COLUMBIA UNIVERSITY
Graduate School of Architecture, Planning and Preservation

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Spring 2014 David Wallance

DESIGN PROBLEM: Industrial Loft Building

INTRODUCTION

This course is entitled Architectural Technology 5 (AT-5). It might be subtitled Intentions and Technology. AT-5 is a tech class in which your design skills are an essential tool that you will use to synthesize the various technical systems of a contemporary building type into a coherent expression of an architectural intention. Technical rigor is the pre-condition for design. If it doesn't work, you will have to redesign it until it does.

Technical rigor does not mean that your design concept should necessarily express a technological image (although you may choose this as an intention), nor does it mean that technology is an end in itself. Your choice of intention, and your ability to articulate it, will determine your choice of technology.

In order to focus your attention on the problem of expressing an architectural intention through the choice and development of building technology, we have created a design problem in which many of the design issues with which you have been preoccupied in your other studio work are eliminated. The site is abstracted and minimal in context. The only important contextual attributes are latitudinal and longitudinal coordinates, and compass (solar) orientation. Building volume and floor to floor heights are pre-established. The time is the present. Building technology is continually evolving, and many (but not all) materials and methods that were once ubiquitous are now anachronistic. By the same token, future possibilities in technology have not yet arrived, and your design cannot presume that a technology will be invented in order to provide support for your intention. This is not to say that the revival of lost craft skills or technical innovation are not valid aspirations, but only that these are not a part of the pedagogical method of this course. Innovation within existing technical means, however, is not discouraged.

Similarly, the industrial loft building program has been selected with the aim of limiting interior spatial development to that which you achieve by the articulation of the building envelope and structural system, and to a lesser (but still important) extent, environmental systems.

PROGRAM

A speculative loft building for the industrial arts. Conceptually modeled after the "Hotel Industriel" building type, the building is intended to provide open commercial loft space for artisan workshops and light manufacturing concerns. Floors are to be sub-dividable for multiple tenants.

SITE

A 450ft x 450ft flat open field in the Bronx, NY, bounded by primary roads on all four sides. Soil is 6 ksf, well drained. The water table is 8ft below grade. See the attached Site Plan.

MASSING

The building is seven stories high, with 70ft x 280ft rectangular floor plates.
Floor elevation datum is as follows, given relative to the Ground Floor as +0ft:

Roof	+116ft
7th Floor	+88ft
6th Floor	+74ft
5th Floor	+60ft
4th Floor	+46ft
3rd Floor	+32ft
2nd Floor	+18ft
Ground Floor	+0ft

See the attached Section Diagrams.

CORE

The building will have two identical cores, as shown on the attached Typical Core Plan. The core will function in a variety of orientations.

Each core will have one heavy-duty traction elevator intended for passenger and freight use. The elevators will have a lifting capacity of 20,000 pounds. A minimum of 26ft is required from the top of the 7th floor slab to the underside of the machine room ceiling. Because the 7th Floor to Roof height is 28ft, you should be able to accommodate the machine room without building a penthouse. The elevator pit depth is 6ft.

Each fire stair must be a minimum of 44 inches wide (see Code Requirements below). Fire stairs may be used for inter-floor access. One stair must access the roof.

There will be two mechanical equipment rooms on each floor. Fresh air must be brought to, and exhaust air taken from, each mechanical room. You may provide ducts to doghouses on the roof, or to louvers in the exterior wall at each floor, for supply and exhaust. Adequate separation must be provided between fresh and exhaust air.

The location of the cores is up to you (provided that exits to fire stairs meet code). You may re-arrange the core but you must retain all of the functional elements. It is critical that you establish your core layout very early on, or you will not have enough time to fully develop your design.

STRUCTURE

The structural system will be a skeleton frame of reinforced concrete or steel. Shear walls, braced frames, moment frames or a combination thereof can provide wind resistance. Loads are as follows:

Typical Floor Live Load:	125 psf
Roof Snow Load:	30 psf
Wind Load:	30 psf (inwards and outwards)

BUILDING ENVELOPE

The building envelope may be a curtain wall, cladding, or a frame and infill system. Materials may include, but are not limited to: aluminum, steel, pre-cast concrete, terra-cotta, stainless steel, and glass. Glazing assemblies must be non-ferrous.

