



# URBAN FRAME

A Convention Center in Columbia, South Carolina



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

MASTER OF ARCHITECTURE

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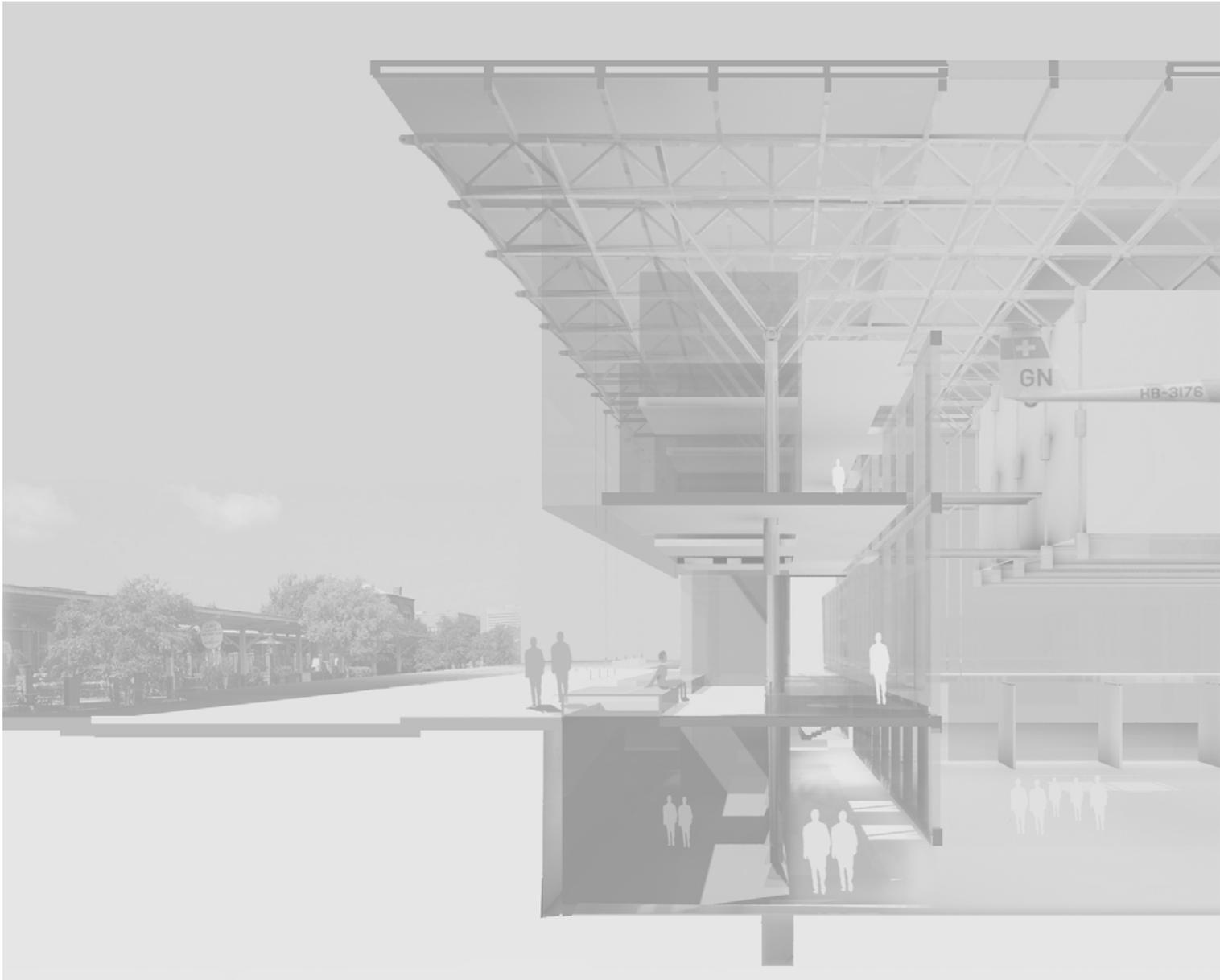
Professor Michael O'Brien

June 2004 Blacksburg VA



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# ABSTRACT

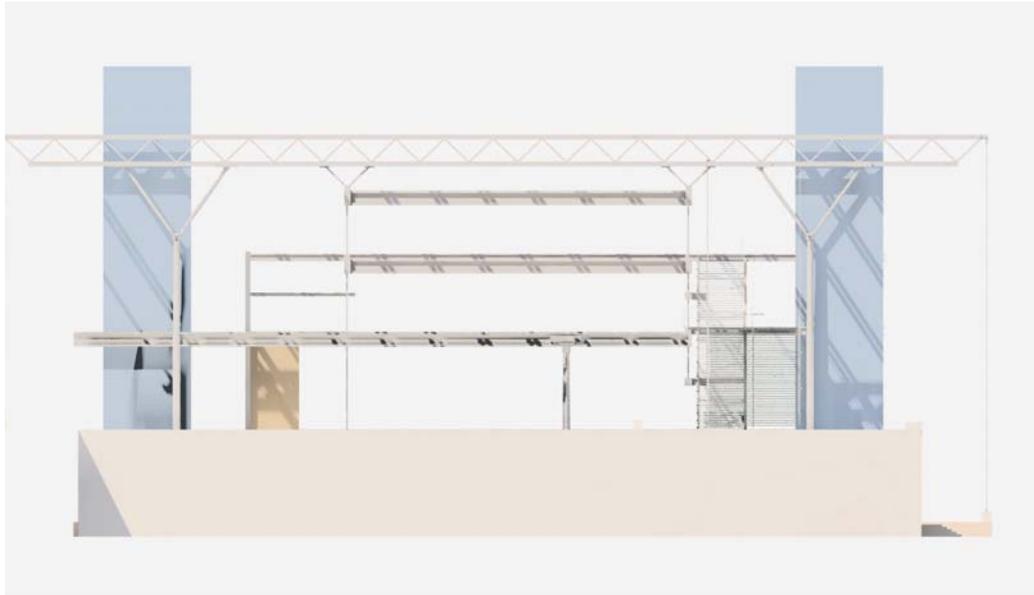
## From Structure to Urban Frames

In the context of this thesis, the notion of frame is recognized as enclosing borders, or the outline of views, rather than as a load-bearing structural element.

This thesis investigates how frames can build urban connections and, at the same time, structure sequences of movement and define a path with a variety of spatial experiences.

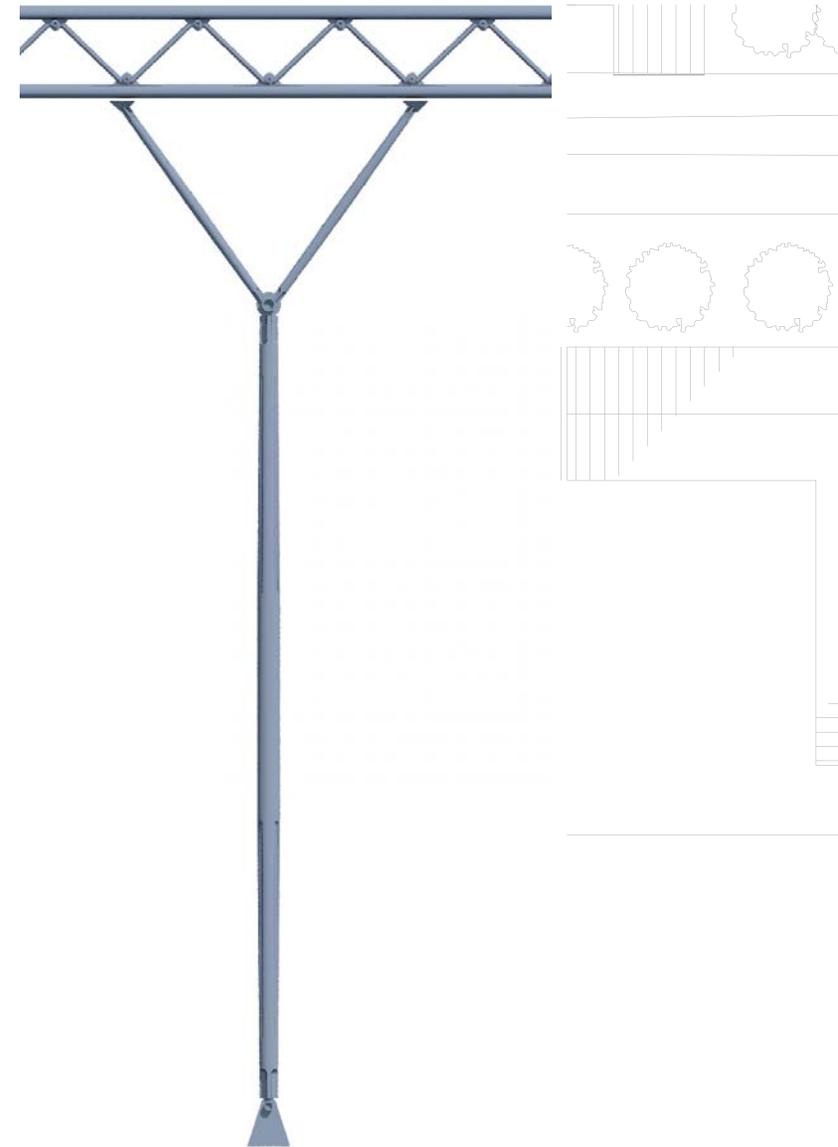


## STRUCTURE and FRAME

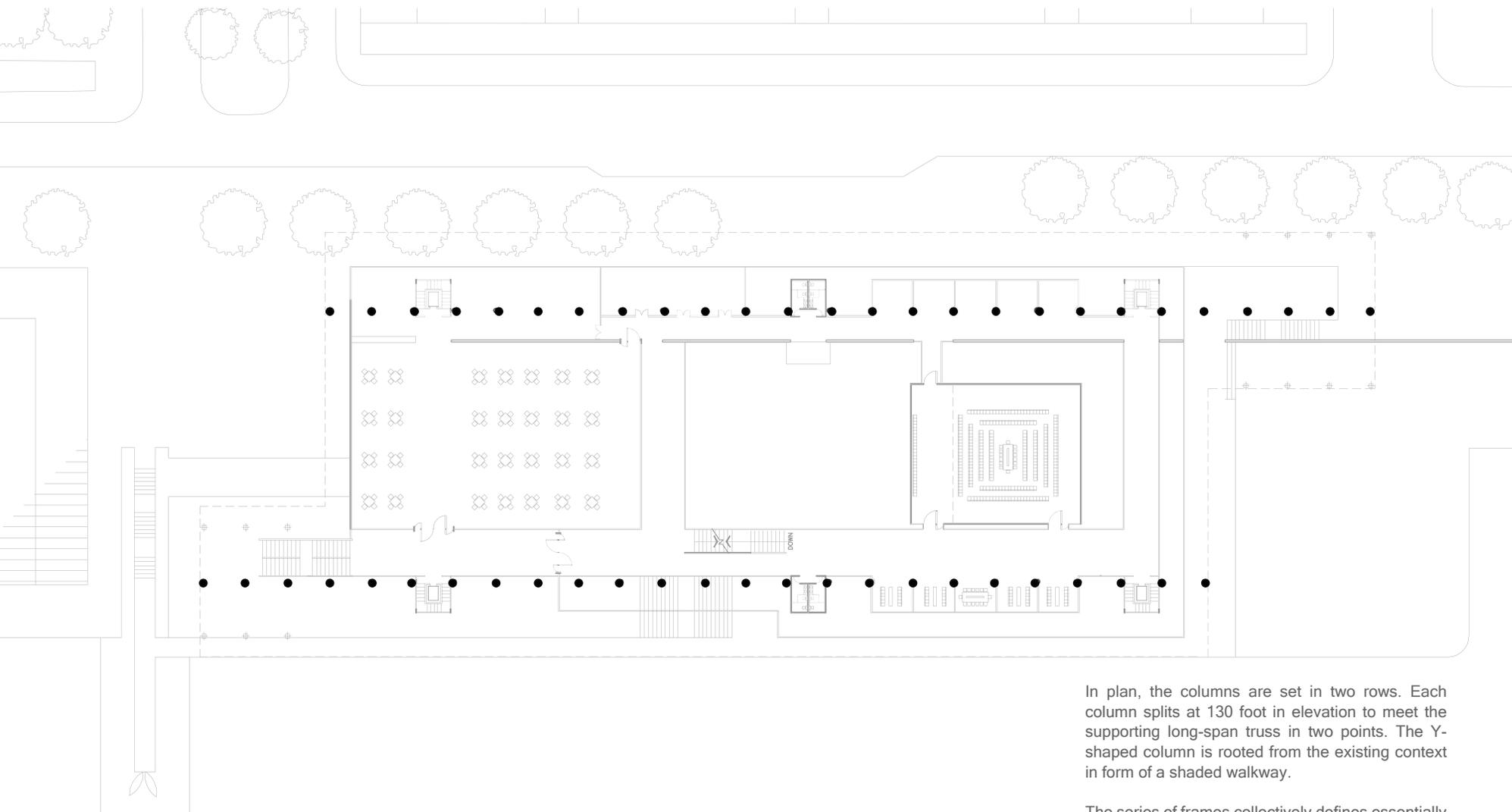


A typical physical frame consists of three basic elements: Two columns and one beam. In this case these three elements are realized in steel, a light-weight and very strong material suggesting skeletal qualities.

The connection between the column base and foundation, and also between the column and the horizontal beam, a truss in this case, employs a pin joint. In high strength materials such as steel, pinned connections are ideal shear connections which use little space. Pins are driven into holes of the respective complimentary steel parts. Both pin and hole are precision-made to ensure an accurate fit.

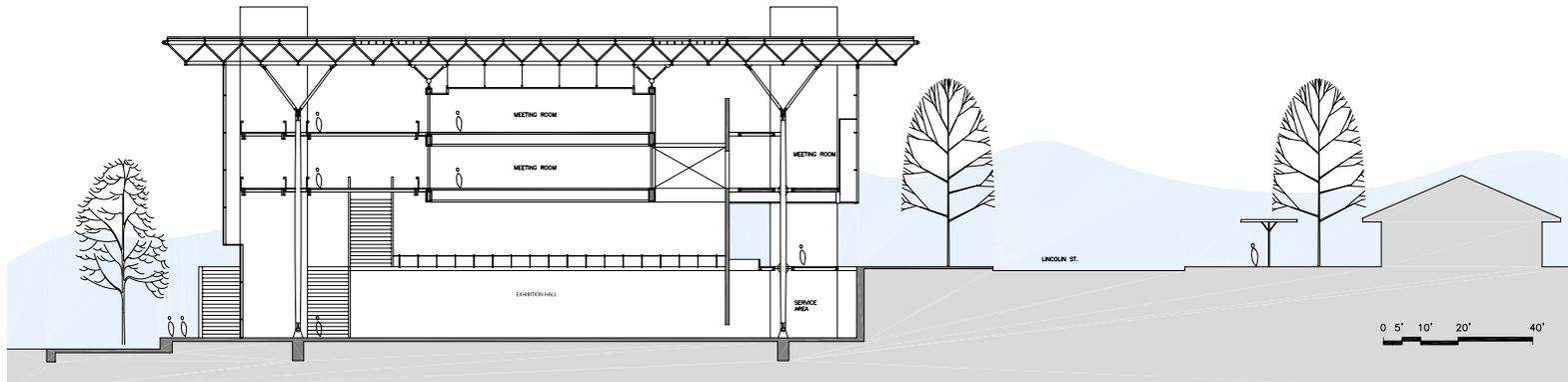


## Structure and Frame

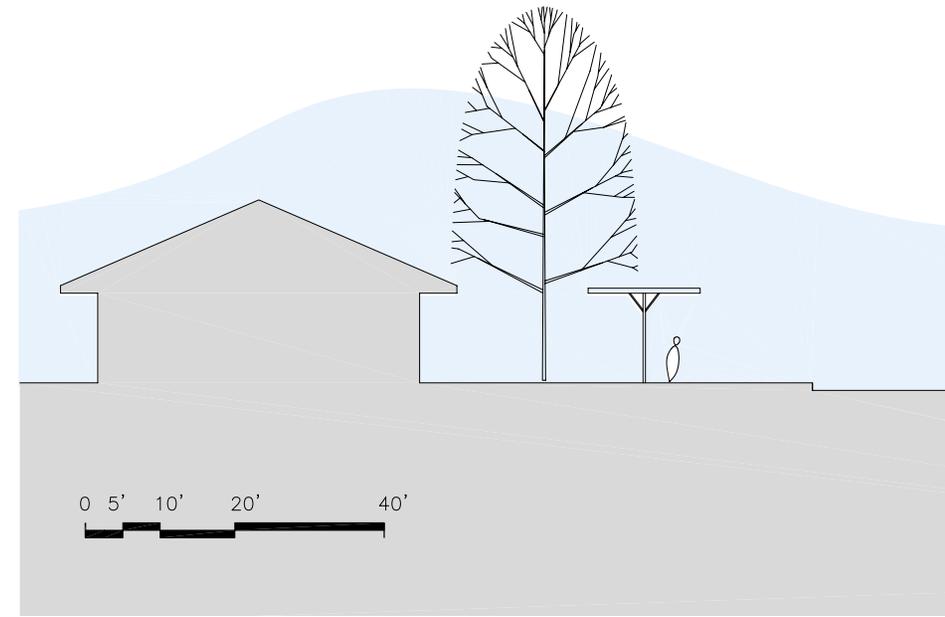


In plan, the columns are set in two rows. Each column splits at 130 foot in elevation to meet the supporting long-span truss in two points. The Y-shaped column is rooted from the existing context in form of a shaded walkway.

The series of frames collectively defines essentially one large open space between the rows of columns where exhibitions can take place.



Inside the array of frames, smaller volumes are suspended from the trusses to define secondary spaces such as meetings rooms. The exhibition hall therefore remains as a large open space.

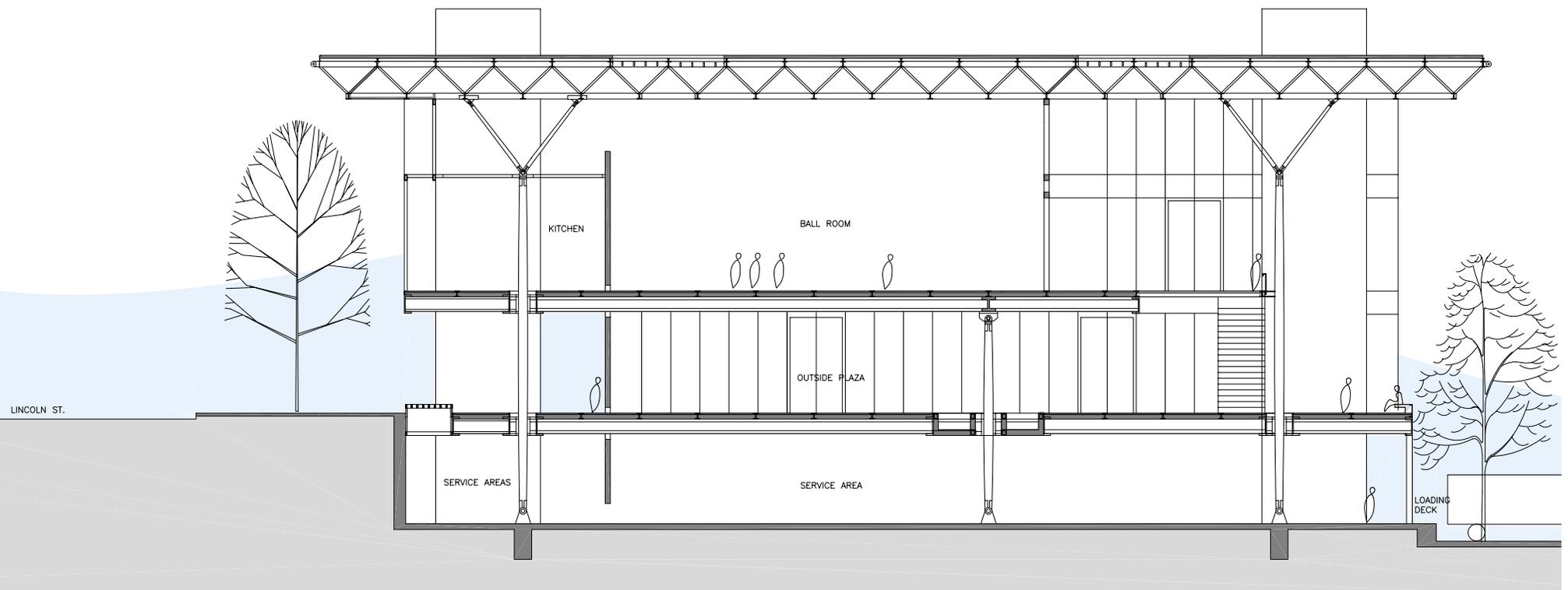


## Structure and Frame

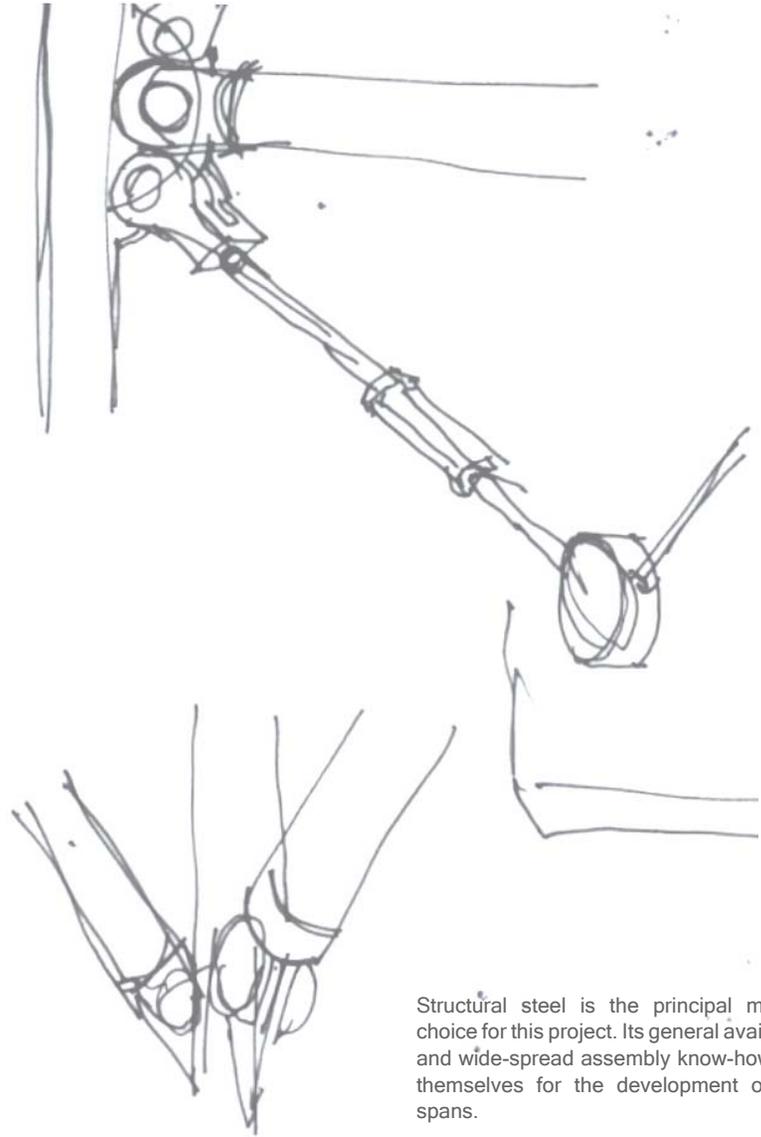
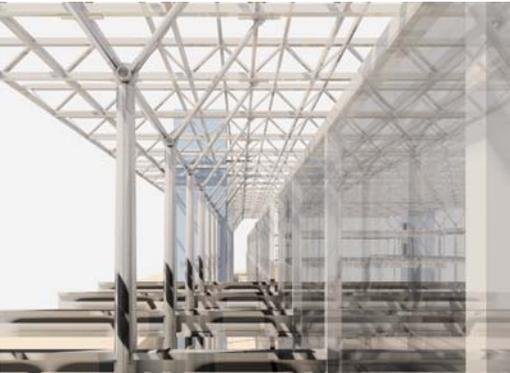
The horizontal member connecting the columns is conceived as a continuous unified truss. It is composed of basic triangular shapes with pin-jointed connections.

