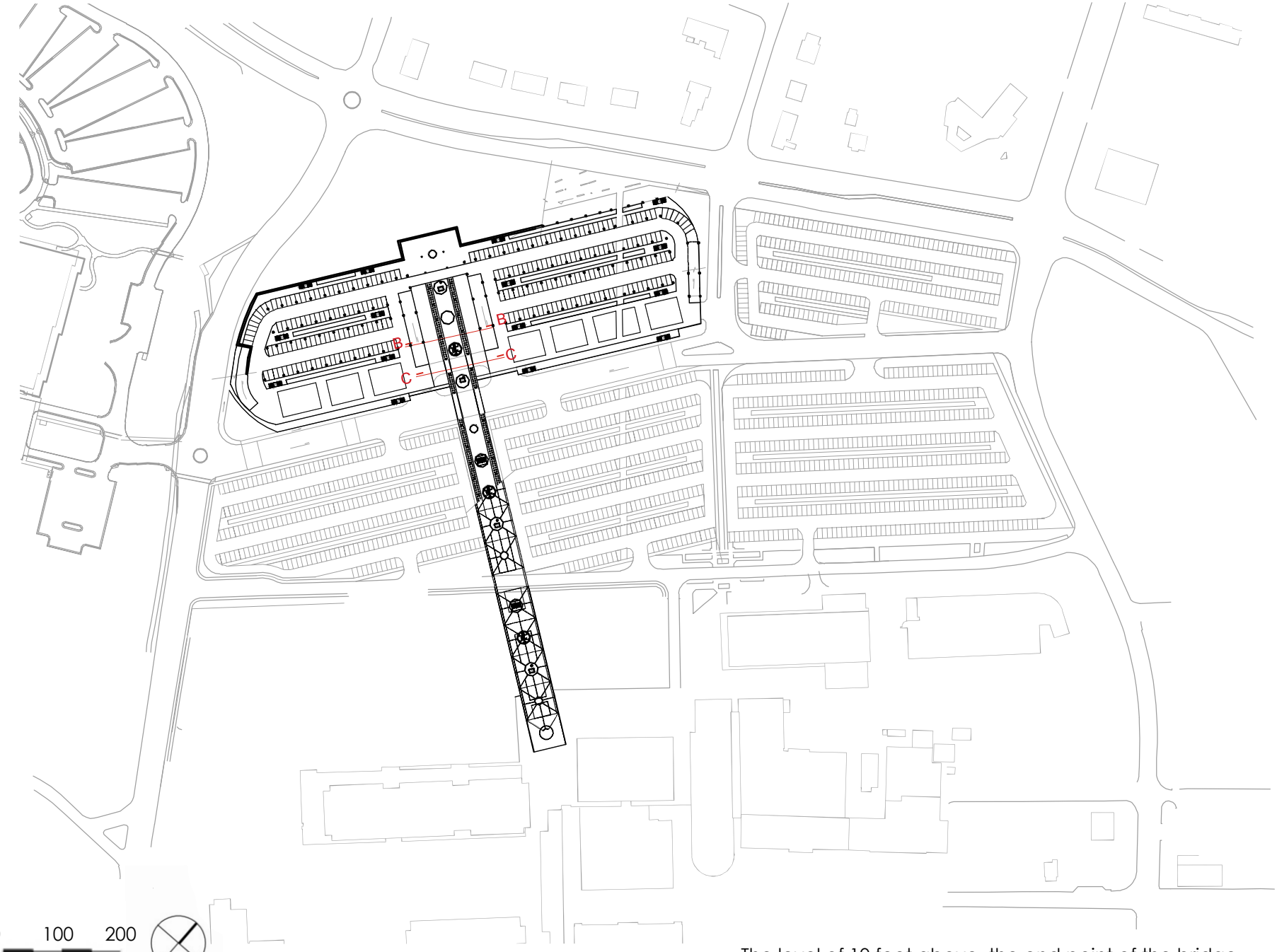
Roof plan of the bridge and the green roof parking garage

0 100 200
Feet


Ground level of the bridge
0 100 200
Feet
A
A

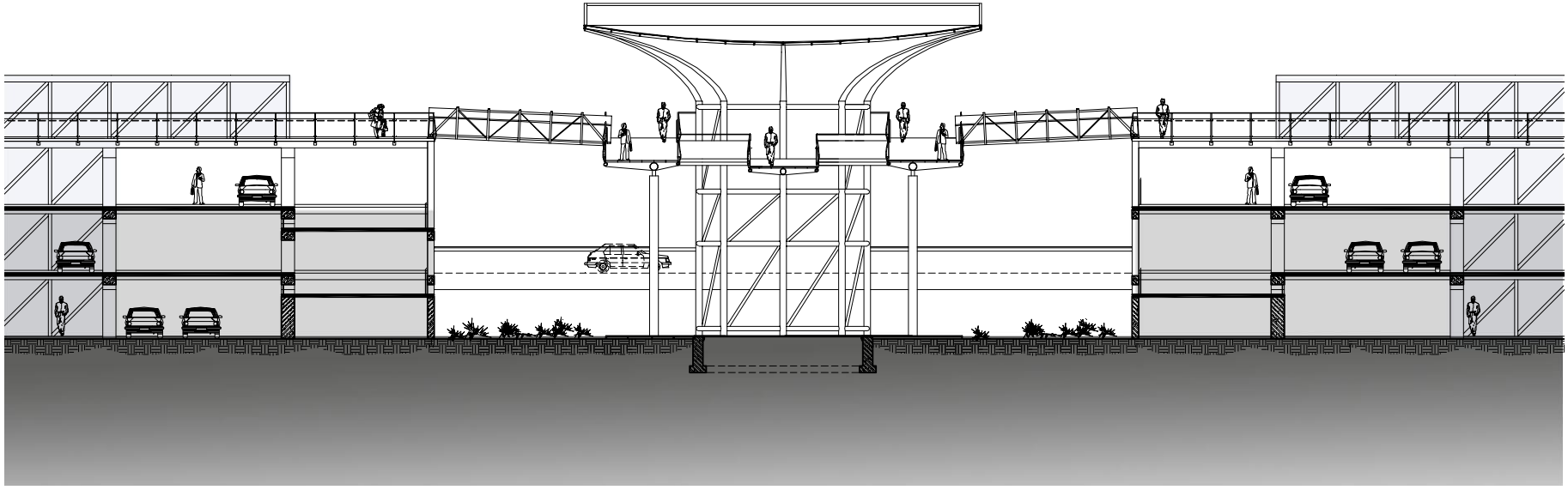

Light well
Parking deck
Bridge to the green roof
Main bridge
Car bridge between parking decks
Green roof of the parking garage
Light well

