

# Concrete and Comfort, Urban Firehouse

James Cooke

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State University in partial fulfillment of the requirements for the degree of

Master of Architecture  
in  
Architecture

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# Concrete and Comfort, Urban Firehouse

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## **Abstract**

Material and structure, being indivisible, provide the basis for this thesis exploration. The material of choice was concrete, inspired by the use of cast objects made in the studio. Through the act of form making and casting tectonic material integration developed. Intrinsic structural qualities of the material were affirmed with repeated drawing, form making and casting, while exploring the phenomenon of the transferred surface. An open urban site in Washington, DC was chosen before a building type was determined. Neighborhood and site analysis identified the potential need for a Firehouse. This building type allowed the opportunity to explore the use of concrete for vehicles as well as people. Can concrete, maligned for being cold and harsh, hold a building and its uses in comfort and beauty?

# Concrete and Comfort, Urban Firehouse

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## **General Audience Abstract**

I struggled to find a direction for my Master of Architecture Thesis, like most, but knew materiality and tectonics would be the focus. After being enthralled with the annual WAAC Concrete competition, and the rampant use of ROCKITE in the Old Town studio I settled on formed concrete as a driver. An urban site was a given, an empty lot at 14th Street and V Street NW that seemed a manageable size was perfect. Neighborhood and site analysis revealed the potential need for a Firehouse, in the pull-through style popularized by suburban stations.(1) This building type allowed many opportunities to explore concrete structural tectonics, for the human user and the automobile. Ideas of how concrete holds different materials, and how those relationships create a comfortable and useful space were examined in drawing and model.

This thesis was started in the year 2002 at Virginia Tech's Washington Alexandria Architecture Center. Our community was close knit and the tragedy of 9/11 with the attack on The Pentagon just miles from our haven was deeply felt. We did our best to drown out the fear and sorrow, to consider memorial designs and the meaning of safety and patriotism. The camaraderie of the studio and the task of a creative project drove me through a successful thesis defense, but the required documentation proved more difficult. I am forever grateful to my Thesis Committee and the administrators for their understanding and support while I took the long path to complete this document.

Special thanks to John White and Heather Grutzius, Jon Zellweger, Charles McSorely, Matt Sellers and Jo Elle Burgard, Jared Martinson, Scott Stephens, Greg Harrell, Evan Mann, Vincent Whitehurst, Timothy McCready, Eric Jenkins, and those whose names are lost to time. This effort would not have been completed without the love and support of my wife and brother, who I dedicate this document to.

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Concrete and Comfort  
Urban Firehouse

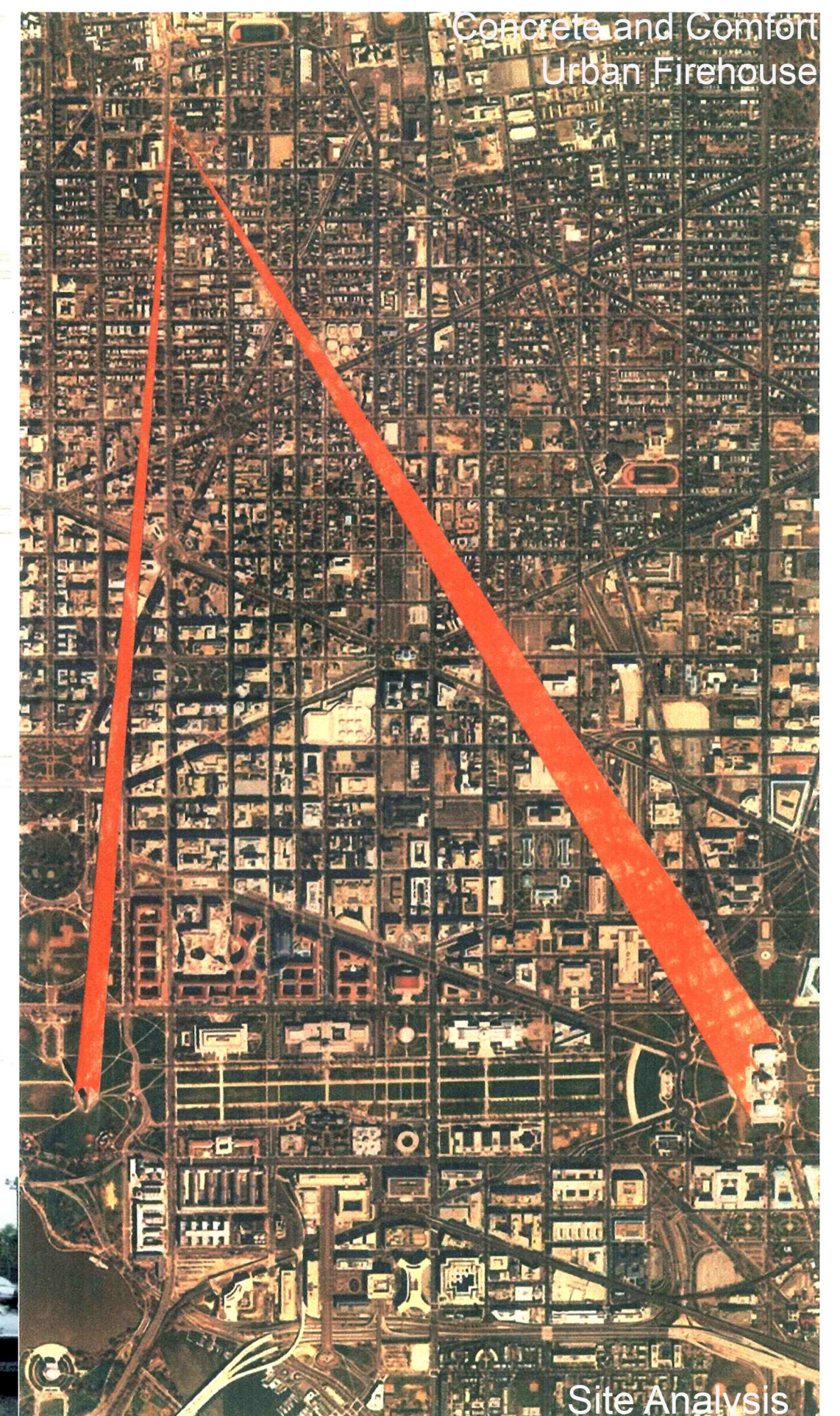


The Project Site is located at the intersection of 14th and V Streets in Northwest Washington, D.C. The immediate neighborhood hosts a large residential population that supports a diverse commercial offering.

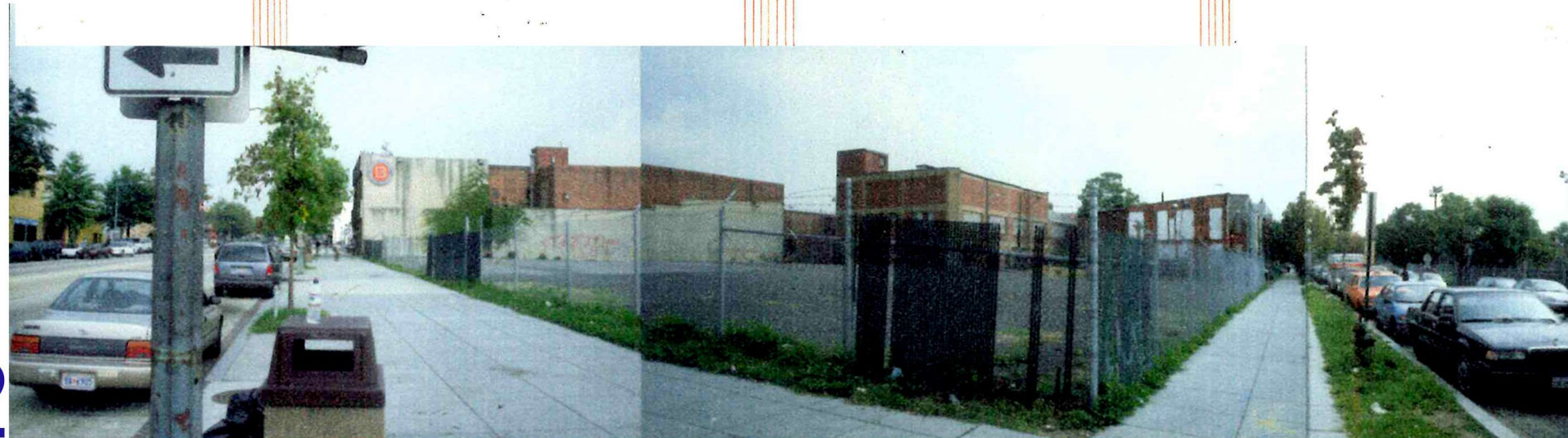


Site Location

Concrete and Comfort  
Urban Firehouse

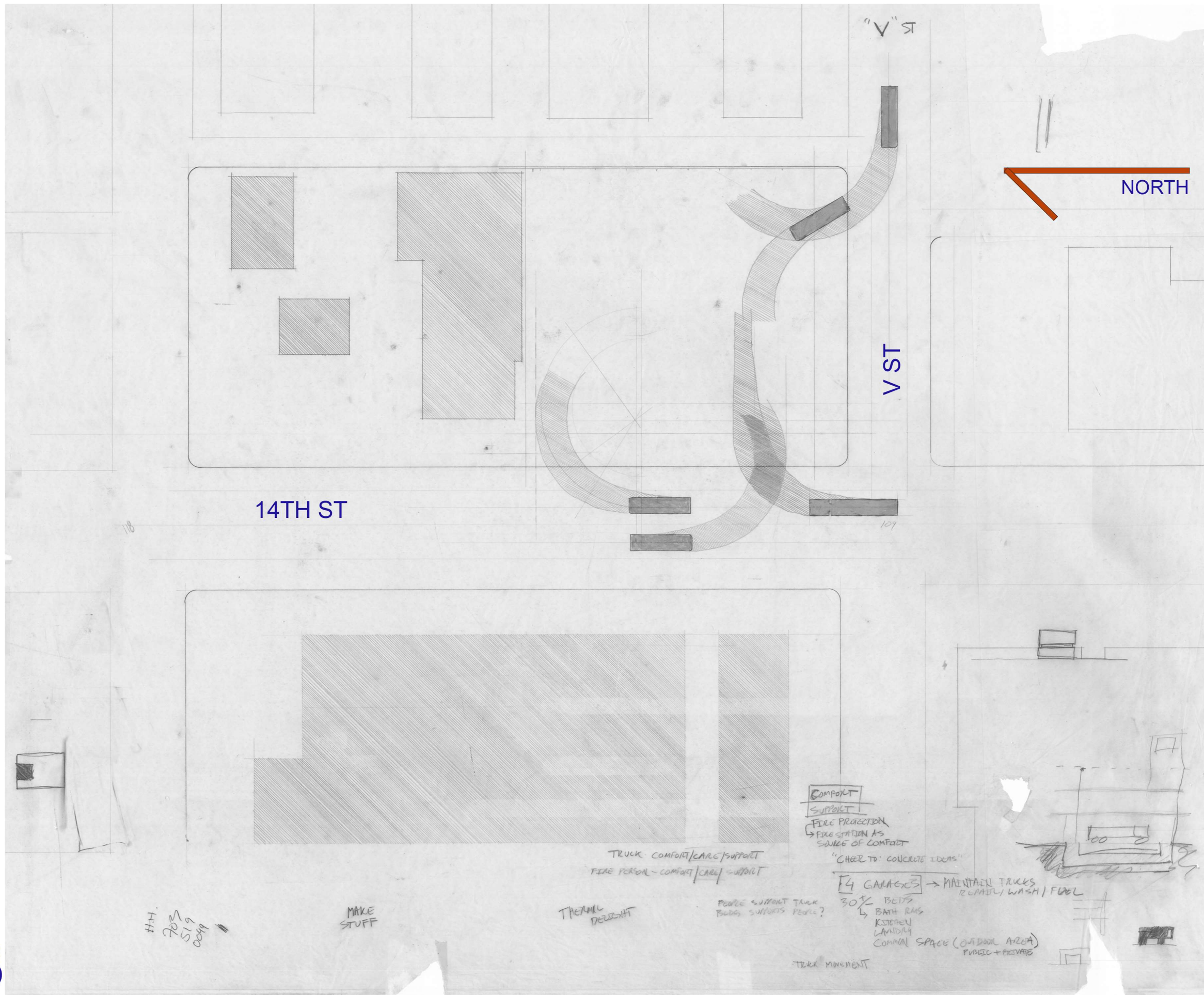


Site Analysis



02

# Concrete and Comfort Urban Firehouse



The existing traffic patterns created strict rules for the layout of the site. Fire stations with apparatus over 50 feet in length typically require a pull through garage, in contrast to the usual urban fire stations with back-in garages. The single entry garage can cause traffic delays while fire apparatus maneuver in reverse.

I chose to have the apparatus entrance on V Street, a single direction low volume cross street. The apparatus exit is on 14th Street. Four lanes make up this important artery, allowing for a larger response area.

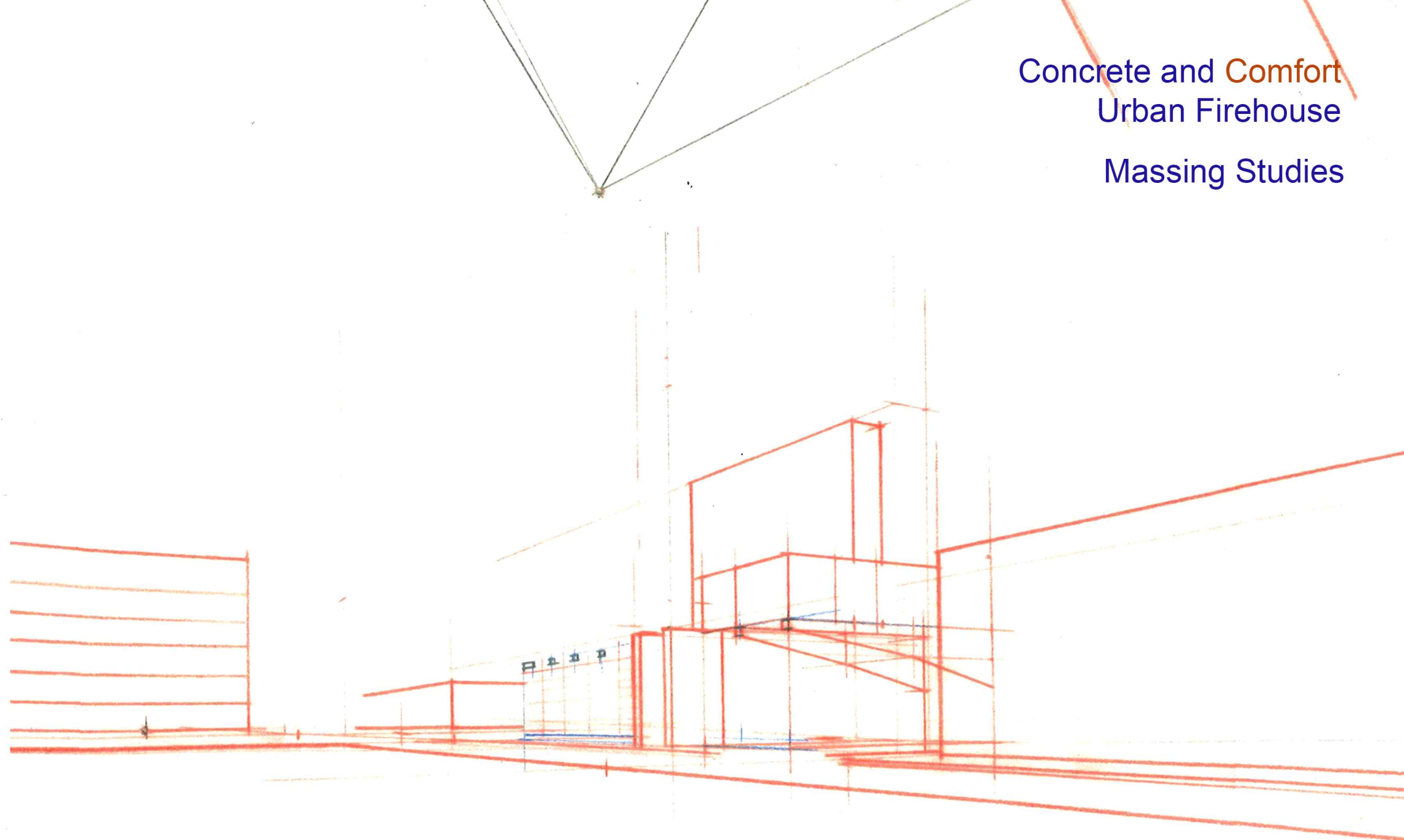
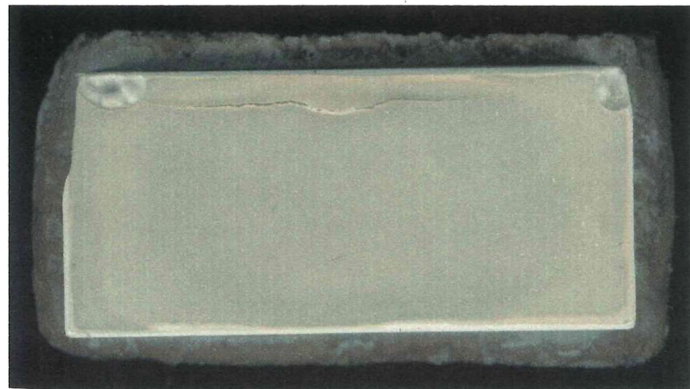
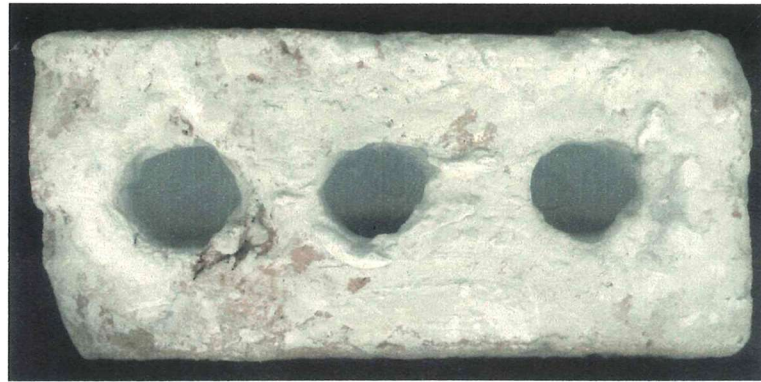
The building orientation created by the flow of vehicular traffic helped create the main connection to the community.

The apparatus garage fronts V Street with its best face, a side view of the iconic Fire Engine and Ladder Truck.

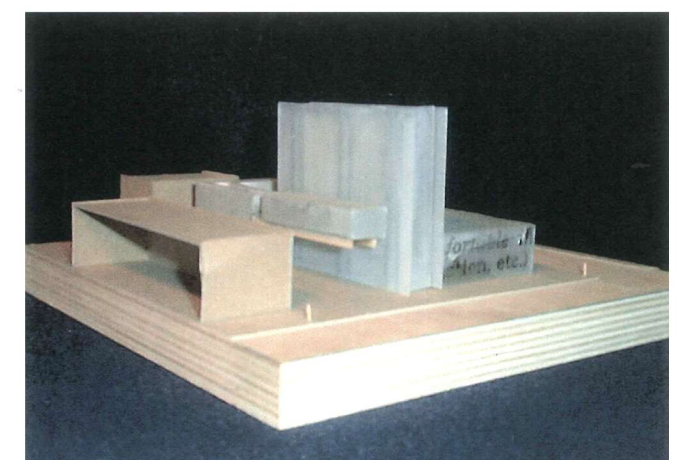
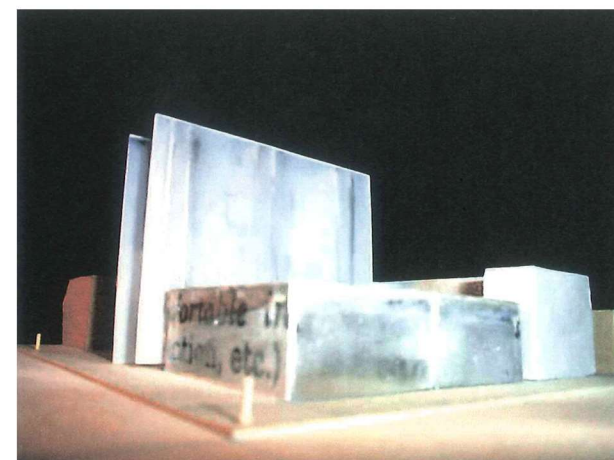
An early turning radius study, with Prof. Holt sketch of the side view station.