Each truss is supported by a pair of columns to form the frame. The trusses support the uniform flat roof and several suspended volumes.

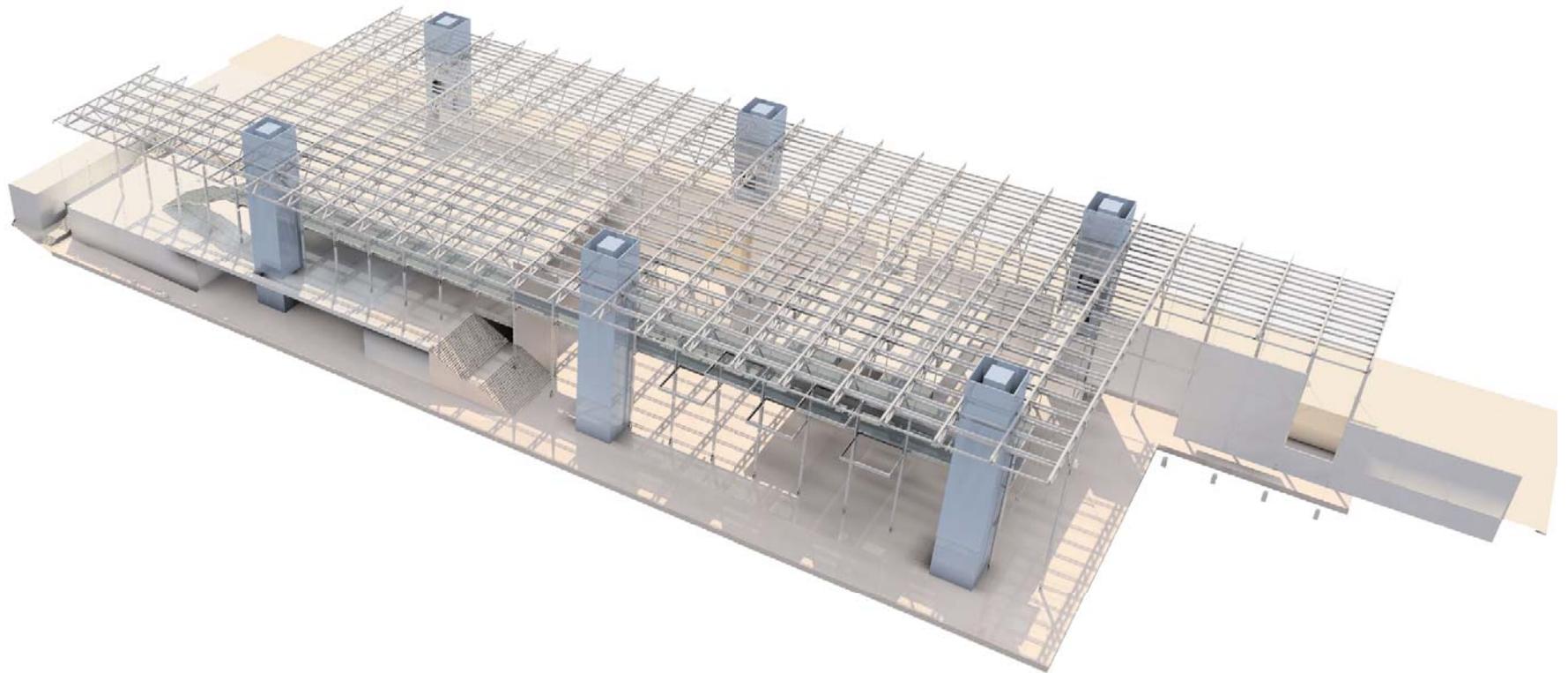
One additional row of smaller columns assists the ballroom floor due to its long span.



## MATERIAL and SYSTEM



Structural steel is the principal material choice for this project. Its general availability and wide-spread assembly know-how offer themselves for the development of long spans.



The overall view of the whole building structure.  
Six service towers help the whole building to resist  
wind load and other lateral forces.



## FRAMING URBAN CONNECTIONS

## Urban Conditions



The City of Columbia

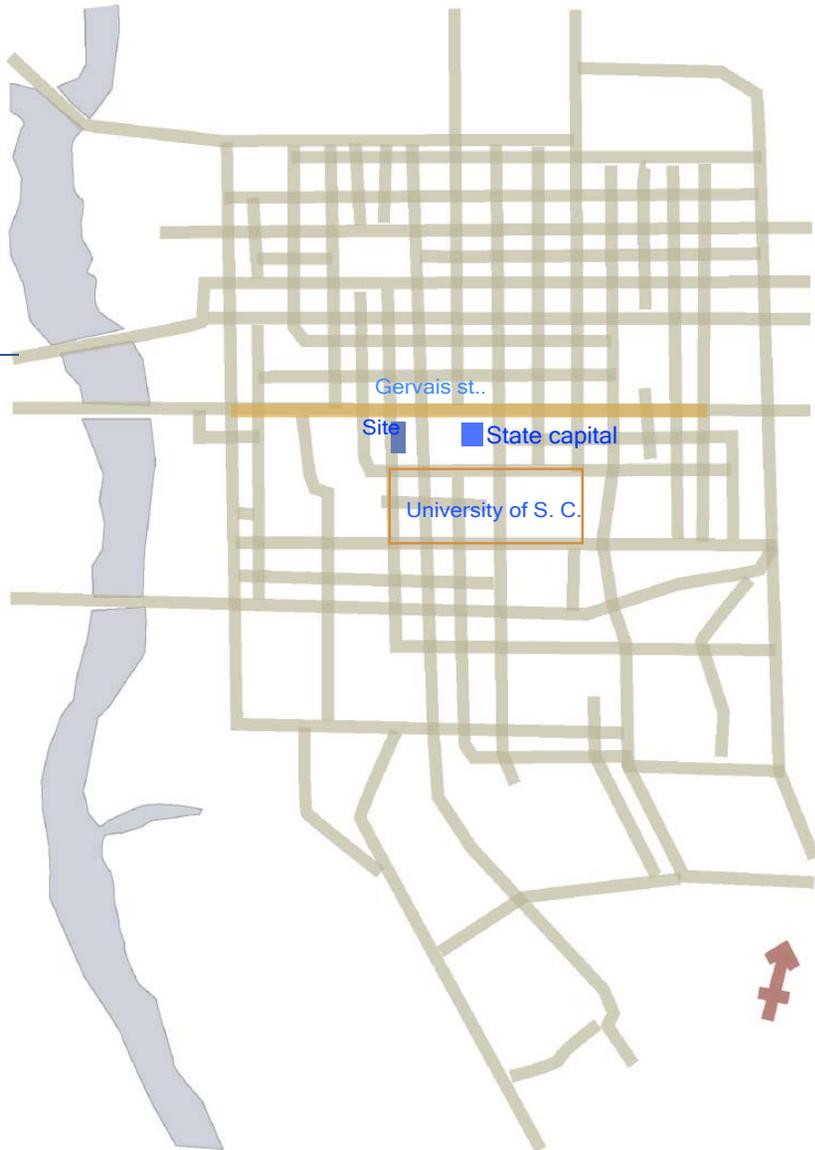
Columbia, originally laid out in 1787, is one of the first “planned cities” in the United States. The city’s street grid is one of the dominant elements of city’s urban form, resulting in parallel lines and right angles. The Congaree River passes through on the west side of the city.

The site of the building is located on Lincoln Street, between Gervais Street, downtown commercial area, and University of South Carolina.

Among the landmarks that can be seen from the site are the State Capital, the tallest office building in the city, and the Carolina Center, the new USC basketball field.

This project seeks to establish missing links, strengthen connections, and bring positive changes for the existing urban form.

Urban Conditions



State capital



Tallest office building in the city



New USC basketball field

## Framing Urban Connections

Although the proximity of the river in this project suggests the articulation of an urban link between downtown and the waterfront, this project will focus on the connection between downtown and the Carolina Center, a sport complex which belongs to USC.

The building's initial orientation follows the city grid, parallel with the Lincoln Street. This helps to strengthen existing urban block pattern which currently is defined only by the street itself. A plaza is laid out at the intersection Lincoln and State Street. This intersection marks a strategic location from which a future linear urban link could stretch from the Capital to the River, crossing the plaza the proposed pedestrian walk connected the Carolina Center sports complex to downtown.

The Convention Center's contribution to this walk consists of a shaded path during the day and an illuminated exhibition wall during the night along Lincoln Street.

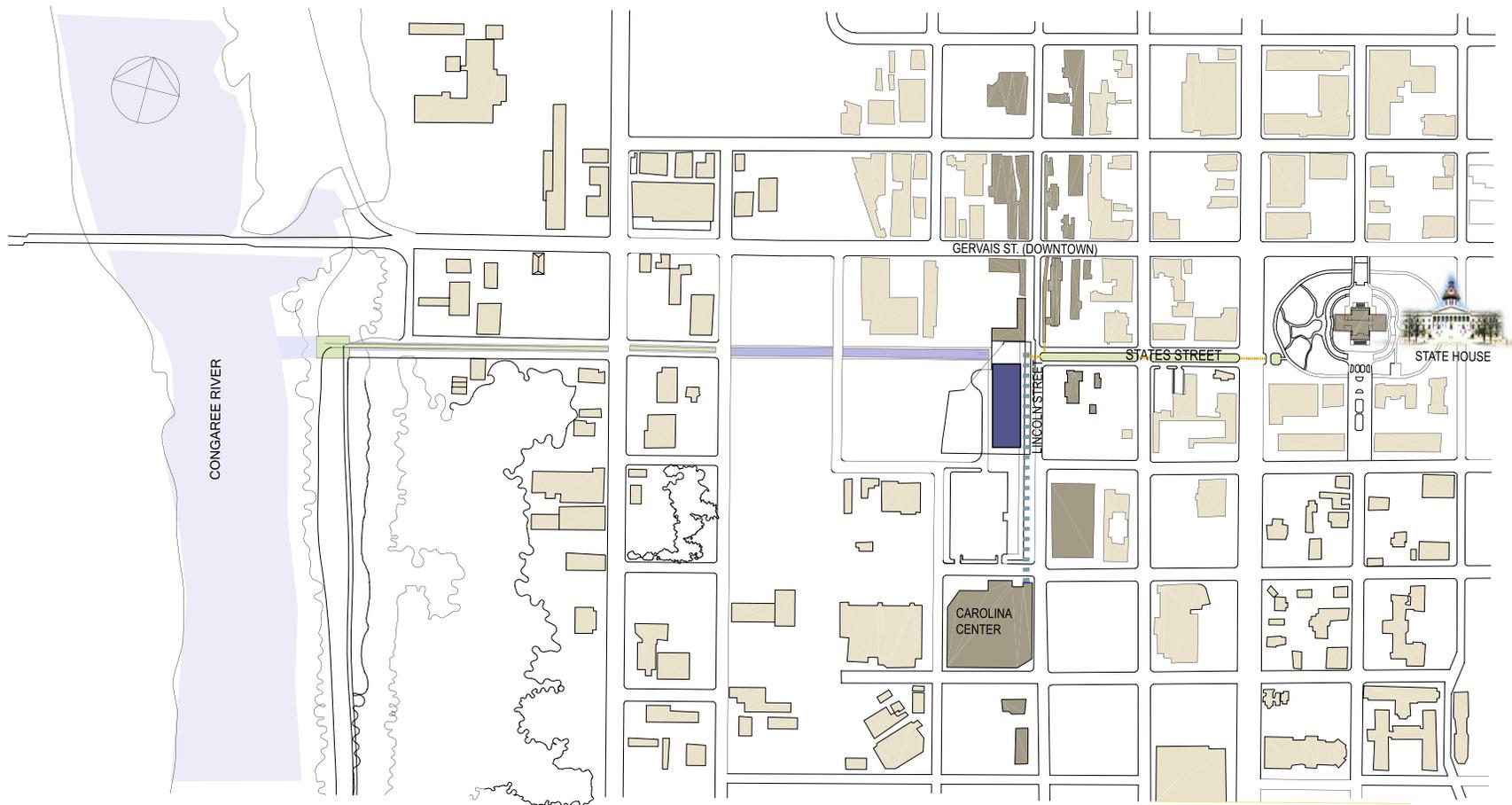
This corner offers a piazza like public room for the city and also serves as the street level entrance for the convention center.



Downtown

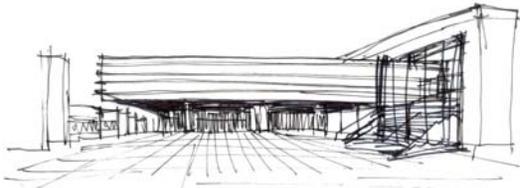


Carolina center

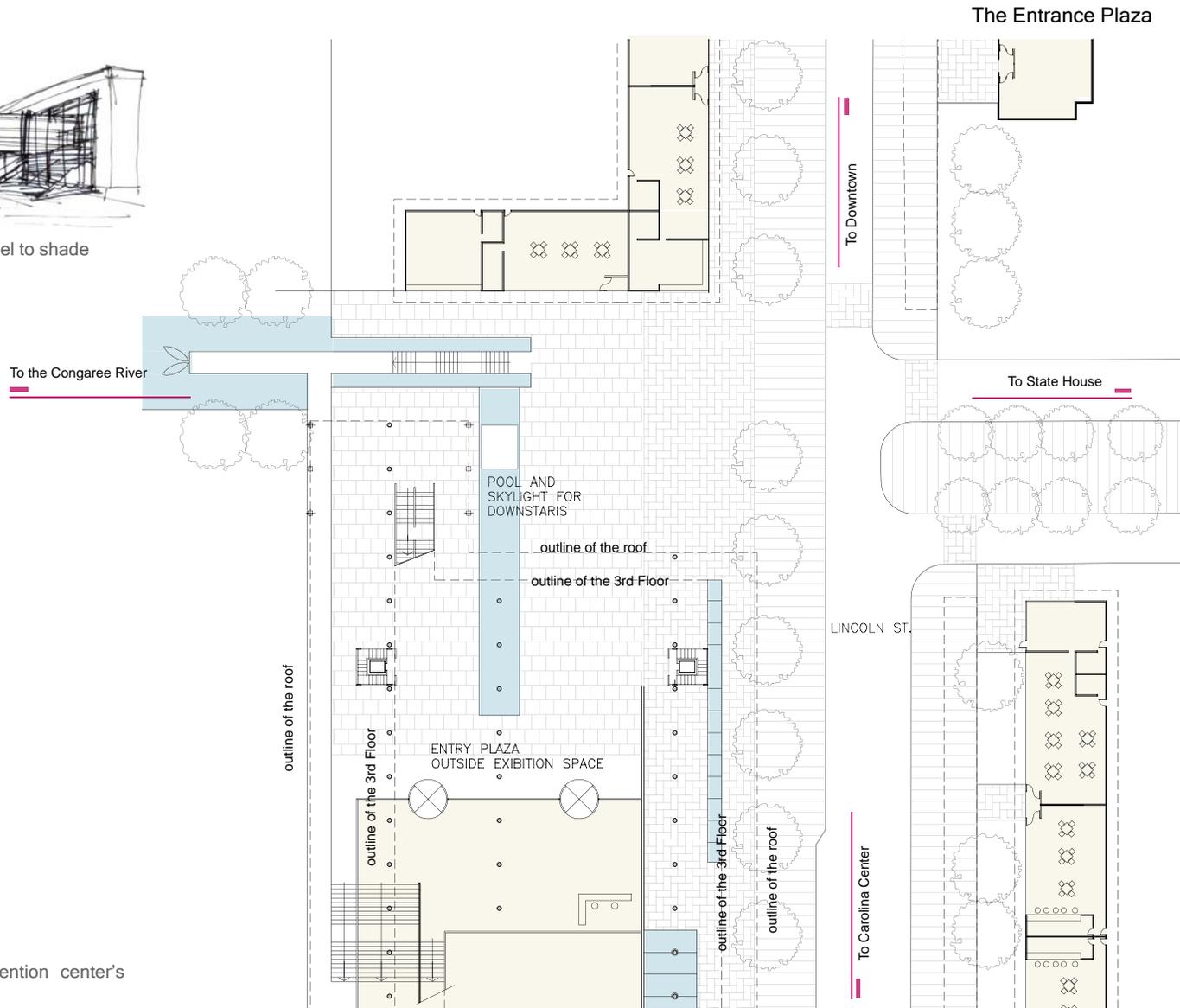


The Entrance Plaza



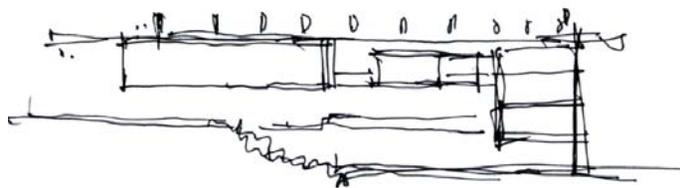
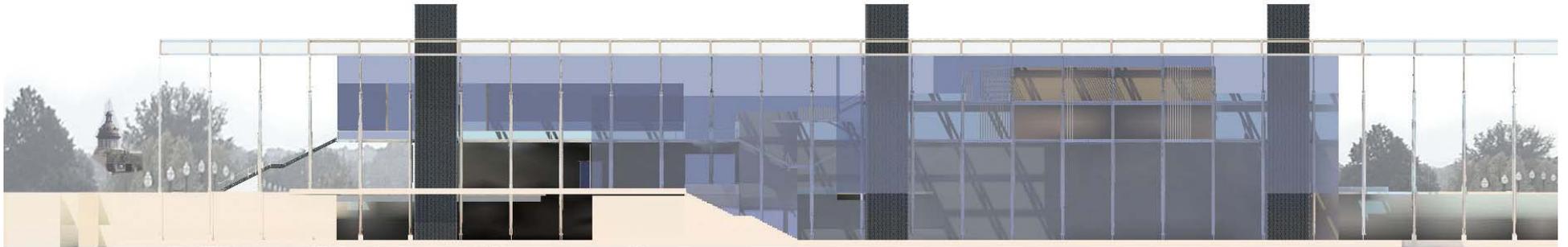


The ballroom is lifted up to third level to shade a part of plaza below.



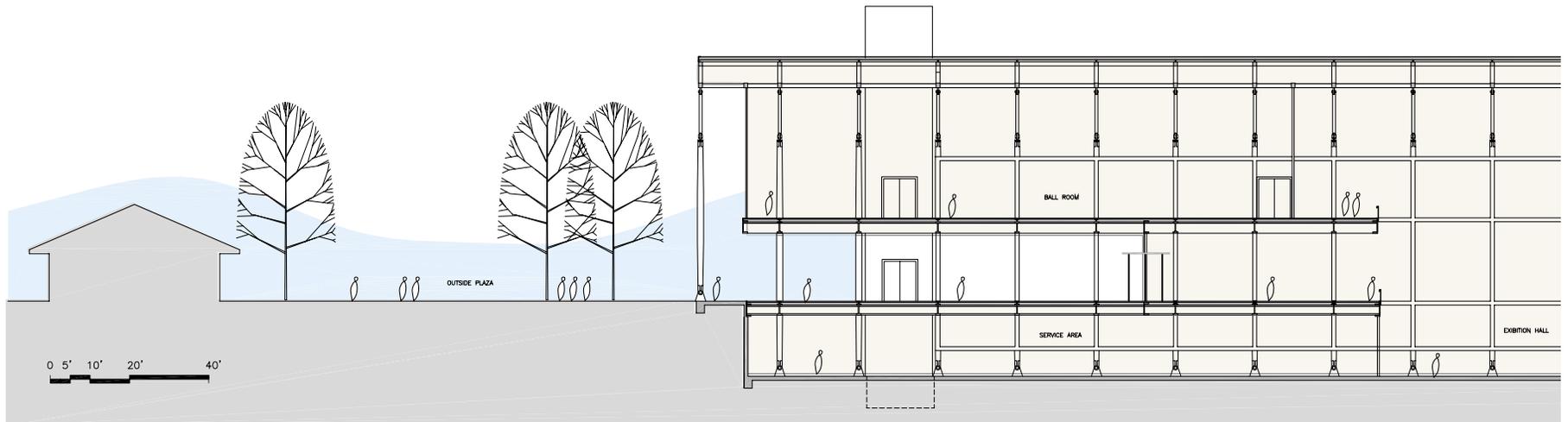
This plaza serves as the convention center's entrance from street level.