A-A Section

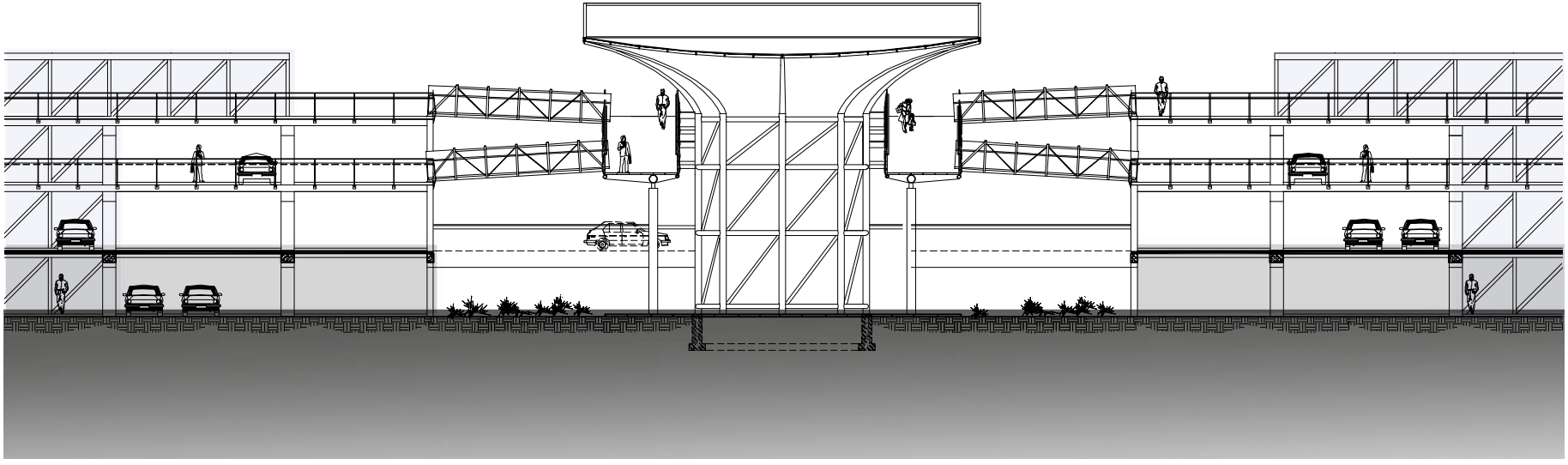


0 100 200
Feet

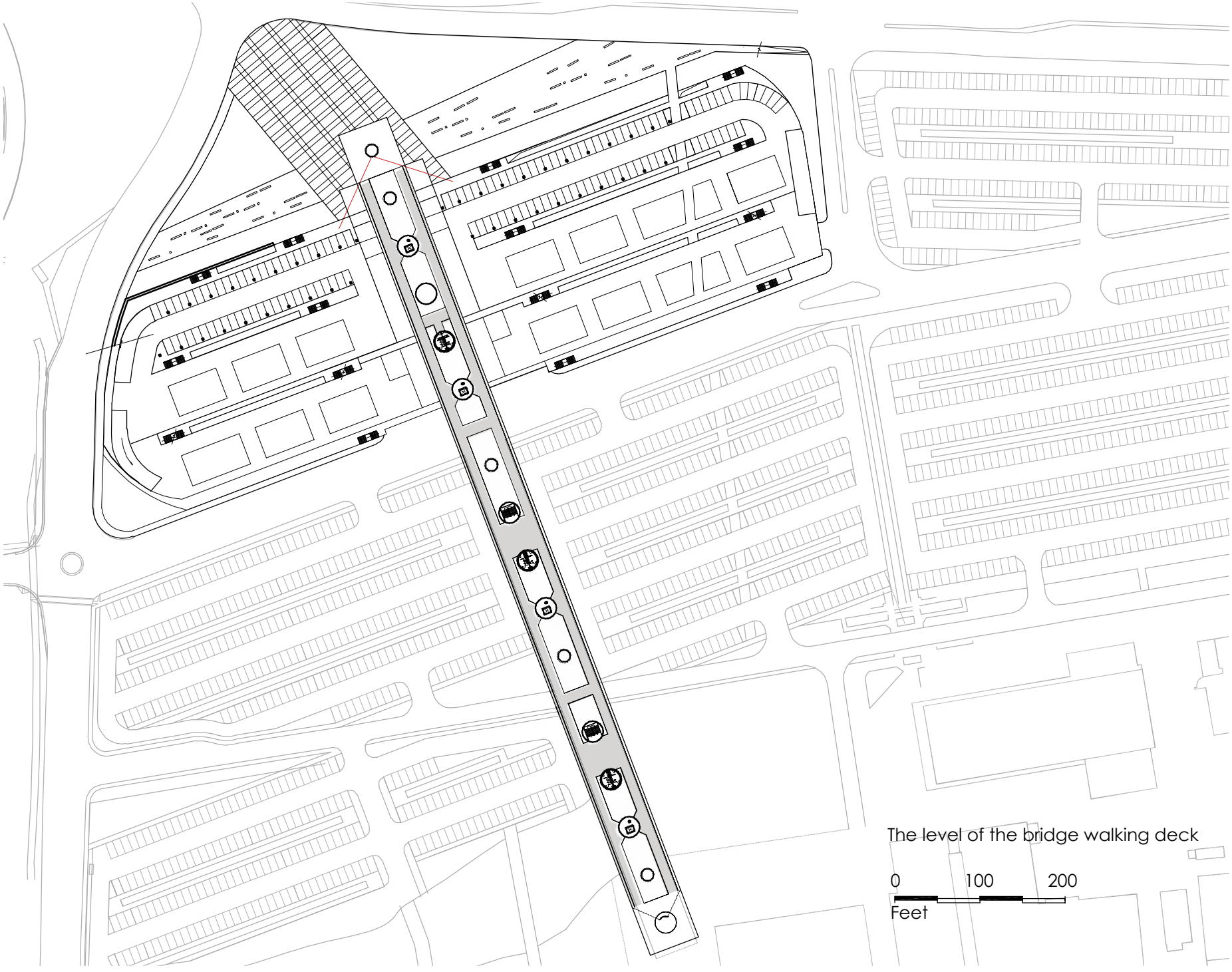
The level of 10 feet above the end point of the bridge