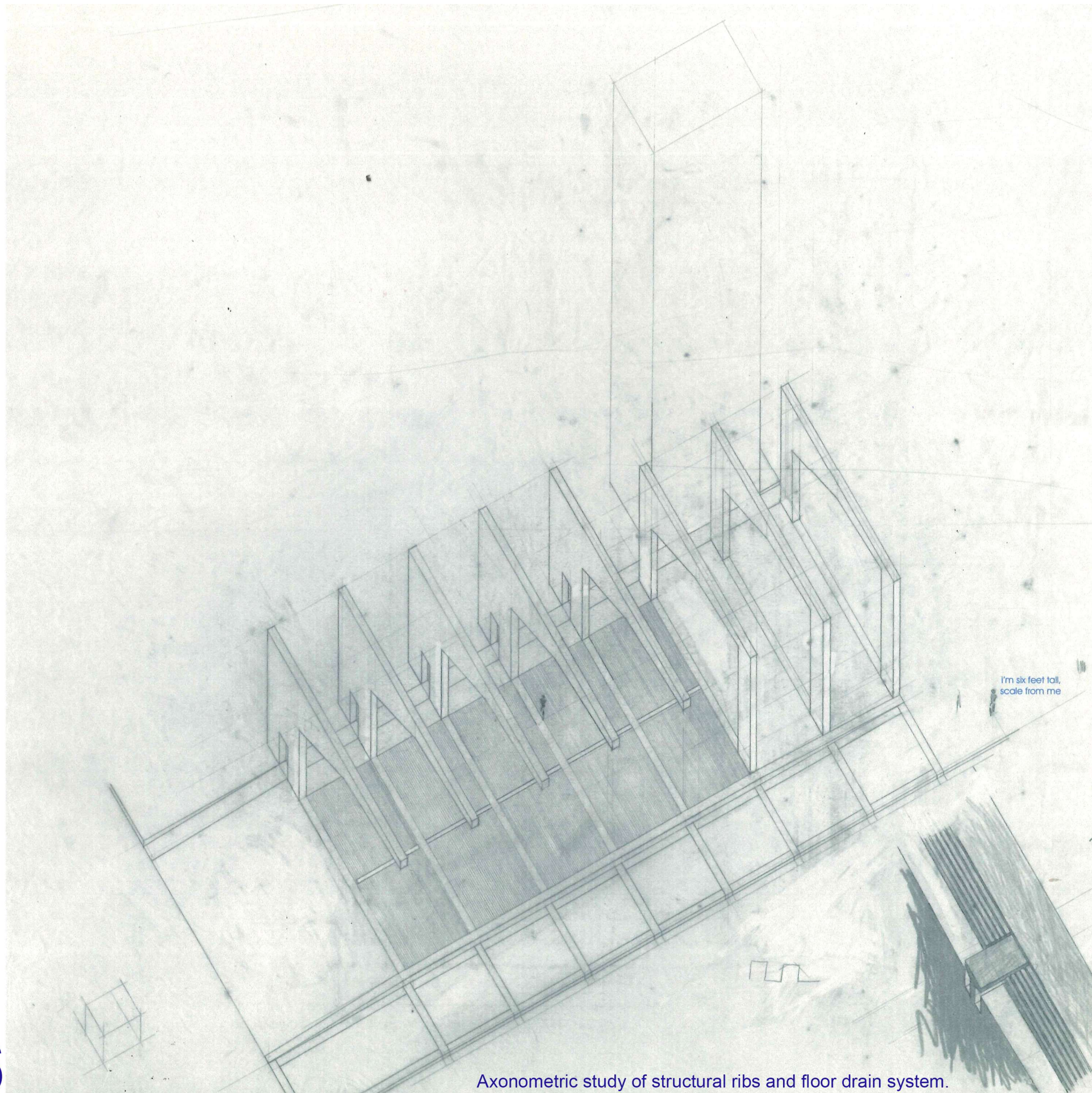
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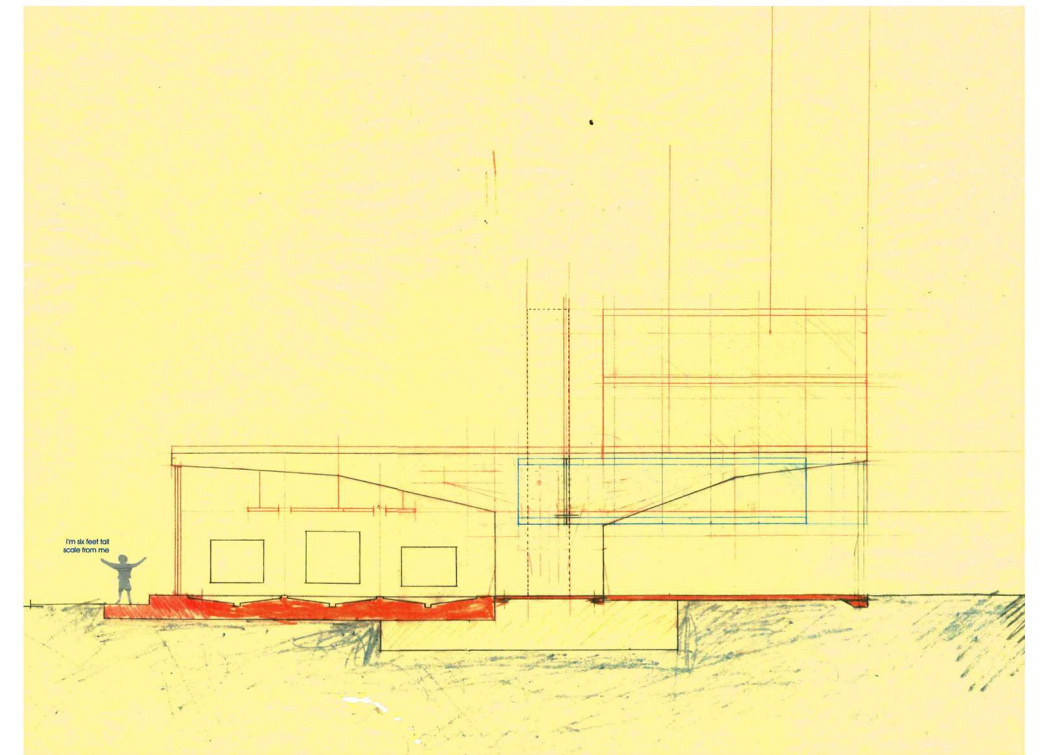


Early studies always contained the tall element, conceived as a tower in section, then stretched out to create a natural ventilation effect for the whole building. The tower will also serve its traditional role as a place to hang dry hoses. Despite advances in material technology hoses are still dried in an unfurled state. The risk of a coiled hose freezing is real, and a wet hose is heavier. Rockite, chipboard, polycarbonate, brick.

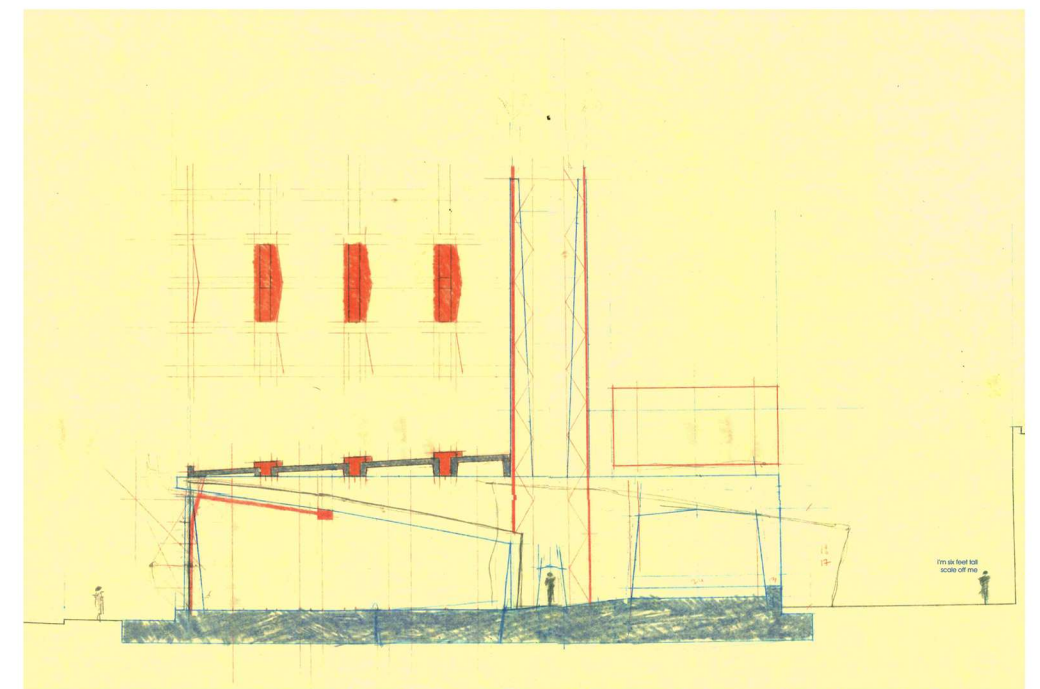




Axonometric study of structural ribs and floor drain system.



Section study with wing cantilever beams, floor drain form.

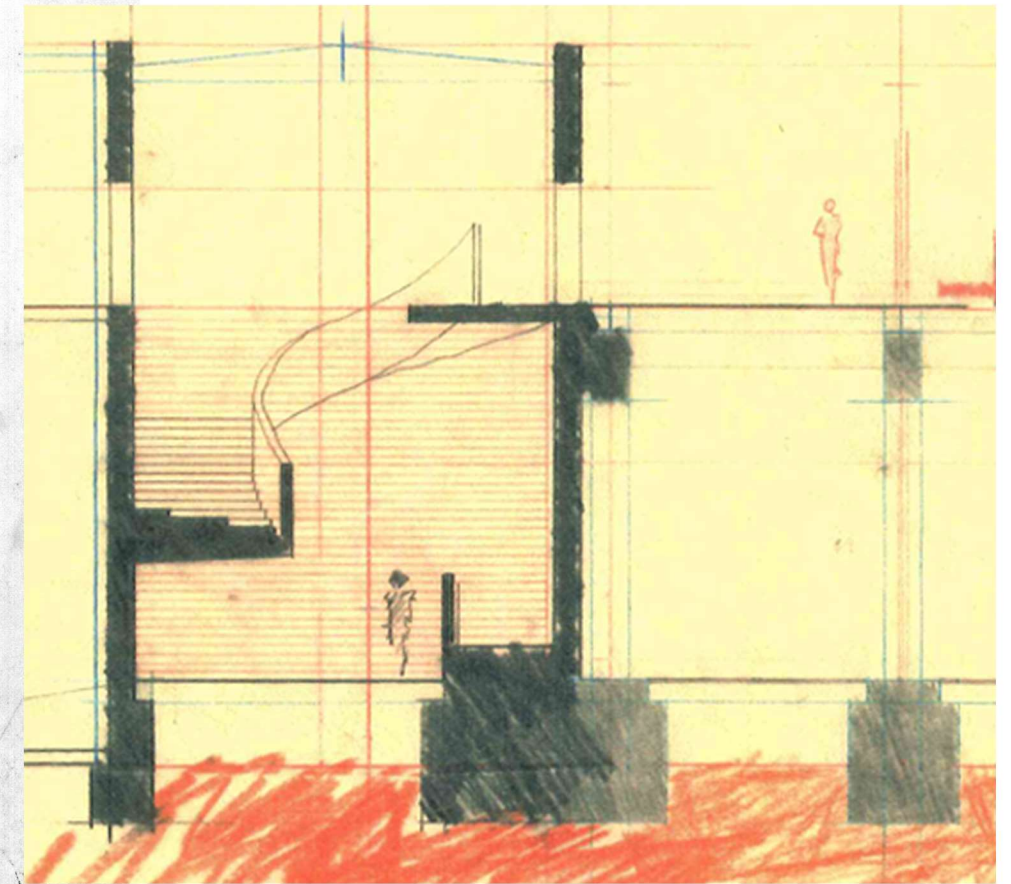
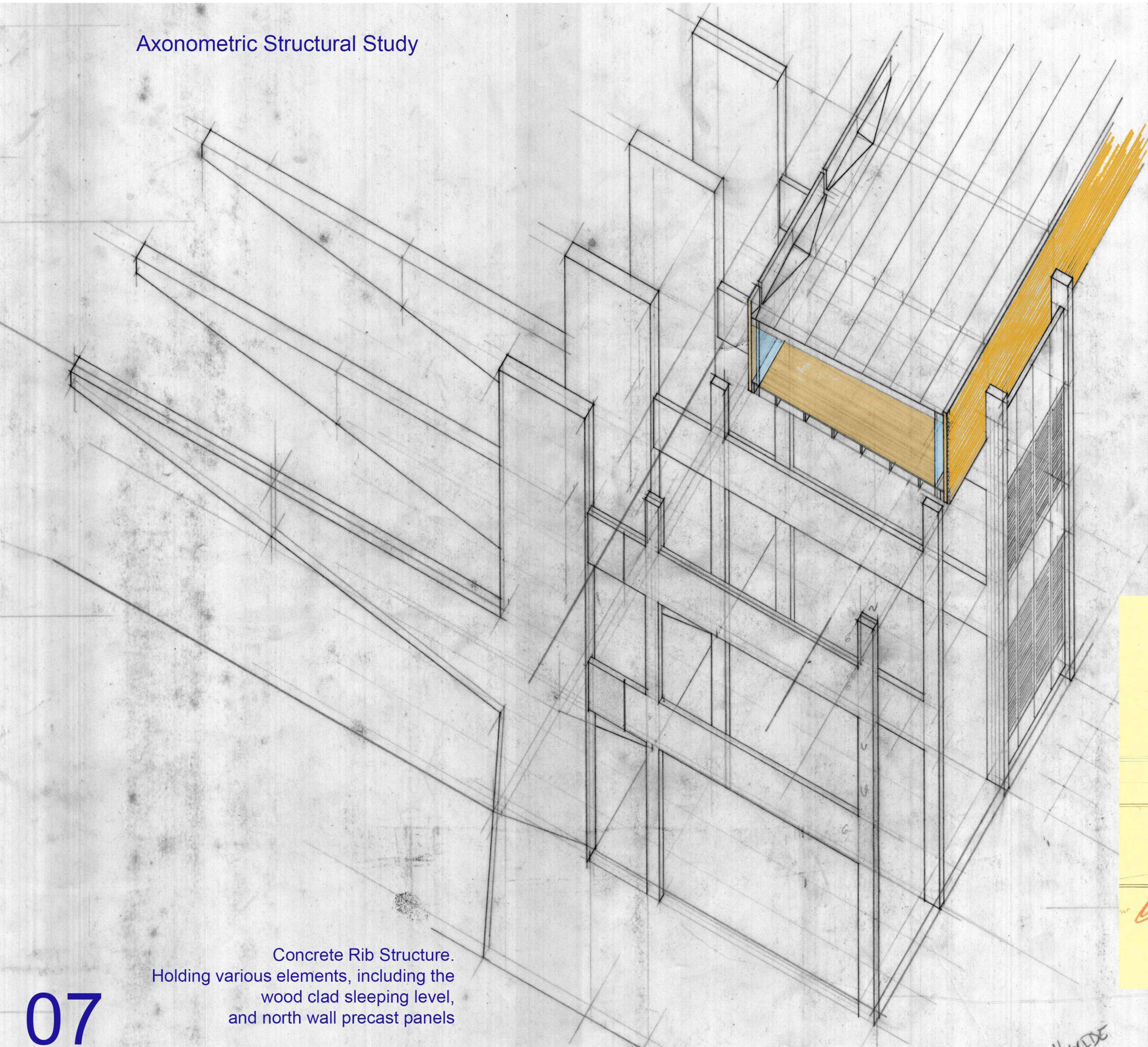


Section study with tower, panelized roof system.

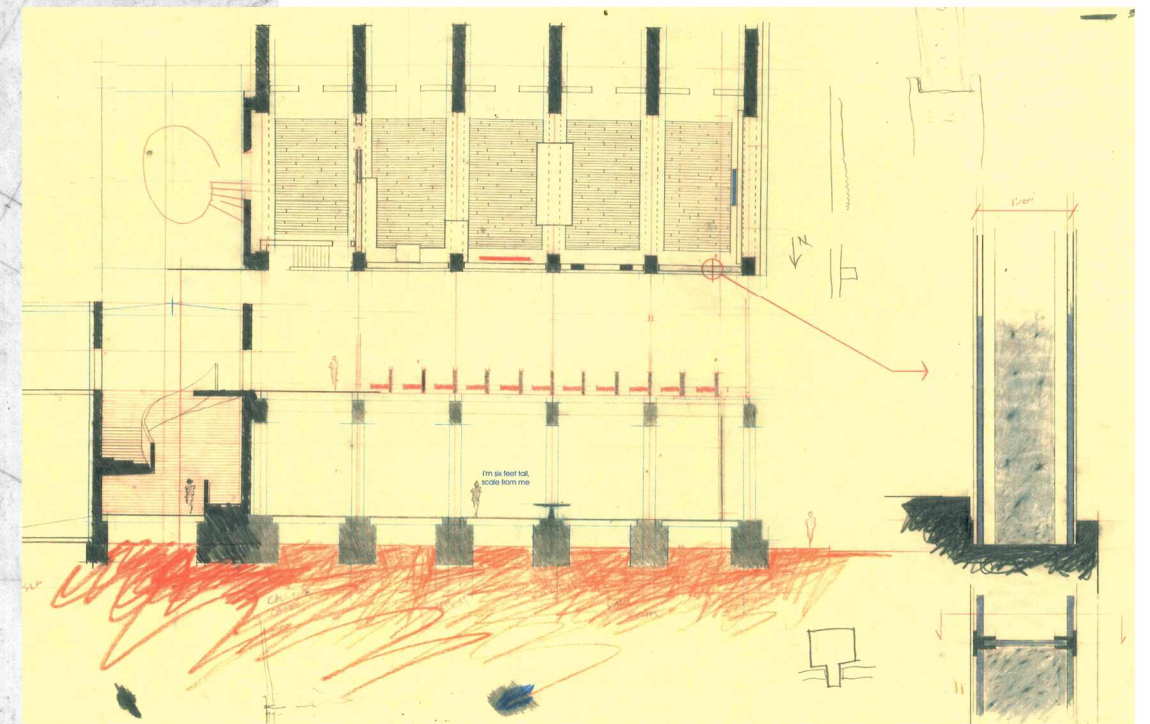
A series of poured concrete ribs, to cantilever over the apparatus garage. Design of the overall structural system and building form coincided with explorations of details.

Development of Structural Systems and Patterns

Axonometric Structural Study



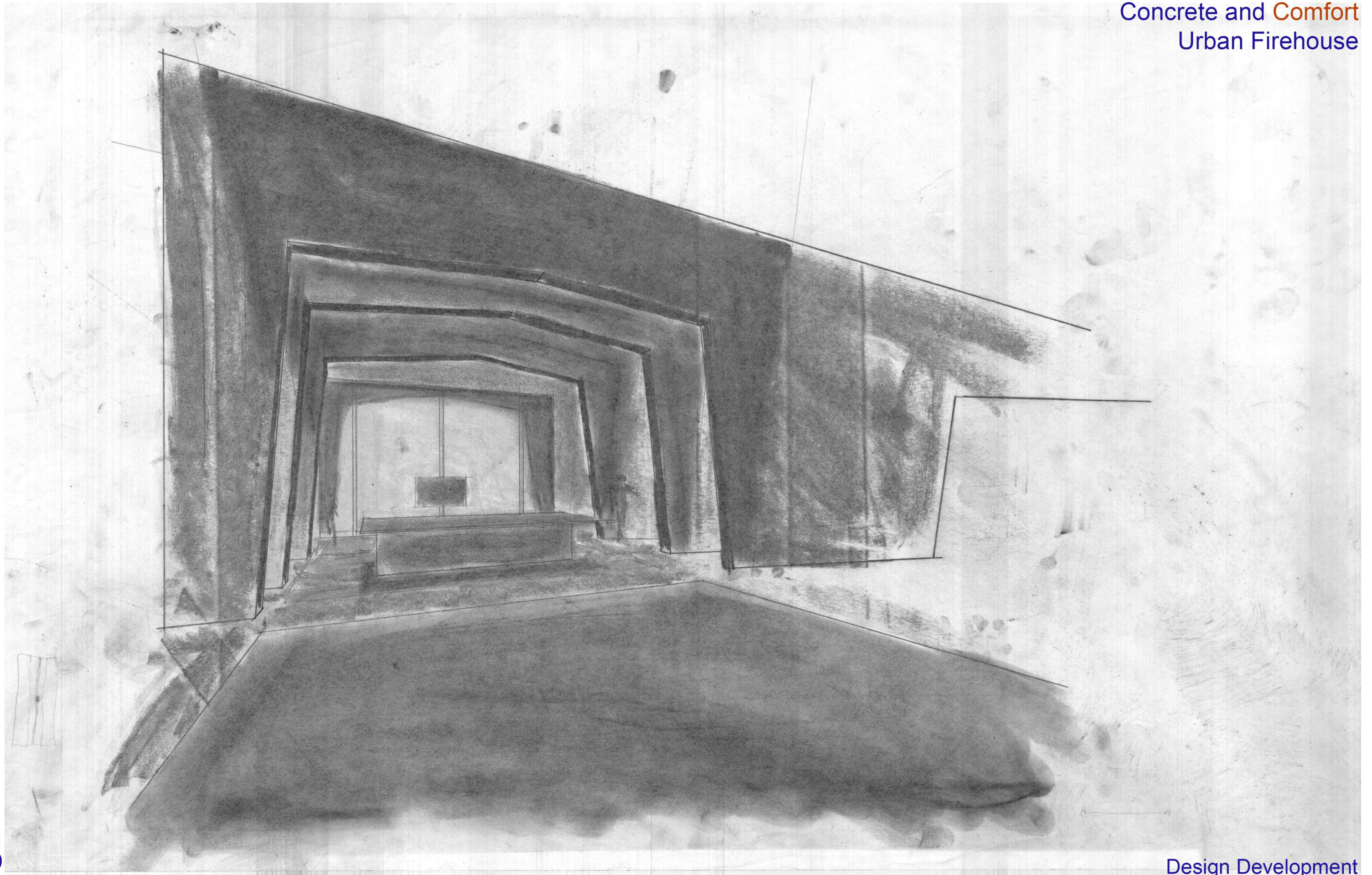
Spiral Stair Section Study 3/32" = 1'-0"