The Entrance Plaza

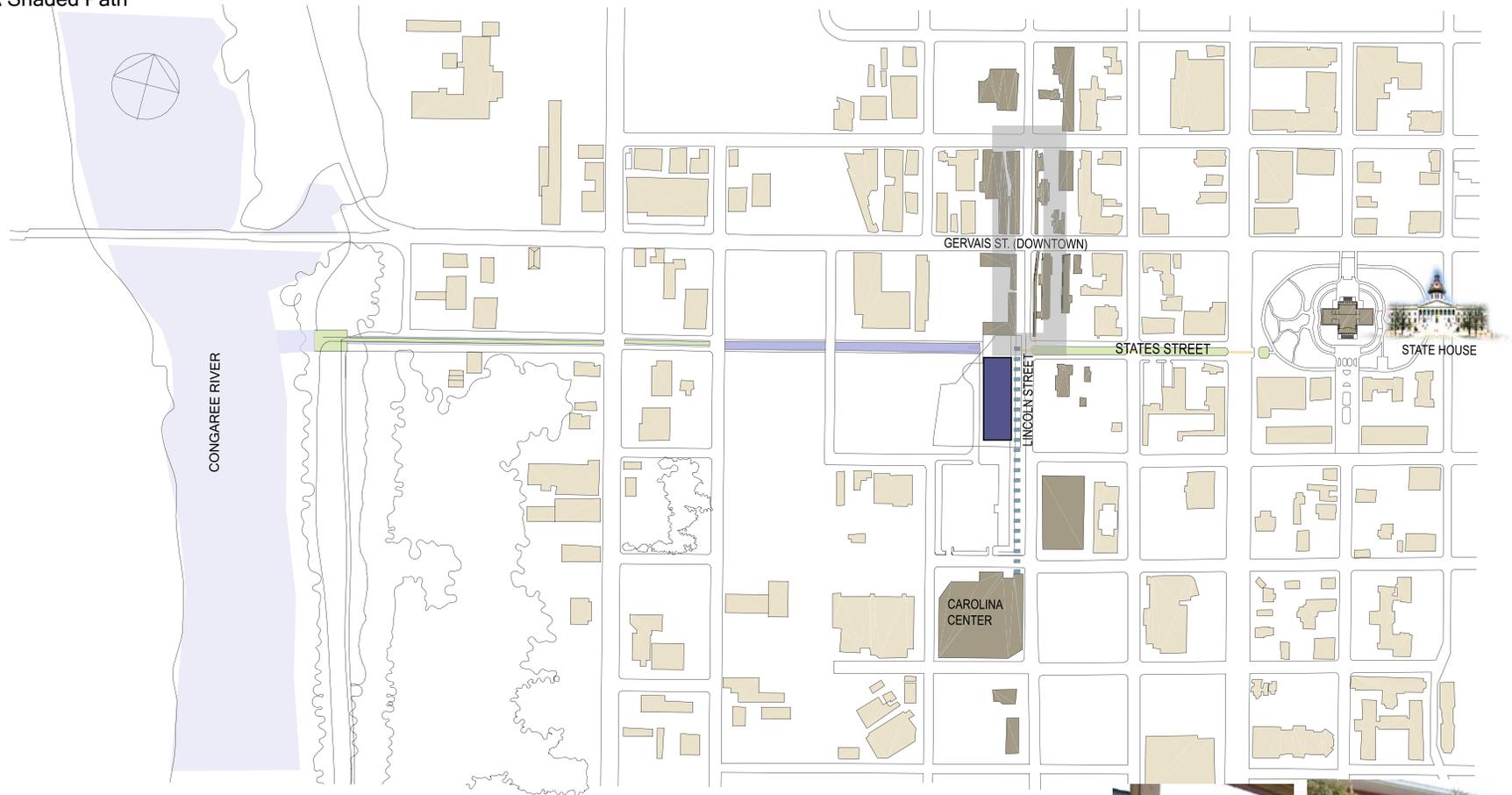


## The Entrance Plaza

Section through the plaza and the entrance of convention center shows their relationship of one and another.



## A Shaded Path



The climate in Columbia is moderate in the winter and extremely hot in the summer, averaging highs of 56 degree F in January and 91 degree F in July and August. Shade is a desirable element for the conduct of urban life.

At the moment, a shaded path, starting in the downtown area and extending two blocks along Lincoln street, is an urban front porch with charming shops and restaurants. It protects people from sun and rain and offers itself as an element to be continued.



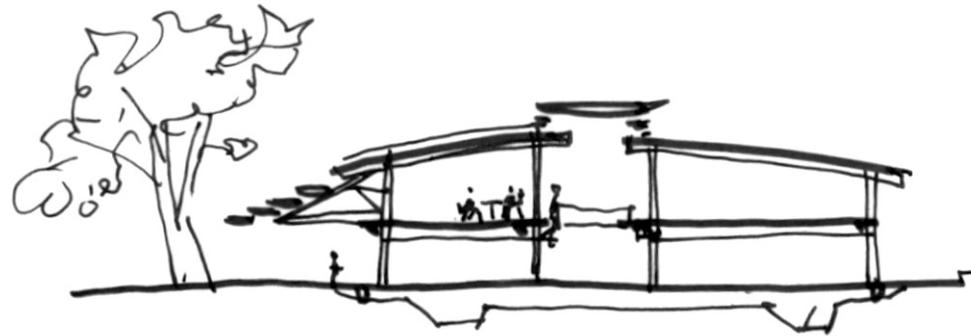
A Shaded Path



## Architecture and Shade

1. Shading generated by the extension of the roof.

In this example, a shading device extends the roof outline. Its overhang defines a public space and makes a connection between the two ends of the building. In response to the angles of the sun, lower roofs lend themselves better to this approach.



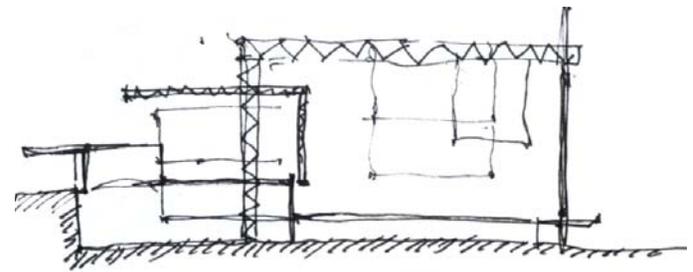
Lycee Albert Camus by Norman Foster

## Architectural Shading

2. Shading generated by a separate architectural element.

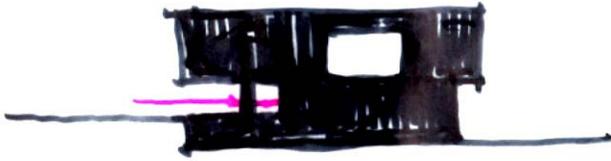
For a four-story building with a flat roof, an extension of the roof would demand very long horizontal extension before shade could be generated along the ground floor sidewalk.

In this case, a detached shading element will be used instead, separated from roof structure.

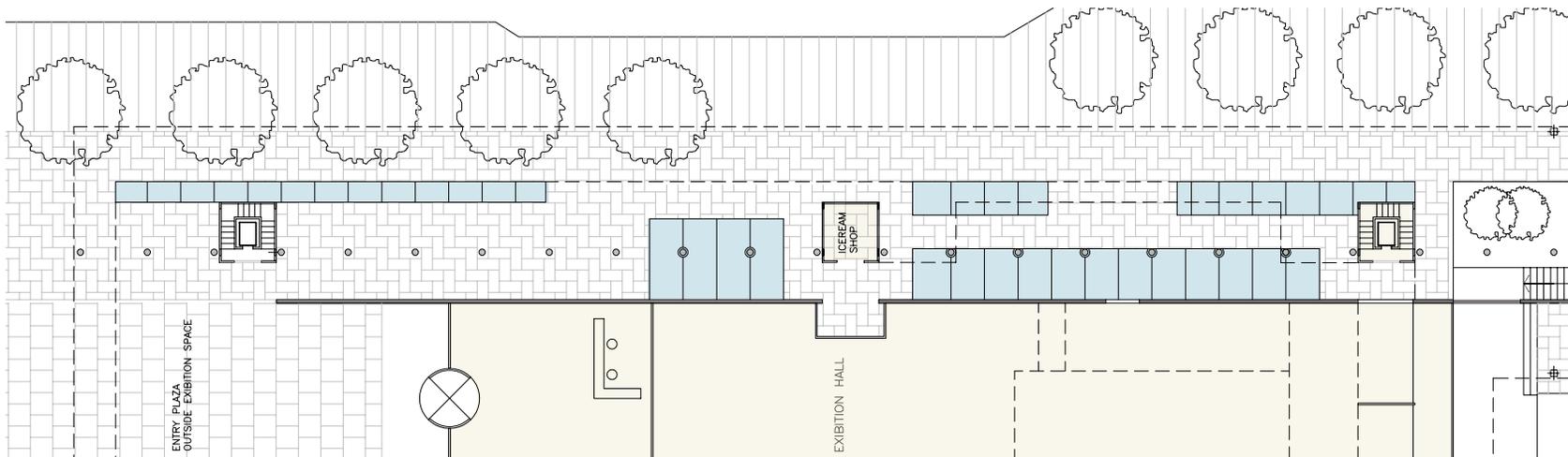


## The Colonnade

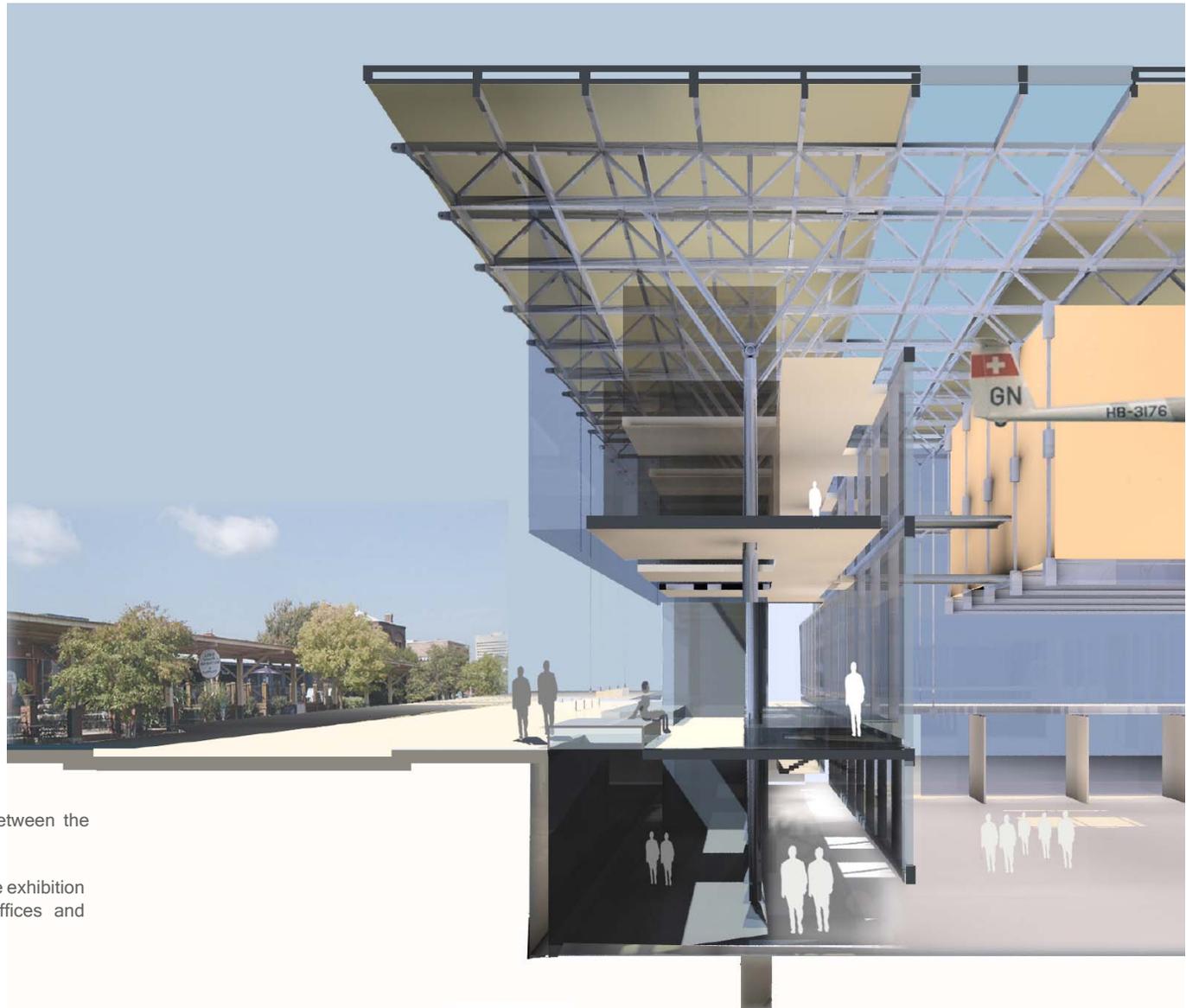
Along Lincoln Street, hovering building volumes overlap the sidewalk. Under this building overhanging, shade is generated. The elements of the path along this facade are building floor, columns, sidewalk surface, and a translucent and transparent exhibition wall.



A colonnade as the shaded path. The very early morning sunlight angle allows light to reach the floor of the path. The shade moves in later in the day.



## Shaded Path on the Street

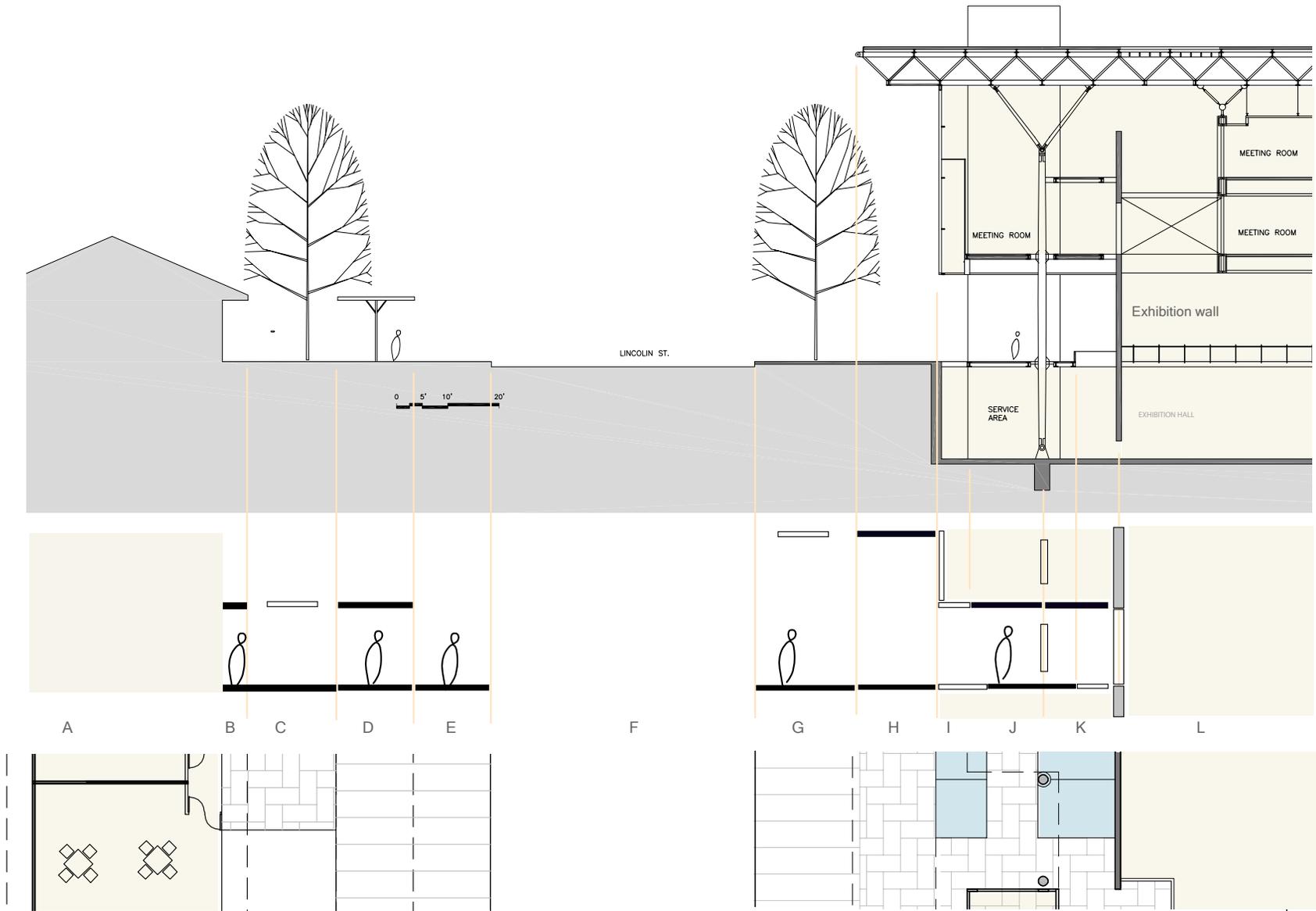


This view shows the relationship between the path and the street.

The path is defined on one side by the exhibition wall, the overhanging ballroom, offices and partially exposed columns.

## Street Layers

- A Inside
- B Roof Overhang
- C Tree Shade
- D Shading element
- E Walkway, 24x24 paving block
- F Car Lanes
- G Walkway, 24x24 paving block, covered by trees
- H Walkway, 12x12 paving block, covered by overhang
- I Walkway with low transparent ceiling and transparent floor
- J Walkway with opaque ceiling and floor, and columns
- K Walkway with partially transparent ceiling, floors, columns and exhibition wall
- L Inside



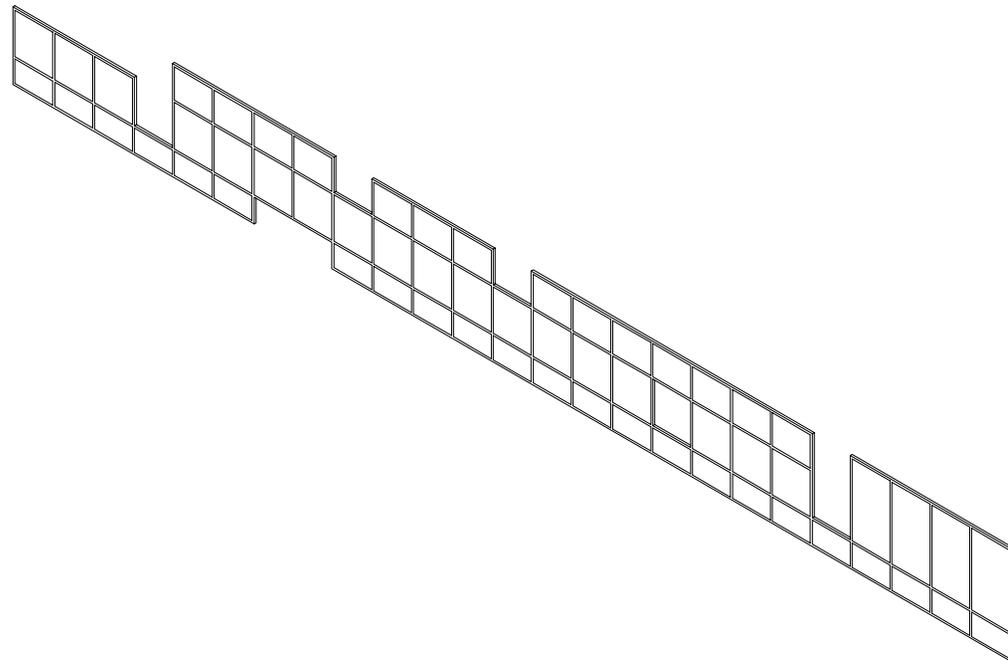
## The Illuminated Exhibition Wall

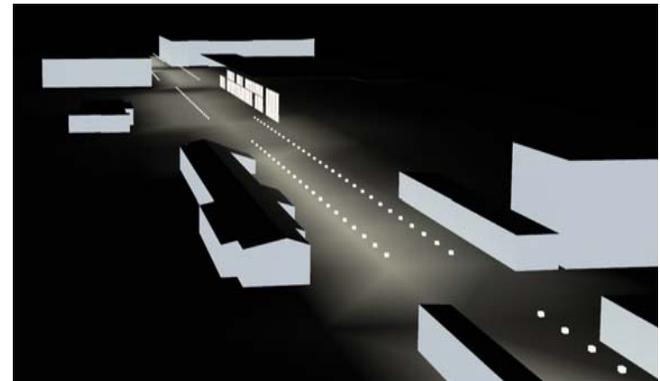
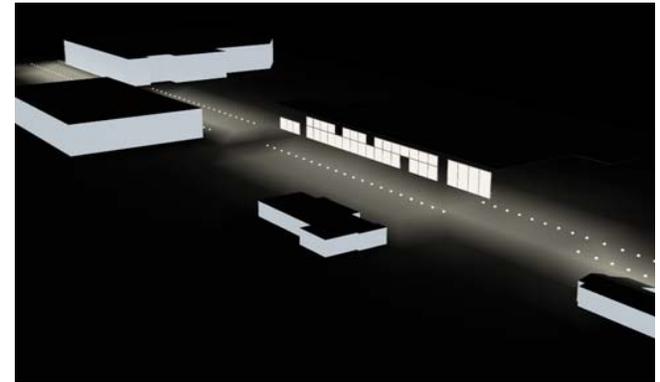
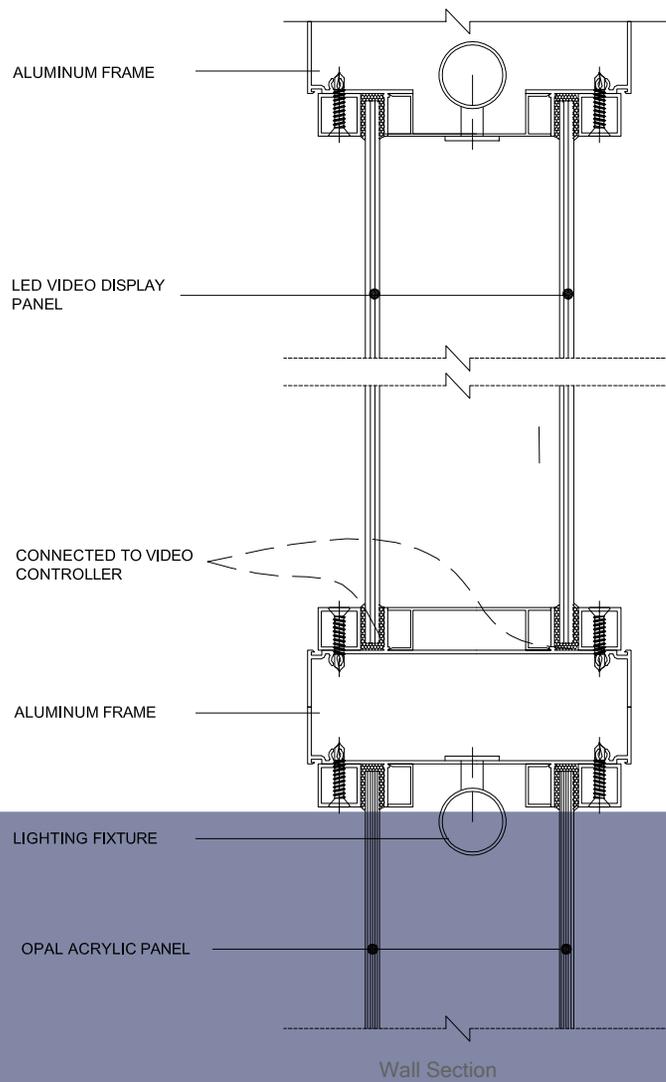
At night, the connection between downtown and the sports complex is assisted by a line of continuous lights along the street. New lights are added to complete the line.