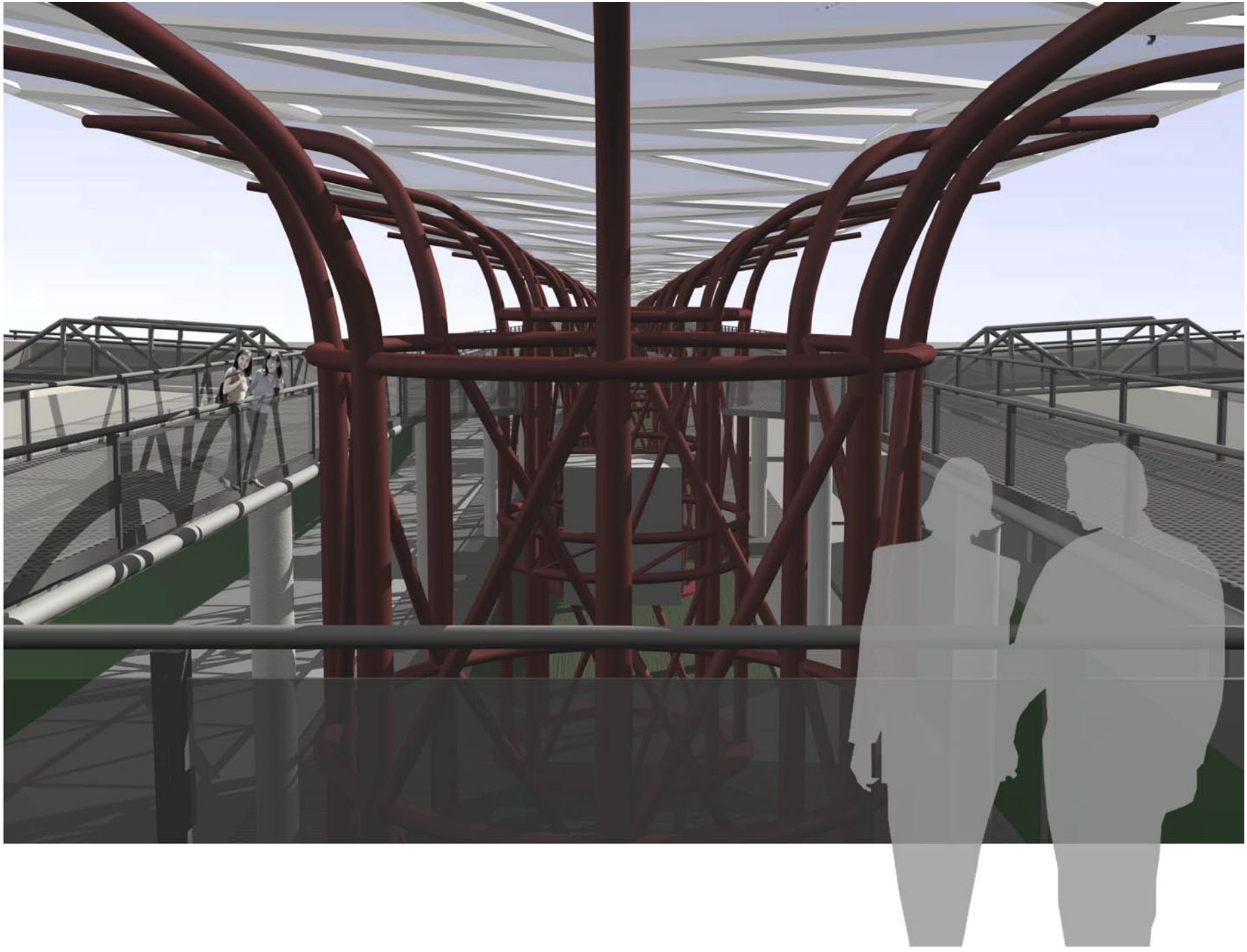


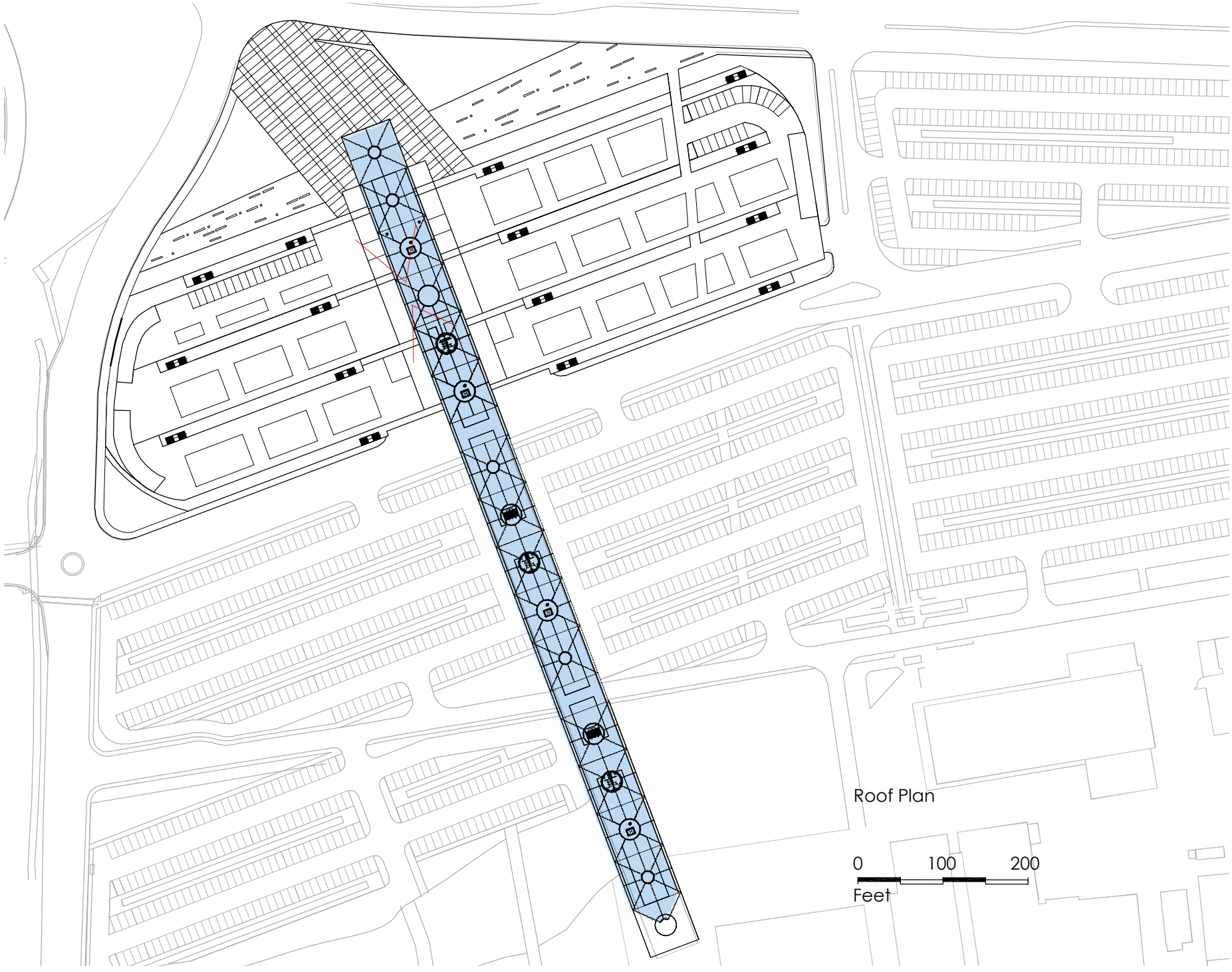
B-B Section

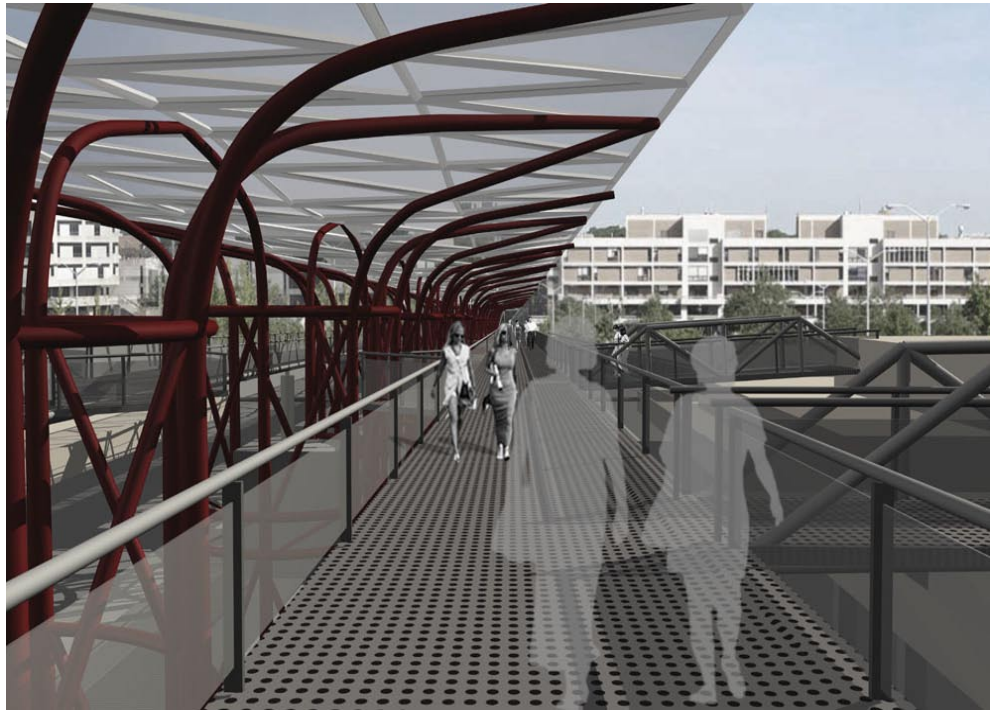


C-C Section

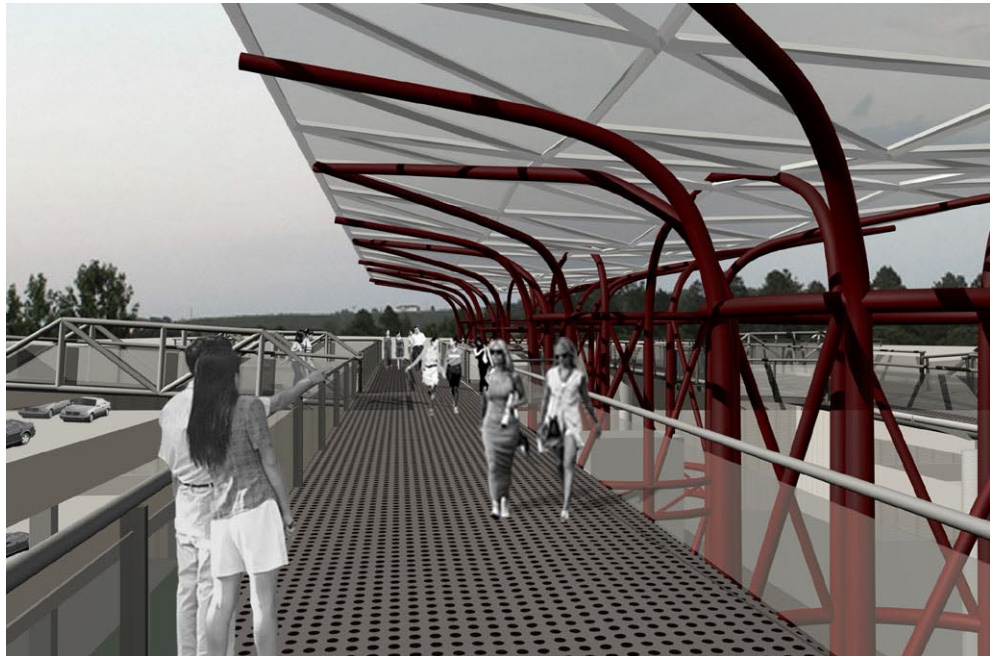