The façade, as the mediator between the external and interior environments, should be designed with consideration given to the issue of energy conservation. Active and passive solar control devices, specialty glass products, integrated technologies such as photo-voltaics, etc. may be used to meet the requirements of an energy efficient envelope. The façade may allow for natural ventilation. Concepts in which the façade operates interactively with environmental systems and structural mass may also be investigated.

ENVIRONMENTAL CONTROL SYSTEMS

The building receives steam which will be converted to hot water by means of heat exchangers that will be located on the First Floor of your building (these will require an additional 1000 SF room not shown on your core plans to house the heat exchangers and pumps that will be required), and chilled water via a loop that supplies from and returns to a mechanical plant on an adjacent site. These fluid media are the basis for the development of your environmental control system. They will be may be used to temper the air that is distributed through the building via fans and ductwork, or they may possibly be used as part of a radiant heating / cooling system.

An important aspect of the design problem is the relationship (integration or separation) of the mechanical design and distribution system with the building structure as well as with the exterior envelope.

Environmental control systems will be covered in greater depth later on in the semester.

CODE REQUIREMENTS (Refer to 2008 New York City Construction Codes)

Use and Occupancy: Factory Group F-2 Low Hazard

Construction Classification: Type IB

Maximum Floor Area Allowance per Occupant: 100GSF per occupant (per table 1004.1.2)

Floor Area: 70 X 280 feet = 19,600 GSF

Maximum Occupancy per Floor: 19,600 / 100 = 196 p.

Egress Width (Stairs) per Occupant: .3 inches (per table 1005.1)

Number of Exits Required per Floor: 2 (per table 1018.1)

Egress Capacity (Stairs): 196 X .3 inches = 58.8 inches. Since the minimum stair width is 44 inches X 2 = 88 inches, and the required capacity by calculation is less, minimum stair width of 44 inches governs. However, if there are any outswinging doors, the ADA (Americans with Disabilities Act) requirements for door approaches would override, and dictate a 60 inch corridor.

Maximum Travel Distance Between Exits (per table 1015.1): 250 feet sprinklered; 200feet unsprinklered

Maximum Dead End Corridor: 50 feet sprinklered; 20 feet unsprinklered (per subparagraph 1016.3.2)

Separation of Exits (unsprinklered) (per subparagraph 1014.2.1): not less than one-half of the length of the building or area served, measured in a straight line between exit doors.

Separation of Exits (sprinklered) (per subparagraph 1014.2.1.2): not less than one-third of the length of the building or area served, measured in a straight line between exit doors.

Minimum Corridor Width: 196 X .2 inches = 39.2 inches (per table 1005.1); 44 inch minimum governs (per paragraph 1016.2).

Exit Door Width: 32 inches clear width (per paragraph 1008.1.1.1). Use 36 inch door width to allow for thickness of door, hinge throw, and width of stop. Note: doors in the fully open position shall not reduce the required landing width by more than 7 inches, and in any position not less than 75% of the required dimension, per paragraph 1008.1.5.

All structural members shall maintain a fire rating of 2 hours (as per table 601). Roof framing members more than 20 feet above the floor below need not be fire-rated (as per Table 601, footnote c.1)

Partitions enclosing all vertical shafts, exit stairways, elevator shafts and elevator machine rooms shall maintain a fire rating of 2 hours (per subparagraph 707.4).

Exit access corridors (corridors within the building allowing access to fire stairs) shall be enclosed with partitions having a fire rating of 1 hour (per subparagraph 708.3).

One fire stair may discharge into a lobby at the Ground Floor Level (in accordance with subparagraph 1023.1); the other fire stair must discharge directly to the exterior or into a 2 hour rated horizontal egress passageway leading directly to the exterior.

Exterior walls do not have to be fire rated, except where necessary to maintain fire separation between floors. Where exterior walls serve as part of a shaft enclosure, the exterior wall portion need not be fire rated (per subparagraph 707.6) (per table 602).