Along the convention center, a light frame exhibition wall is the major source of illumination, displaying active exhibition graphics to animate the urban environment and lead along the path.



A view beside the illuminated exhibition wall on the street.



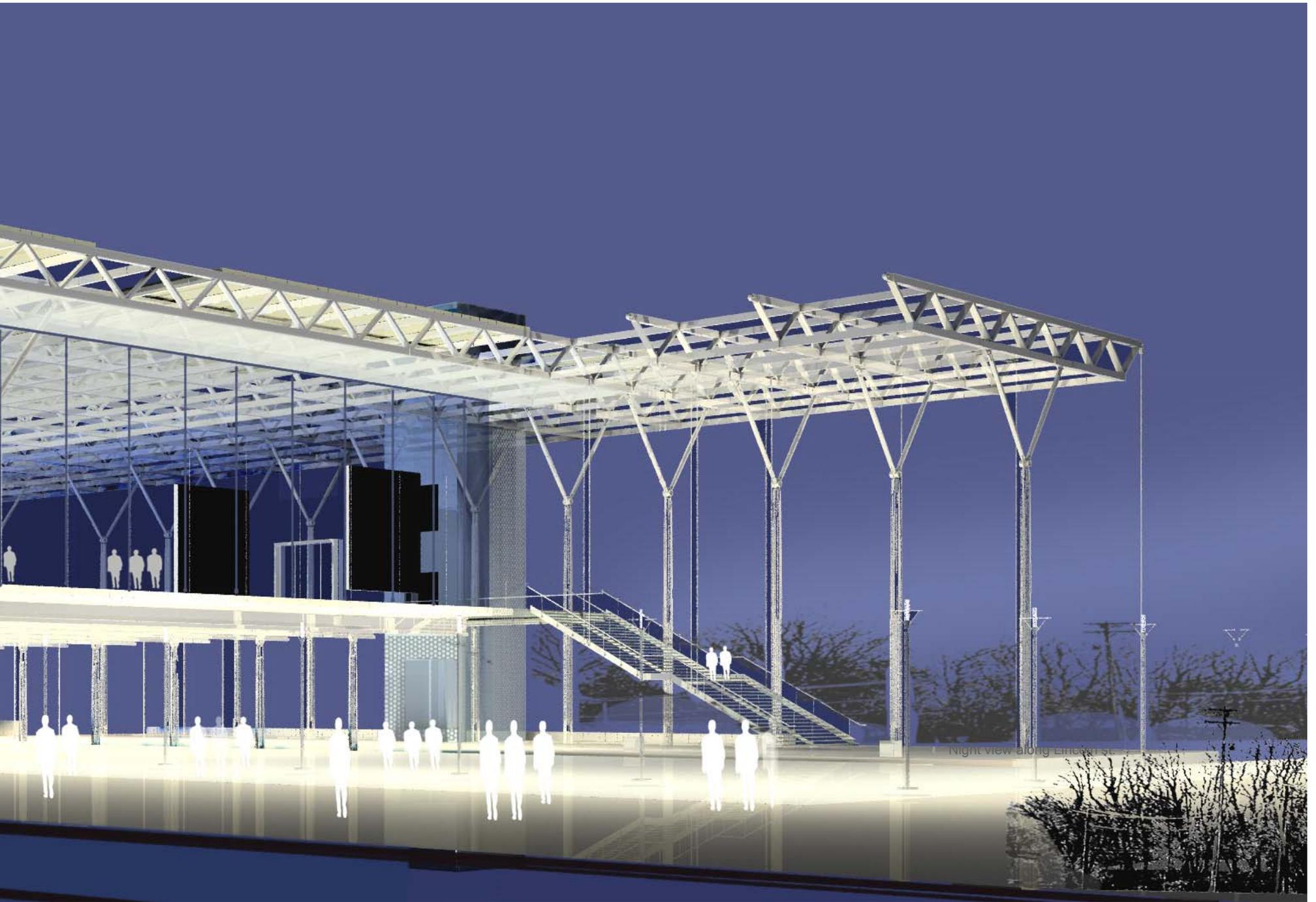


Bird's eye view of illuminated wall along Lincoln Street

## Illuminated Exhibition Wall

The exhibition wall also functions to separate the service area from the exhibition hall. And it allows the exhibitions to occur both outside and inside of the Exhibition Hall.





Night view along Eirehnti st.



## MOVEMENT and SPATIAL EXPERIENCES

## Preliminary Study

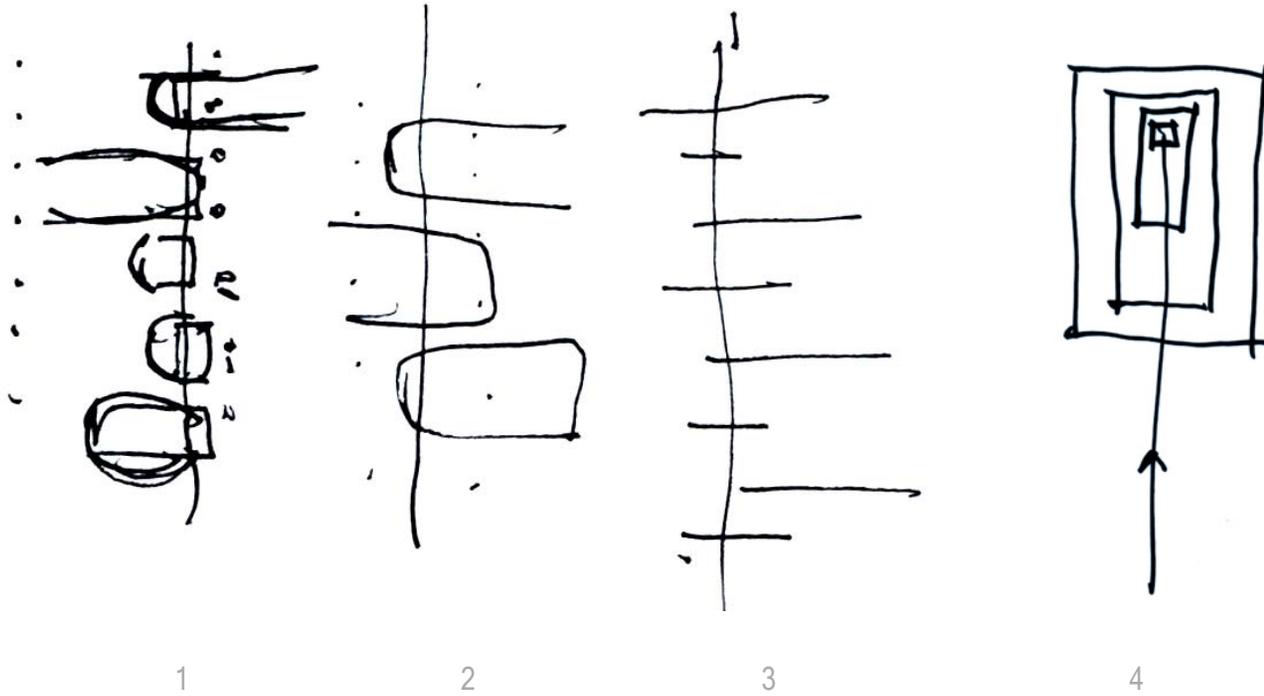


## Sequence of movement and spatial experience

The path cutting through the 130,000 square foot building, offers 500 foot of architectural articulation.

Path assumptions:

- 1 A path with different spatial volumes.
- 2 A path with openings on different sides.
- 3 A path passing through different frames
- 4 A path passing multiple-layered boundaries

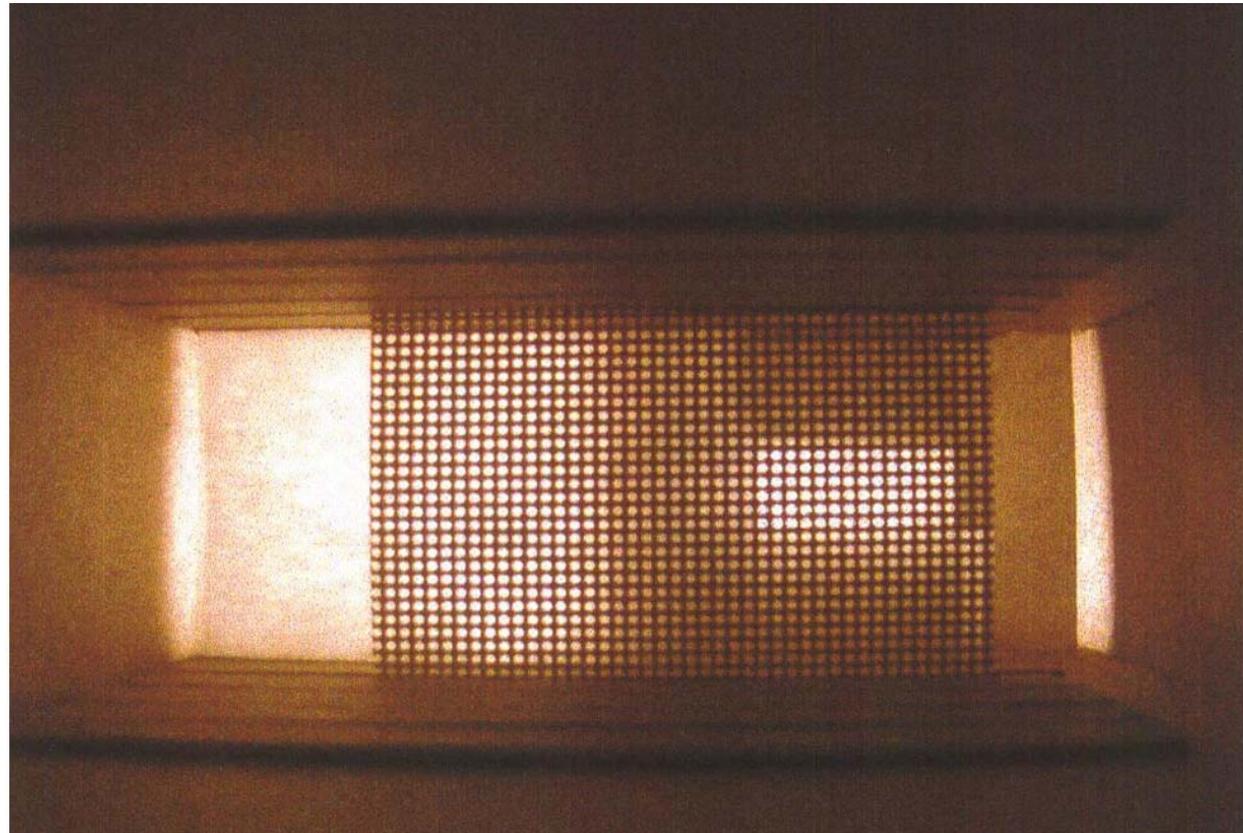


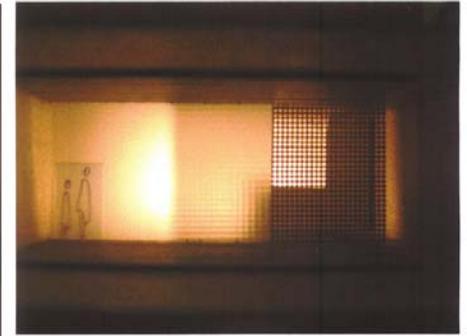
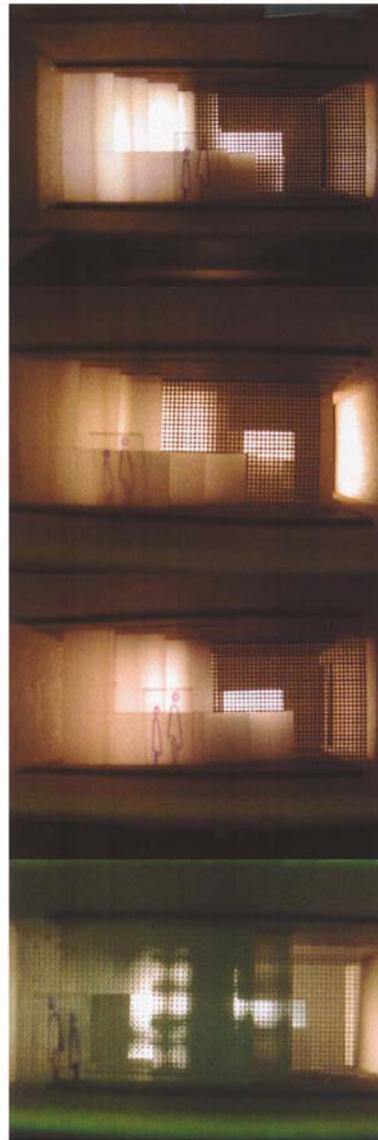
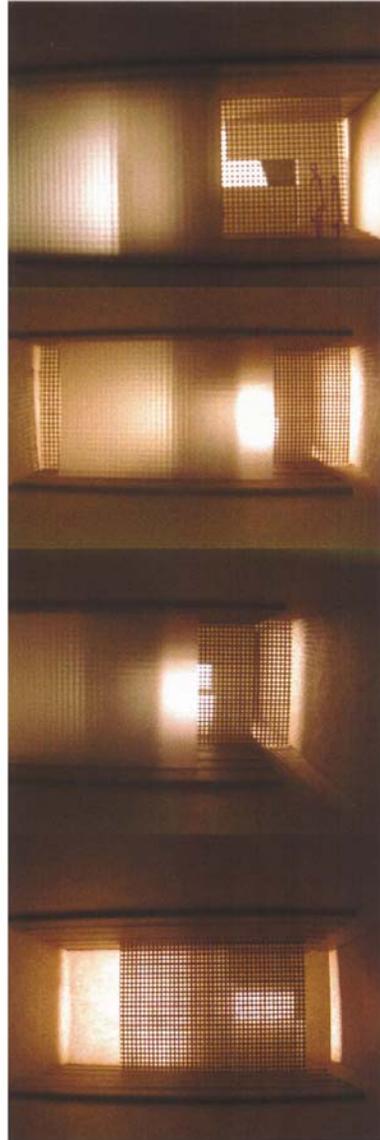
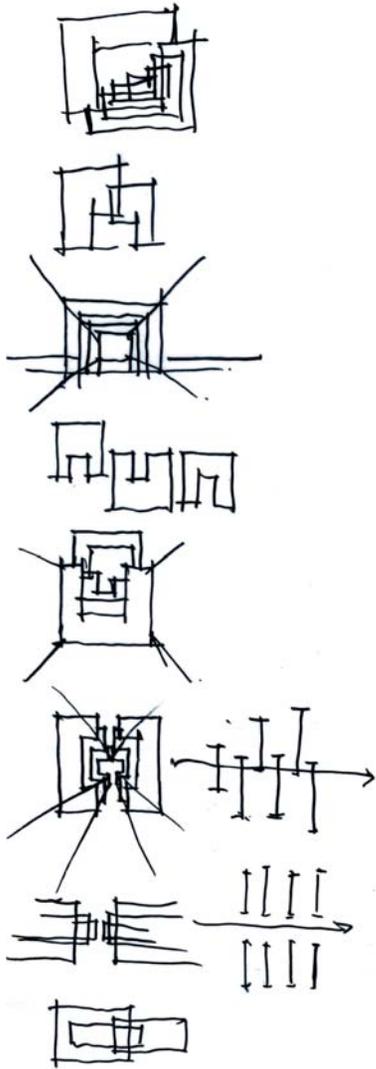
## Space and Light Along the Path

Preliminary studies of spatial events along the path.

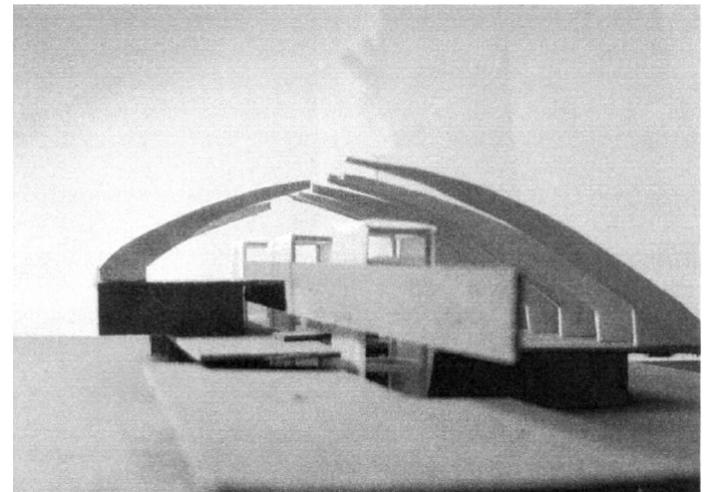
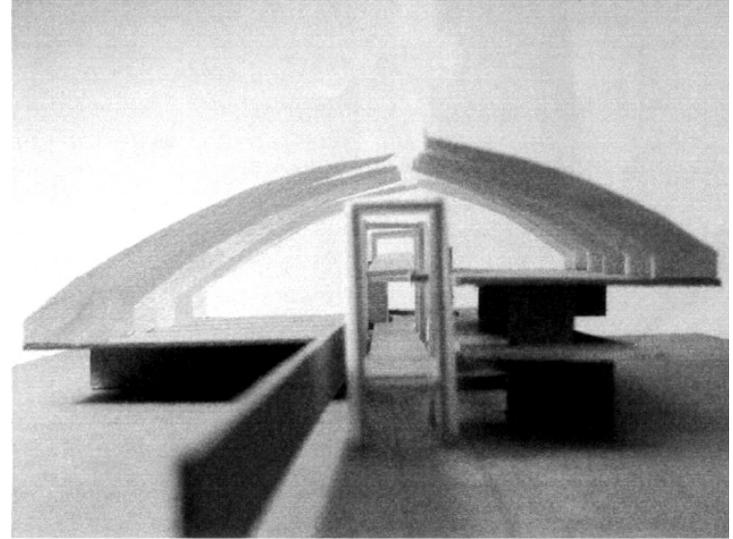
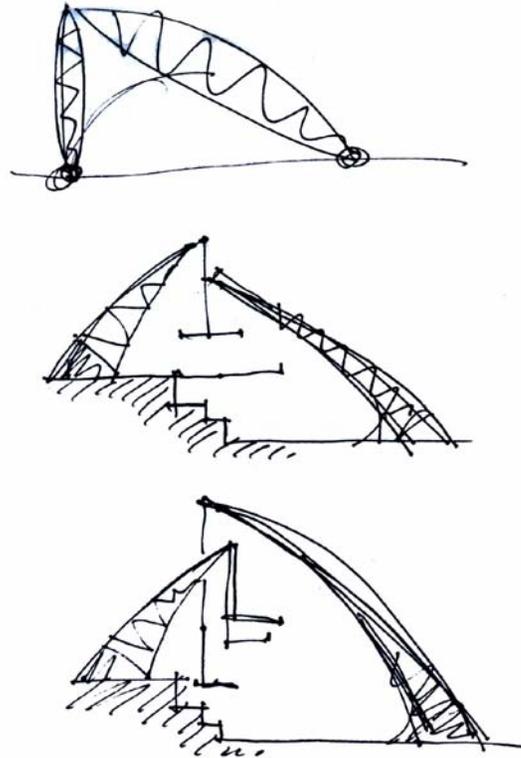
Along the path, layers of various transparencies define a series of different shapes.

The investigation focuses on possible light conditions along the path in conjunction with exhibition boards. The most attractive view is generated by the combination of partitions with different transparencies. Partition boards are assumed to be opaque to accommodate typical exhibitions.