The level of the bridge walking deck
0
100
200
Feet




Roof Plan
0
100
200
Feet



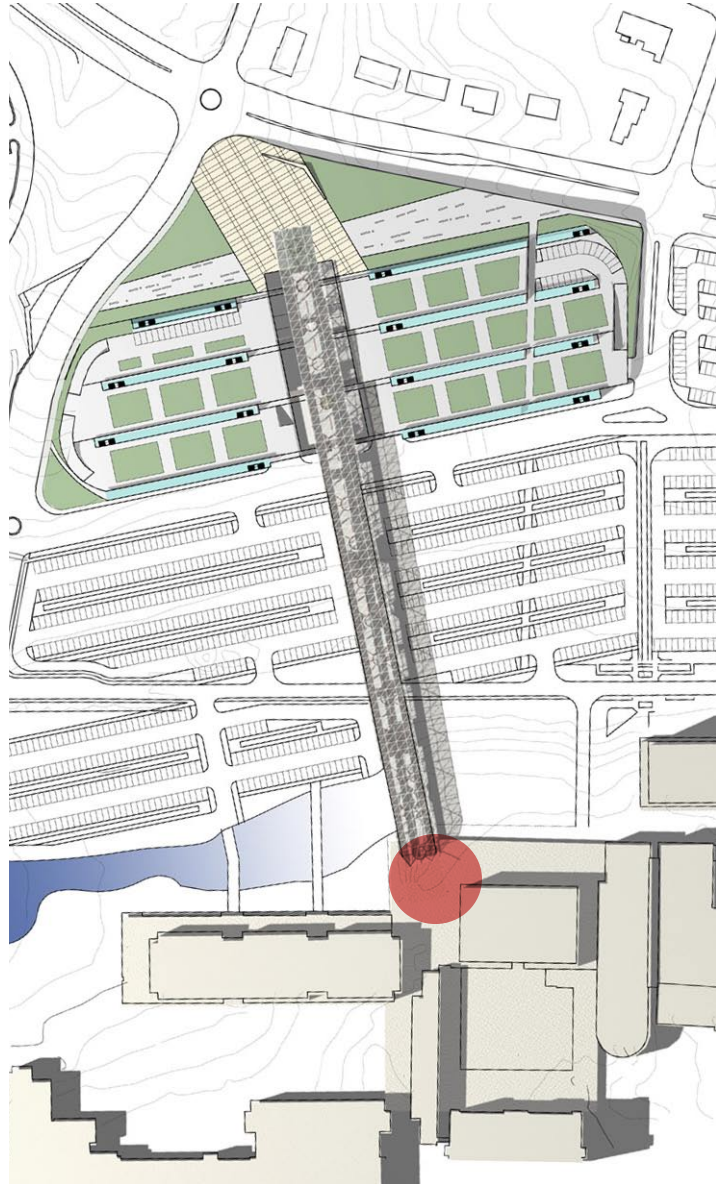
The view from the walking deck to the school