Exterior walls must maintain a fire rating of 1 hour at spandrel locations in order to prevent fire spread from floor to floor. There are two ways to satisfy this requirement.

- 36 inch high spandrel at the floor line with a 1 hour fire rating to prevent inter-story fire spread (per subparagraph 704.9).
- 30 inch horizontal 1 hour fire rated projection from the floor slab beyond the face of the curtain wall (per subparagraph 704.9).

The 1 hour spandrel requirement is waived provided that there is an automatic sprinkler system throughout the building (per subparagraph 704.9.2).

The intersection between floors and exterior curtain walls must be fire-stopped (per subparagraph 713.4).

All glass located within 18 inches of the floor (in section) shall be safety glazing to withstand human impact loads. Safety glazing may be laminated glass, tempered glass, or wire glass. In lieu of the above, a 1½ in wide (in cross section) horizontal member located between 24in and 36in above the floor may be used to protect the glass.

All glass in railings, doors, and within 12 inches of a door shall be safety glazing.

All skylight and sloped glazing (more than 15 degrees from the vertical) shall be insulating assemblies with an inner lite (glass towards the interior) that satisfies requirements for safety glazing. All safety glazing products other than laminated glass must incorporate a screen below the glass to protect the occupants from falling glass.

The building shall comply with the Energy Conservation Construction Code of New York State (ECCCNYS 2010) for commercial buildings:

http://publicecodes.cyberregs.com/st/ny/st/b1200v10/index.htm

PRESENTATION REQUIREMENTS

Presentation drawing techniques are to be analytical, precise, and truthful. Whatever techniques you choose, we strongly suggest that you commit to them early and work on developing their full graphic potential. As part of the week-by-week development of your project, simultaneously generate free-hand or hand drafted design and detail studies on trace. The use of 3D computer modeling is encouraged as a method of generating fast studies of massing, solid/void relationships, solar shading, etc.

Line drawings, with tone and pattern, should be sufficient to explain your intention. Use line weight and line style to achieve depth and hierarchy. Photorealistic renderings may come only after your project has been fully delineated. Renderings are not a presentation requirement and will not affect your grade.

The following are minimum drawing requirements. You may want to propose additional drawings to include in your presentation, which you should discuss with your critics.

Mid-term review drawing requirements:

	Sheet Title:	Scale:
1.	Typical Floor Plan	1/8” = 1’-0”
2.	Building Elevations	1/8” = 1’-0”
3.	Typical Building Sections	1/8” = 1’-0”
4.	Typical Bay Elevation, Section and Plan	1/2” = 1’-0”

The mid-term review should also include sketch studies of key structural and curtain wall details at 3”=1’-0”.

Final drawing requirements (minimum):

	Sheet Title:	Scale:
1.	Typical Floor Plan Showing Structural Framing	1/8” = 1’-0”
2.	Building Elevations	1/8” = 1’-0”
3.	Typical Building Sections	1/8” = 1’-0”
4.	Typical Bay Elevations, Sections and Plan Sections	1/2” = 1’-0”
5.	Isometric, Axonometric, or Perspective Cutaway at Exterior Cladding / Structure	1” = 1’-0”
6.	Typical Structural Detail Axonometrics (2 required)	3” = 1’-0”
6.	Curtain Wall / Cladding Axonometrics at component joinery (2 required)	3” = 1’-0”
7.	Reflected Ceiling Plan Showing Mechanical Distribution	1/8” = 1’-0”

TECHNICAL REPORT

A technical report is to be turned in at the end of the semester, on the day of your Final Review.

The technical report should begin with a statement of the architectural intention of your building, followed by a description of each of the technical systems that you developed – structure, cladding and environmental control.

The technical report should include a discussion of the relationship between the technical development of your project and your architectural intention – why you selected the materials and systems that you did; how you manipulated the technical systems to achieve your intention; how were the various technical components and systems integrated; how your intention influenced your approach to detailing, etc.

You may include reduced size copies of your drawings bound into the report.

At the end of the report attach an appendix that will include your structural and HVAC calculations.