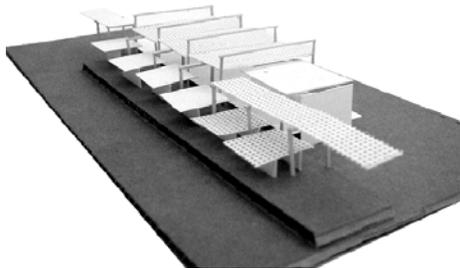
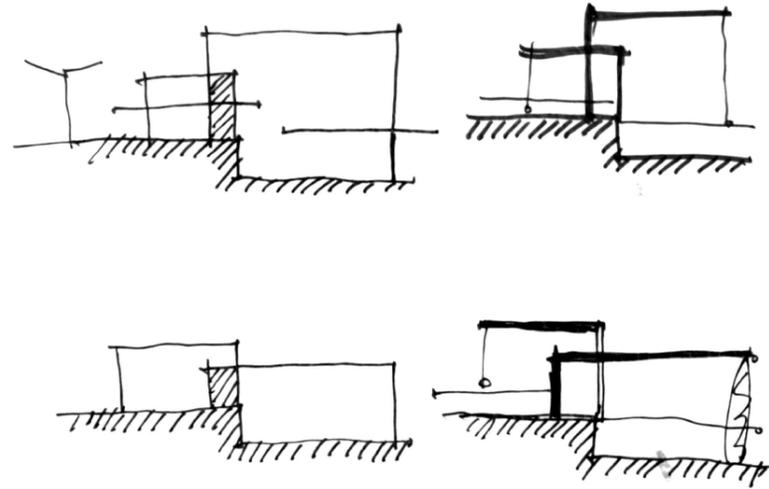
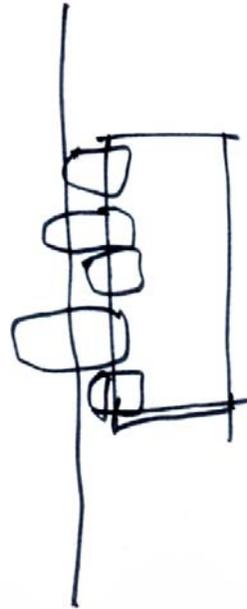
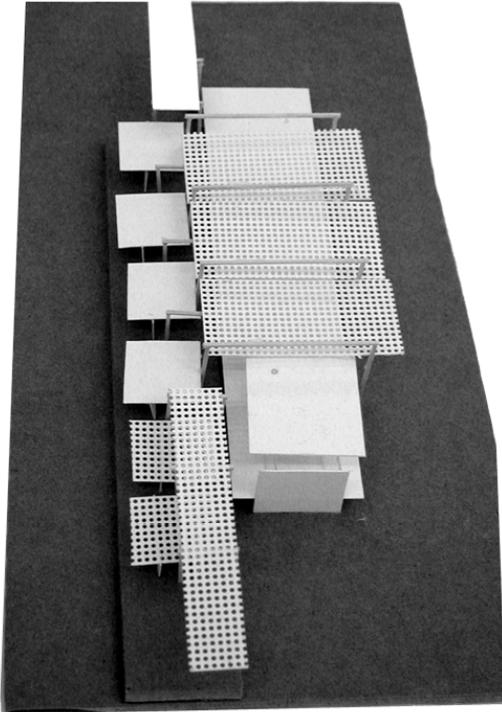


## Space and Structure Along the Path



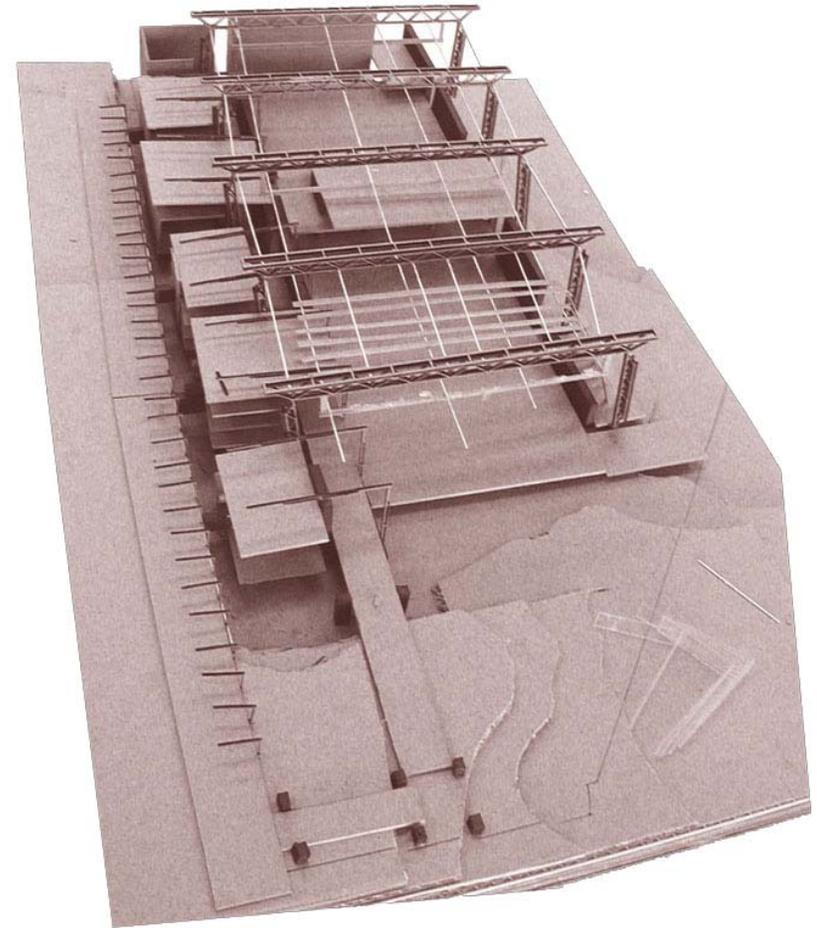
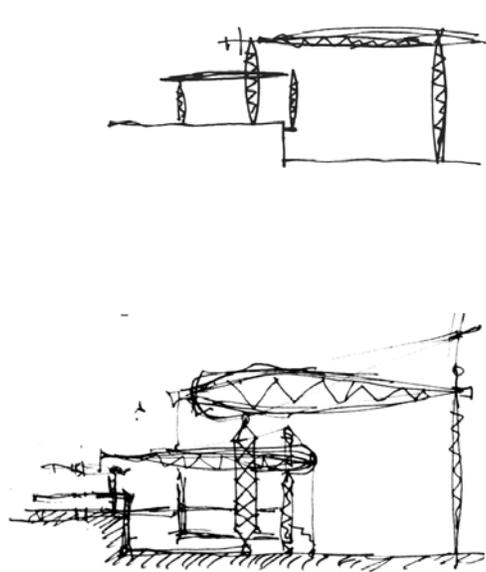
Two structural members define the path in between.

## Space and Volume Along the Path



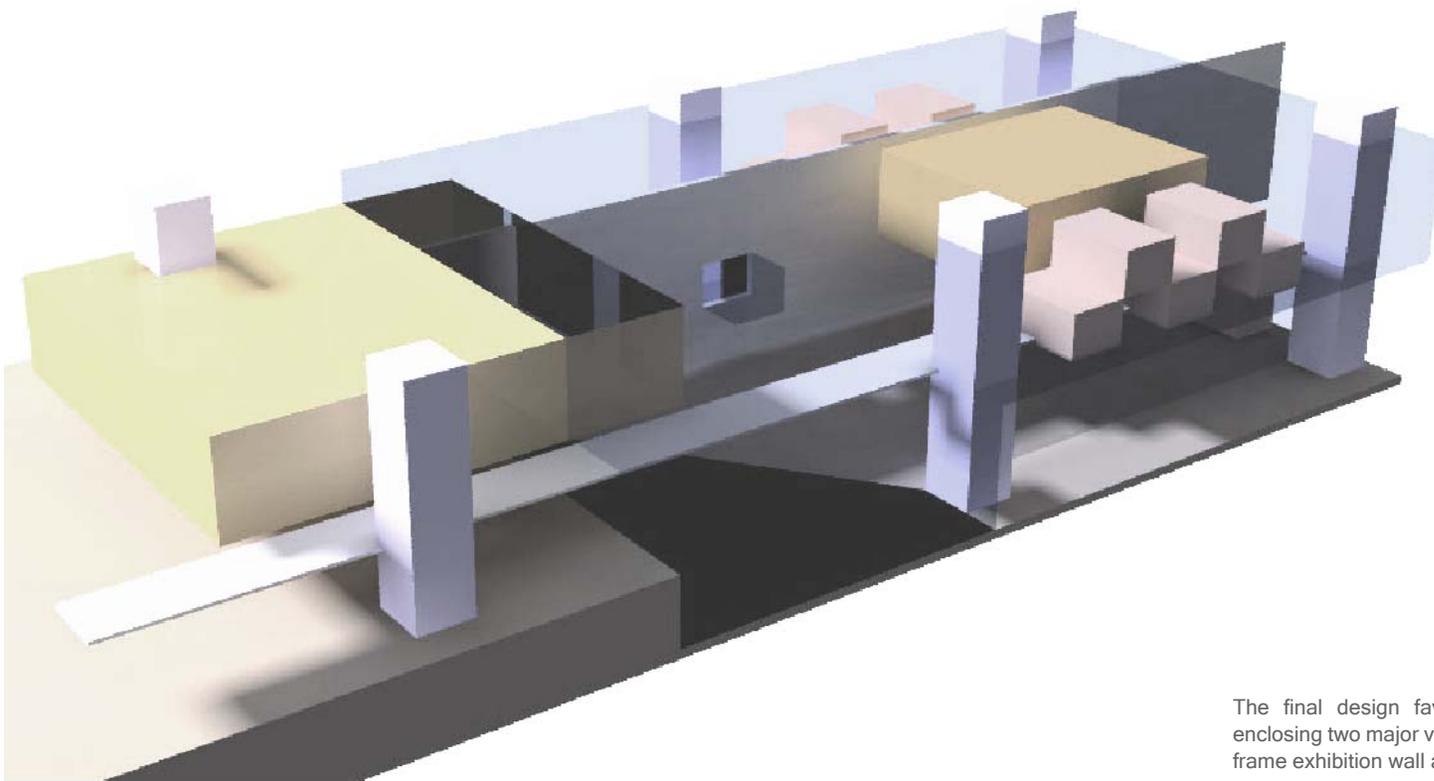
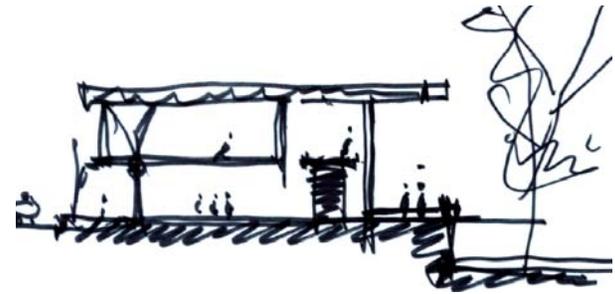
Small volumes are inserted into a large volume.  
A path in between belongs to both rooms.  
Volumes transform from transparency to opacity

## Space and Columns

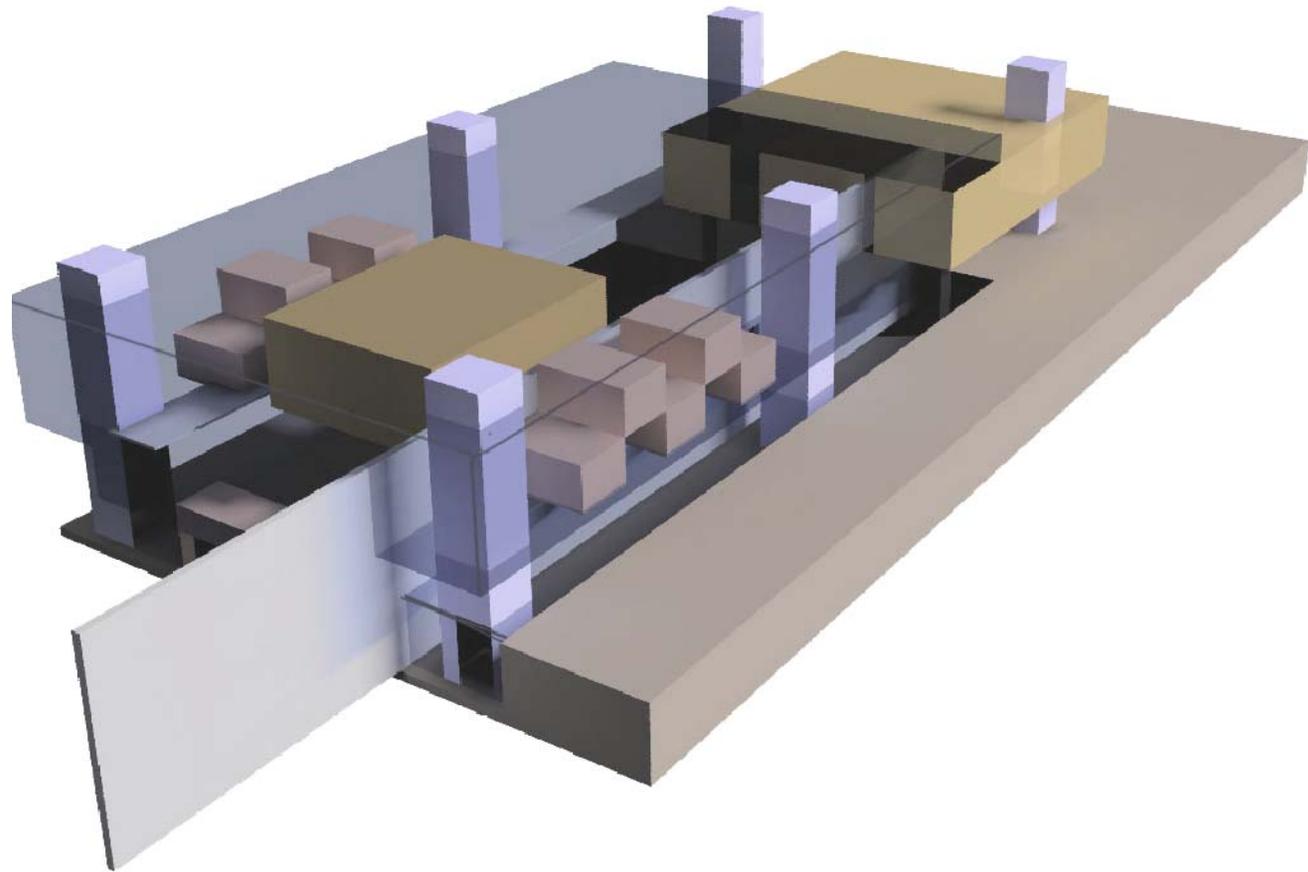


Based on the previous studies, at least four rows of columns are required to define the building and maintain economically feasible space ratio.

Final Choice

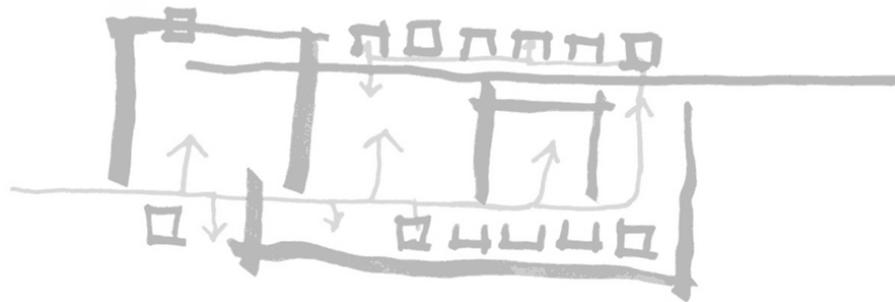


The final design favors two rows of columns, enclosing two major volumes, combined with a light frame exhibition wall and a path.

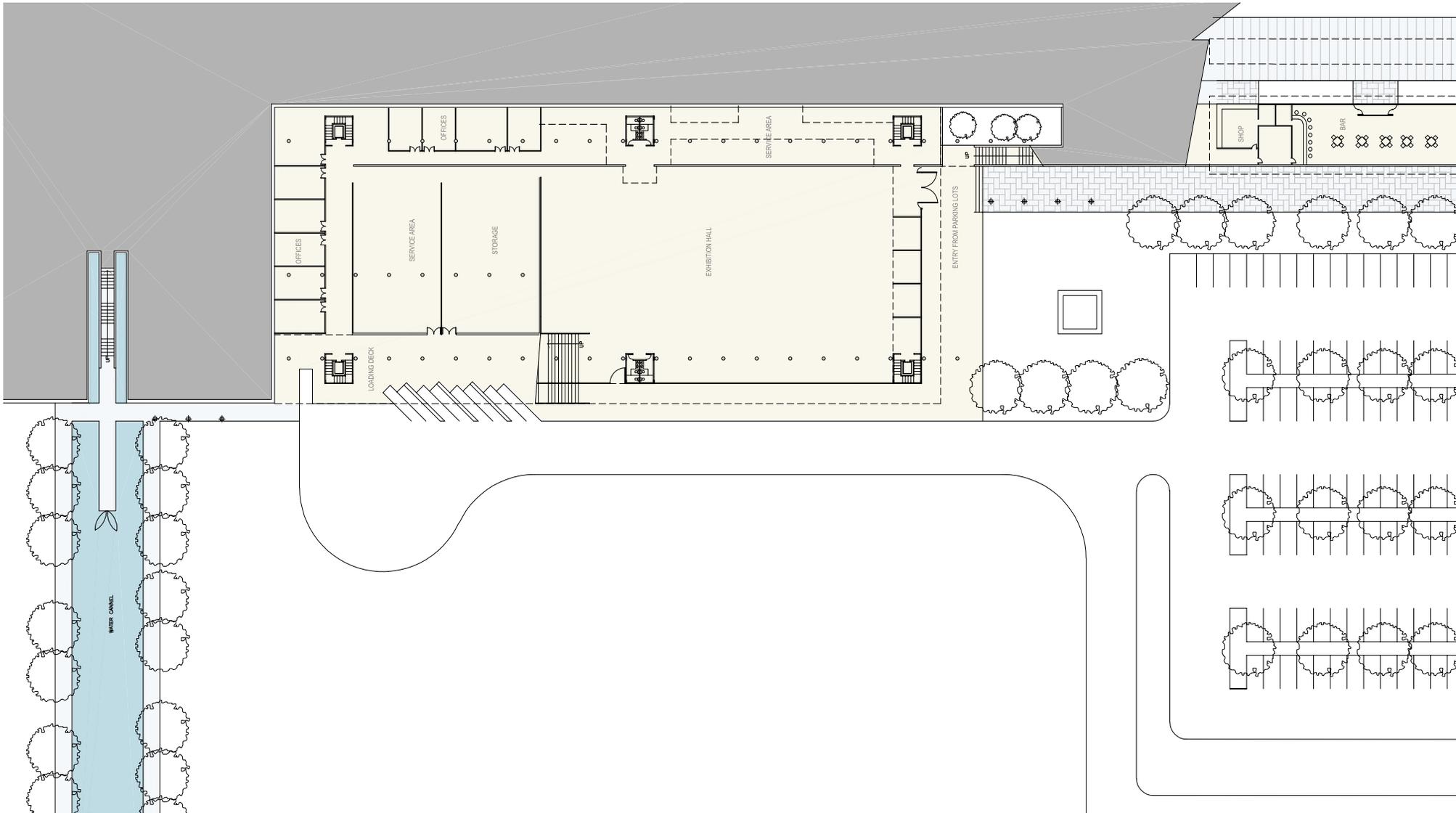


The concept models show the composition of different volumes.

The largest volume is the ball room, smaller ones are meeting rooms on both sides of the Exhibition wall. There are six service towers with stairs and rest rooms inside. Finally a glass box is the boundary for the Exhibition hall.