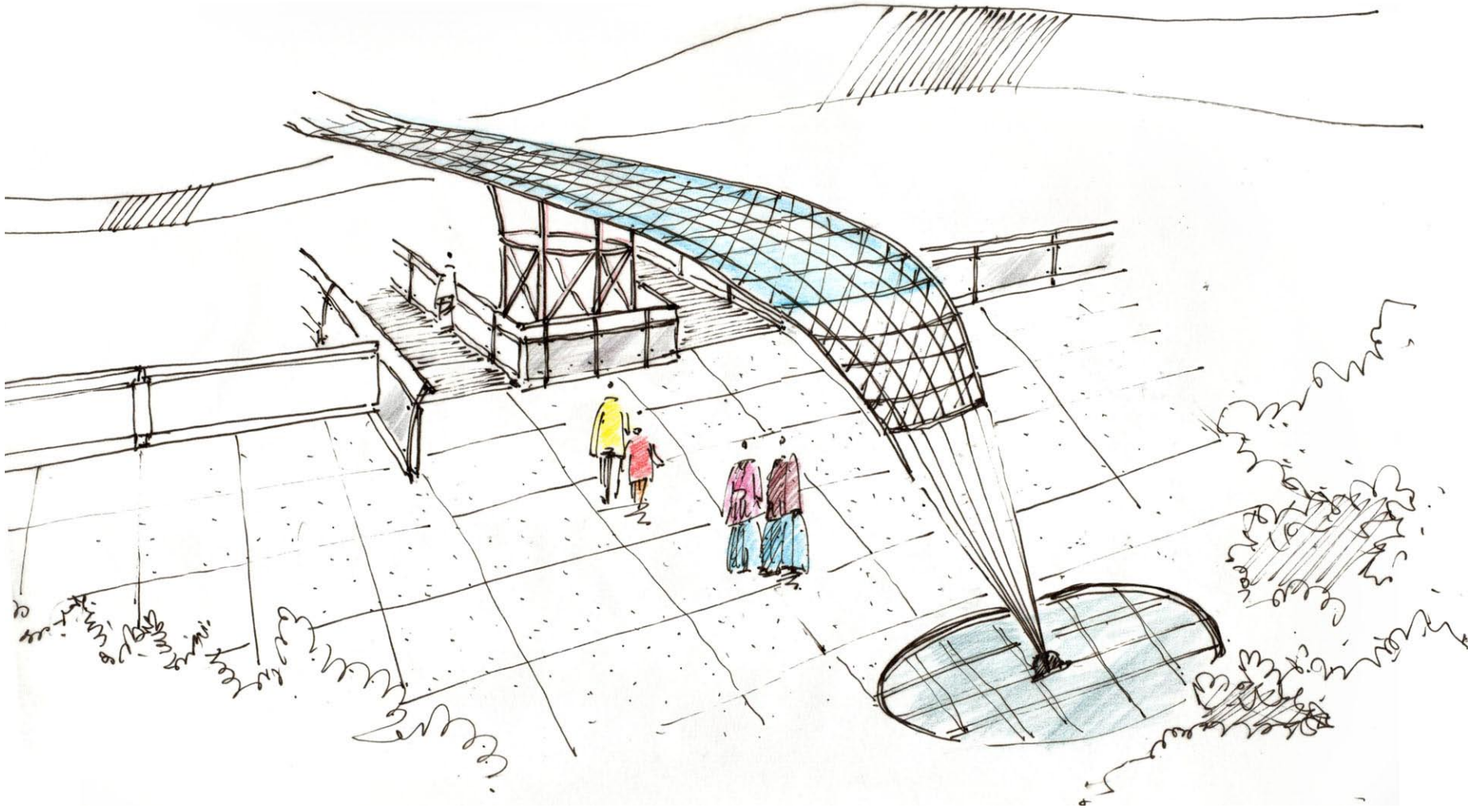


The view from the walking deck to the intersection of Price's Fork and West Campus Drive