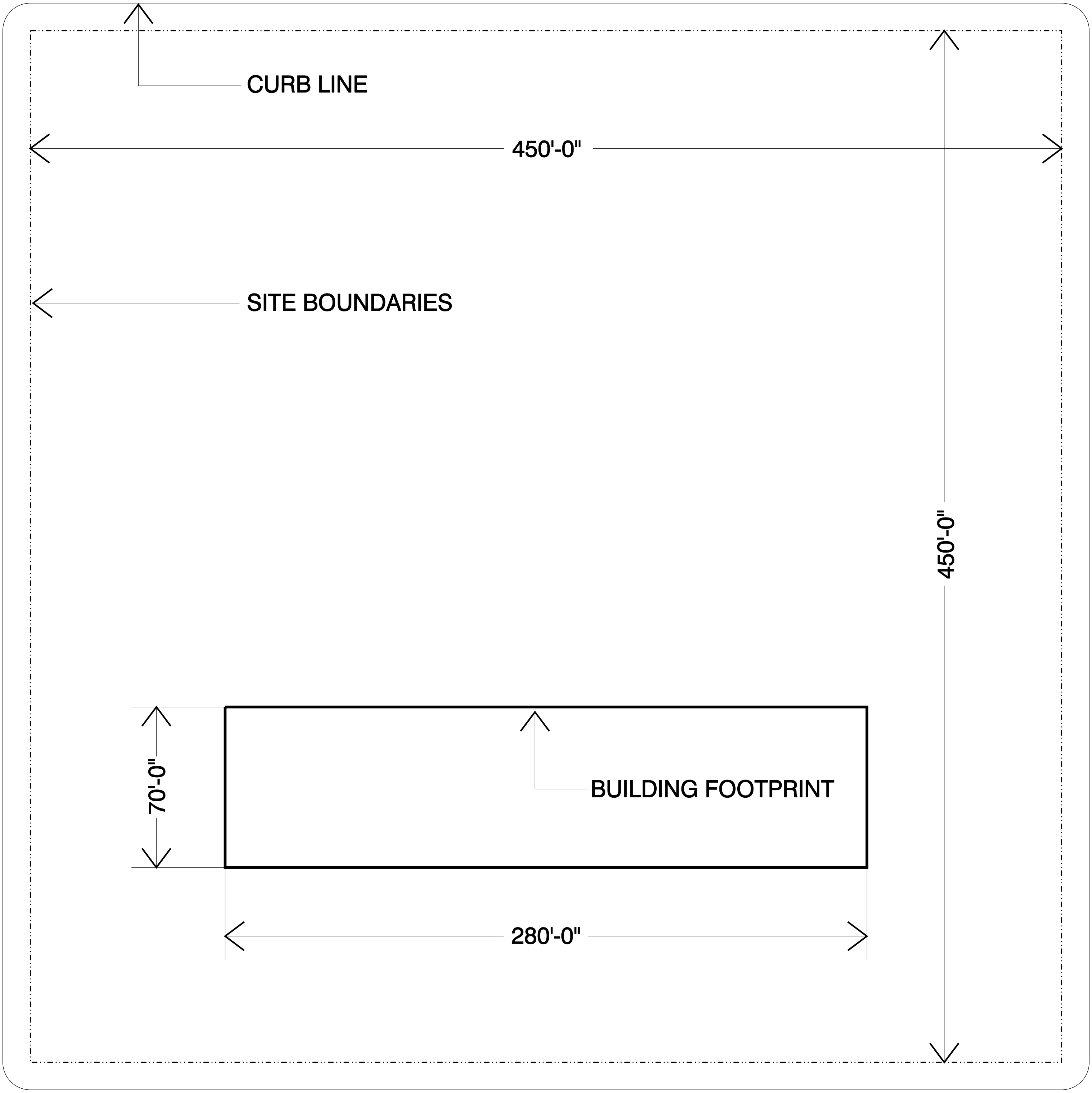
The technical report must be typed, 8½ X 11 format.

MISCELLANY

You will be handed a series of Technical Exercises that will consist of design and analytical tasks that complement and further the development of your project. The Technical Exercises are meant to give you a structure within which to pace the development of your project. This is not a course that you can complete successfully by a last minute charrette. There are too many incremental and interrelated steps that you must take that require time to incorporate feedback from your critics.