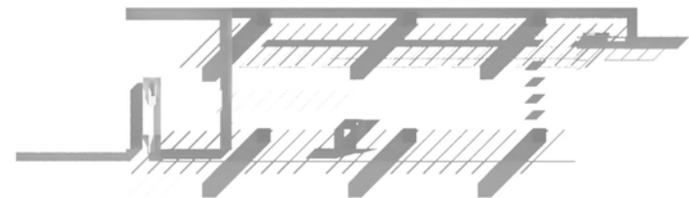
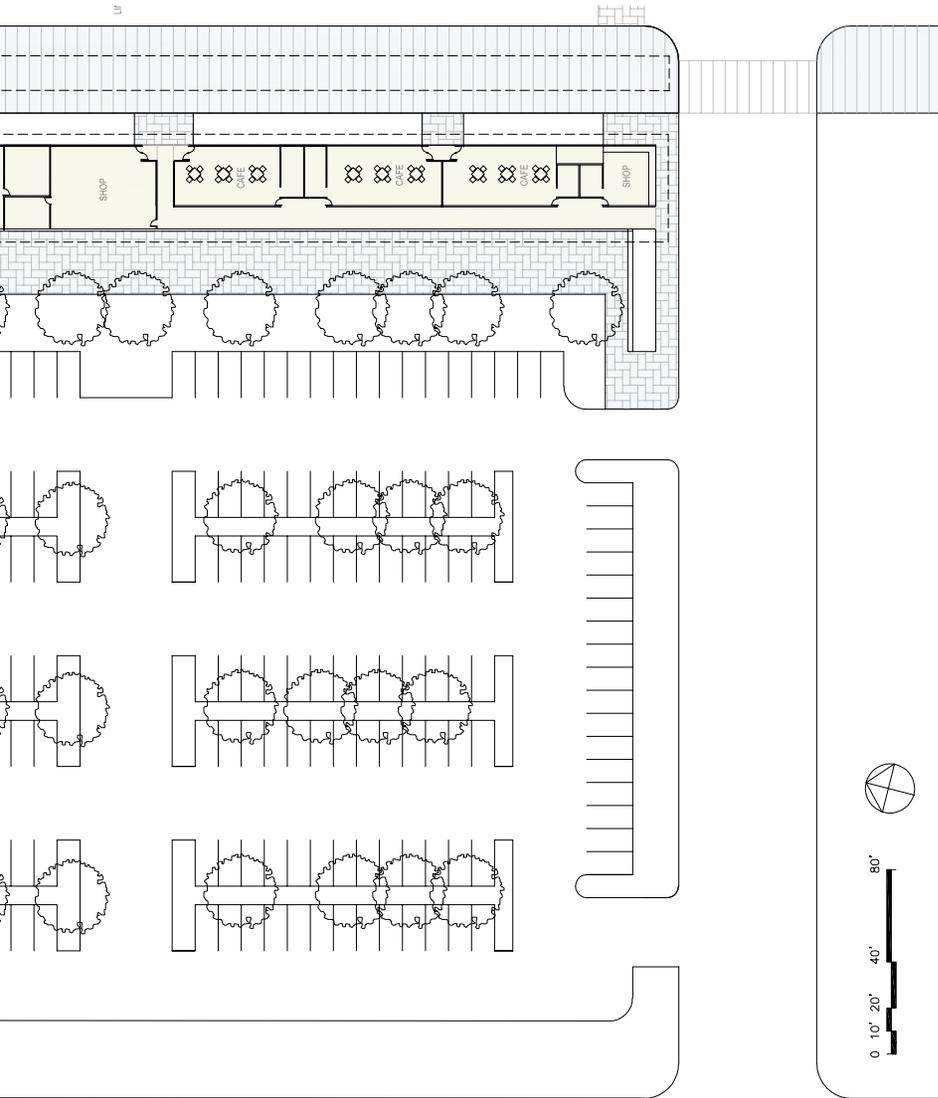
Movement and Spatial Experience  
in Two Sequences

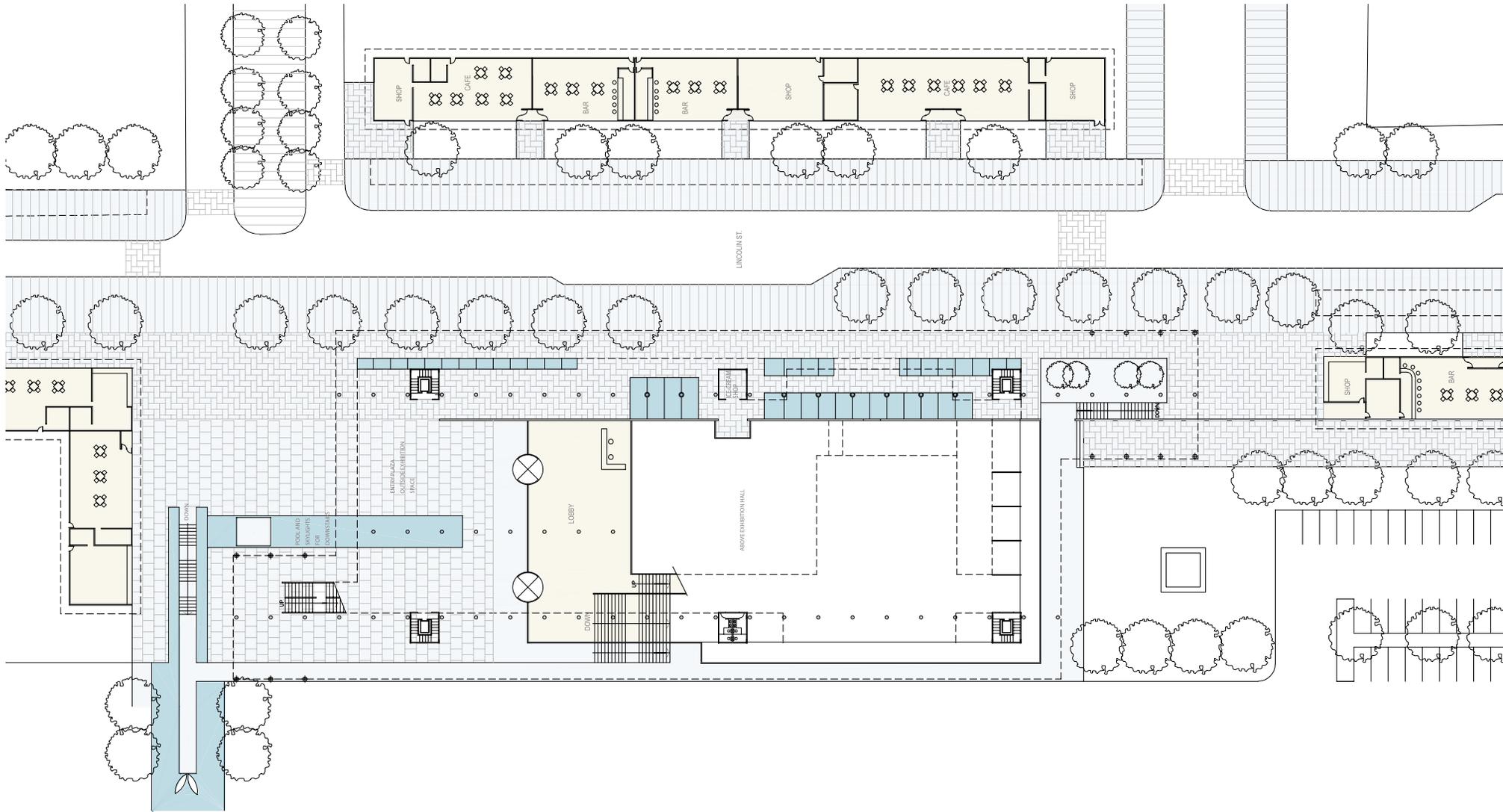


### 1st Floor Plan

Visitors arriving by car will enter the building from the first floor level. The exhibition hall is directly beyond the entry and service area in the back. With the main floor of exhibition hall located at this level, it will be easier to load and unload exhibition materials.

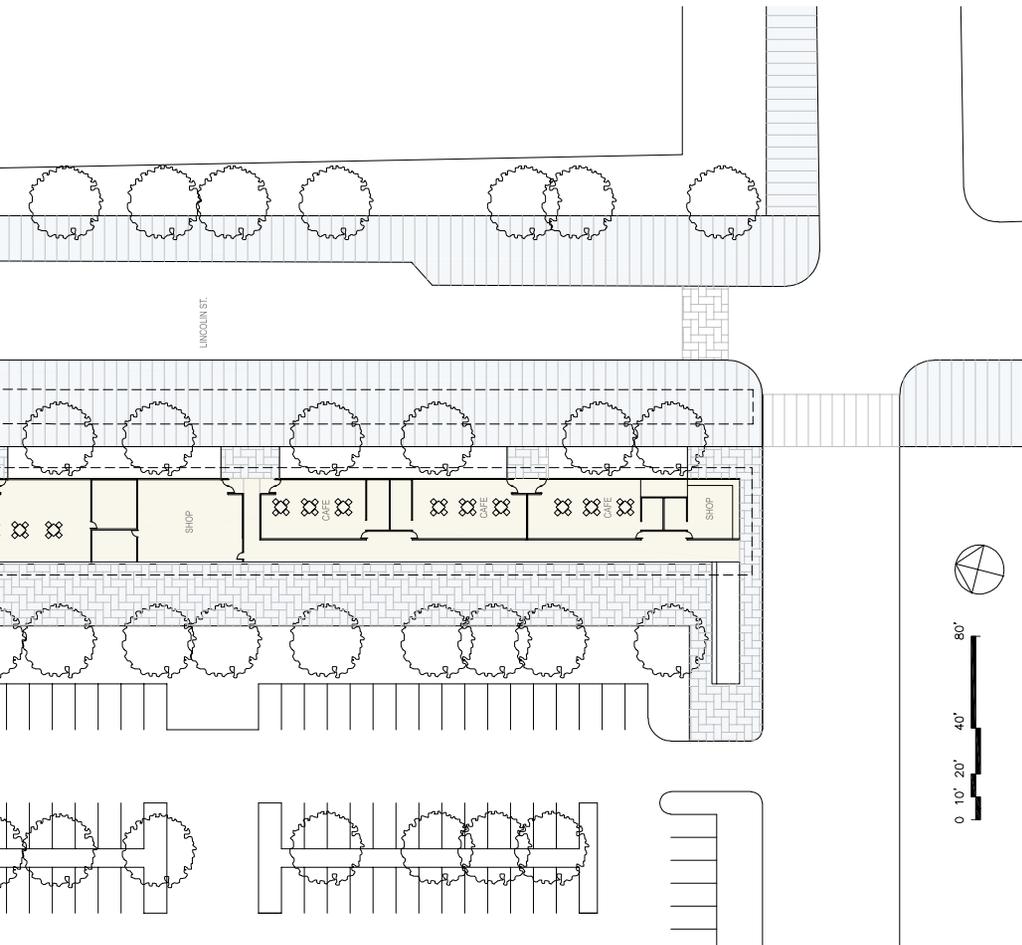
The exhibition wall penetrates the space and separates the exhibition hall from the service area.

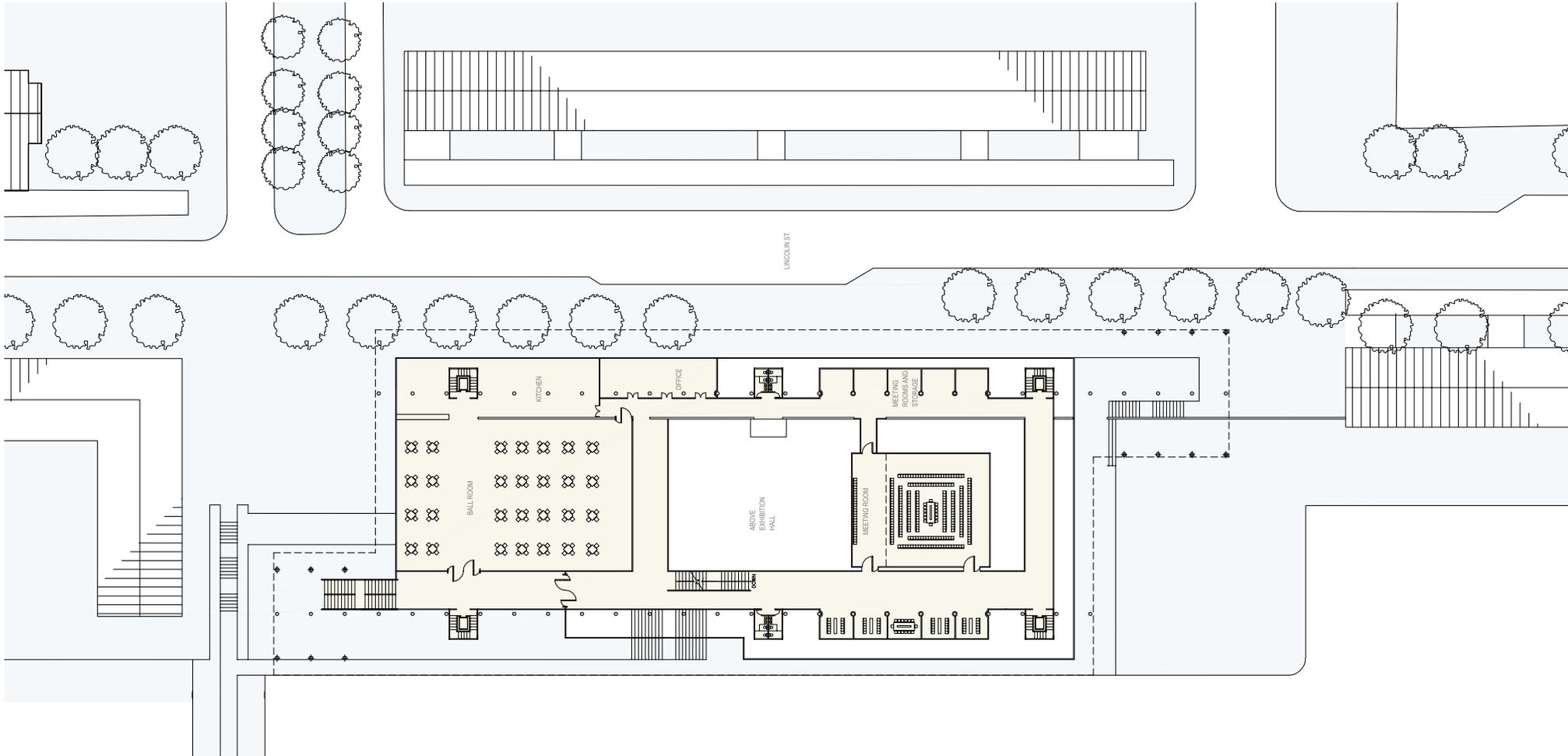




**2nd Floor Plan**  
Lincoln St. level

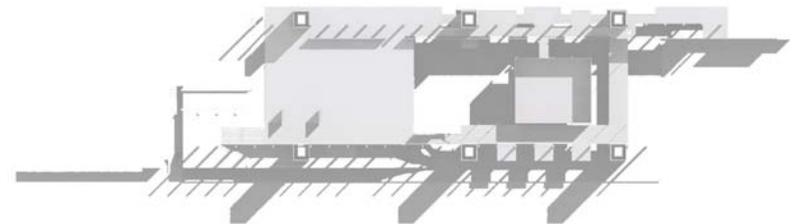
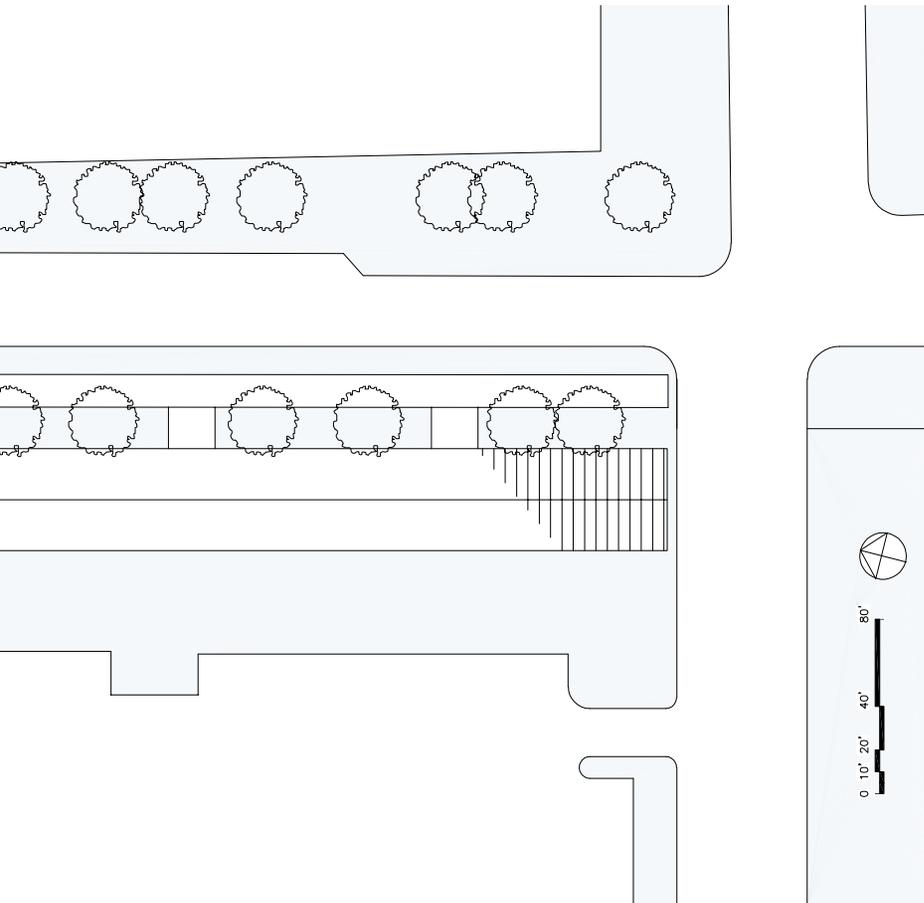
Several small buildings along the street are proposed to offer space for small restaurants, bars and shops. This building line will help to complete the street and city grids, with offerings for urban activity outside of the fine frame of a convention center.

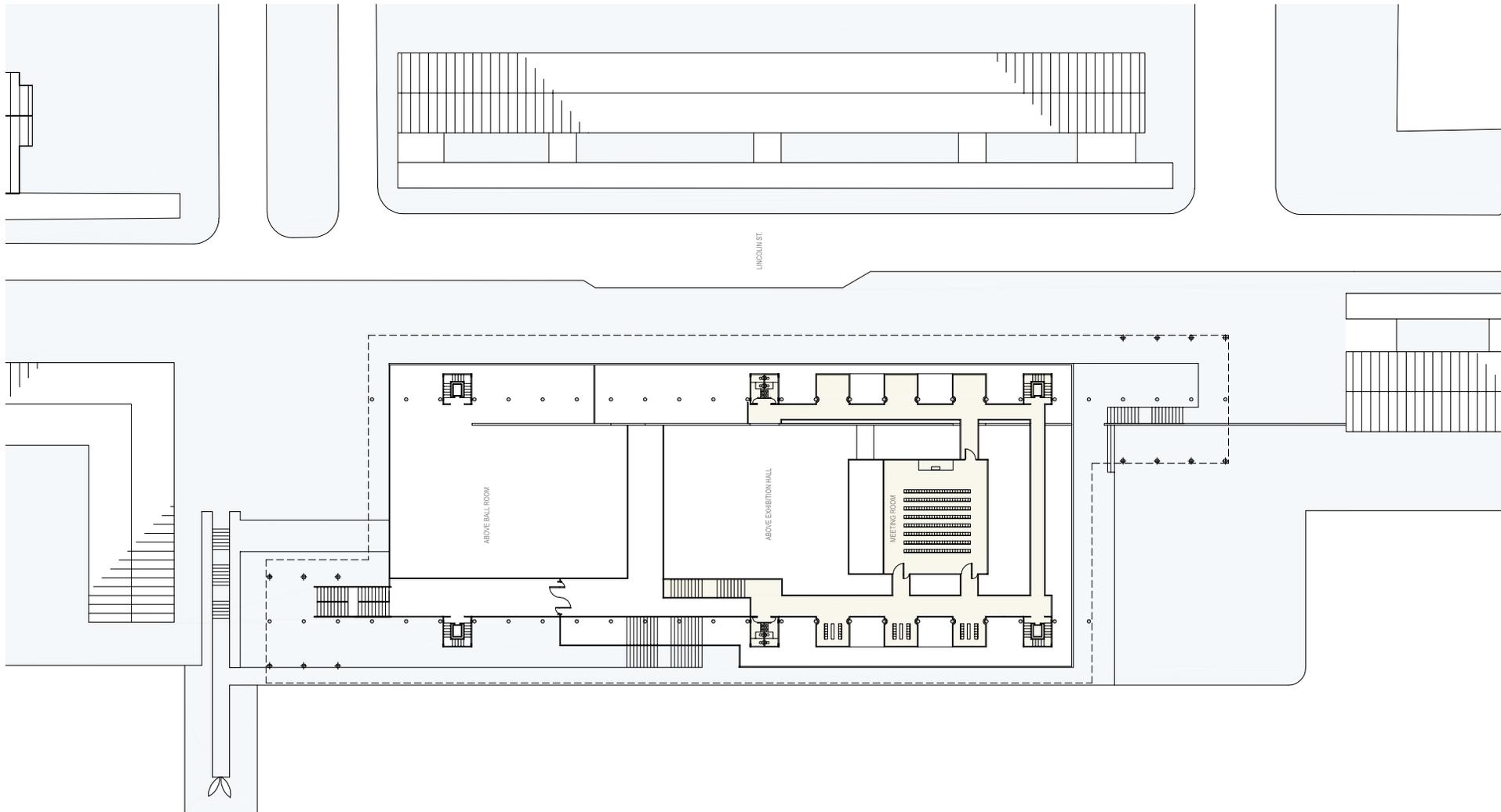




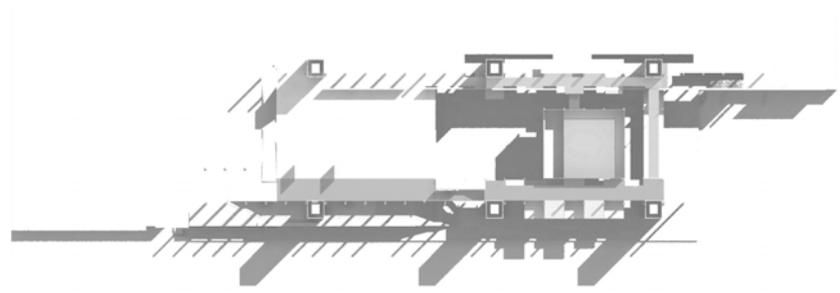
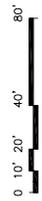
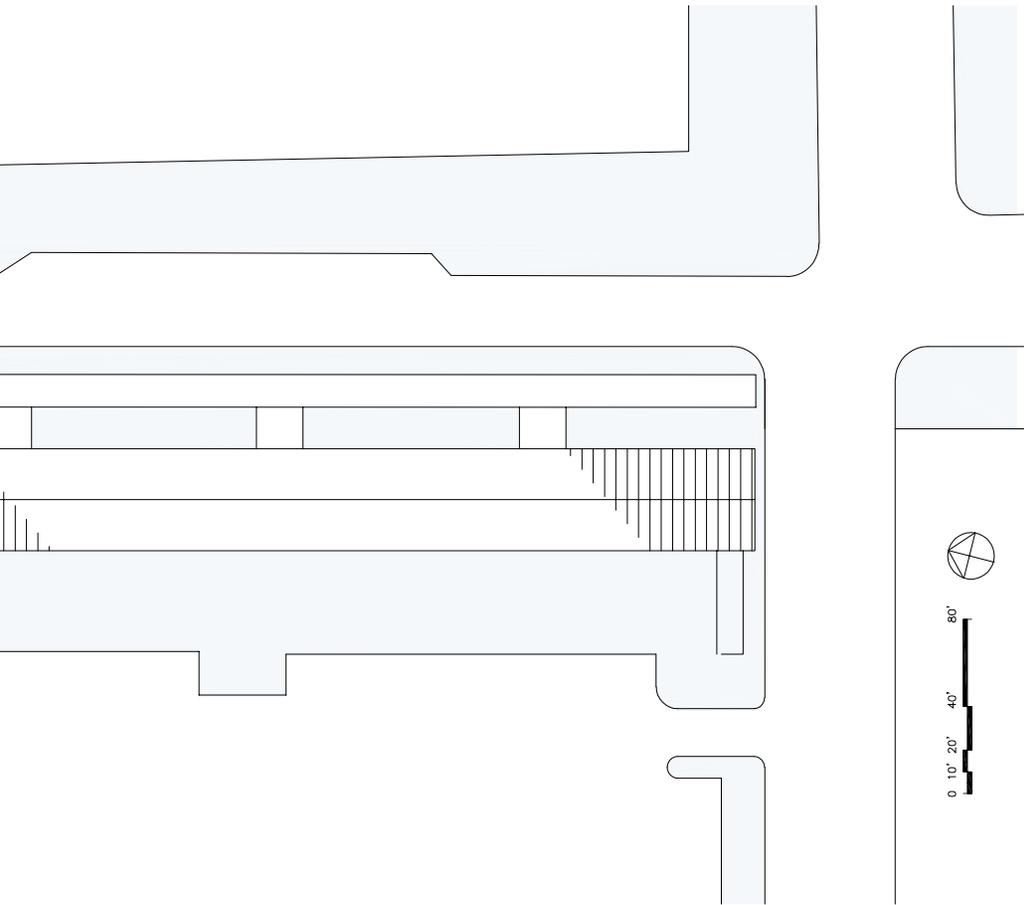
### 3rd Floor Plan

Meeting rooms and offices are located on the 3rd and 4th floor. Bridges connect meeting area and office area along the Lincoln Street.