Plan/Section Study 1/32" = 1'-0"

Design Development

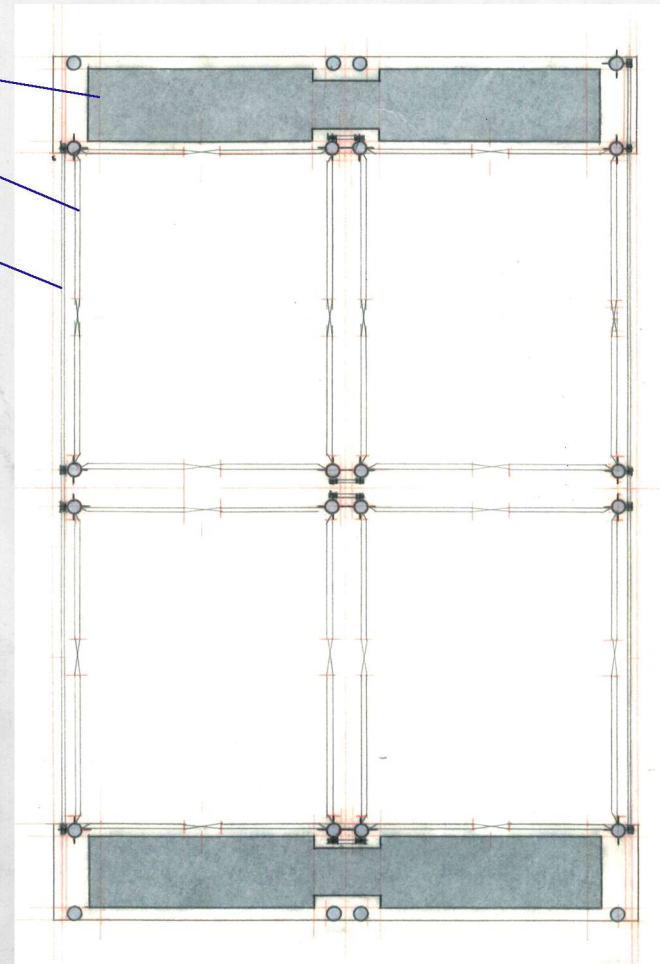
Concrete Rib Structure.  
Holding various elements, including the  
wood clad sleeping level,  
and north wall precast panels



Concrete and Comfort  
Urban Firehouse

Structural Design  
Development

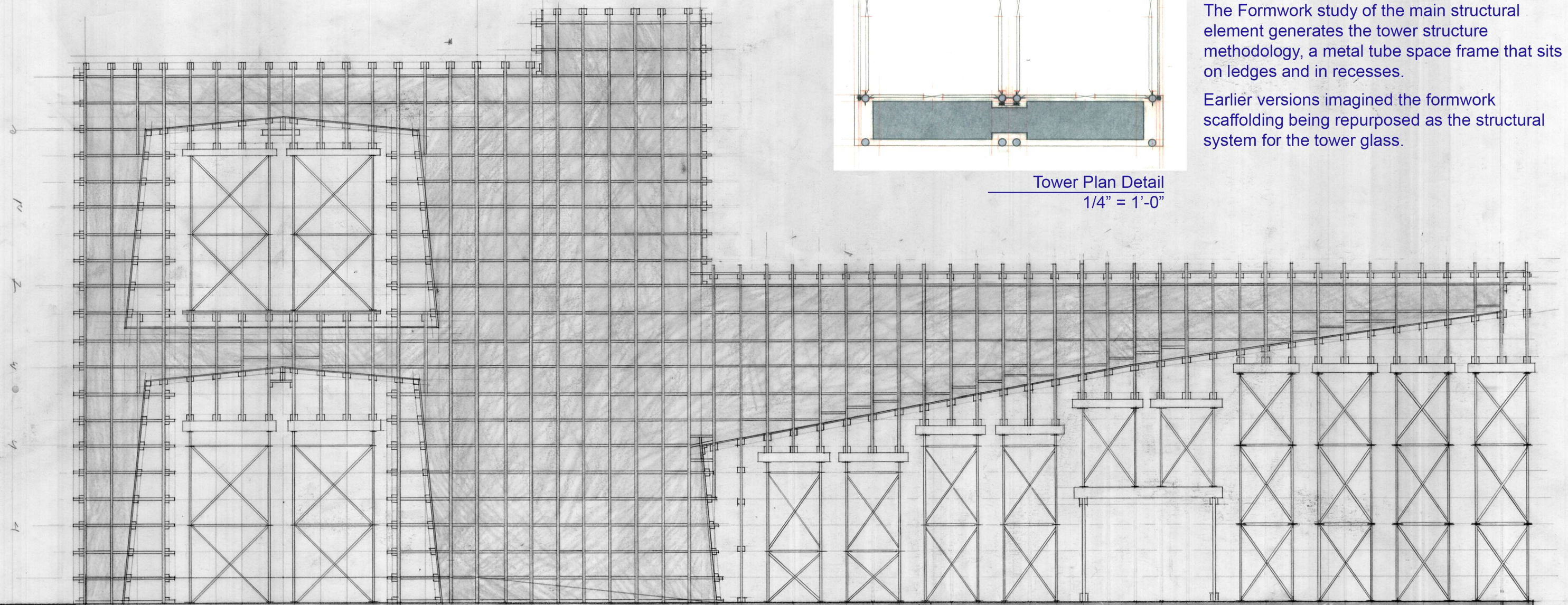
Concrete Tower Rib  
Scaffold/Space Frame  
Glass



The Formwork study of the main structural element generates the tower structure methodology, a metal tube space frame that sits on ledges and in recesses.

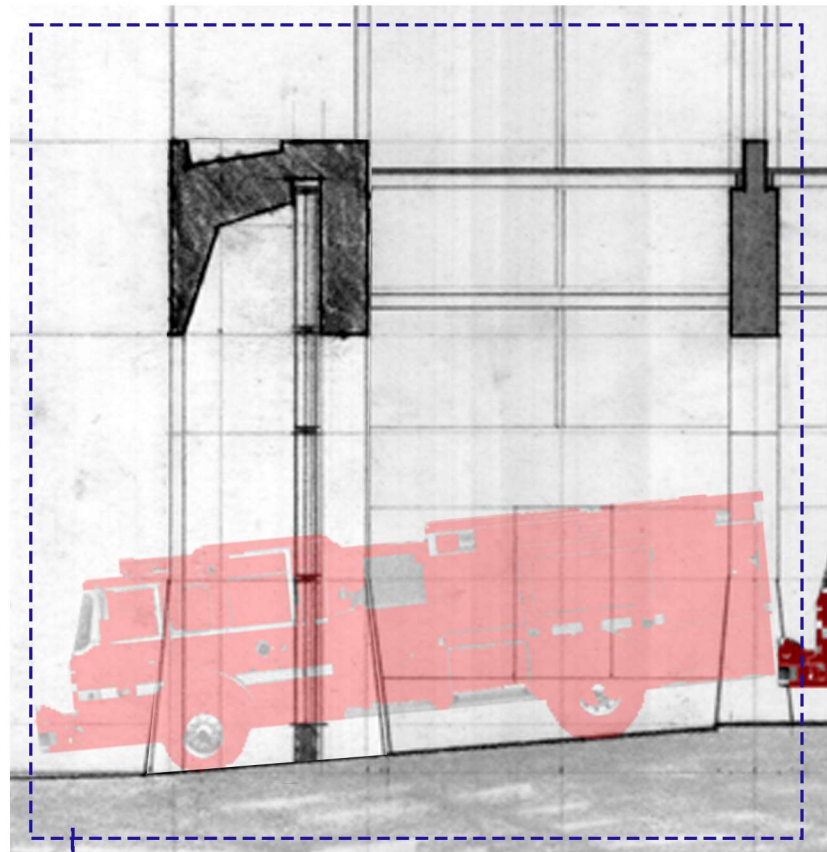
Earlier versions imagined the formwork scaffolding being repurposed as the structural system for the tower glass.

Tower Plan Detail  
1/4" = 1'-0"

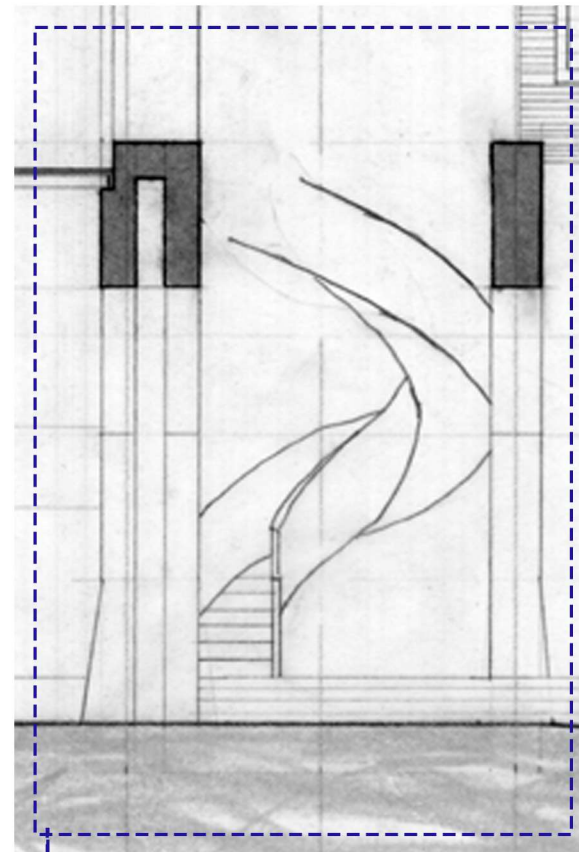


Elevation Study of Formwork for Main Structural Element  
1/8" = 1'-0"

Concrete and Comfort  
Urban Firehouse  
Penultimate Drawings

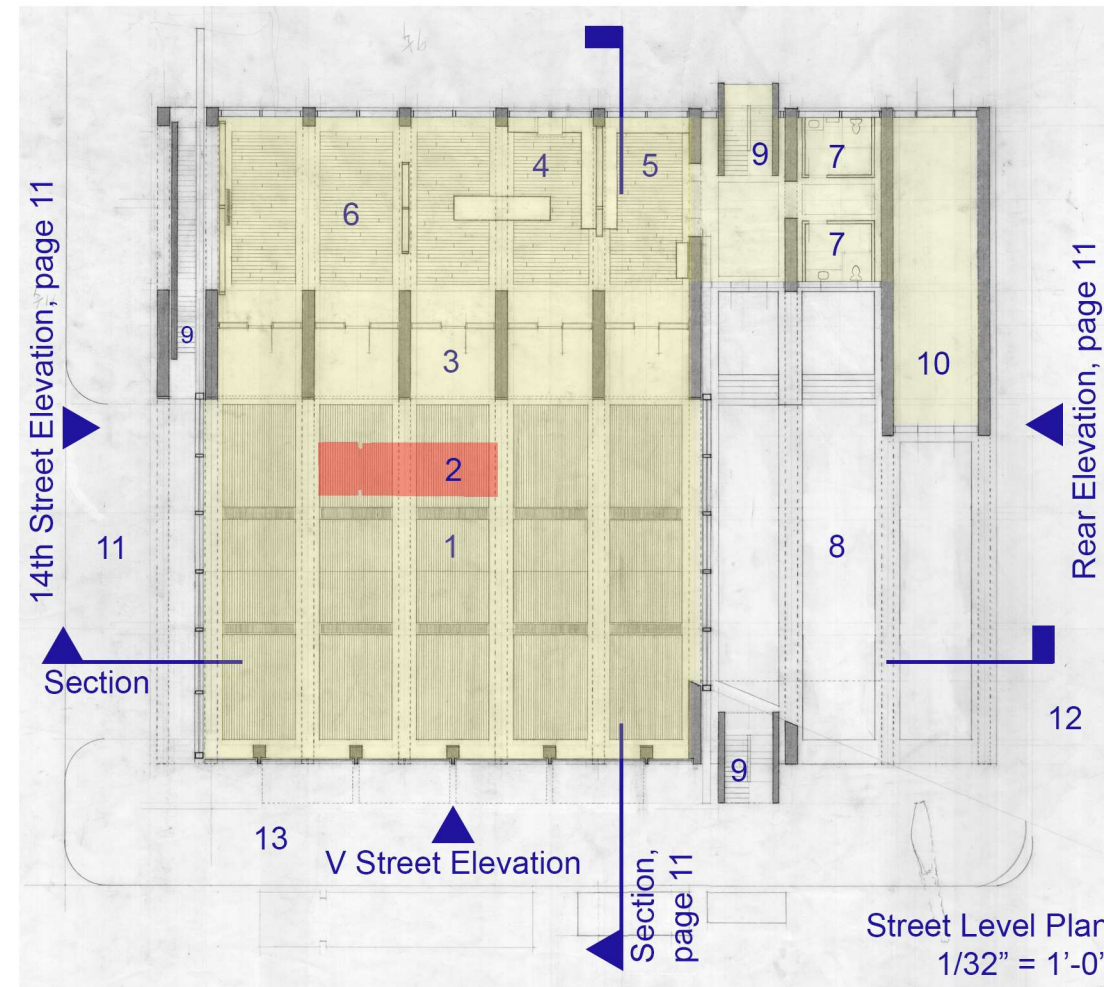


14th St. Exit Ramp, Articulated Beam



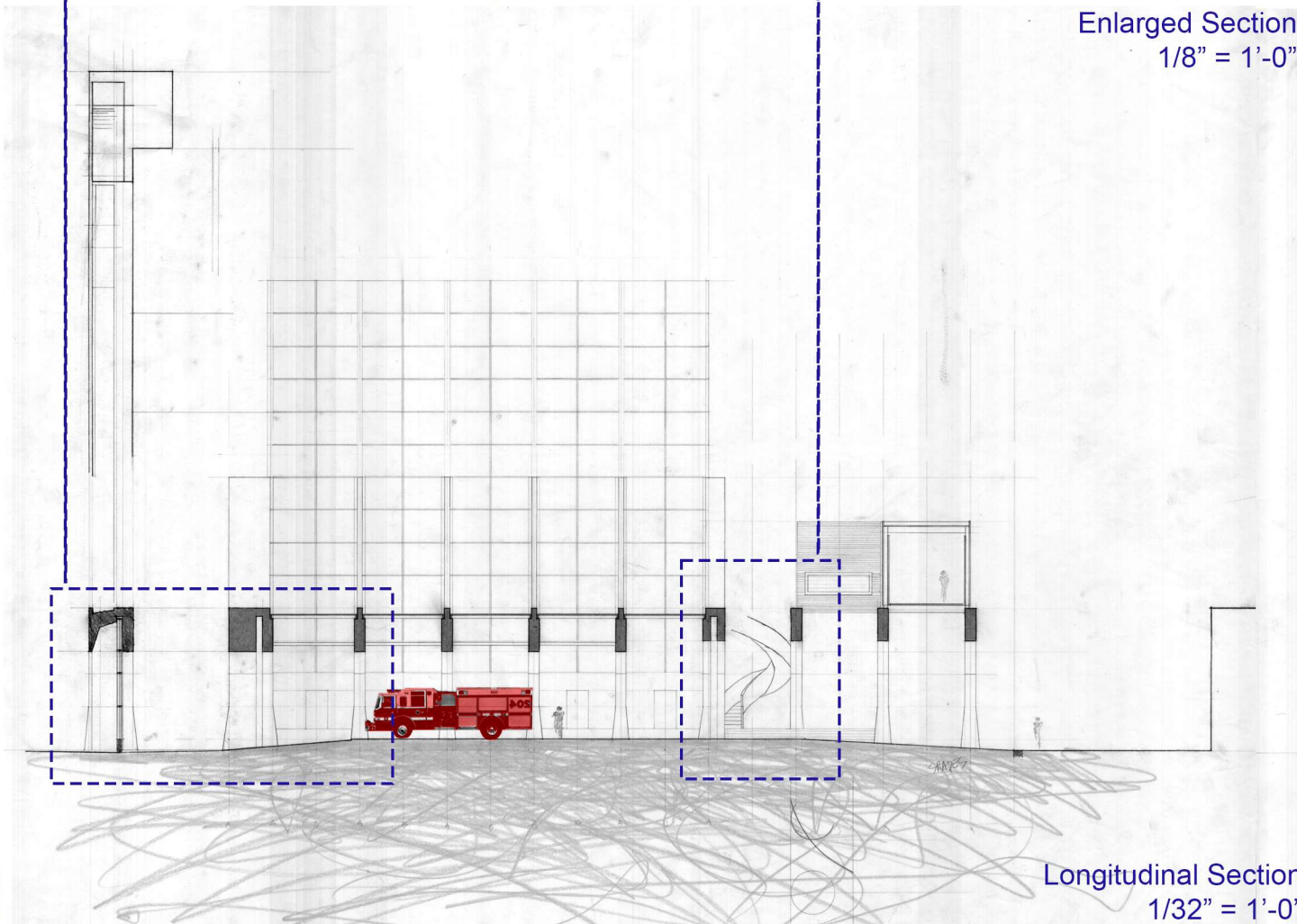
Spiral Stair

Enlarged Section  
1/8" = 1'-0"



Street Level Plan  
1/32" = 1'-0"

- Key
1. Apparatus Garage
  2. Apparatus
  3. Protective Clothing Storage
  4. Kitchen
  5. Dispatch
  6. Recertification Lounge
  7. WC
  8. Exterior Apparatus Parking
  9. Stair
  10. Storage
  11. 14th St. Exit Ramp
  12. Alley Entrance
  13. V Street Sidewalk
- Interior Space



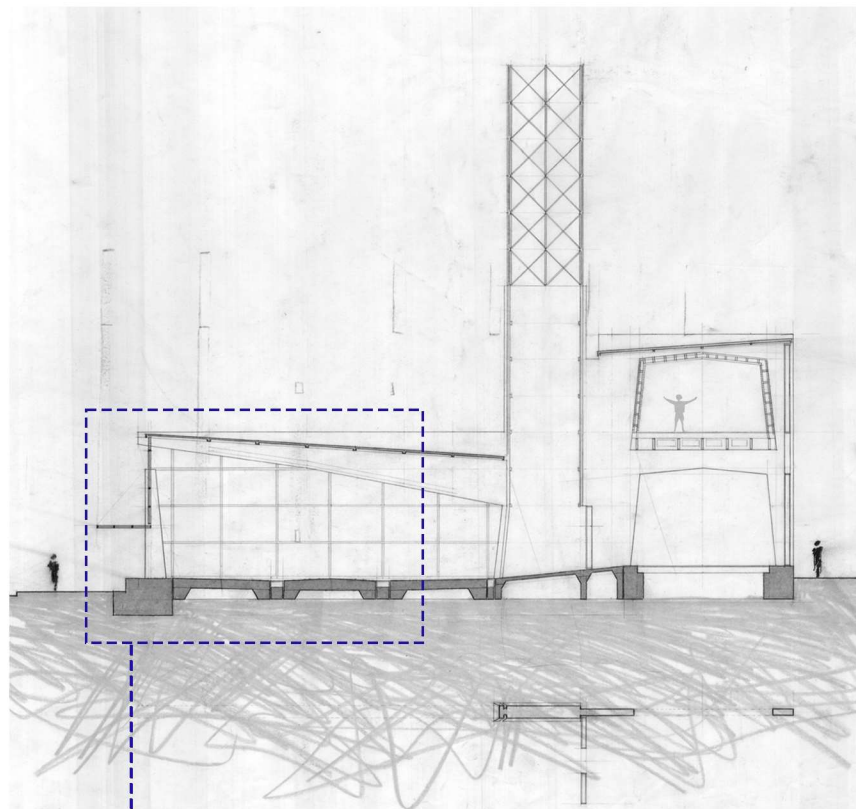
Longitudinal Section  
1/32" = 1'-0"



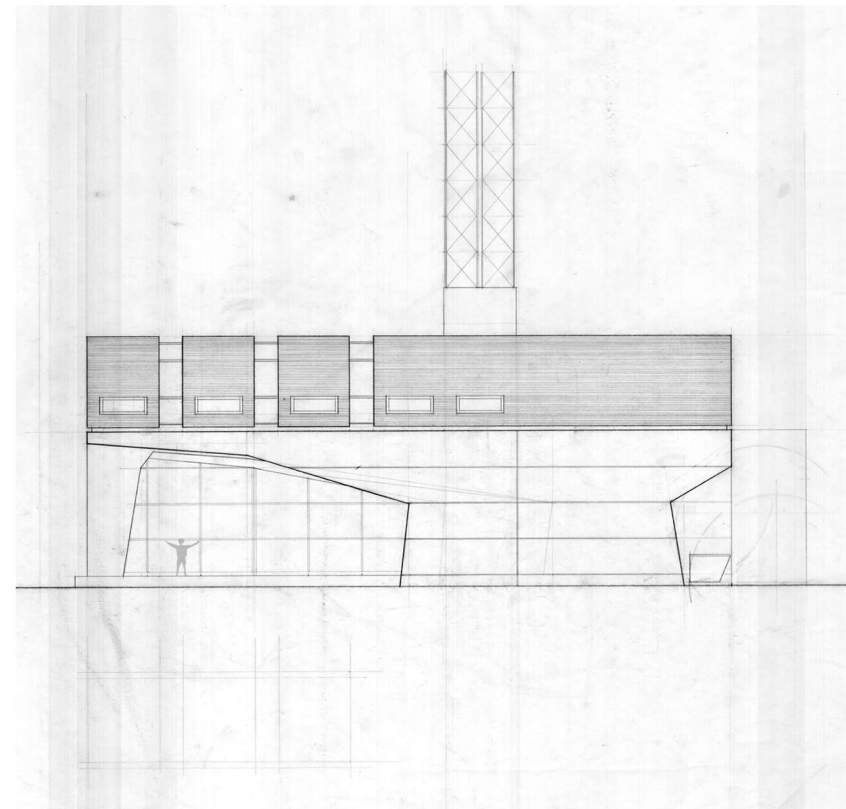
V Street Elevation  
1/32" = 1'-0"

Criticism in the penultimate review points to shortcomings in the building plan. The project has been developed around the cantilevered structural rib in section, producing uncapped tubular spaces. A public entrance from 14th St. is missing, and vertical circulation has to be consolidated and reconfigured. Further articulation of the concrete structure will aid these efforts.