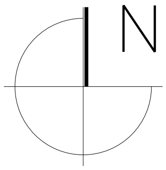
Hand-out dates for the Technical Exercises are given on the course schedule. Beyond that, your critics will determine goals for work to be brought to class the following week.

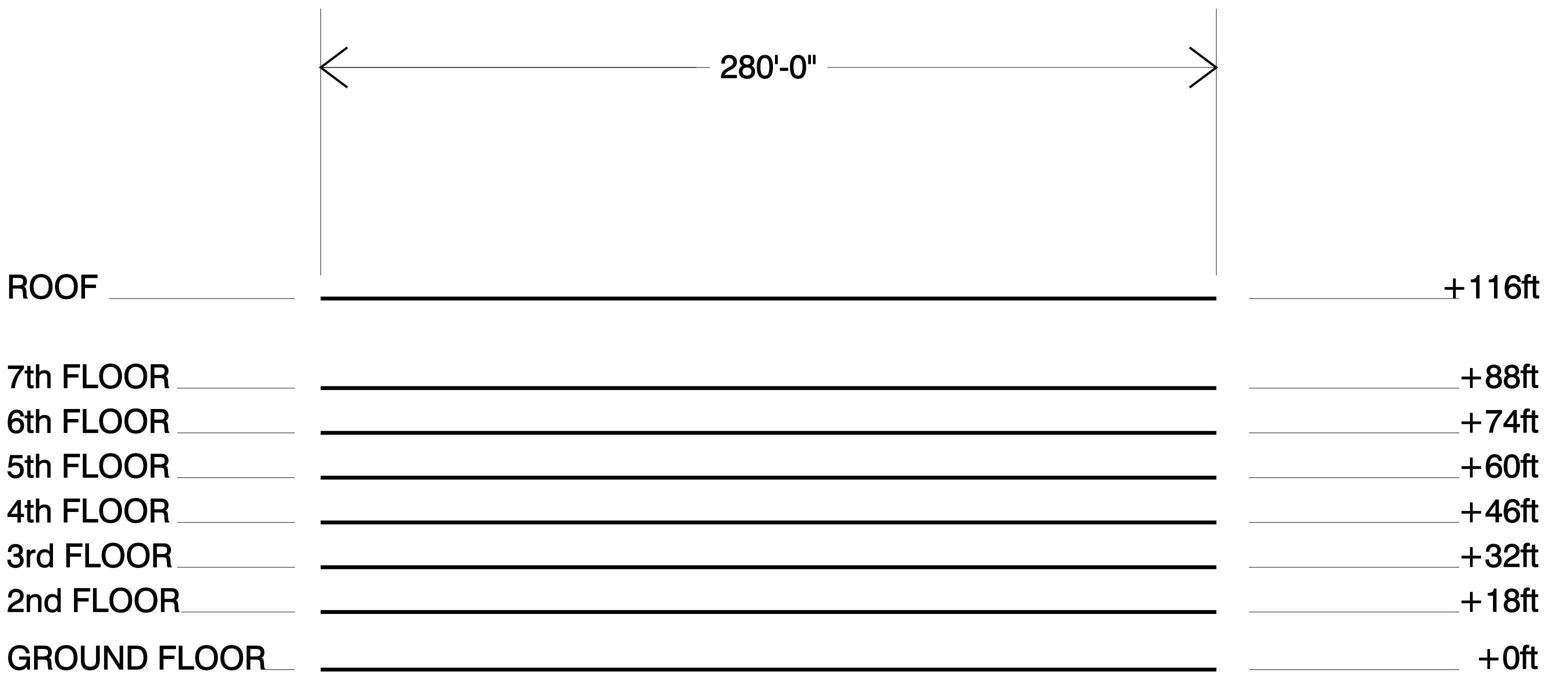
All students on each team are expected to contribute equally to work outside as well as to in-class participation. Grades may not be uniform for members of a team, and will be based on perceived contributions by each individual. This does not mean that everyone must perform the same tasks. The work can and should be divided up, but divided up equitably.