4th Floor Plan

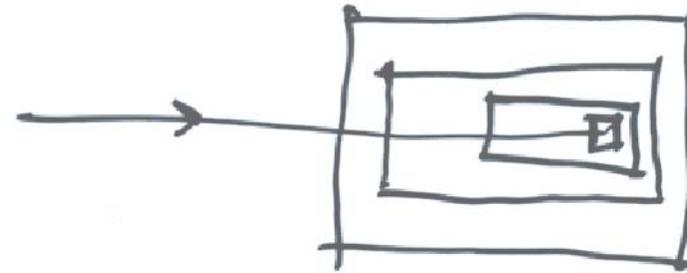


## Sequence I

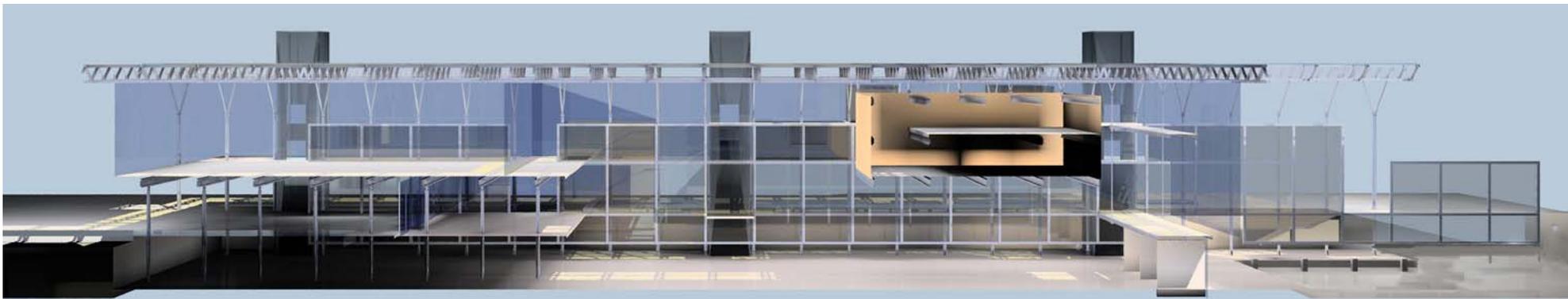
### Plaza - Lobby - Exhibition Hall - Meeting Room

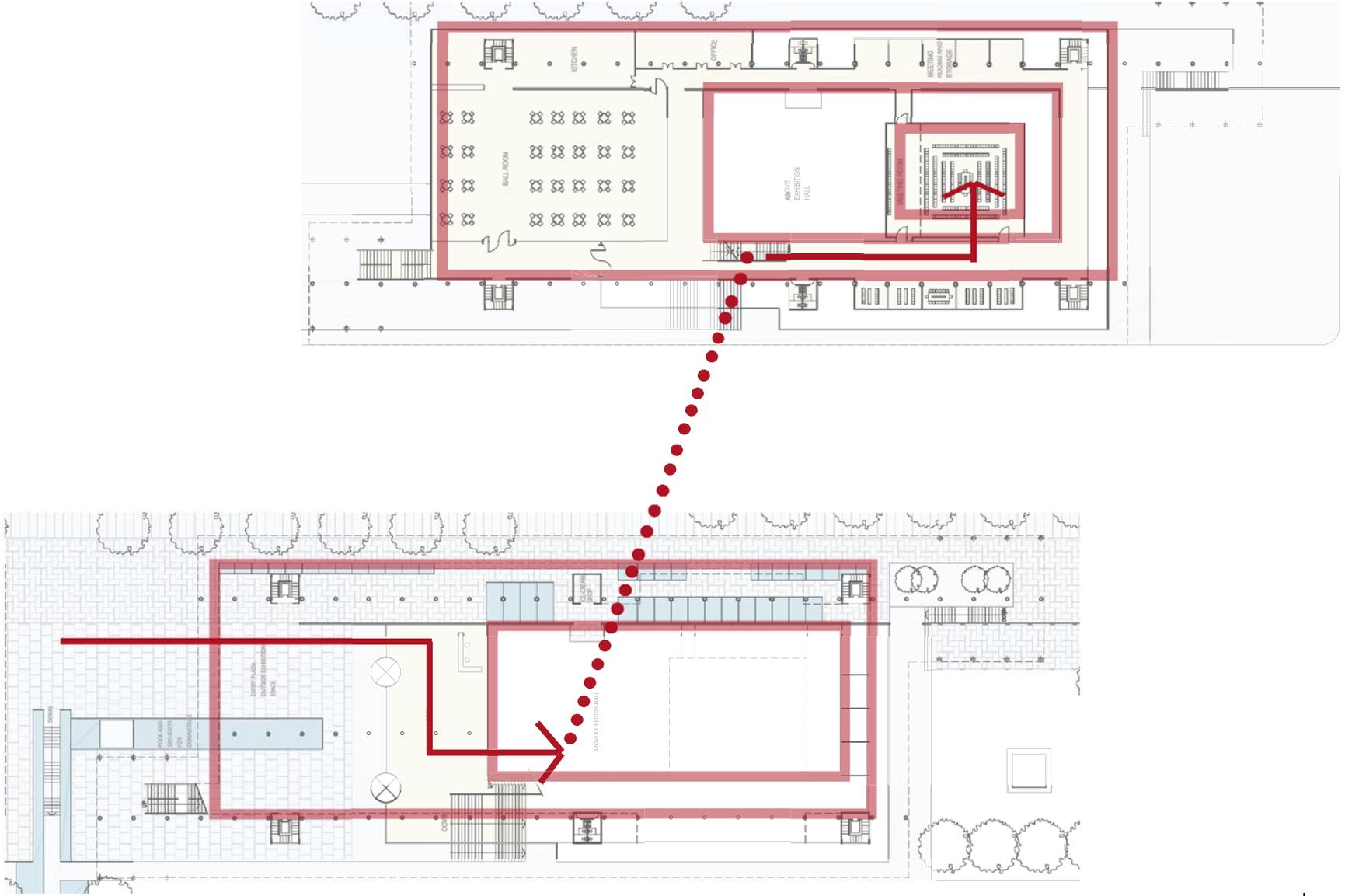
The path follows from street to the plaza, through the lobby, through the exhibition hall and finally to the meeting rooms.

Multiple layered boundaries are crossed as travel towards the center space.



section





Sequence I

Plaza - Lobby - Exhibition Hall - Meeting Room



Plaza

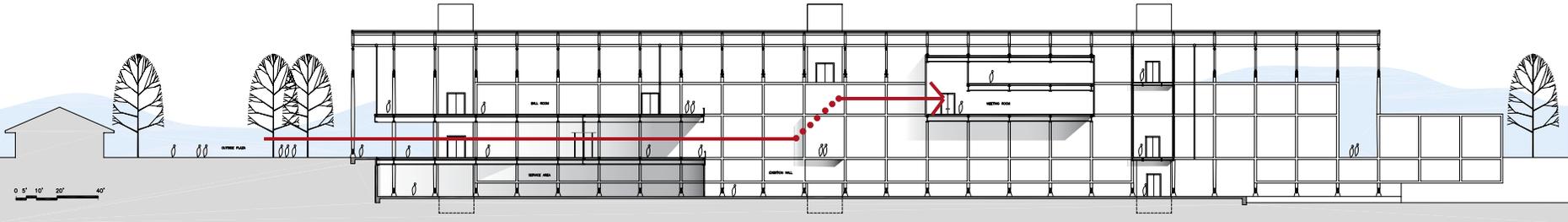


The view looking east in the plaza, in front of the Lobby

Lobby



The view in the lobby, the exhibition hall is partially visible



Exhibition hall

Meeting room



Inside the exhibition hall with the suspended volume of meeting rooms



Inside the meeting room. Opaque surfaces restrict sun light and provide a more introvert atmosphere.

## An object in space, a suspended volume

A volume is suspended from the roof structure to free the space below.

To architecturally define an object in space, perhaps three characteristics can be identified. The first is differentiation in shape, such as the contrast of rectangle and circle. Second, differentiation of volumes, such as the contrast of big and small volumes. And finally, the differentiation of materials, The DZ bank by Frank Gehry is an example with all three characters. He employed to generate contrast between object and existing space.

In my case, I choose only two of the characters: different materials, and volumes. Shape stays the same rectangular language, which favors less complex assembly.



DZ bank by Frank Gehry





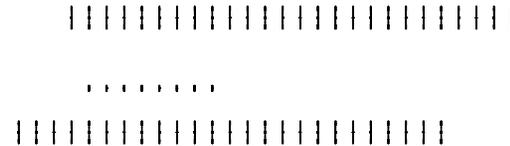
Sequence II:

Guidelines for the sequence II:

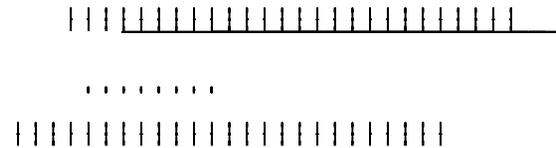
Movement direction



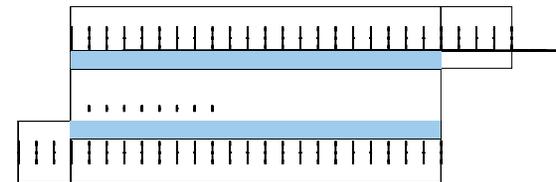
Columns



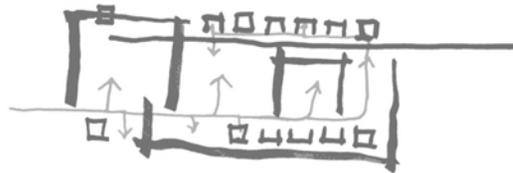
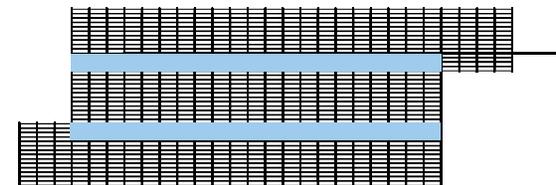
Exhibition Wall



Lights band

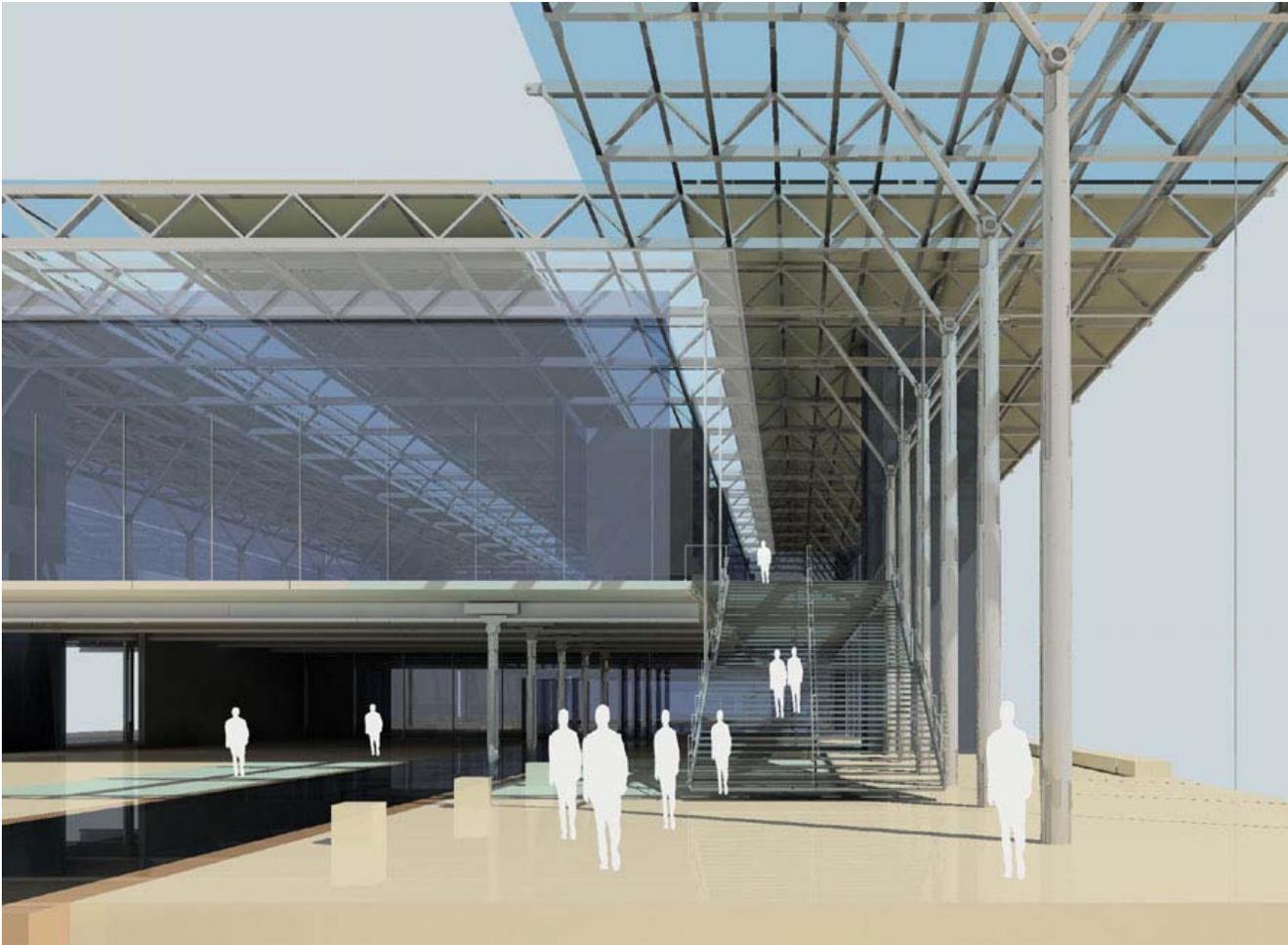


Combinations



Sequence II:

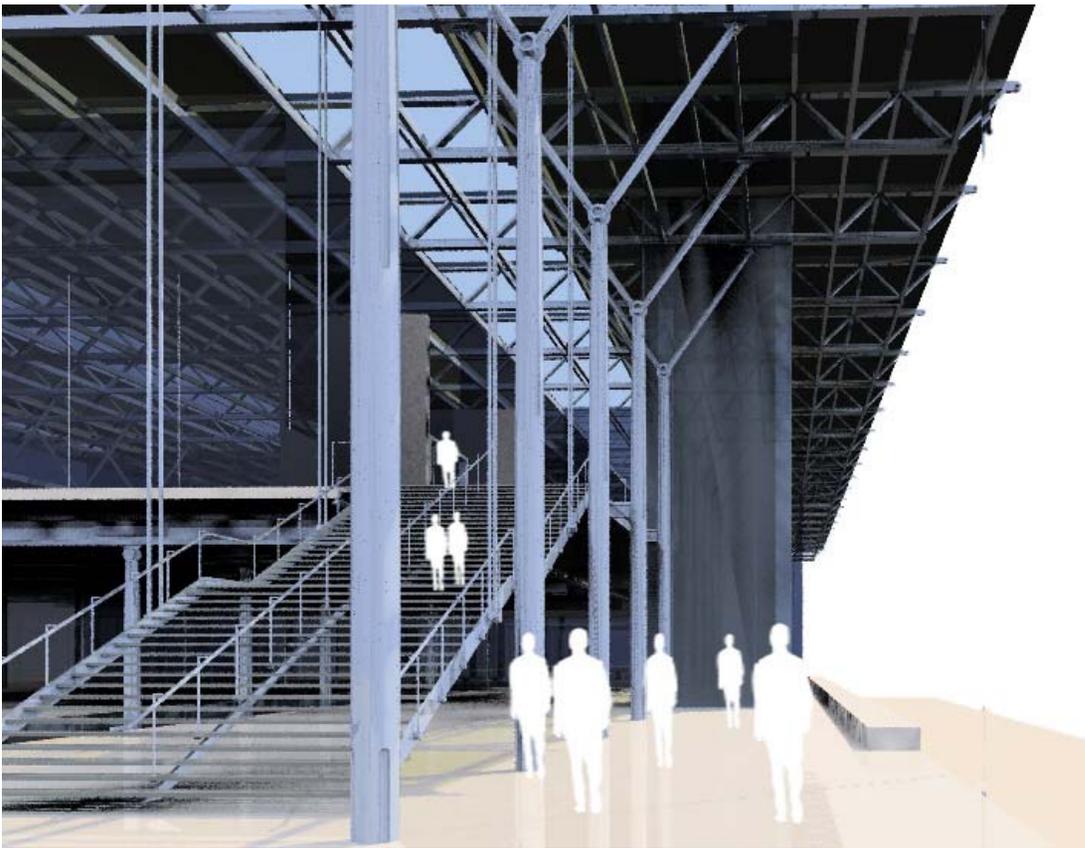
Plaza - Ball Room- Exhibition Hall - Meeting Rooms -Path - Exhibition Wall - Street



From the plaza, visitors go up the stairs, pass the ball room and enter the exhibition hall. Following the corridors and the skylights, they can either go straight or proceed to the upper level to reach different meeting rooms, and the other side of exhibition wall just around the meeting rooms. Then they can get out of the building on Lincoln Street or go back to ball room and the exhibition hall.

Sequence II:

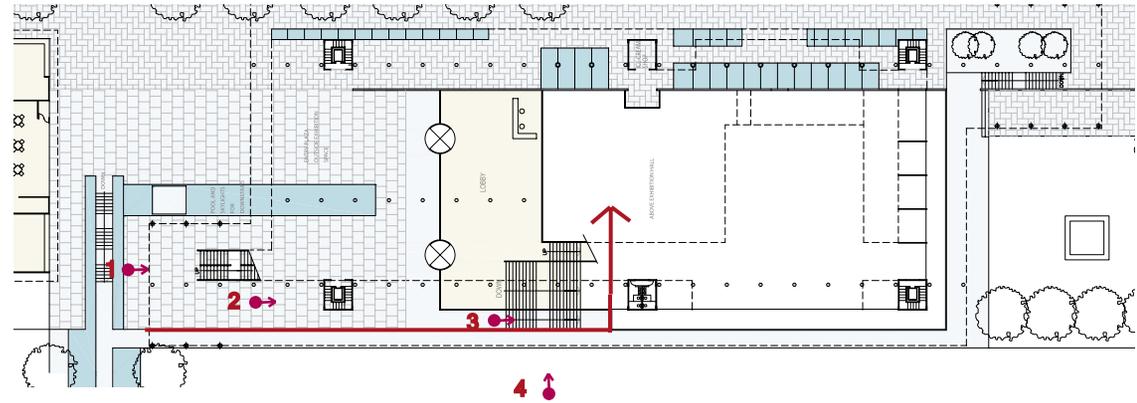
Plaza - Ball Room- Exhibition Hall - Meeting Room - Path - Exhibition Wall - Street Exit



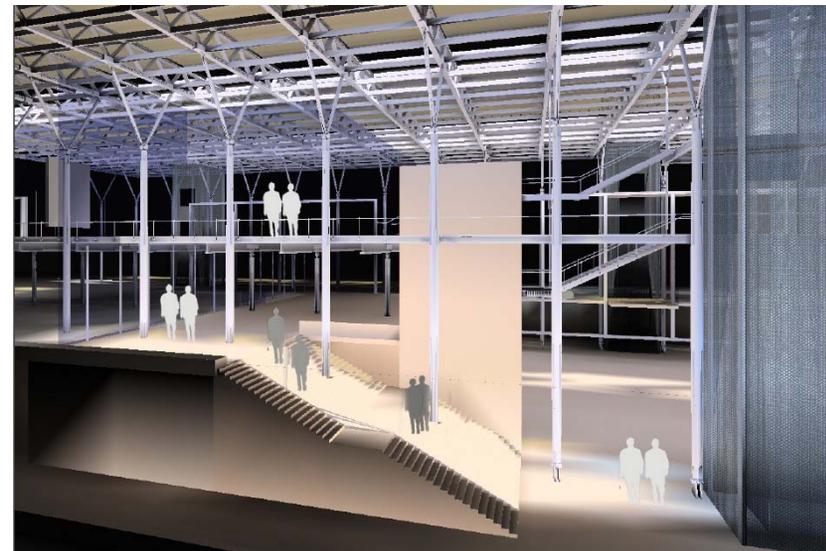
2. This view shows the area beside the entry to the ball room. The columns and the roof define the entry and public space.