Concrete and Comfort  
 Urban Firehouse  
 Penultimate Drawings



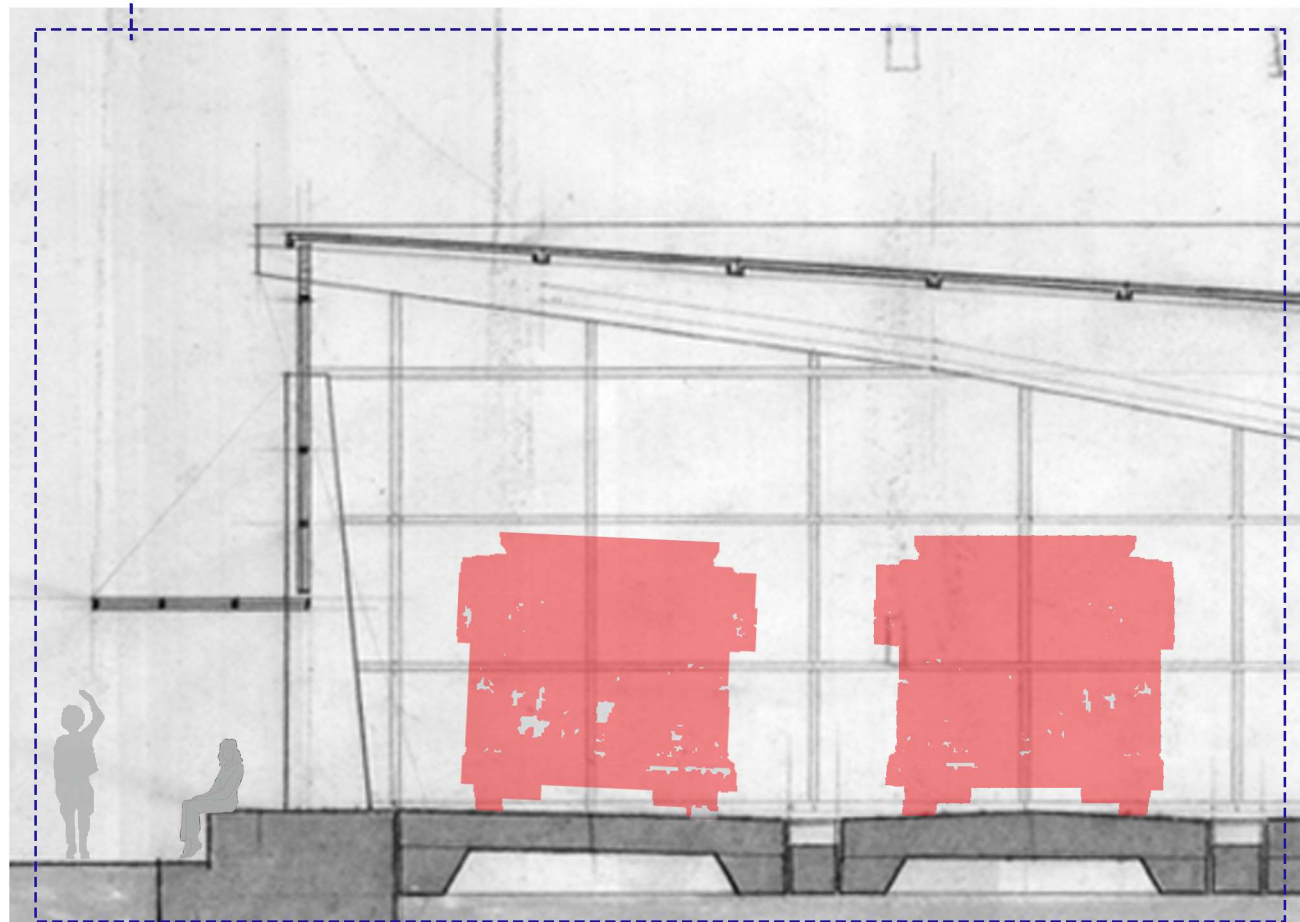
Transverse Building Section  
 1/32" = 1'-0"



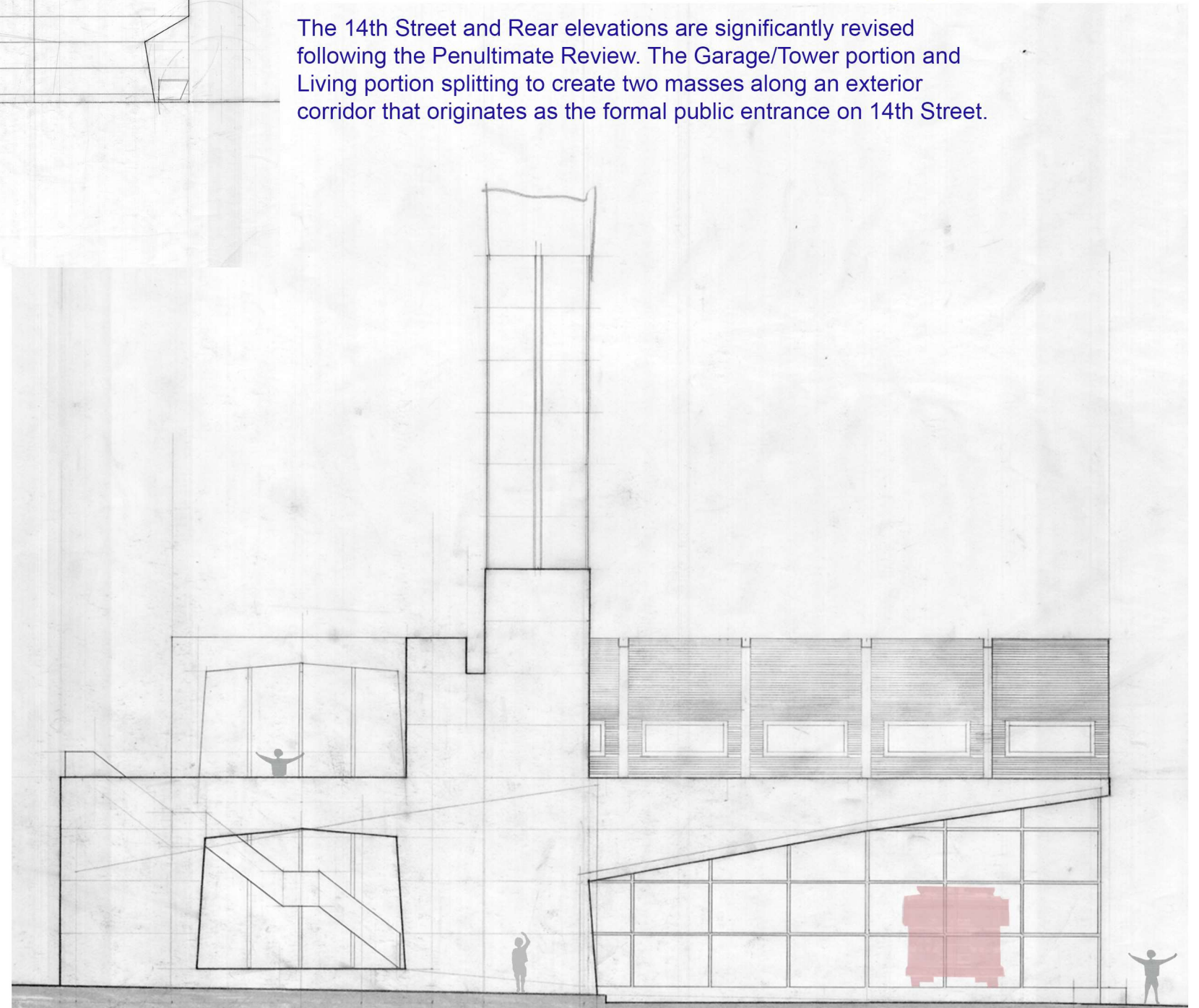
Rear Elevation  
 1/32" = 1'-0"

The Apparatus Garage Porch Door. An aluminum frame window and door system with large upswinging panels that create shelter for the 82 foot long stoop on V Street. The stoop is to be a community space, a way for the Firehouse to extend its service to the people.

The 14th Street and Rear elevations are significantly revised following the Penultimate Review. The Garage/Tower portion and Living portion splitting to create two masses along an exterior corridor that originates as the formal public entrance on 14th Street.



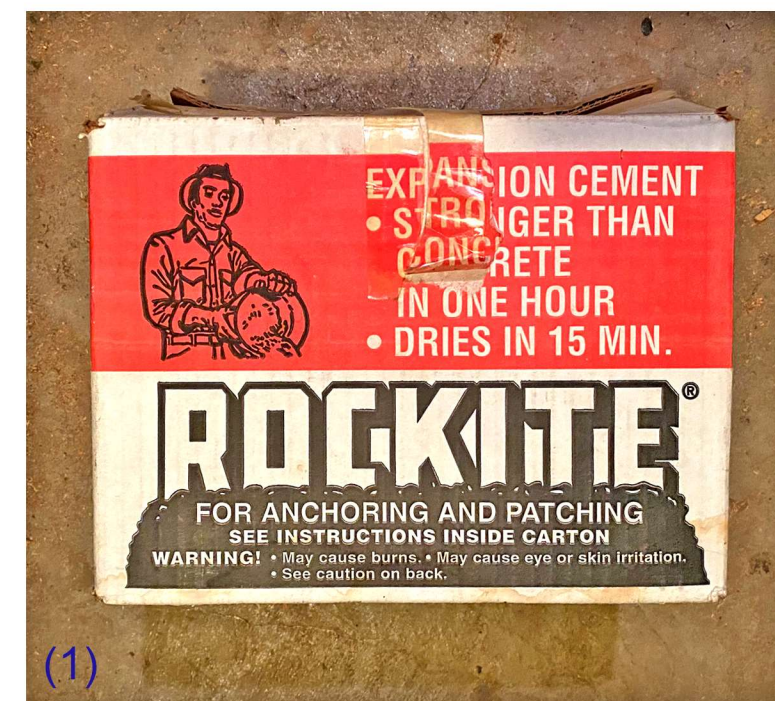
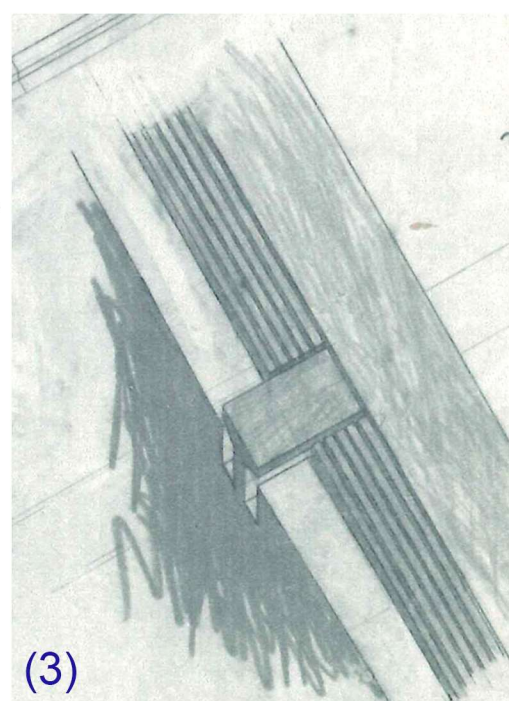
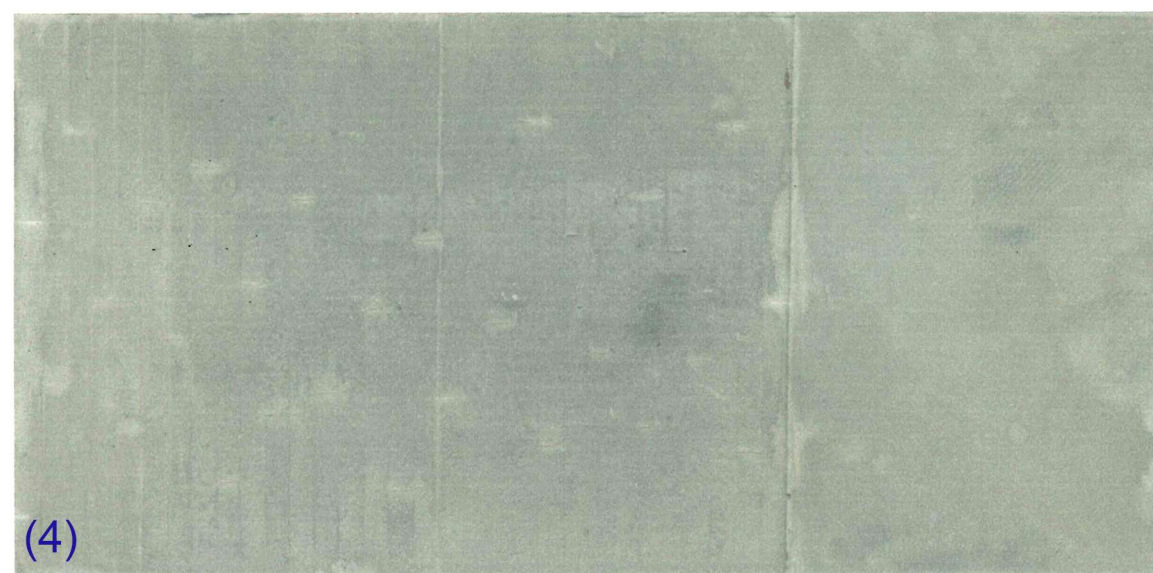
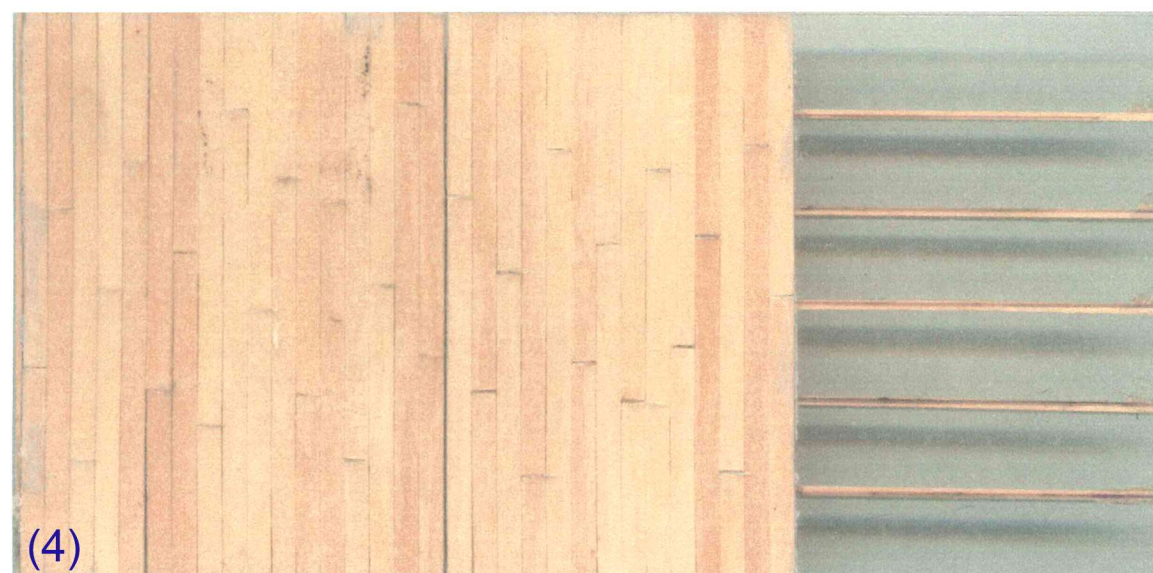
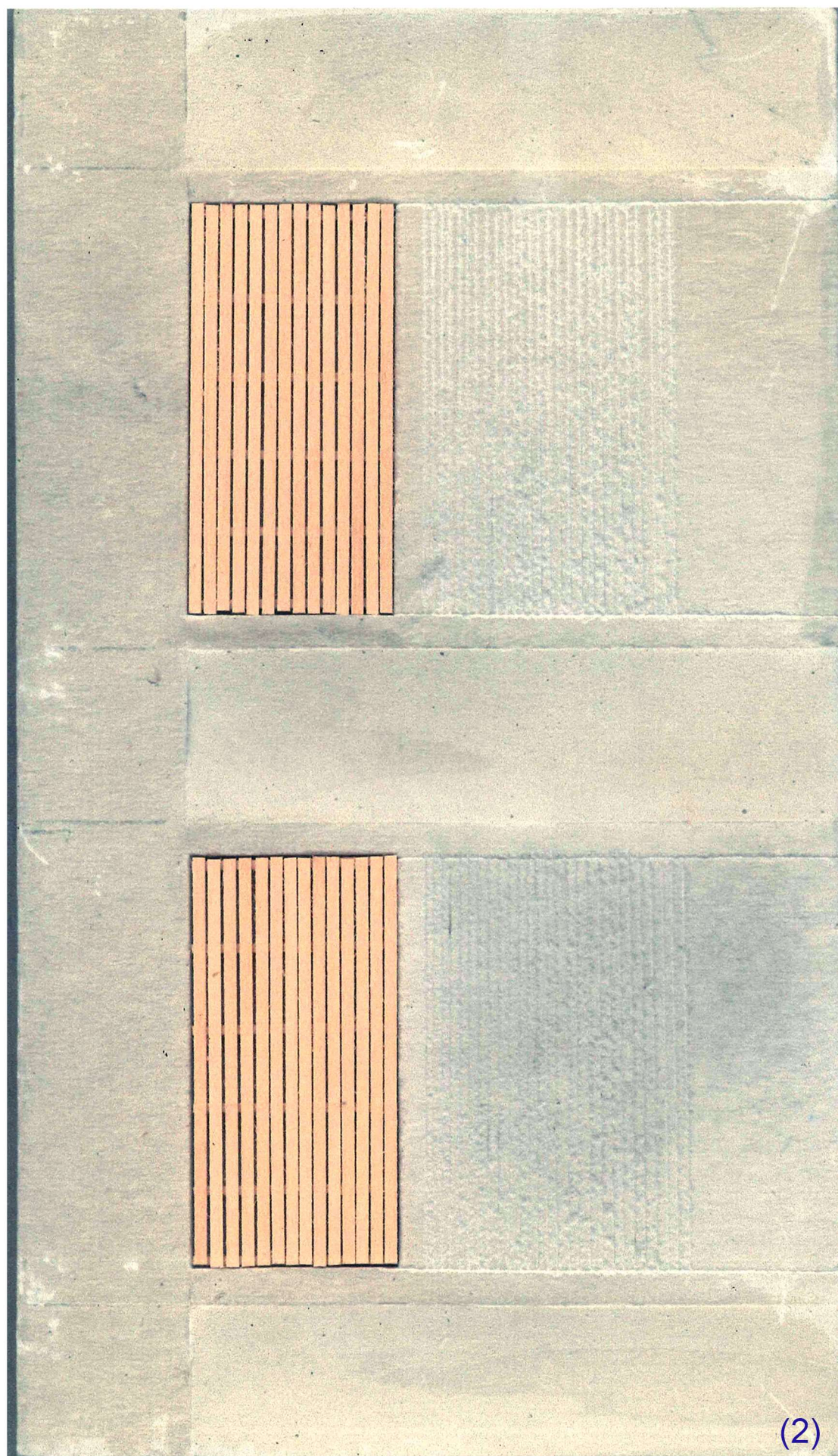
Apparatus Garage Porch Door Section  
 1/8" = 1'-0"



14th Street Elevation  
 1/16" = 1'-0"