SITE PLAN

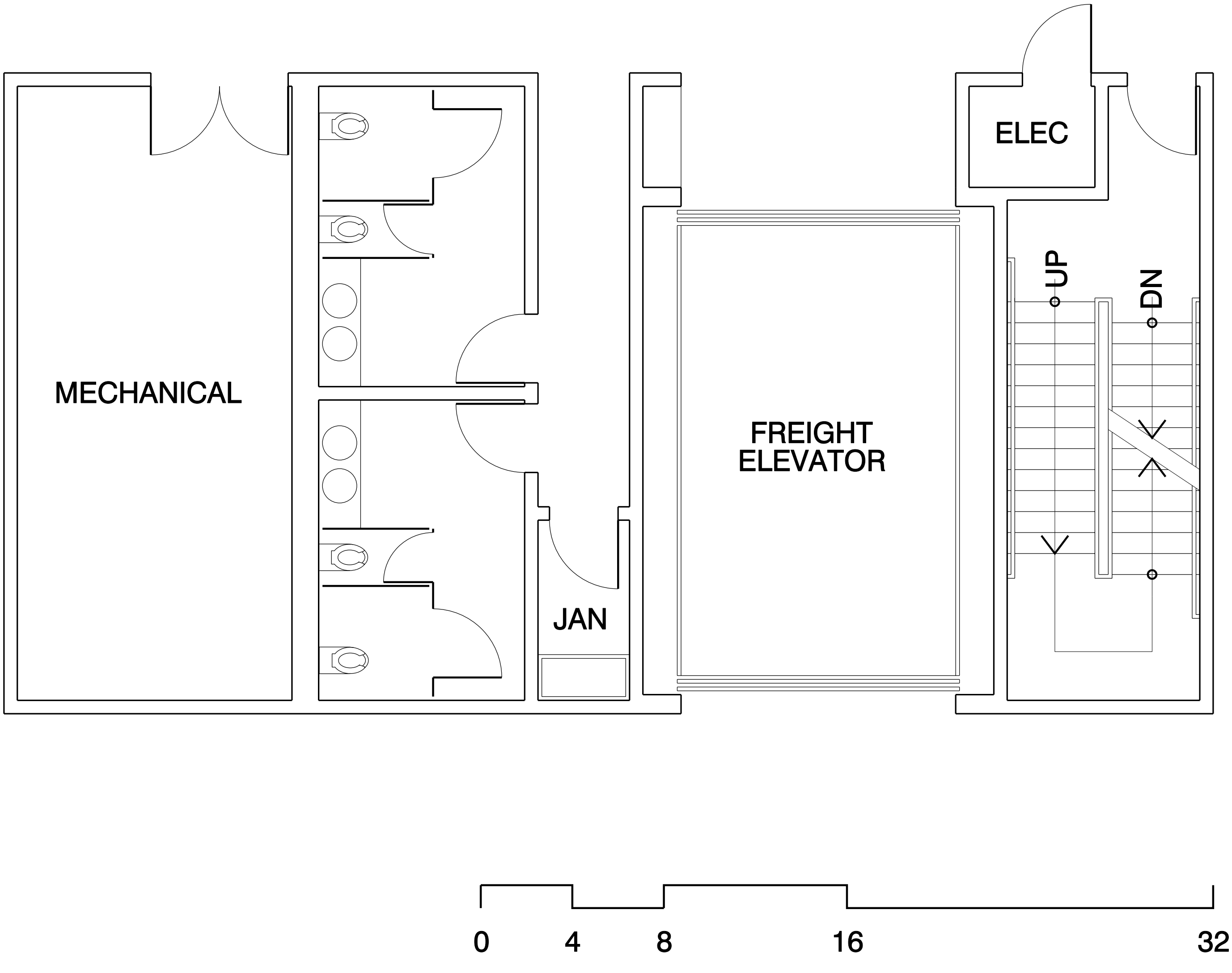
1"=64'-0"





SECTION DIAGRAM

1"=64'-0"



TYPICAL CORE PLAN

1/8"=1'-0"