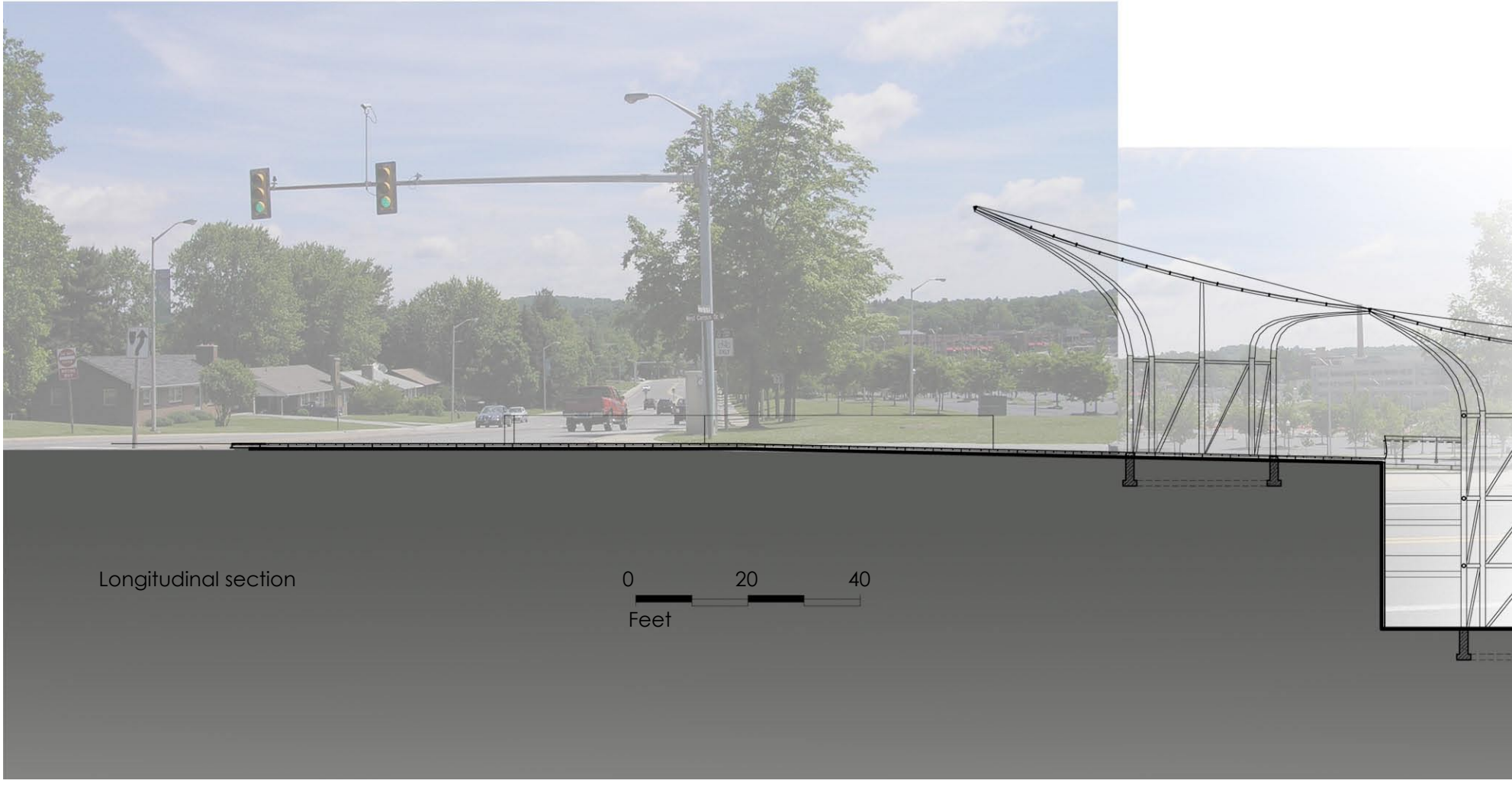
The end of the bridge

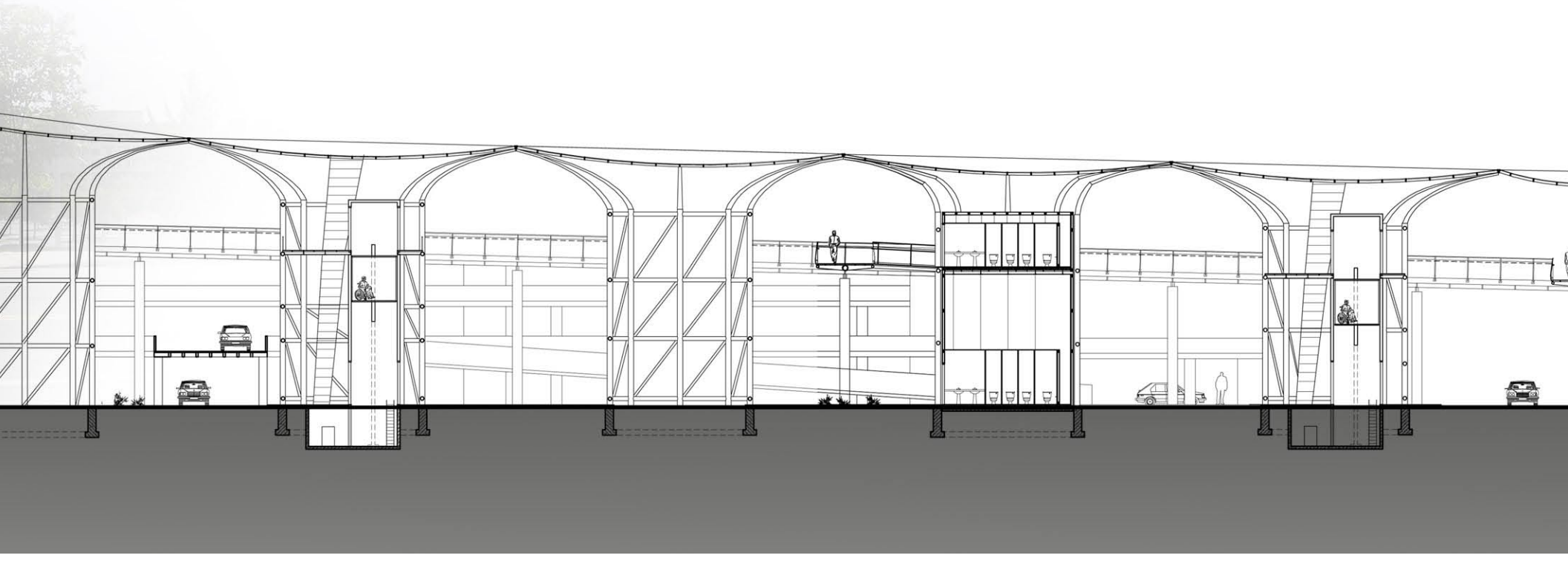
The bridge joins the existing pedestrian network at the platform between Derring Hall and Cowgill Hall.