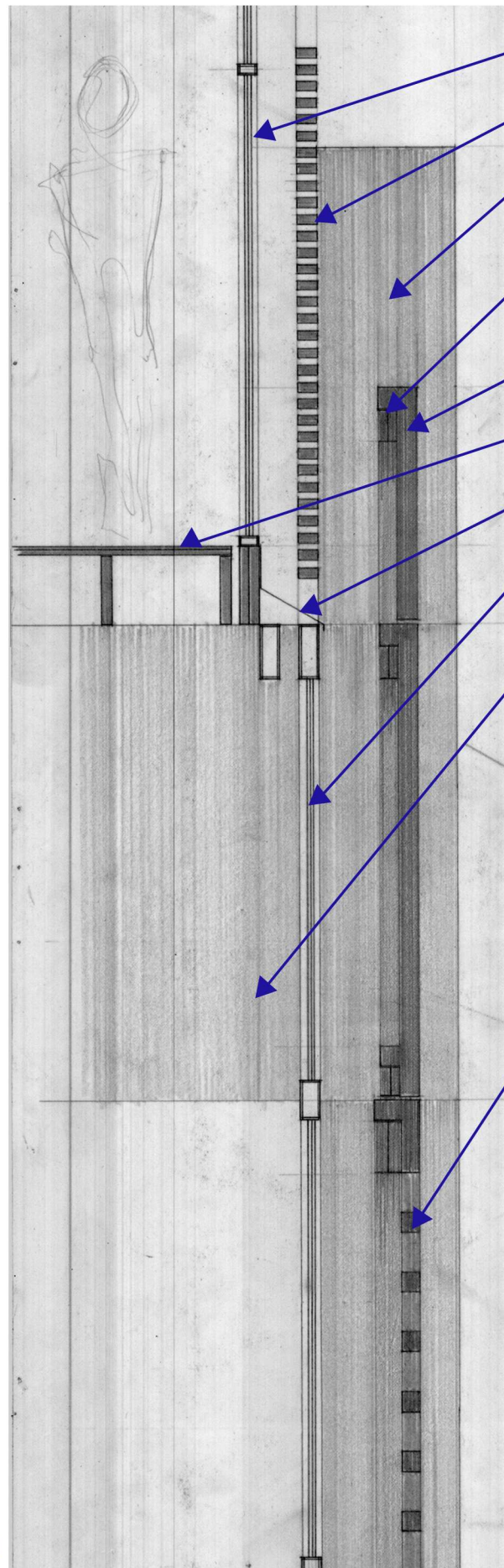
# Concrete and Comfort Urban Firehouse

## Casting Floor Studies

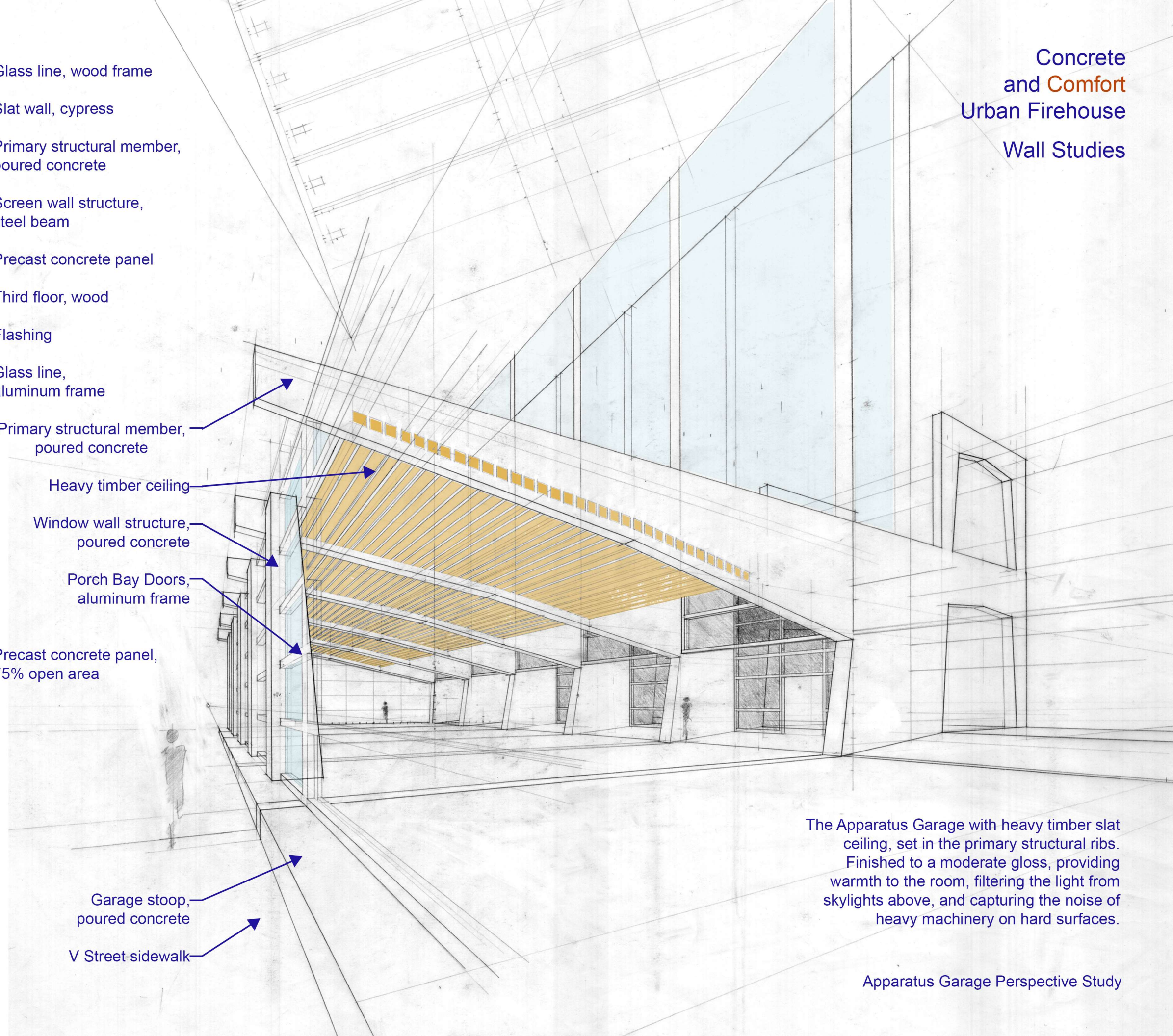


Concrete floor patterns, finishes, and uses were explored using ROCKITE (1), the ideal material to explore scaled volumes and form making in the studio. An expanding cement material without aggregate that sets up in 20 minutes, warming to the touch as the chemicals react. The surface cures to a beautiful gray black swirl that can be modified by altering the mix ratio. The Apparatus Garage Floor (2) will be grooved for sure footing when wet, sloping towards a water reclamation system.(3) The floor will be formed to hold wood flooring sections at areas that require lengthy work while standing. Board Formed panels (4), scale lumber, plexiglass and ROCKITE in a chipboard bounding box.

Concrete  
and Comfort  
Urban Firehouse  
Wall Studies



- Glass line, wood frame
- Slat wall, cypress
- Primary structural member, poured concrete
- Screen wall structure, steel beam
- Precast concrete panel
- Third floor, wood
- Flashing
- Glass line, aluminum frame
- Primary structural member, poured concrete
- Heavy timber ceiling
- Window wall structure, poured concrete
- Porch Bay Doors, aluminum frame
- Precast concrete panel, 75% open area

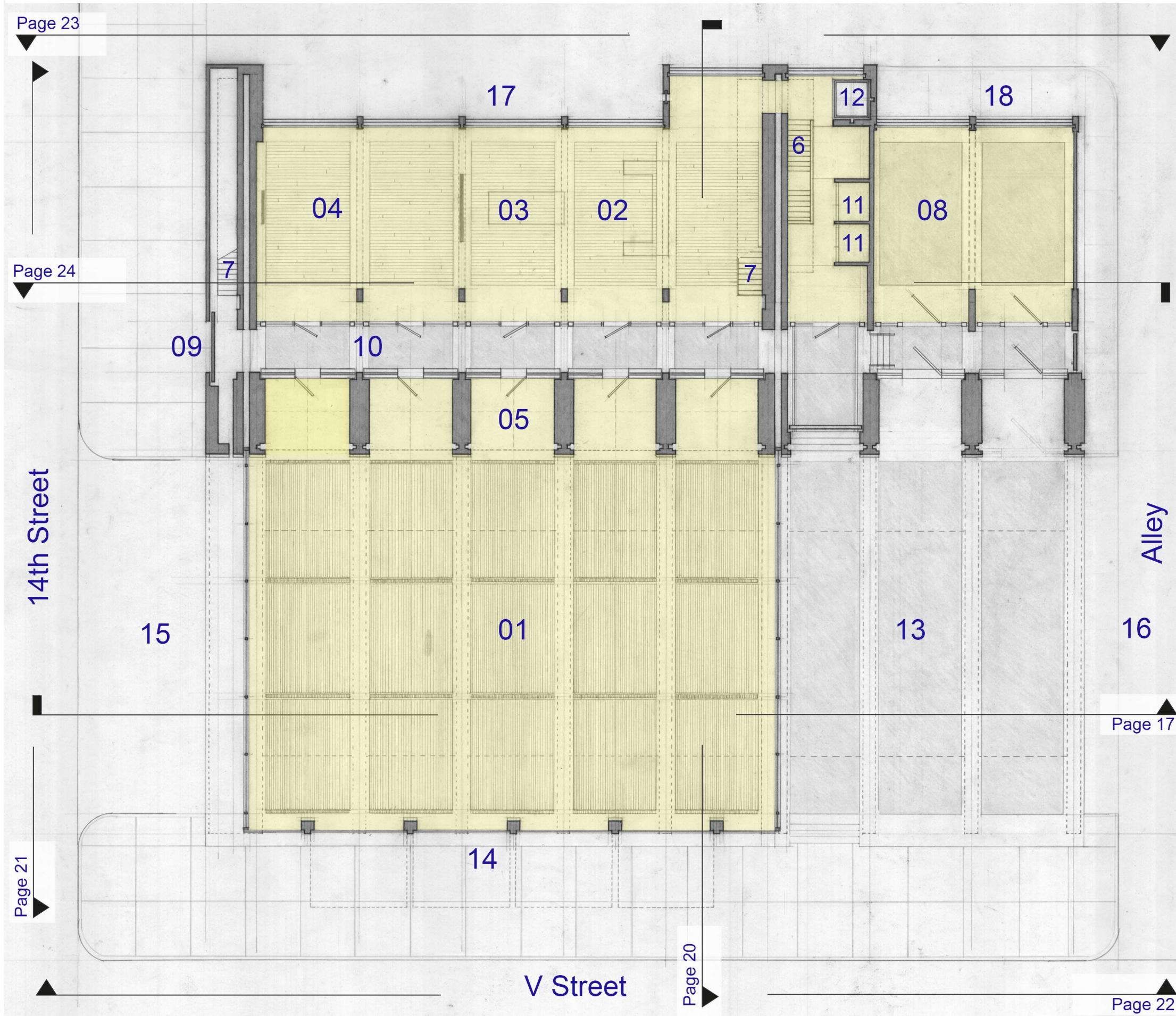


The Apparatus Garage with heavy timber slat ceiling, set in the primary structural ribs. Finished to a moderate gloss, providing warmth to the room, filtering the light from skylights above, and capturing the noise of heavy machinery on hard surfaces.

- Garage stoop, poured concrete
- V Street sidewalk

Concrete and Comfort  
Urban Firehouse

Final Drawings



- Key-
- 01. Apparatus Garage
  - 02. Kitchen
  - 03. Dining Area
  - 04. Recertification Area, TV
  - 05. Protective Clothing Storage
  - 06. Stair Down
  - 07. Stair Up
  - 08. Storage
  - 09. Formal Public Entrance
  - 10. Exterior Corridor
  - 11. WC
  - 12. Elevator
  - 13. Exterior Apparatus Parking
  - 14. Covered Stoop
  - 15. Exit Ramp to 14th Street
  - 16. Apparatus Entrance
  - 17. Parking
  - 18. Rubbish

Interior Space

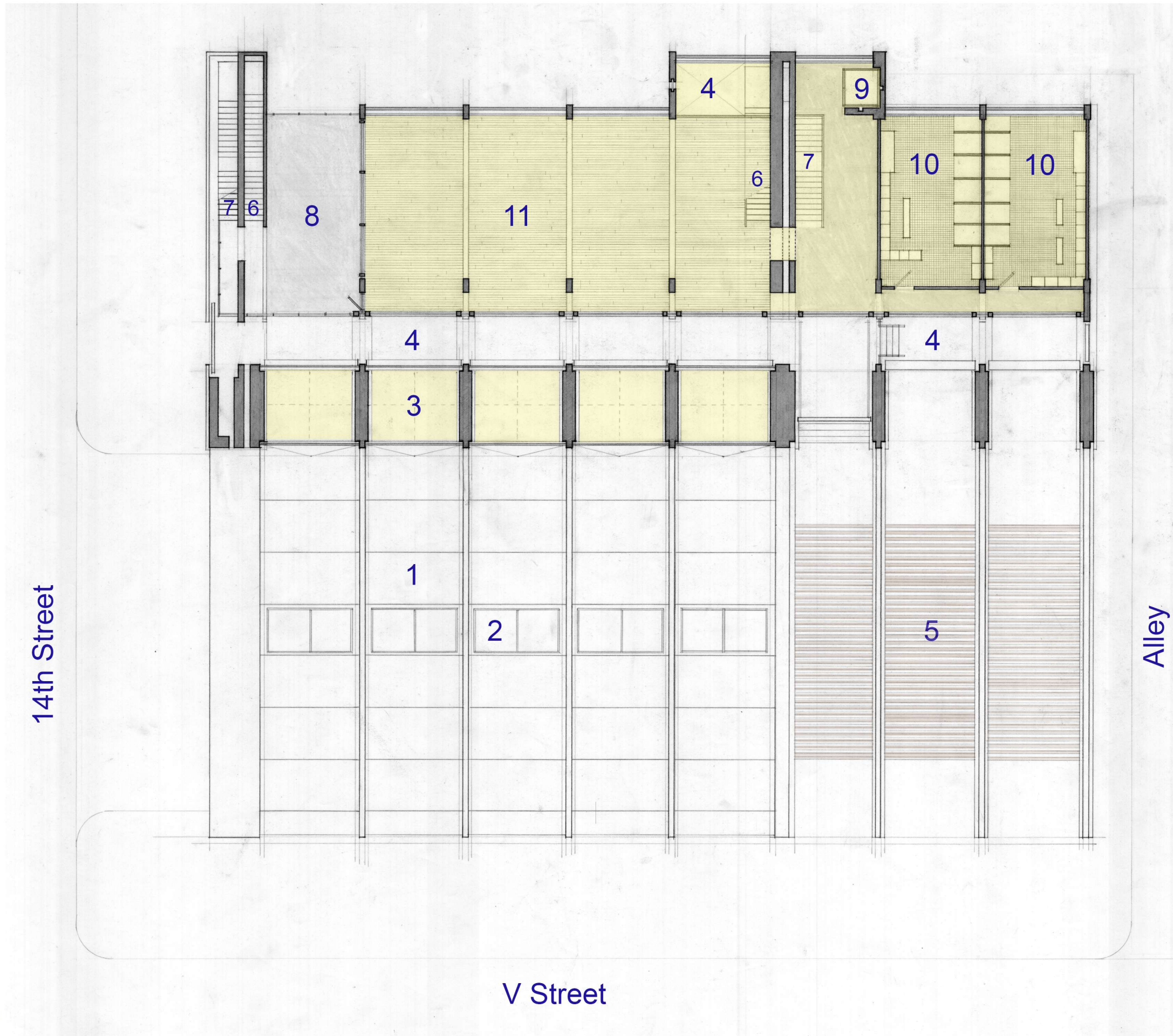
Street Level Plan

Scale: 1/16" = 1'-0"



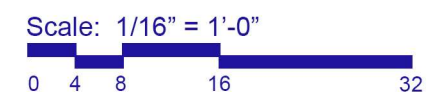
Concrete and Comfort  
Urban Firehouse

Final Drawings



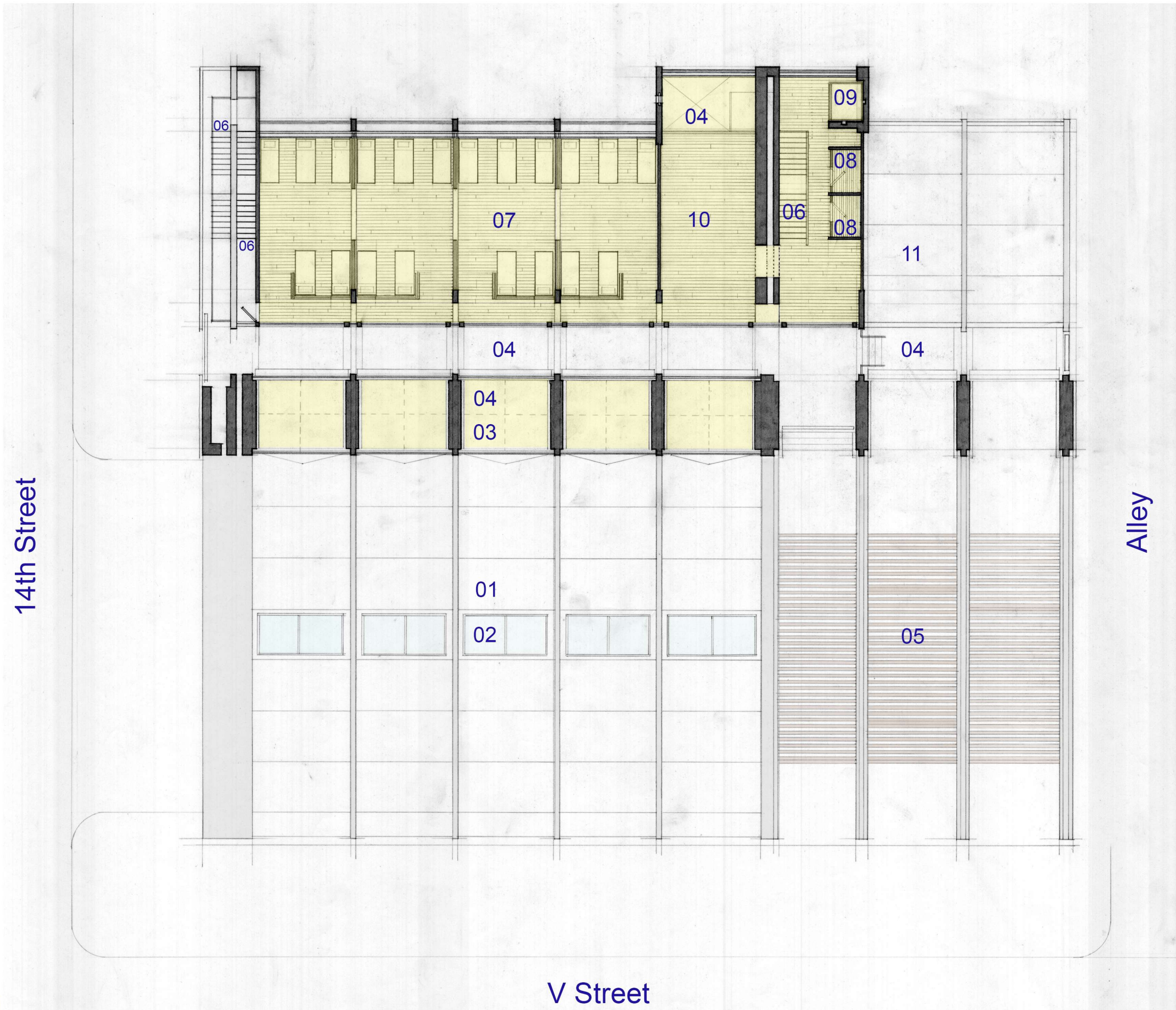
- Key-
- 01. Roof of Interior Apparatus Garage
  - 02. Skylight
  - 03. Hose Drying Tower
  - 04. Open To Below
  - 05. Open Timber Shade Structure
  - 06. Stair Down
  - 07. Stair Up
  - 08. Exterior Porch
  - 09. Elevator
  - 10. Locker Room
  - 11. Exercise Area
- Interior Space

Second Level Plan



Concrete and Comfort  
Urban Firehouse

Final Drawings



- Key-
- 01. Roof of Interior Apparatus Garage
  - 02. Skylight
  - 03. Hose Drying Tower
  - 04. Open To Below
  - 05. Open Timber Shade Structure
  - 06. Stair Down
  - 07. Sleeping Room
  - 08. WC
  - 09. Elevator
  - 10. Lounge
  - 11. Roof

Interior Space

Third Floor Plan

Scale: 1/16" = 1'-0"