Sequence II:

Plaza - Ball Room- Exhibition Hall - Meeting Rooms -Path - Exhibition Wall - Street



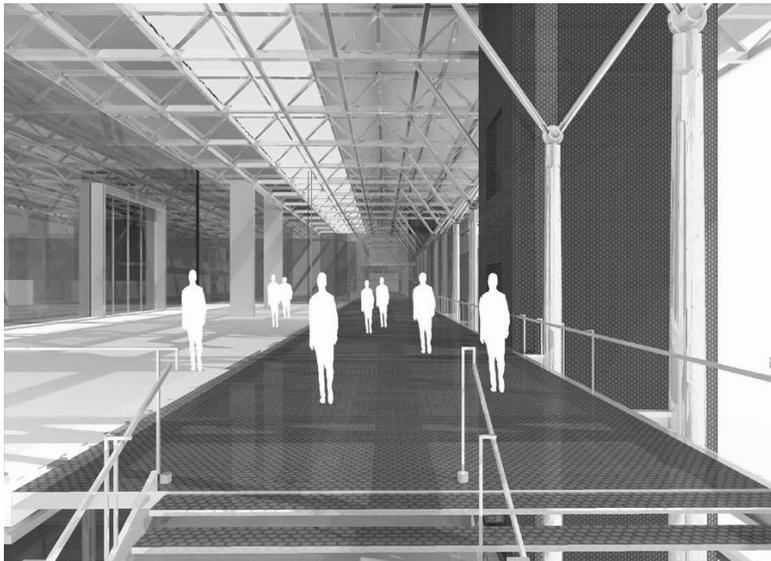
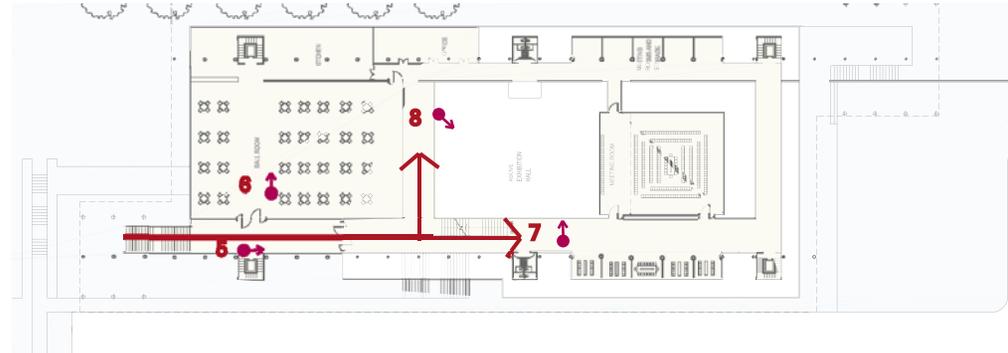
3. The view of stairs lead from the street level to the first level Exhibition hall.



4. The view of stairs lead to the exhibition hall. Vertical space on one side of columns, layers of corridors on the other. This is the transition space from low ceiling corridors to the high ceiling Exhibition hall.

Sequence II:

Plaza - BALL ROOM- Exhibition Hall - Meeting Room - Exhibition Wall - Street Exit



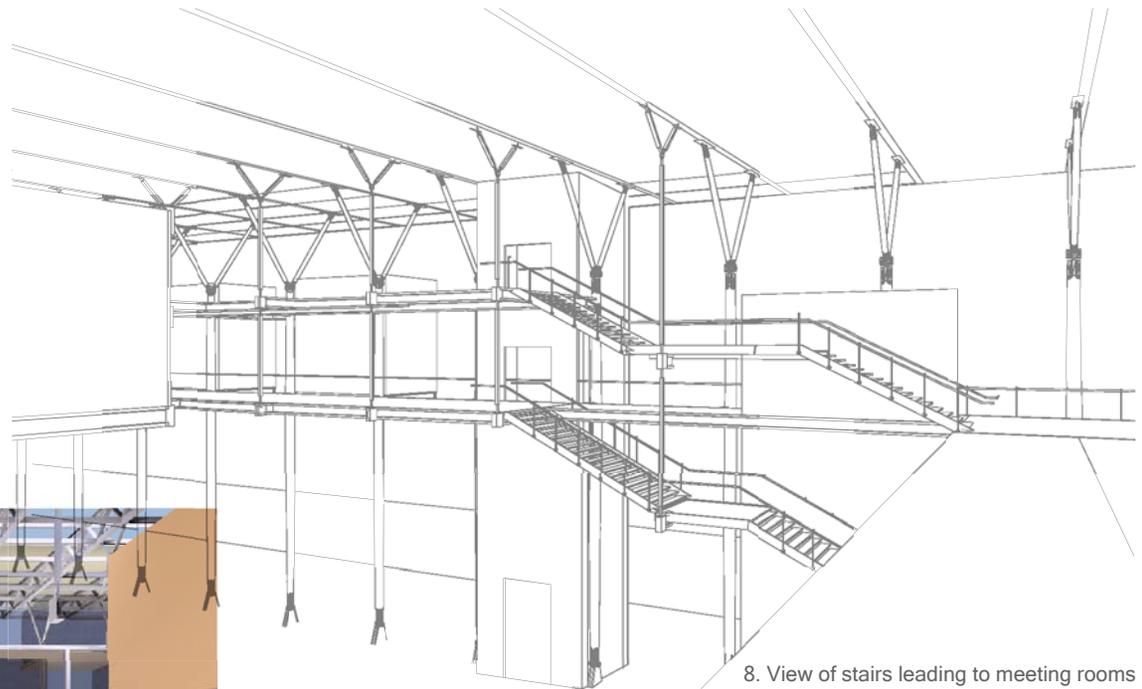
5. Visitors pass the ball room, with open space on the one side and the enclosing space on the other side. Spacial movements is guided by the skylights and columns.



6. Ball Room Entrance, looking east.



7. Exhibition Hall Perspective



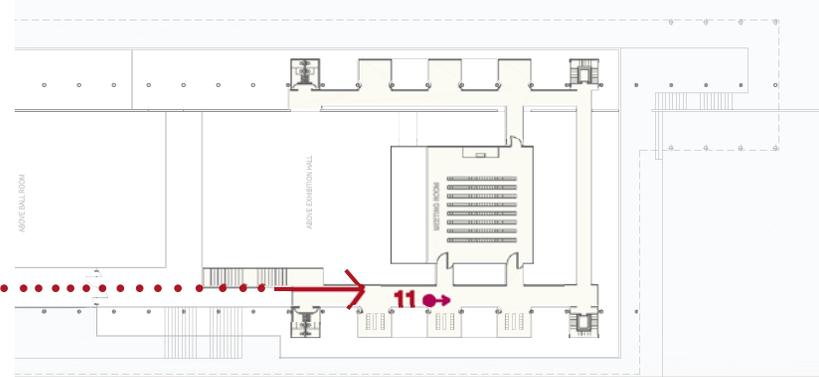
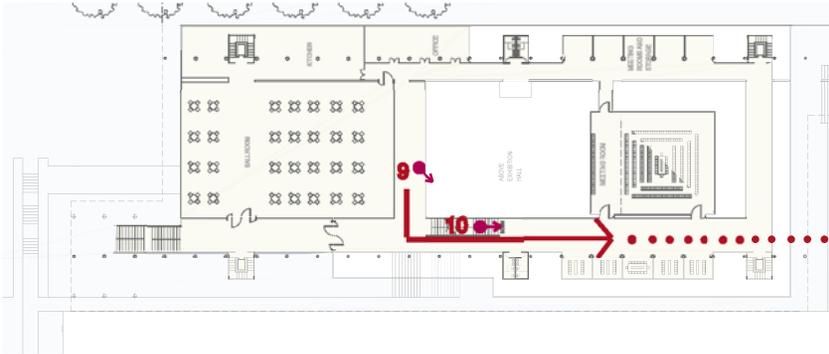
8. View of stairs leading to meeting rooms

**Sequence II:**

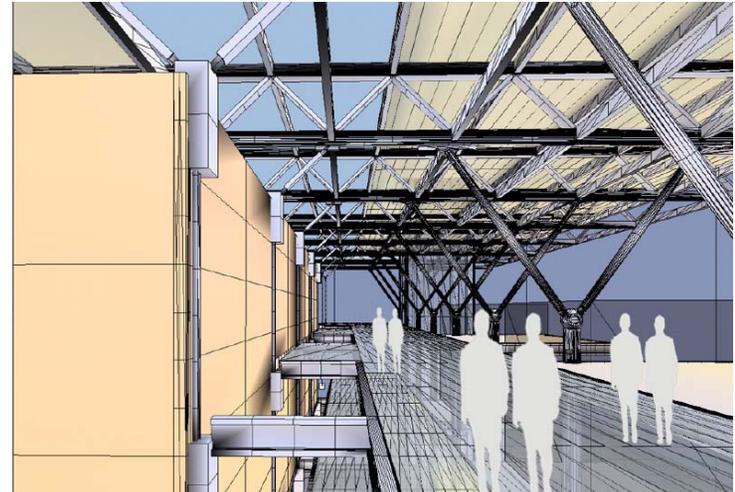
Plaza - Ball Room- EXHIBITION HALL - Meeting Room - Path - Exhibition Wall - Street Exit



9. View shows entrance area for the suspended meeting room.



10. A gap between the meeting rooms and the walkway amplified by a Light band above, mark the edge conditions. The gap is smaller at lower level, and bigger upstairs. The existing of the gap helps to present the meeting rooms as a separated rectangular volume.



11. Y-shaped columns line up to frame the views along the path.

Sequence II:

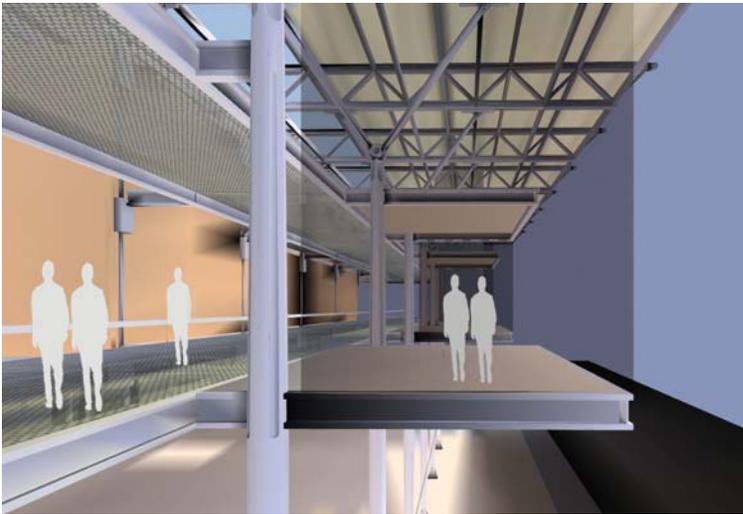
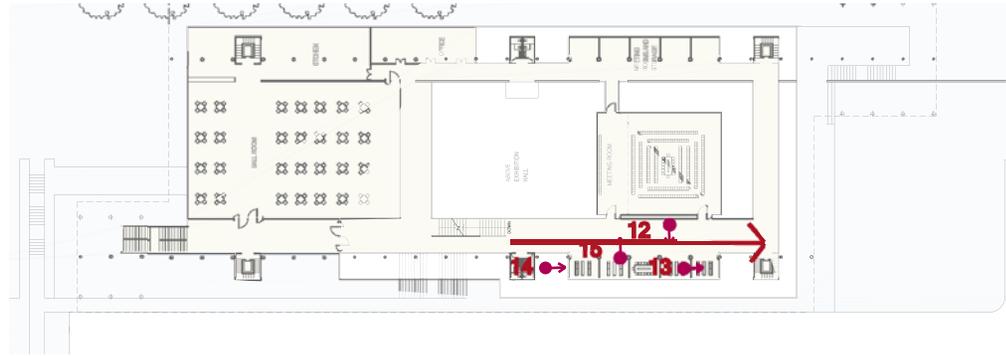
Plaza - Ball Room- Exhibition Hall - MEETING ROOMS - Path - Exhibition Wall - Street Exit



12. View of the small opening between the two meeting rooms



13. View from one meeting room to others. Transparent partitions allow visitors to see through rooms.



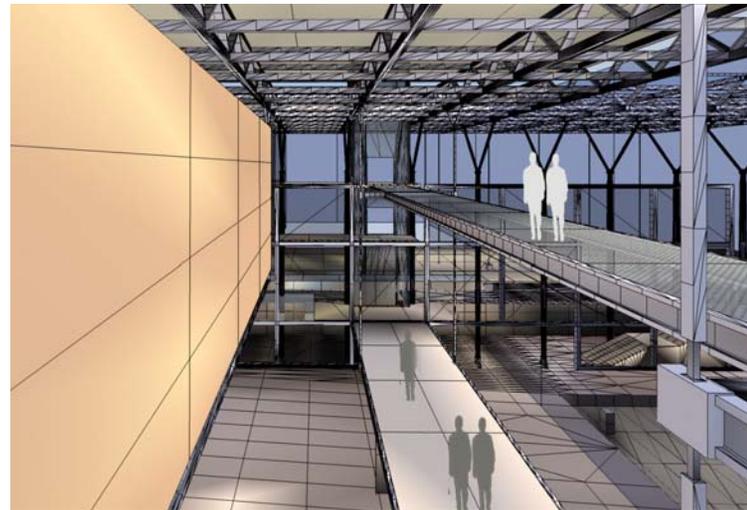
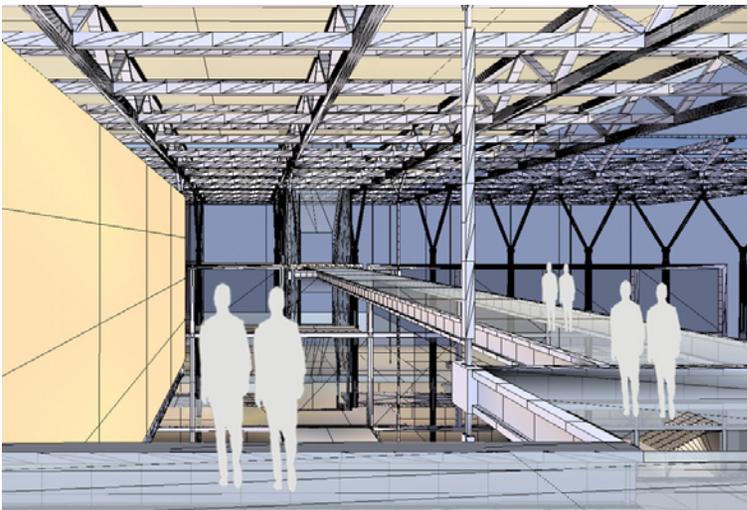
14. View of meeting rooms and the underside of the Exhibition hall



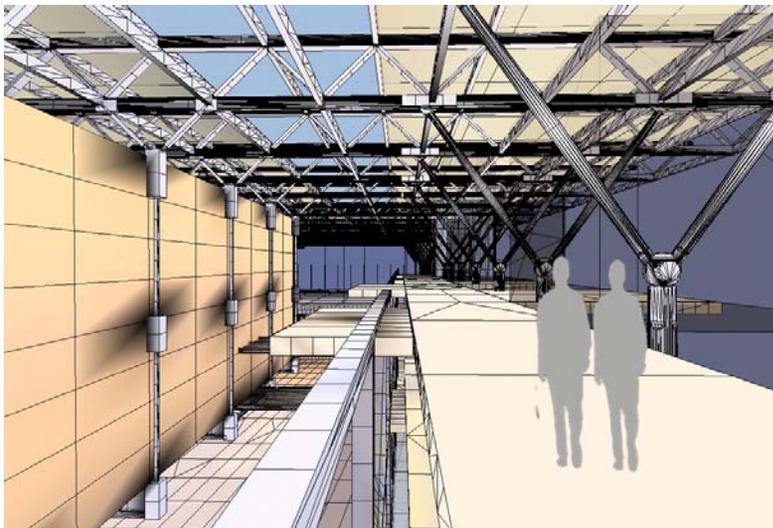
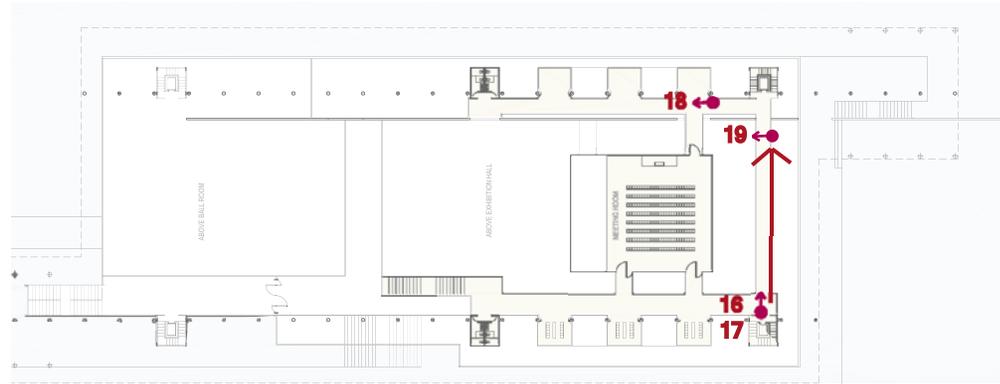
15. View from a smaller meeting room to the corridor

Sequence II:

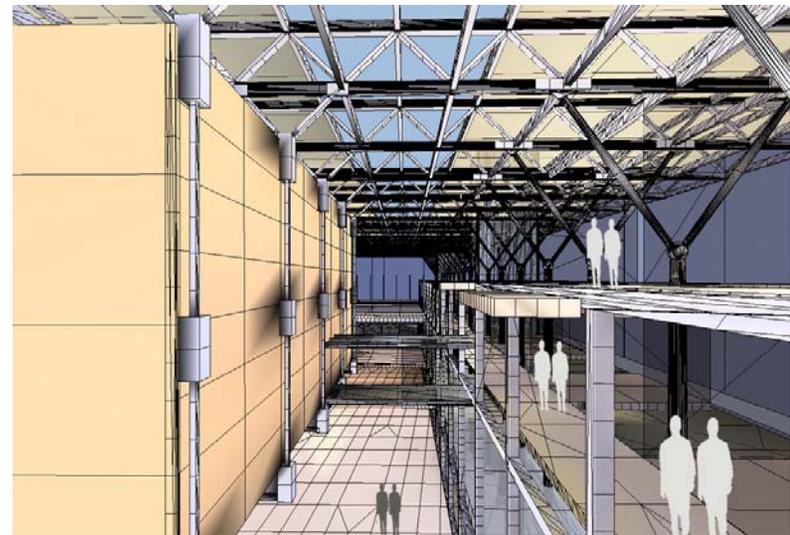
Plaza - Ball Room- Exhibition Hall - Meeting Room - PATH - EXHIBITION WALL - Street Exit



16,17. The isolation of the meeting rooms from the walkway amplify the vertical space.



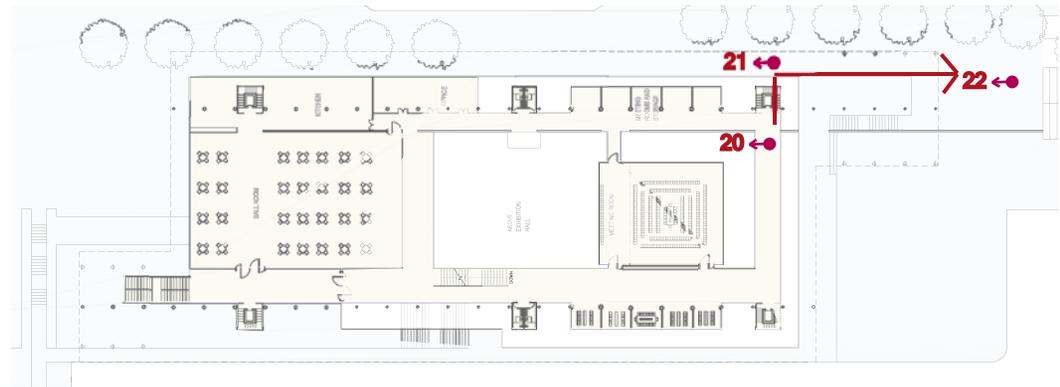
18. View of the another side of exhibition wall



19. View between the meeting room and the exhibition hall

Sequence II:

Plaza - Ball Room- Exhibition Hall - Meeting Rooms - Path - EXHIBITION WALL - STREET EXIT



20 Between meeting room and the exhibition wall.



21. On the street level, beside the exhibition wall.



22. View towards the east entrance on street level



## CONCLUSION

A frame defines a large open space between two rows of columns. In this case the frame can be seen as a load bearing element.

The same frame also structures the sequence of movement through the building. A path serves as the means by which the spatial opportunity of the frame is aligned. Along this path, the frame offers order to the sequence of large to small volumes, from transparent to opaque, and from inside to outside. The frame operates as the static counterpart to a spatial dynamic.

The elements of the physical frame extend beyond the enclosed building limits to offer shade for pedestrians along the street and the plaza. Through the extension, the linear character of the path between two major destinations of the city is articulated.

In this sense, a frame may not only be understood as a pragmatic structural layer, but as an entity of order contributing equally to structure, room and the urban extension of a building.

## ACKNOWLEDGMENT

This Book is dedicated to my family for their endless love and support, especially to my husband Lin for all those helps he offered at those moments I most needed.

I would like to thank my committee members, Professor Heinrich Schnoedt, William Galloway, and Michael O'Brien for their guidance and encouragement, for being inspiring and supporting teachers. I have enjoyed every moment of their mentorship.

My special thanks to my studio friends, for the joys, support, critiques and great times shared.

# BIBLIOGRAPHY/ PHOTOGRAPHIC CREDITS

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