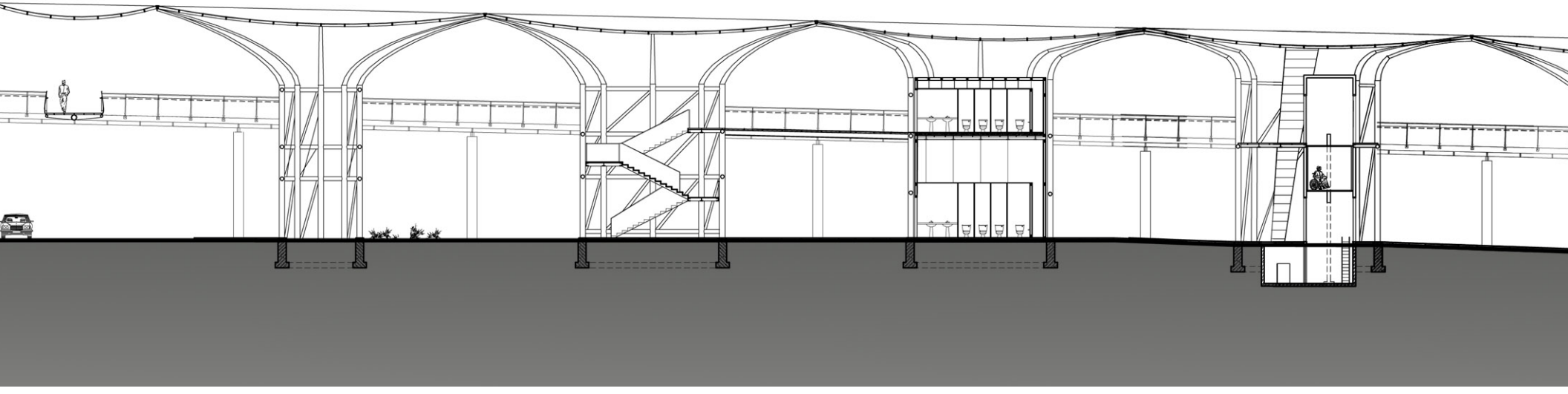


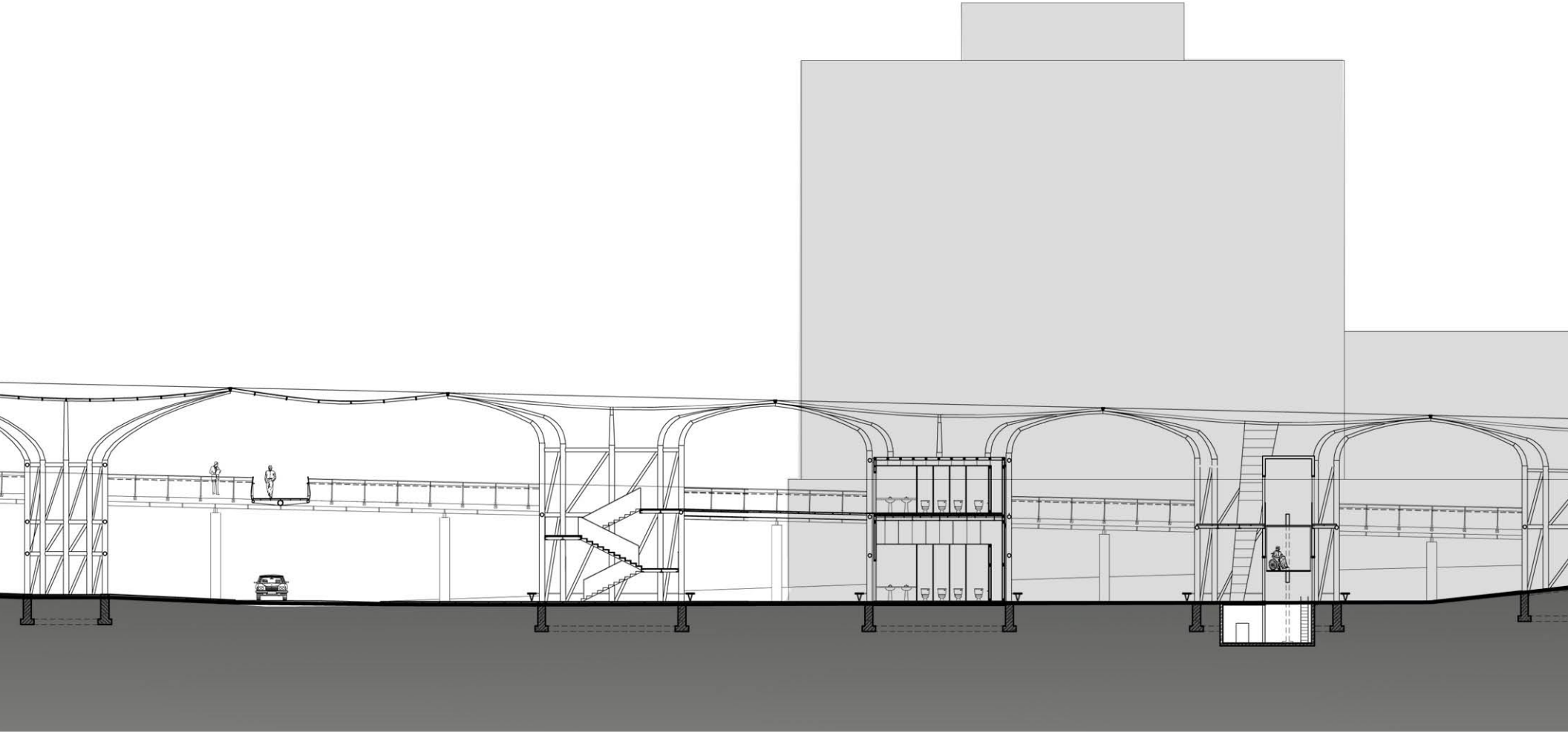


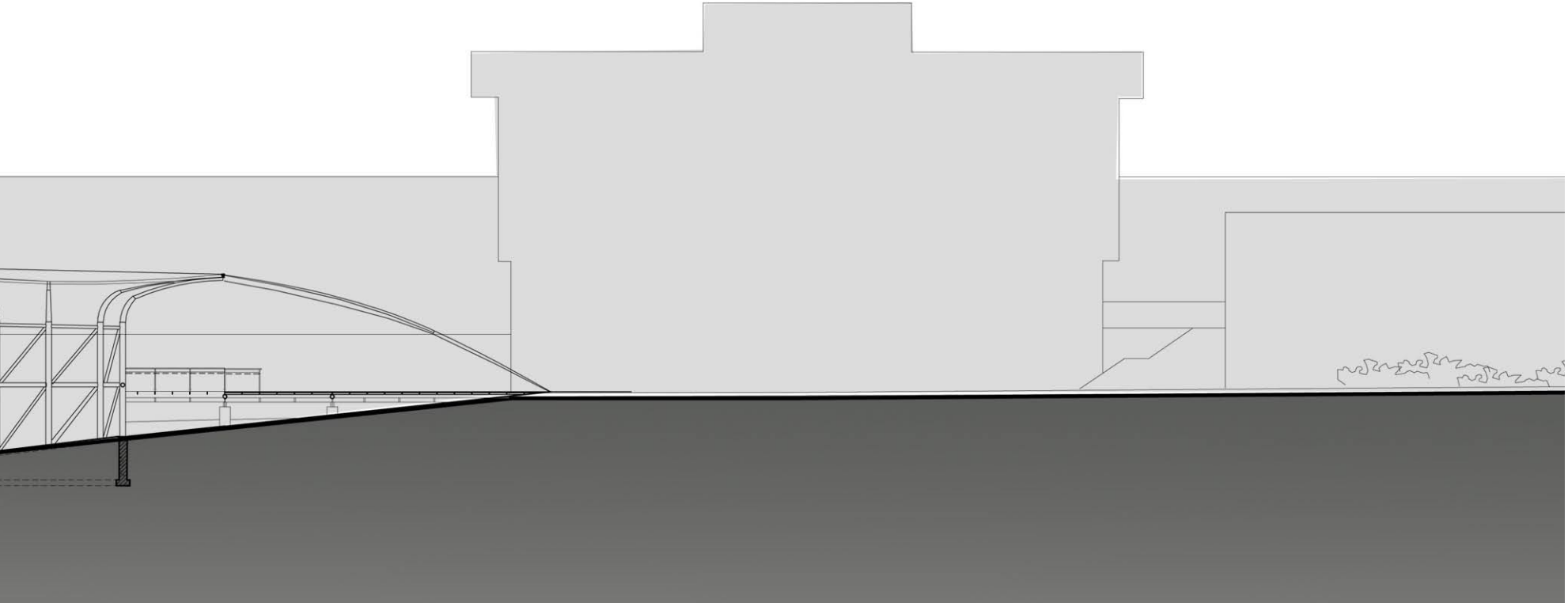
A sketch of the ending of the canopy.
Cables are used to hold it in position.


Longitudinal section
0
20
40
Feet









Conclusion

Architecture is a significant contributor to a cultured environment. A bridge, which provides a direct connection to destinations is initially a response to the basic human needs of efficient transportation between two points. In this case, the architectural qualities develop between an elevated rectilinear surface for people and an independent shelter in form of a flowing canopy above. The primary proposition is the provision of an enjoyable path crossing the terrain between the parked automobile and the central campus. The distance, while not short, is structured with architectural perspectives and possibilities of human interaction. The separation of elevated pedestrians and cars below assures not only safety but offers a dignified and cultured human space. Because of its length and position relative to the campus buildings, the bold linear element owns the potential to contribute to the built identity of the institution.

Generally, the aesthetic problems and how to separate path for pedestrians from cars are always concerns for parking lots. Unfortunately, they are often neglected. The purpose of my thesis is bringing people's attention to this issue, and simultaneously give a solution to it.

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Notes / Credits:

Images and drawings: all images and drawings are by the author.

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