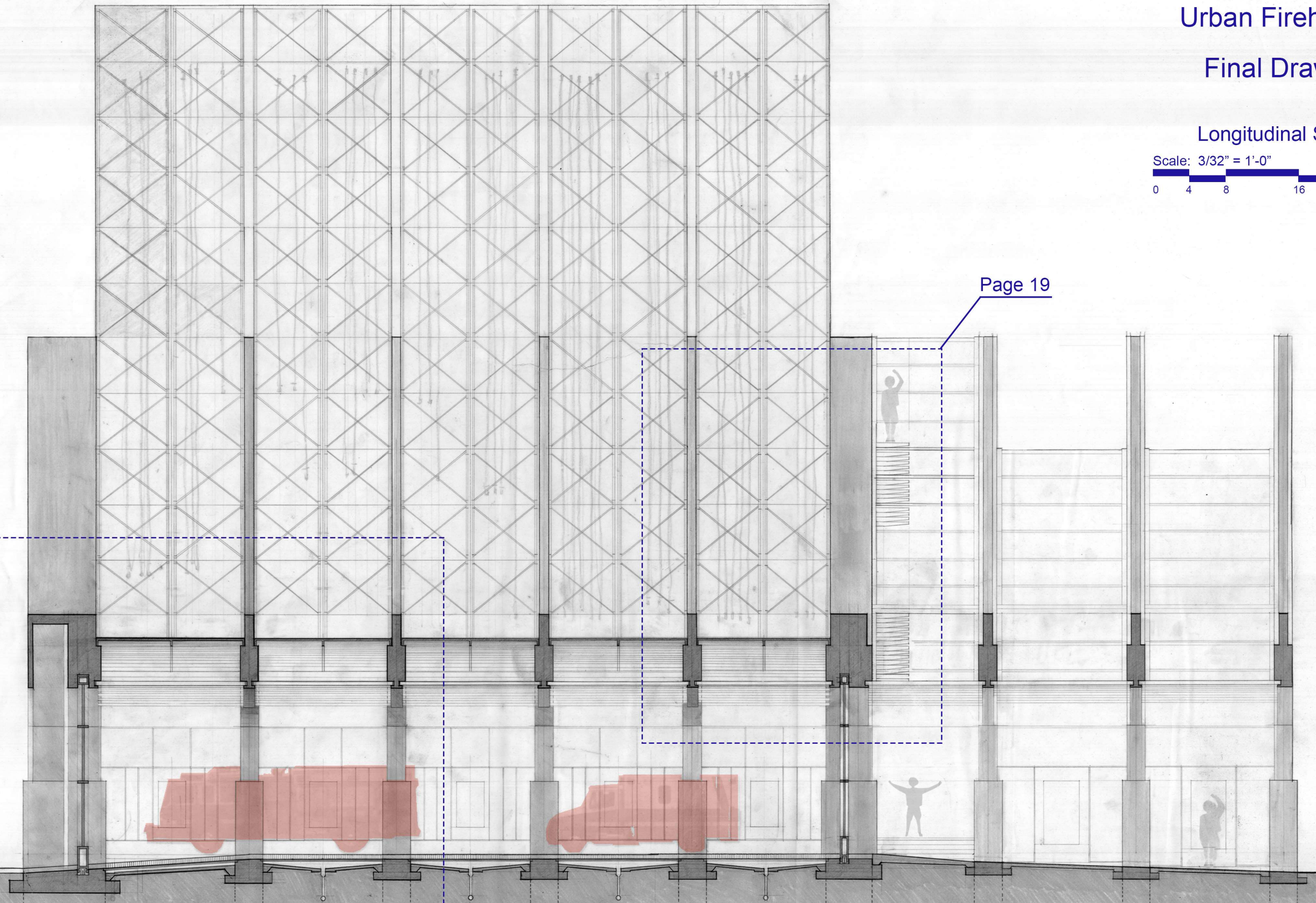
Scale: 3/32" = 1'-0"



Page 18

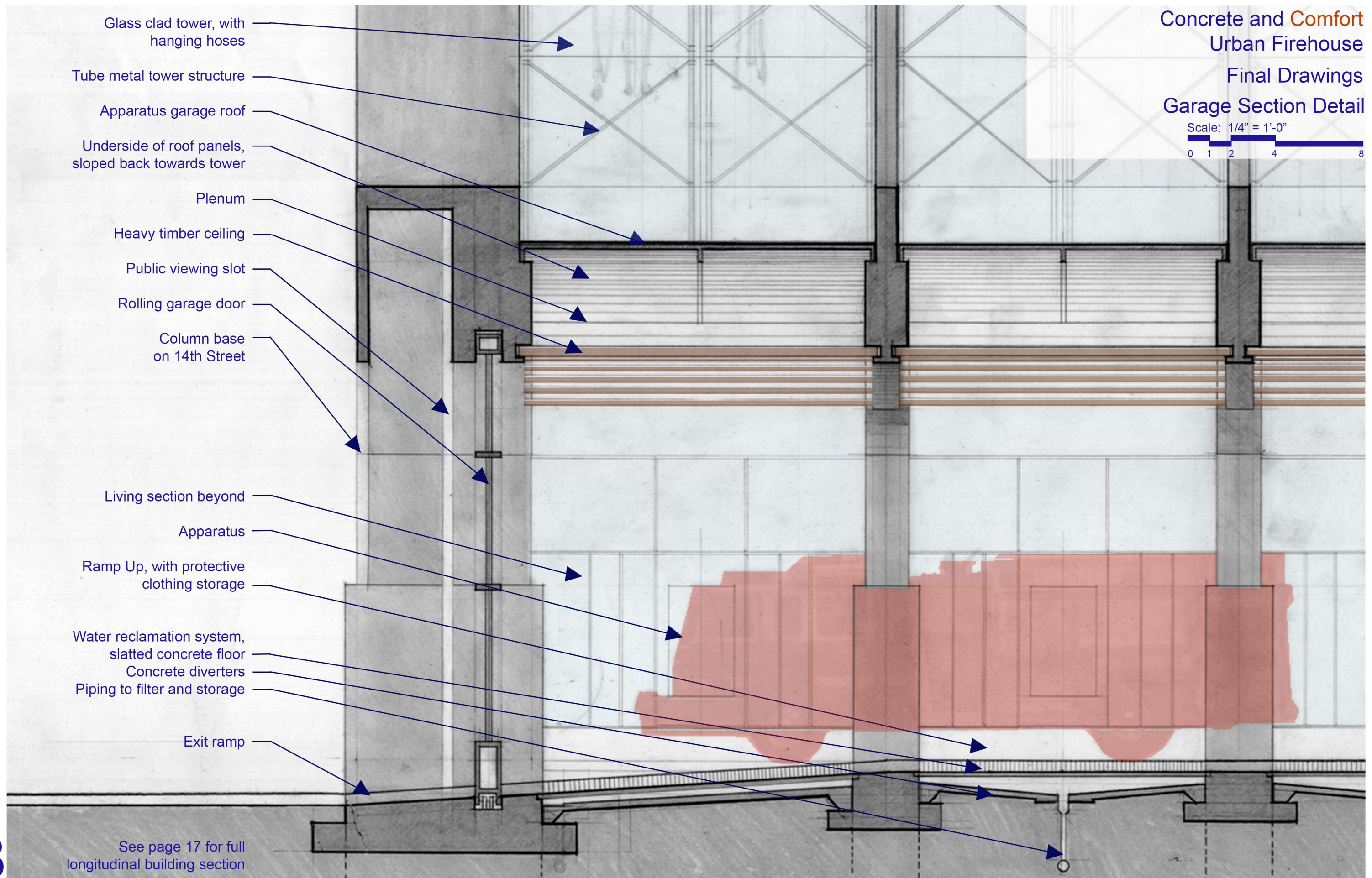
Page 19

14th Street

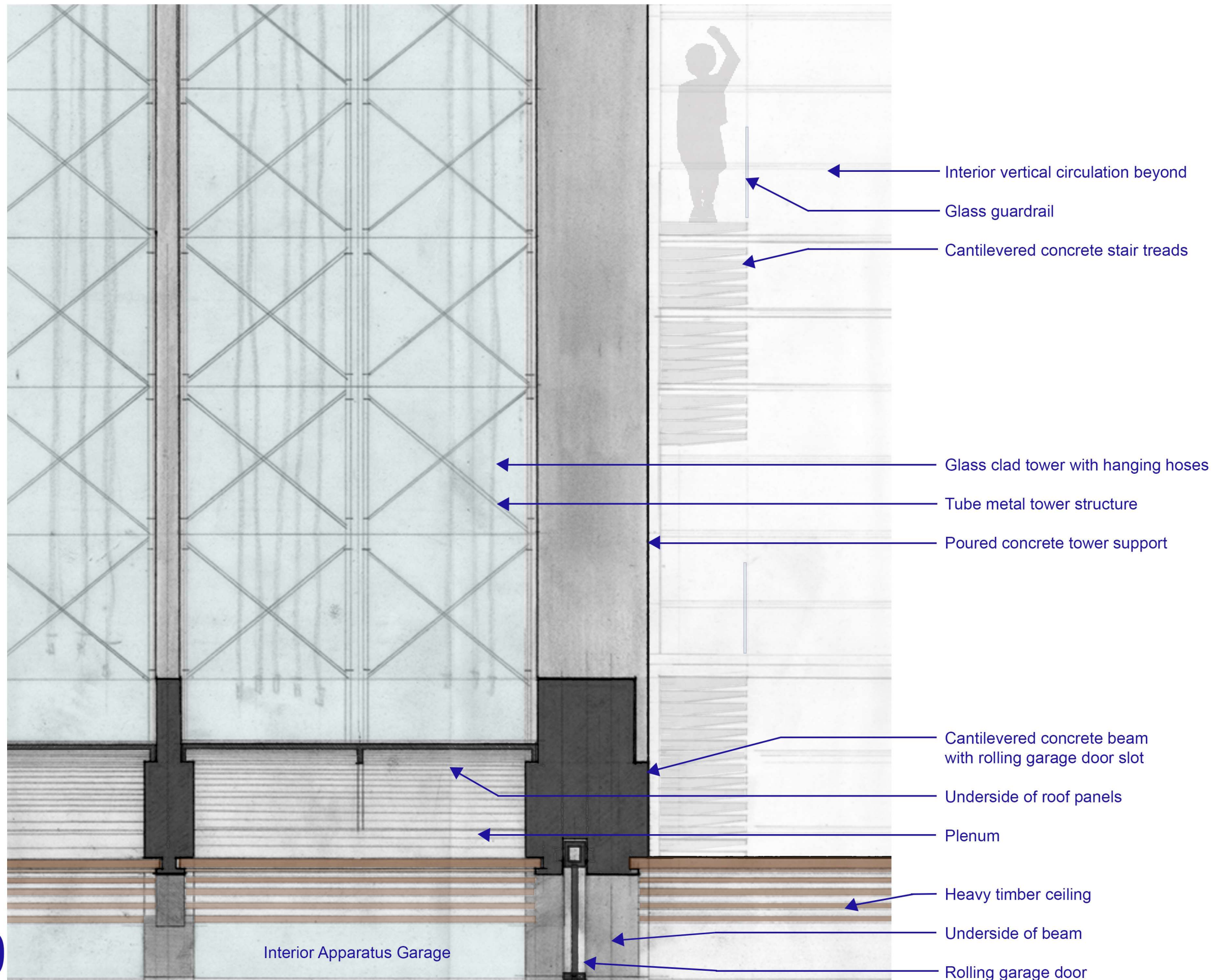


Concrete and Comfort  
Urban Firehouse  
Final Drawings  
Garage Section Detail

Scale: 1/4" = 1'-0"  
0 1 2 4 8



Concrete and **Comfort**  
 Urban Firehouse  
 Final Drawings



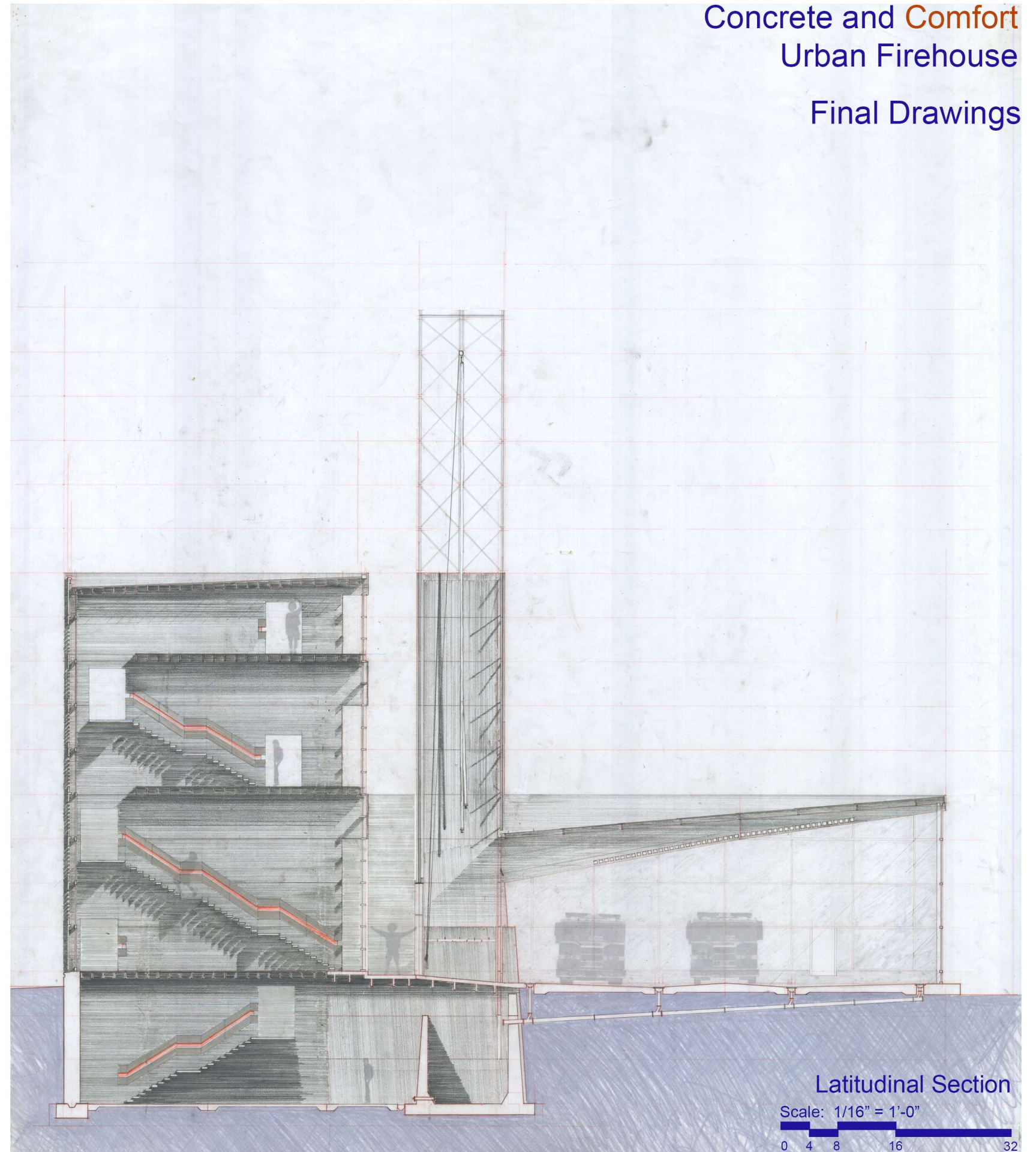
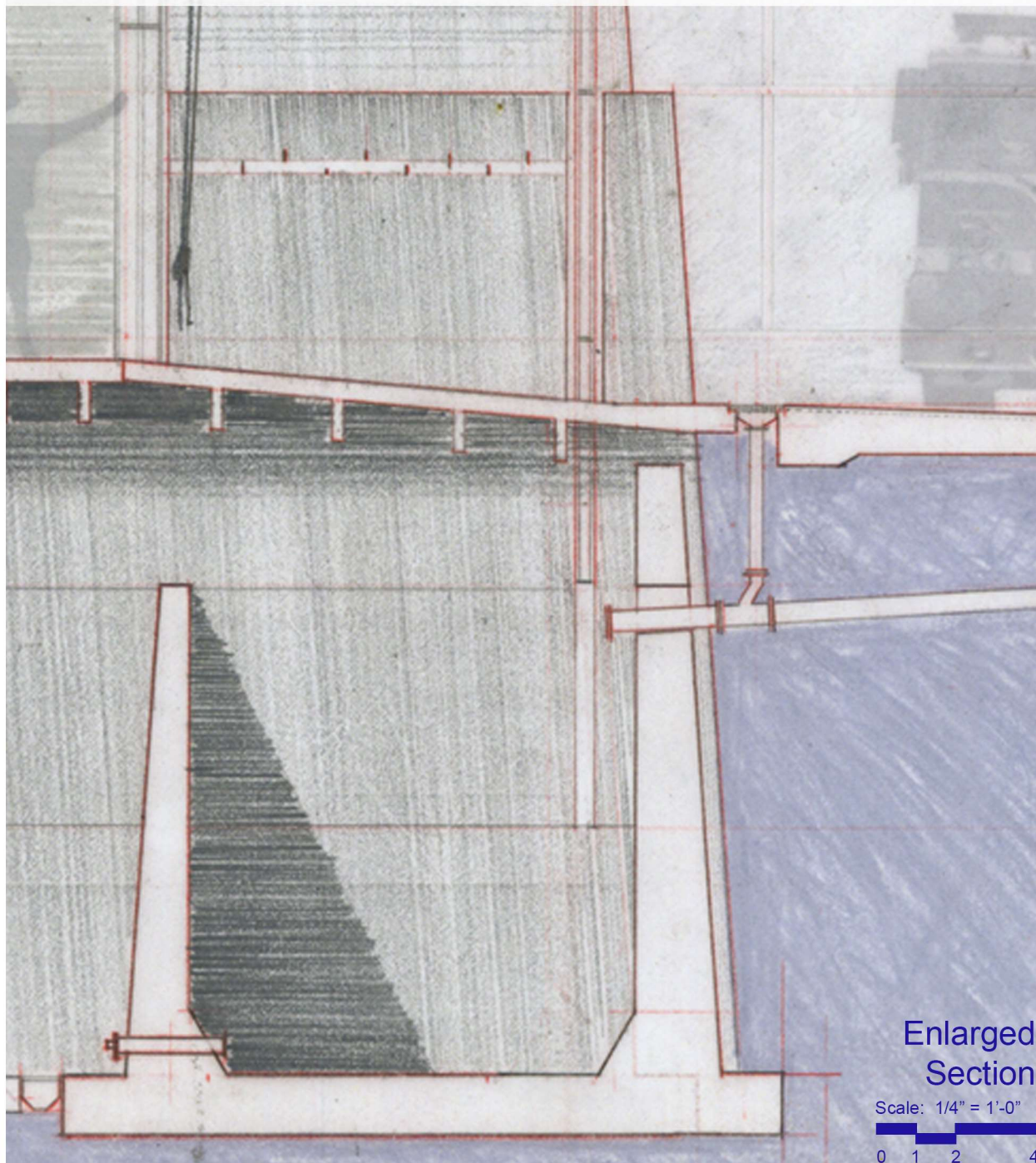
See page 17 for full longitudinal building section

Garage Section Detail

Scale: 1/4" = 1'-0"  
 0 1 2 4 8

Concrete and Comfort  
Urban Firehouse  
Final Drawings

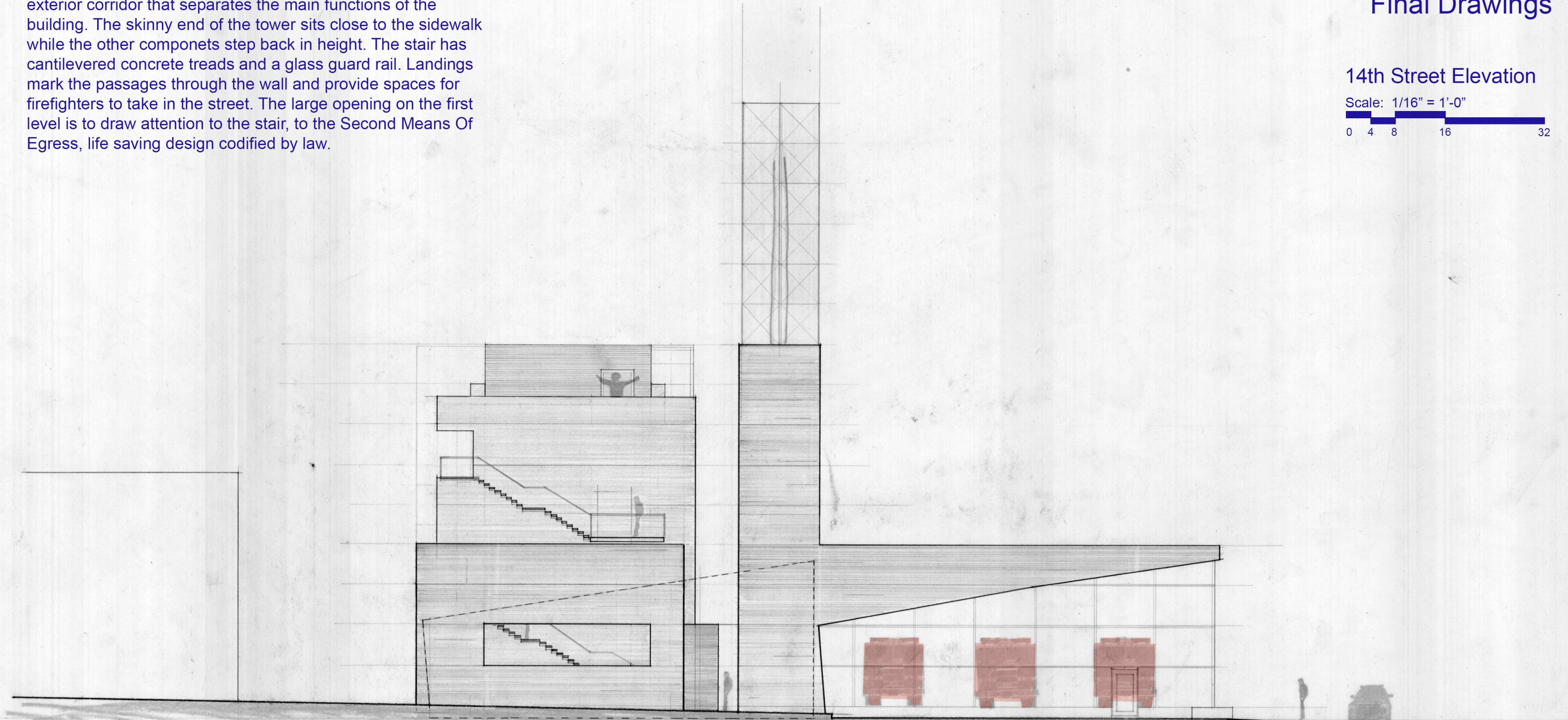
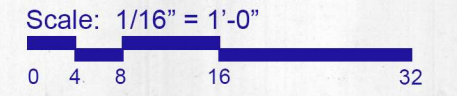
This building section shows the stair wall in elevation. Treads of concrete cantilevered from the poured concrete wall, with a handrail cast into the wall, polished smooth. Lighting from within the handrail cavity changes color to indicate a call to action. The basement shows the water reclamation tank piped from the apparatus garage floor and roof. The first floor space and its lofty 24 foot tall ceiling takes light from the exterior corridor that separates the dispatch, kitchen and recertification area from the apparatus garage. The tower's massive concrete base holds a metal structure supported glass enclosure. Hoses are pulled by rope and pulley up into the 90 foot tower to dry. The second floor of the peopled side of the building is generously proportioned and light filled to accommodate an exercise room. The third floor a space for rest and recovery.



Trucks at the ready, the apparatus garage door will slide across the building, into the ensemble of layered walls that hold the street facing egress stair. The main public entrance is protected by a large sliding concrete door and leads to the exterior corridor that separates the main functions of the building. The skinny end of the tower sits close to the sidewalk while the other components step back in height. The stair has cantilevered concrete treads and a glass guard rail. Landings mark the passages through the wall and provide spaces for firefighters to take in the street. The large opening on the first level is to draw attention to the stair, to the Second Means Of Egress, life saving design codified by law.

# Concrete and Comfort Urban Firehouse Final Drawings

14th Street Elevation



Facing south, providing full sun for the display of apparatus. The tower is set back more than 60 feet from the bay doors of the garage on V Street, in deference to the residential scale of the the block. These doors shelter a public stoop, an opportunity for the firefighters to engage with the community. At the alley entrance for the apparatus garage there is an open space fronting the monumental sliding door. Three 16 foot bays in approach 55 feet in width, shaded by the heavy timber ceiling that spans each bay as they march towards 14th Street.

# Concrete and Comfort Urban Firehouse

## Final Drawings

V Street Elevation

Scale: 1/16" = 1'-0"



The least visible elevation, where the dumpsters meet the alley. A system of precast concrete panels hung on steel beams that span the primary concrete columns. Some solid panels at locations that necessitate durability or privacy, and some panels with open areas. A glass building envelope sits protected behind these panels. The third floor resting space is clad in a wood slat system, set back from the floor below. The second floor has a porch facing 14th Street. A private outdoor space for the firefighters to fraternize, with the front facing egress stair.

# Concrete and Comfort Urban Firehouse

## Final Drawings

North Elevation

Scale: 1/16" = 1'-0"

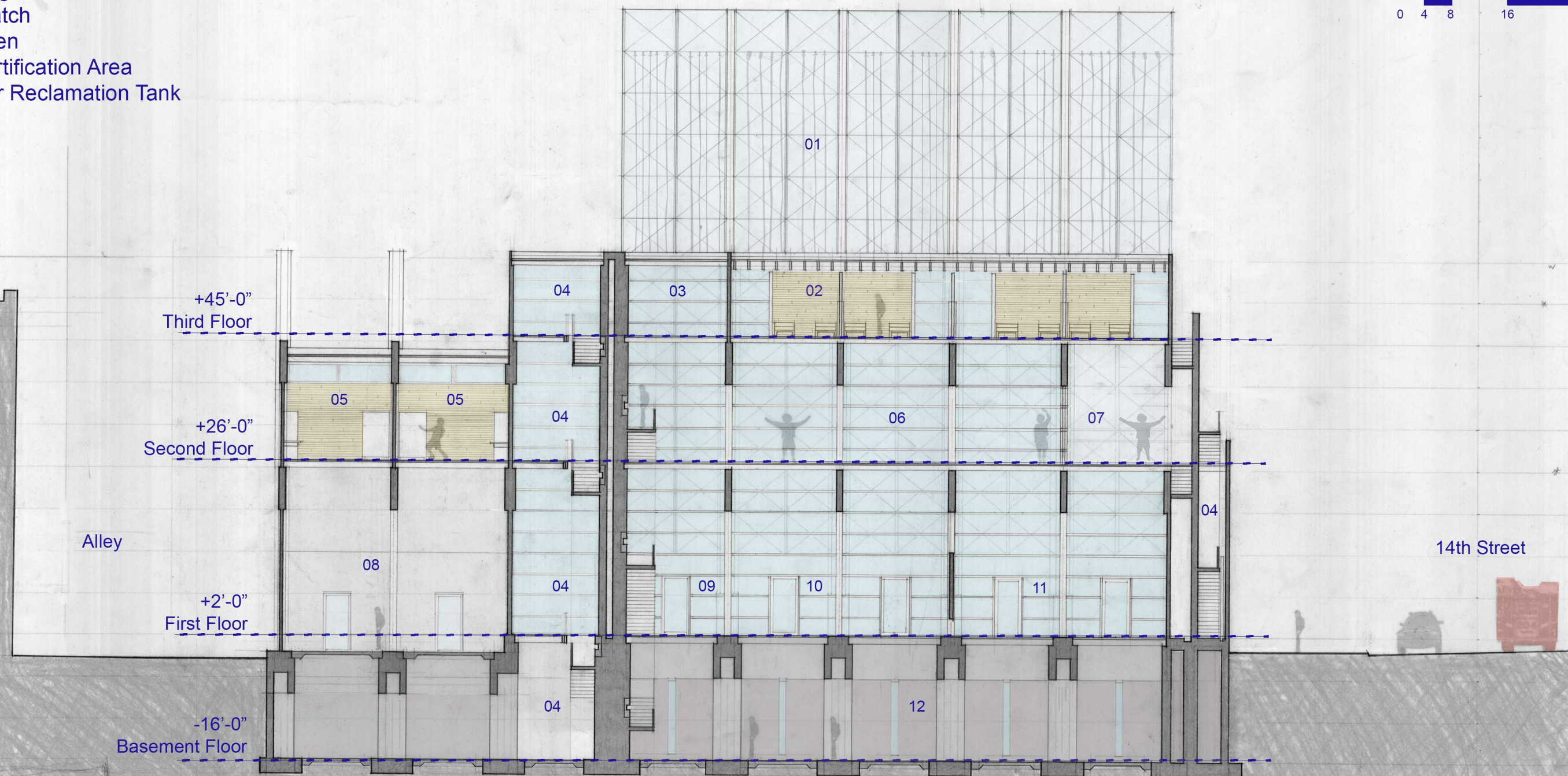


- Key-
- 01. Tower beyond
  - 02. Rest and Recovery
  - 03. Lounge
  - 04. Stair
  - 05. Locker Room
  - 06. Exercise Room
  - 07. Exterior Porch
  - 08. Storage
  - 09. Dispatch
  - 10. Kitchen
  - 11. Recertification Area
  - 12. Water Reclamation Tank

Concrete and Comfort  
 Urban Firehouse  
 Final Drawings

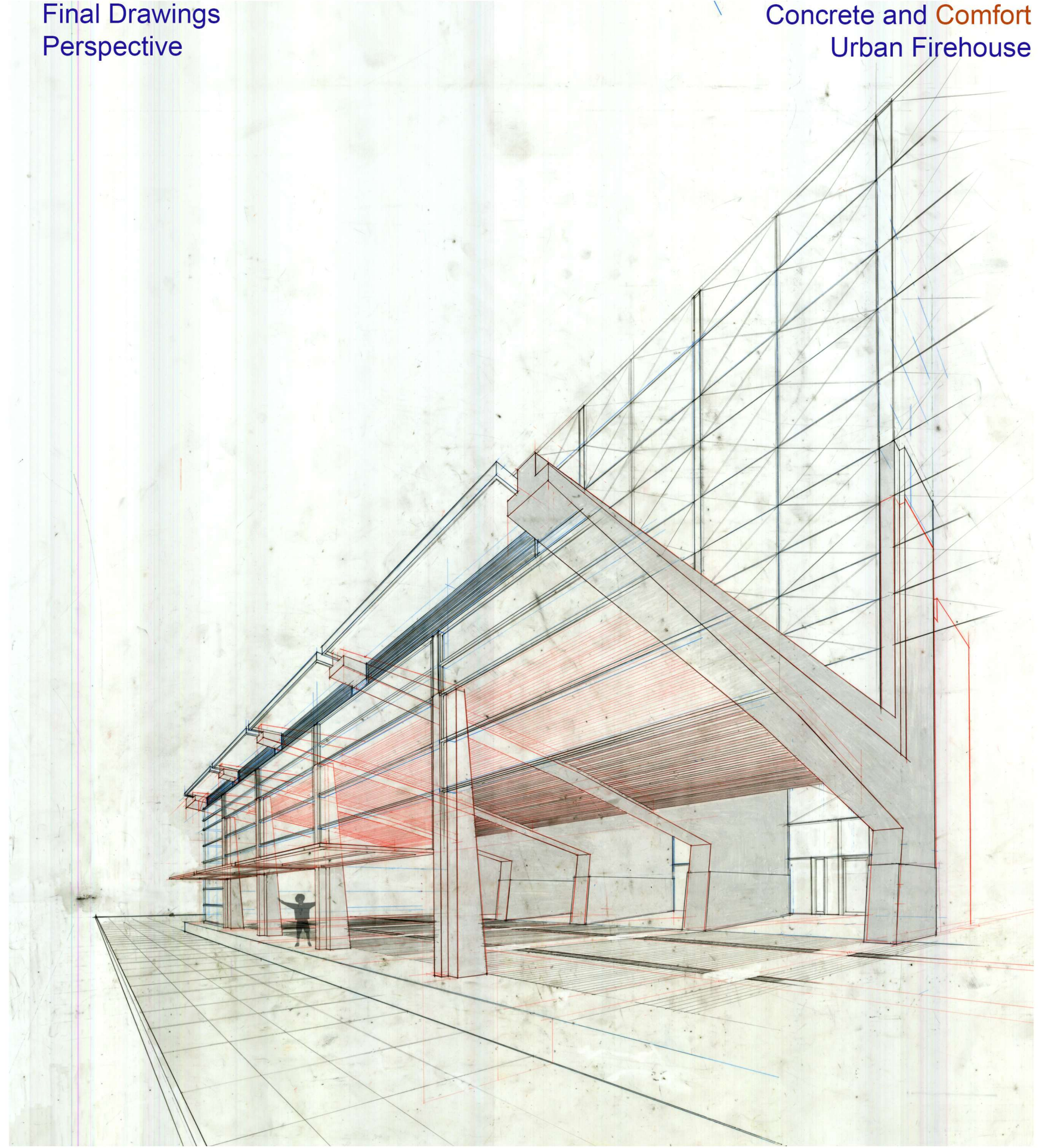
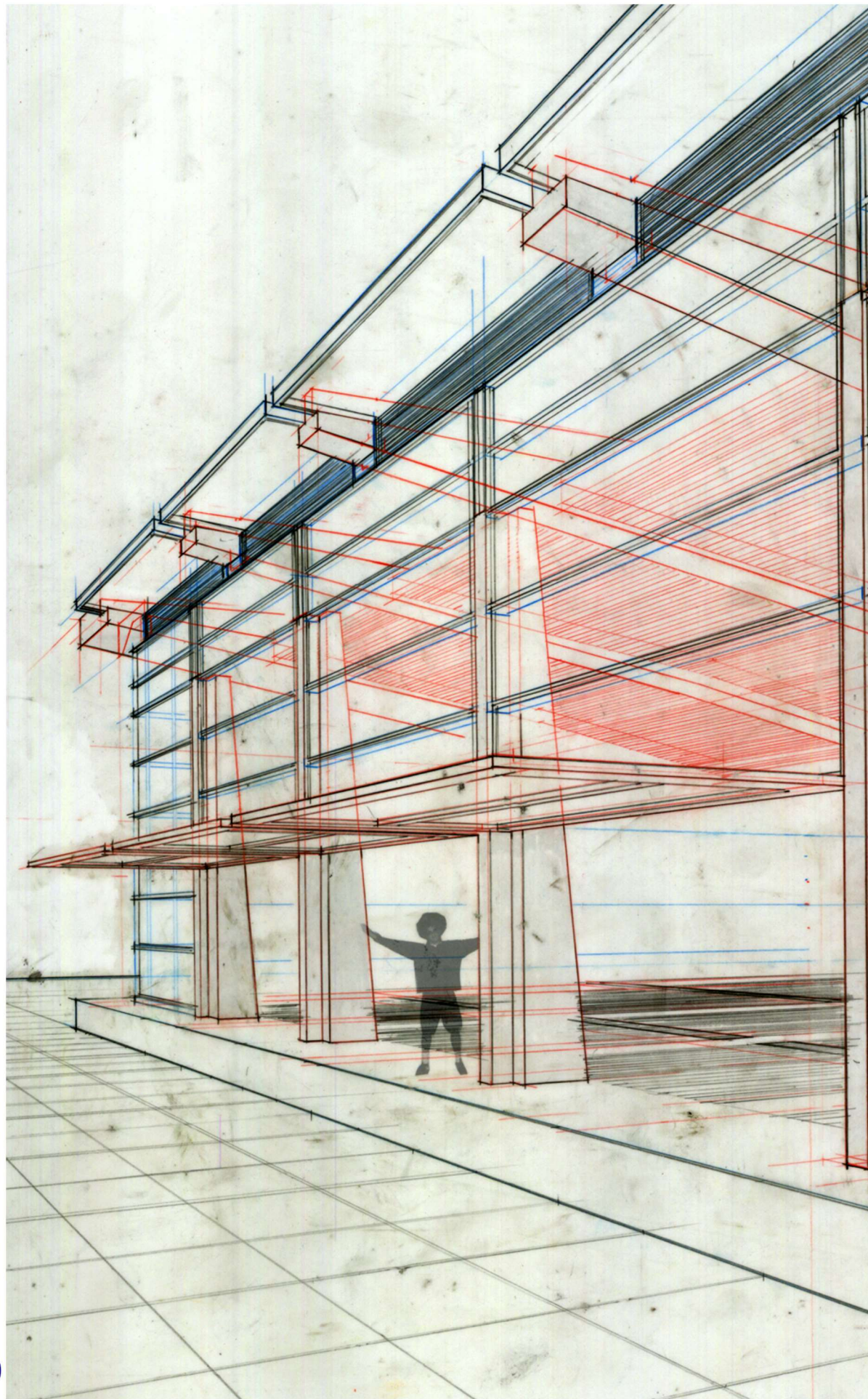
Living Quarters Section

Scale: 1/16" = 1'-0"  
 0 4 8 16 32



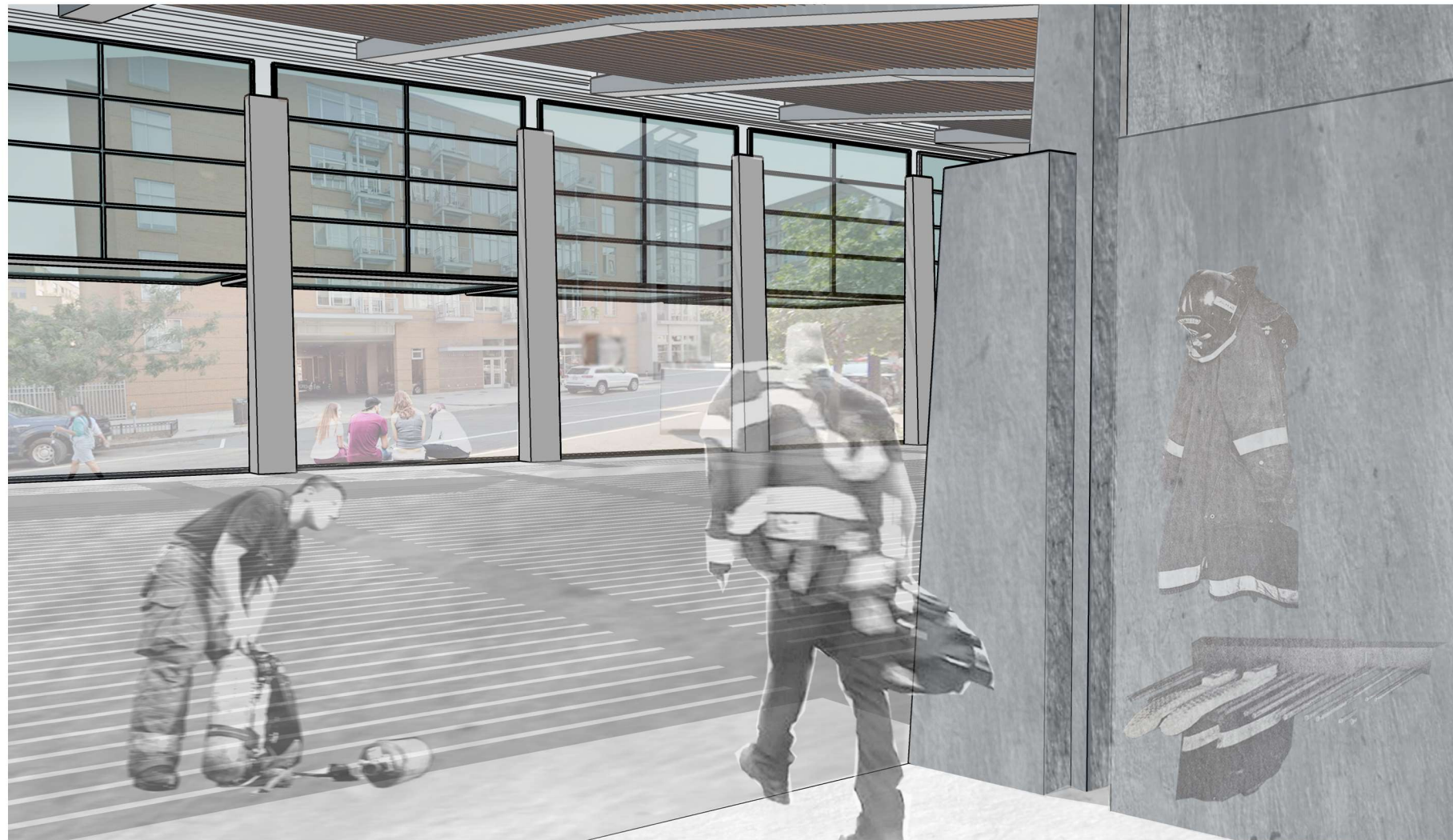
Final Drawings  
Perspective

Concrete and Comfort  
Urban Firehouse

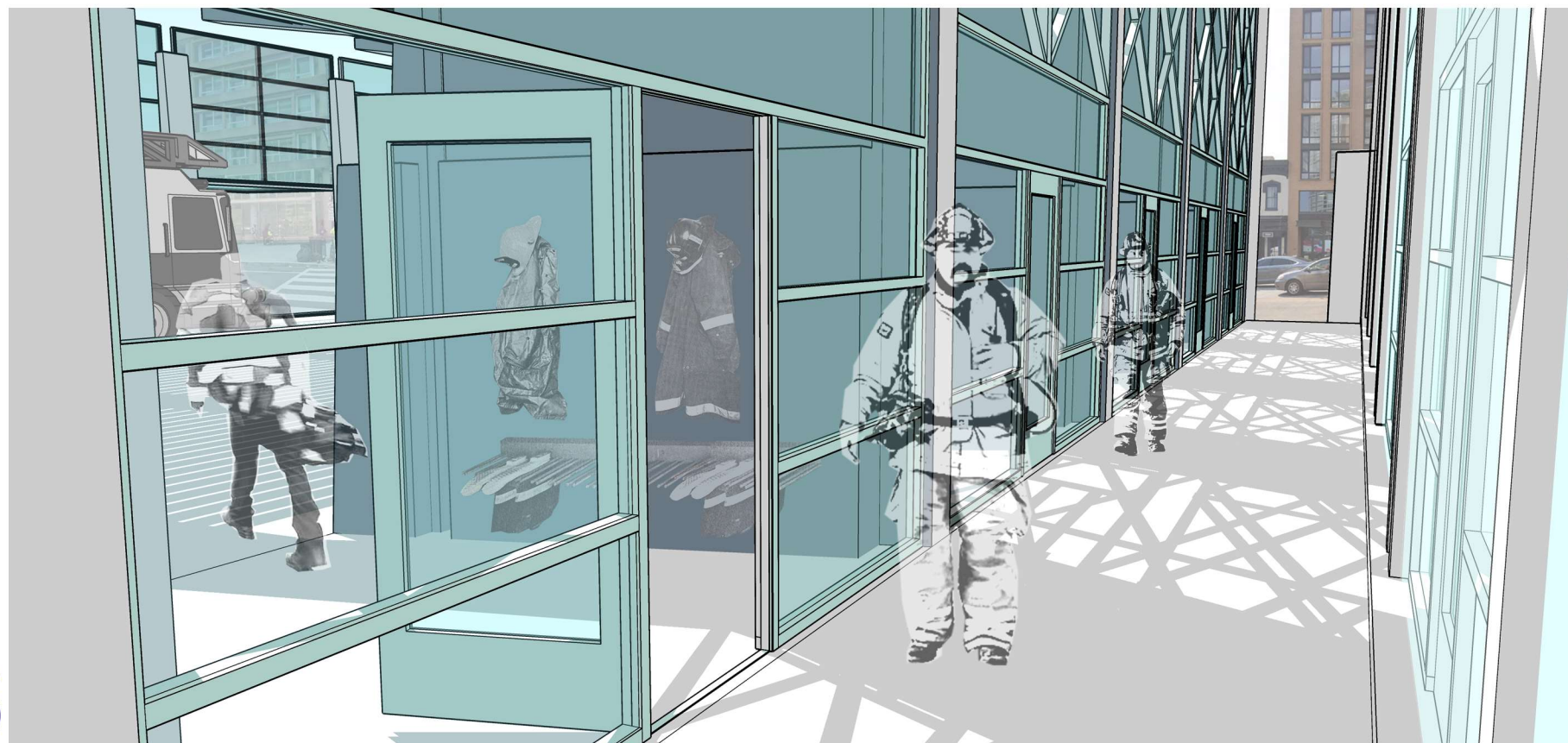


Concrete and Comfort  
Urban Firehouse

Rendered Views



A view from the bottom of the tower where protective clothing is hung, through the Apparatus Garage and the open bay doors over the stoop on V Street.



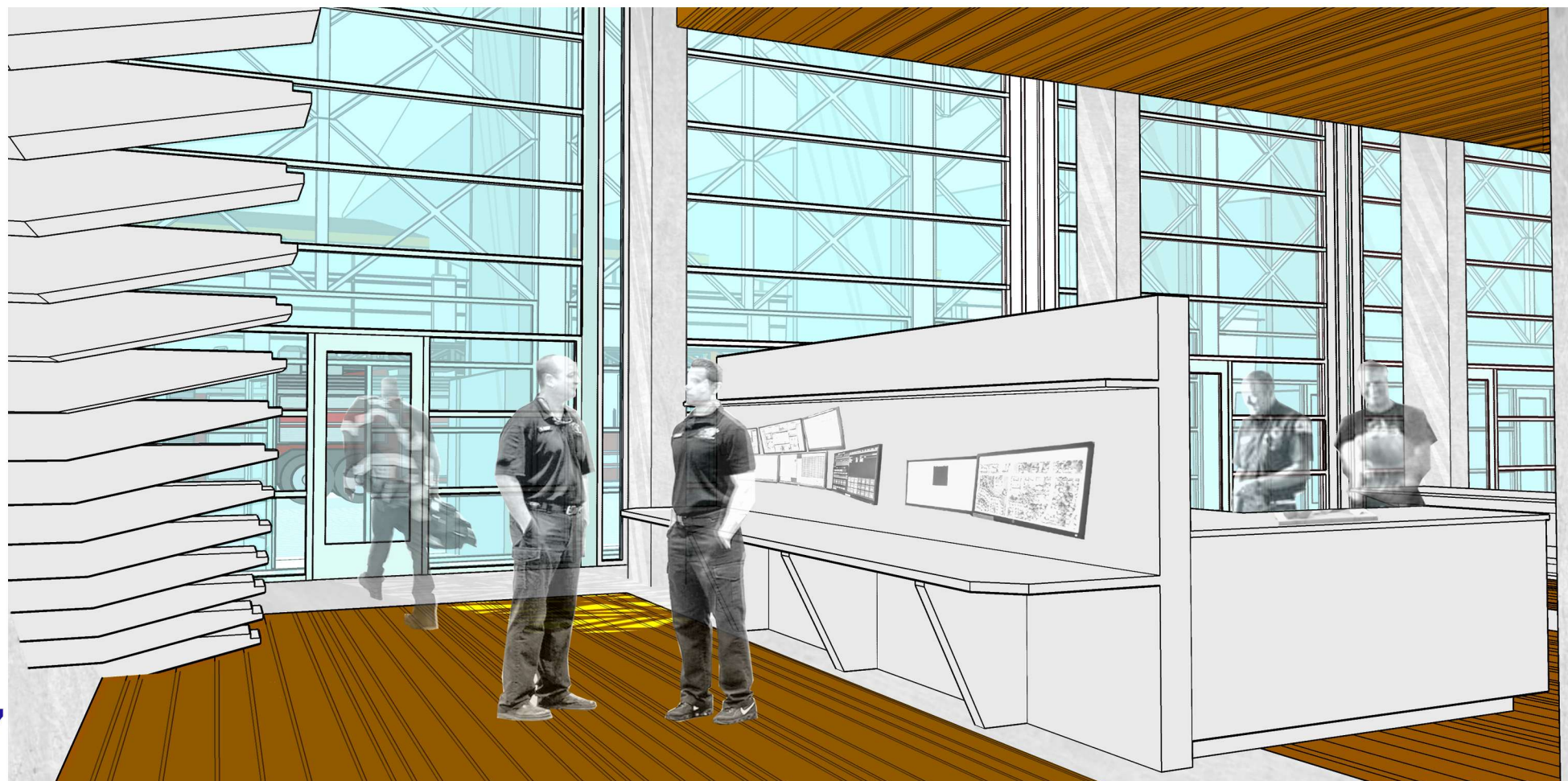
A view down the exterior corridor towards 14th Street. The Apparatus Garage just past the protective clothing area at the base of the tower.

Concrete and Comfort  
Urban Firehouse

Rendered Views



Looking east through the second floor exercise room, with vertical circulation in the background. A forgiving wood floor held by concrete ribs that extend out to hold the glass curtain wall.



Looking south through the Dispatch Area/Kitchen with the Apparatus Garage beyond. The tall light filled multi-use room is the primary gathering space for the firefighters and support staff. The concrete structural frame holds a wood framed floor in this area, with a wood ceiling cloud hung from above. The glass wall is held by the cantilevered concrete beam ends above with steel columns.

Concrete and Comfort  
Urban Firehouse

Rendered Views

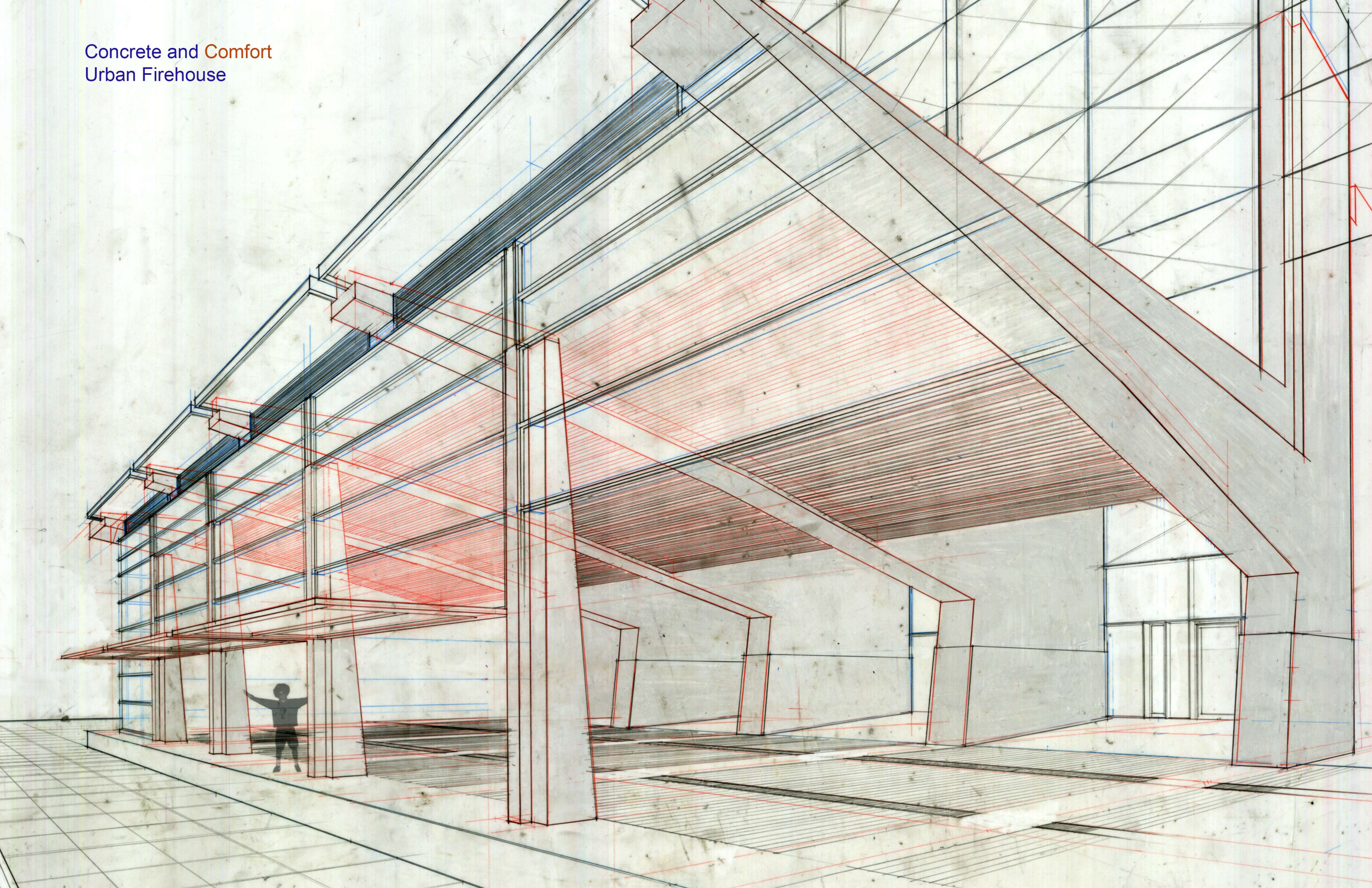


Looking north from the intersection of 14th and U Street at dusk, the tower illuminated marks a place of safety for the community.



Looking west on V Street towards 14th Street the apparatus garage sits at a respectable height on the street, open to welcome the neighborhood. The tower is set back and lit from within, throwing shadows of hoses.

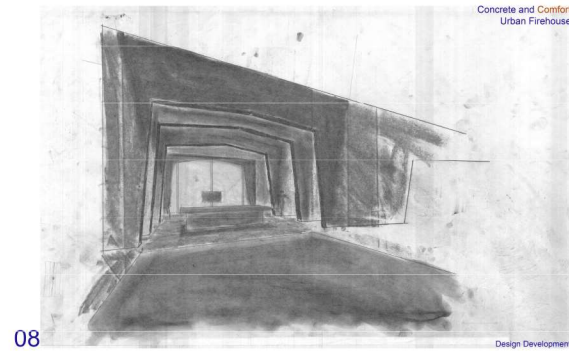
Concrete and Comfort  
Urban Firehouse



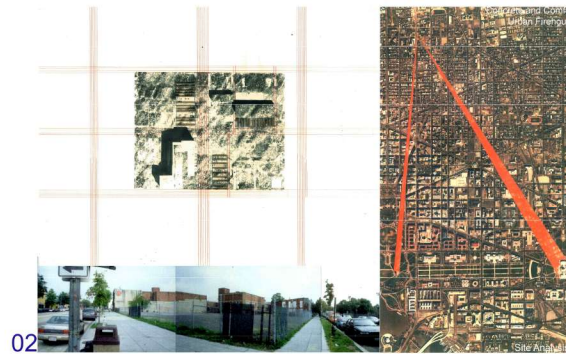
Conclusions for this simple question of concrete's ability to provide comfort were found in the creation of parts and pieces of the building. As a material that can be formed to hold wood and steel, and to take the surface appearance of glass and pattern, opportunities for comfort are boundless. The greatest challenge I faced was completing the project that fell short of my expectations. After successfully defending the thesis I found its incomplete nature hard to document, coupled with the realities of entering professional practice it lost priority. 20 years later, after a ten year hiatus from practicing architecture, I began the work again. I built the project in Sketchup, resolved a few conflicts and created rendered views of the interior that the original effort lacked. Documenting the design process brought the simple answers to light, and to a place I must call complete.

# Concrete and Comfort Urban Firehouse

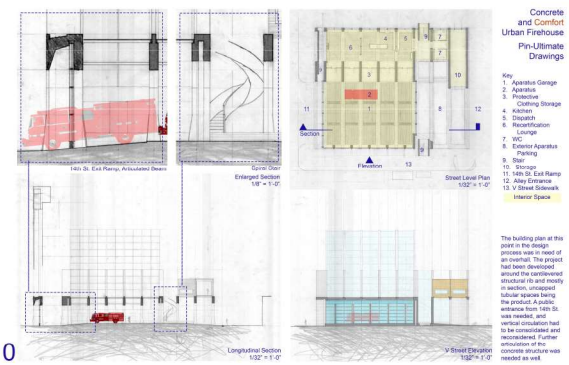
## Index, Bibliography & Image Credits



08  
Page 08  
Perspective sketch- Charcoal on paper



02  
Page 02  
Site diagram- Acetone transferred map photocopy, color pencil, chip board.  
City diagram- Printed map, color pencil.  
Site photos- Disposable camera film hand stiched for panorma.

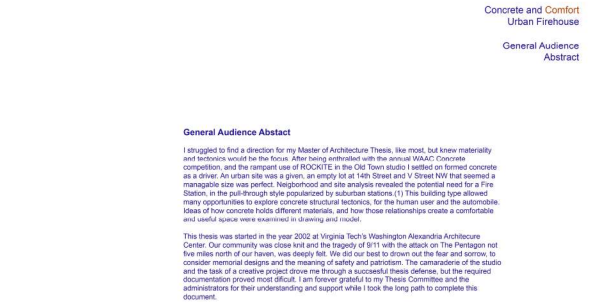


10  
Page 10  
Drawings- Pencil on vellum, color rendered and notated with Photoshop.  
Spiral stair study inspired by Fernández-Galiano, Luis Herzog & de Meuron:1978-2002 Arqitectura Viva, Madrid. 2019

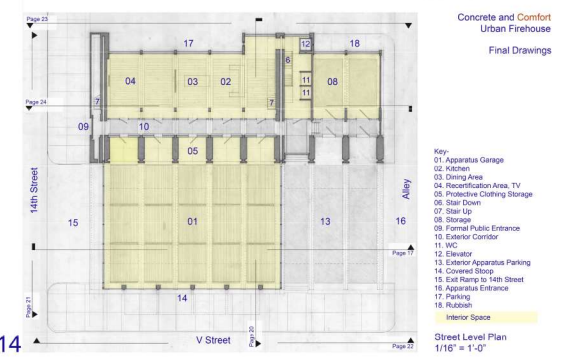


03  
Page 03  
Site plan diagram- Pencil on white trace.  
Turning radius information from- Ramsey and Sleeper Architectural Graphic Standards John Wiley & Sons, New York Sixth Edition, 1970

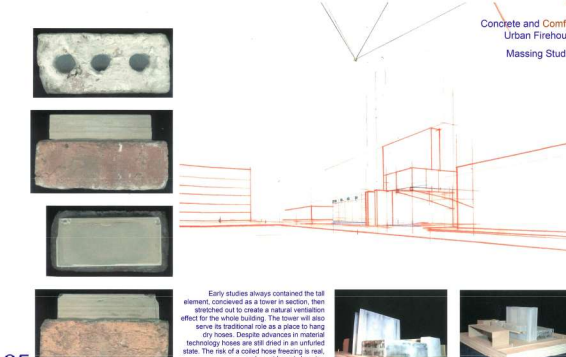
Images are produced by the author unless otherwise noted. Images from other sources have been reproduced for educational use only.



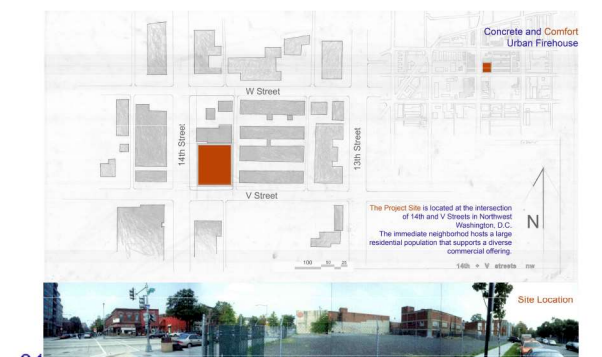
III  
Page III  
General Audience Abstract  
Primary reference- Zurier, Rebecca The American Firehouse Abberville Press, New York. 1982



14  
Page 14  
Final Plan Drawings- Pencil on mylar, with pencil rendering on reverse by Greg Harrell. Color rendered and notated with PS during documentation.



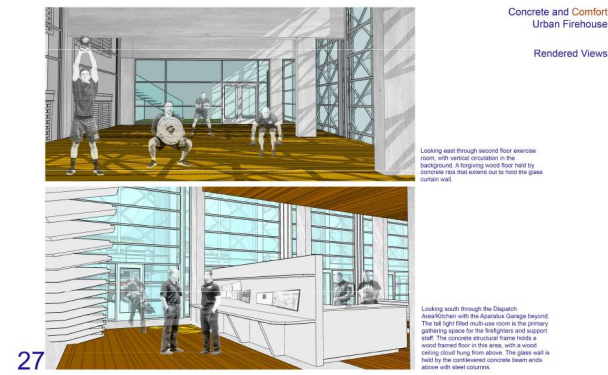
05  
Page 05  
Single point perspective, color pencil.  
Study models-Brick, ROCKITE, chip board, acetone etched plexiglass



01  
Page 01  
Site plan- Pencil on white tracing paper.  
Site photos- Disposable camera film developed August 2002,hand stiched for panorma.

# Concrete and Comfort Urban Firehouse

## Index, Bibliography & Image Credits



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### Page 27

Post Defense Model- SketchUp, PS image editing.

*Two Fire Fighters talking*, [Photograph] McConnell, Thomas. 2016. The Dallas Morning News.

<https://interactives.dallasnews.com/2016/fire-stations/>

*Fire Fighter walking away*, [Photograph] <https://www.bassettiaarch.com/portfoliodetails/firestation5>

*Fire Fighters cooking*, [Photograph] <https://shorelinefire.com/wp-content/uploads/2017/02/Northshore-Fire-Department-kitchen.jpg>

*Fire Fighters exercising*, [Photograph] Pickens, Cody. 2020. Men's Health Magazine <https://www.menshealth.com/fitness/a31040800/firefighter-fitness/>



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### Page 26

Post Defense Model- SketchUp, PS image editing.

*Fire Fighter walking away*, [Photograph] <https://www.bassettiaarch.com/portfoliodetails/firestation5>

*Fire Fighter with air tank*, [Photograph] <https://www.local341.org/>

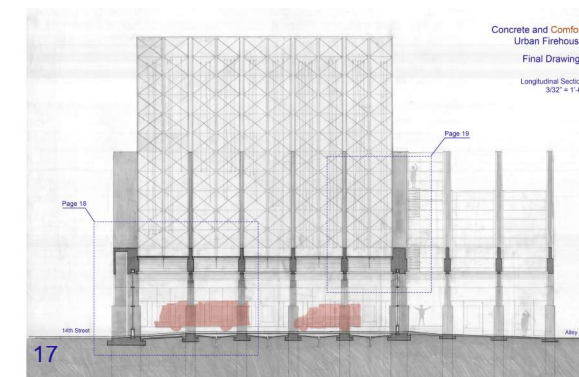
*Fire Fighters walking*, [Photograph] <https://www.istockphoto.com/photos/fire-fighter>

*Fire Fighters equipment*, [Photograph] <https://www.istockphoto.com/photos/fire-fighter>

*Fire Fighters equipment*, [Photograph] Zurier, Rebecca

*The American Firehouse*  
Abberville Press, New York. 1982

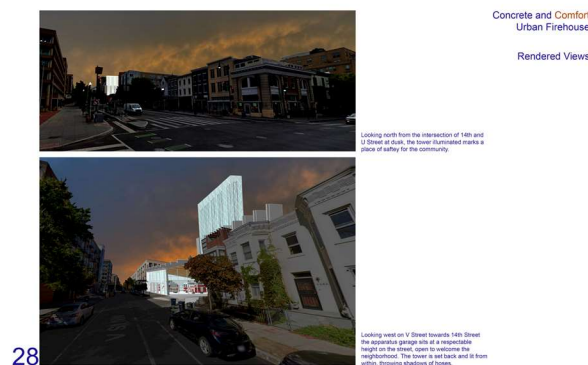
*Street View 14th and V Street NW*, [Photograph] Google Maps Street View, 2022. [google.com/maps](https://www.google.com/maps)



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### Page 17

Final Drawings- Pencil on mylar, with pencil rendering on reverse by Jon Zellweger. Color rendered and notated with PS during documentation.



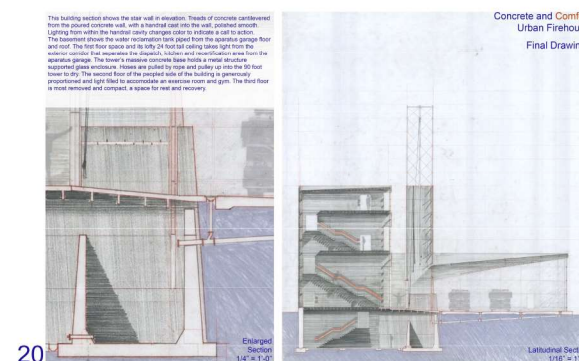
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Post Defense Model- SketchUp, PS image editing.

*Street View 14th and V Street NW*, [Photograph] Google Maps Street View, 2022. [google.com/maps](https://www.google.com/maps)

*Dusk Skies*, [Photograph] Michaelann Cooke



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### Page 20

Final Building Section- 36" by 48", pencil on mylar, with color pencil rendering on reverse. Hanging hose hand rendered in pencil by Jon Zellweger.