

Kent State University

INTEGRATED DESIGN COMPETITION 2011

panutsos + chesnes

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The Yards Development

Washington D.C.

[in collaboration with forest city washington +
capitol river front + the anacostia waterfront initiative]

KENT STATE FORESTCITY CAPITOL RIVER FRONT



Integration Consultants:

Design Director:
Charles Frederick
HVAC Systems:
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Tingey Place Office Complex

The Yards | AW
200 Fourth Street
Washington, D.C.

Design Team:
Thomas Chesnes
Melanie Panutsos

Title Sheet
G.101

**Integration
Consultants:**Design Director:
Charles FrederickTAC: **Matthew Setzkorn**(Previous Director)
Jim Stadleman(Previous Director)
Hollie H. Becker**Tingey Place
Office Complex**The Yards | AW
200 Fourth Street
Washington, D.C.Design Team:
Thomas Chesnes
Melanie Paasikoski**Site Analysis Review:****Restore: Environment: River**

- Eliminate Pollution
- Control Run-off and sewer overflows
- Restore Streams/Wetlands
- Encourage Water-Based Activities
- Restore Riparian Function in the Watershed

Large Scale Projects:

- Long-term Plan: Re-route wastewater
- Continue to Develop Green Roots
- Urban Tree Canopy Goal: 40% canopy cover



Map depicts local proximities to the Capitol Riverfront project.

Issues:**Sedimentation and Erosion**

As of 2000, impervious surfaces covered 25% of land in the Anacostia watershed, resulting in erosion and degradation.

Pollution

The river is impoverished, under used, and highly polluted. It's unsafe to swim or eat fish from the river. Urbanization altered stream flows, and led pollution into the river.

Trash

Each year, approximately 20,000 tons of trash are washed into the Anacostia River from runoff/filtering.

Storm water and Sewers

Water that was once absorbed and filtered by soil/plants now rushes across pavement, picking toxins, bacteria, etc. which are dumped into the river, causing up to 90% of water pollution.

Floodplain

The floodplain expands to cover a large portion of the Navy Yards and continues along a narrow path following the Anacostia. Water on the floodplain should not exceed 1' in 100 yrs.

Connect: Transport: Access

- Pedestrian and Bicycle Access
- Promote shift to public transit
- Redesign bridges in the great civic style
- Redesign highways [connect housing/parks]
- Connect the streets to the parks

Large Scale Projects:

- Sustainable polymer pedestrian bridge
- Focus: water taxi, metro, pedestrian, cycle
- Anacostia Riverwalk Trail

Play: Parks: Riverfront

- Connect isolated parks
- Improve circulation to waterfront

Large Scale Projects:

- The Yards Waterfront Park
- The Anacostia Riverwalk Trail et al.
- Water taxi service
- Multi-national boat recreation (canoe etc.)
- Yards Waterfront Park: Pedestrian bridge
- National Arboretum/Aquatic Gardens

Celebrate: Visit: Character

- Highlight character of the river heritage
- Create parks for concerts, picnics & festivals
- Deliver unique-to-D.C. concepts

Destinations of Choice:

- Nationals Ballpark - 1st LEED ballpark
- Arena Stage - Theater
- Capitol Square Trail connects Civil War forts
- Washington Harbor - mixed use
- Old Town Alexandria - restaurant and retail

Live: Neighbors: Strength

- Improve services and amenities for residents
- Revitalize existing commercial areas
- Connect historic centers to public amenities

**The Front: Capitol Riverfront****Summary:**

The Front is a regional destination that is conveniently and centrally located. Sharing its Northern border with Capitol Hill, The Front is five blocks south of the U.S. Capitol building and west of the Barracks Row district.

Riverwalk Trail:

The Trail will connect 16 neighborhoods in the Anacostia National Park and River. The 10-12 ft wide trail is designed for cyclists, runners & skaters, and walkers. The trail uses Low Impact Development, rain gardens and bio-swales to minimize impact on the natural environment.



Above is an example of a rooftop garden.

Climate Overview:**Humidity**

Washington, D.C. is located in the humid subtropical climate zone.

Summers are hot and humid. In summer months like July, the daily average temperature of 79.2°F (25.2°C) and average daily relative humidity of 66%, can cause medium to moderate personal discomfort.

Cooling Loads

Significant cooling loads are common since high summer temperatures often coincide with high humidity. Winds are an asset during the summer.

Heating Loads

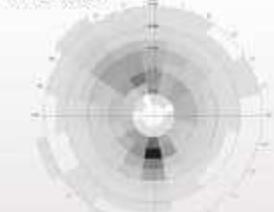
Cold winds are an important concern. The annual snowfall ranges from 12 to 50 inches. There is some potential for solar energy in the winter since the sun shines more than 40% of daylight hours.

Precipitation

The annual precipitation is about 39 in. and occurs fairly uniformly throughout the year. Snow loads on low-slope roofs should be taken into careful consideration.

Ground Temperature:

The average yearly ground temperature is 60 degrees, but varies greatly throughout the year. The maximum ground temperature is 75 degrees at minimum is 35 degrees.

**Wind Rose:**

Rose indicates winds prevailing from South.

Native Vegetation:**General Plants:**

Cat tails, bulrushes, duckweed, swamp sunflower, and water lilies.

Trees:

The official tree of D.C. is the Scarlet Oak. Mixed needleleaf evergreen and broadleaf deciduous trees are also common, but there are very few evergreens in the city center. Common trees include: oaks, cedars, elms, and maples. Washington, D.C. is actually known for its diversity of trees, which vary by individual areas.

Ground Conditions:**Geology**

Gravel, sand, silt and clay. Medium- to coarse-grained sand and gravel, cobbles and boulders near base; contains silts and clays; lignite silty clay; estuarine to marine fauna in some areas.

Soils

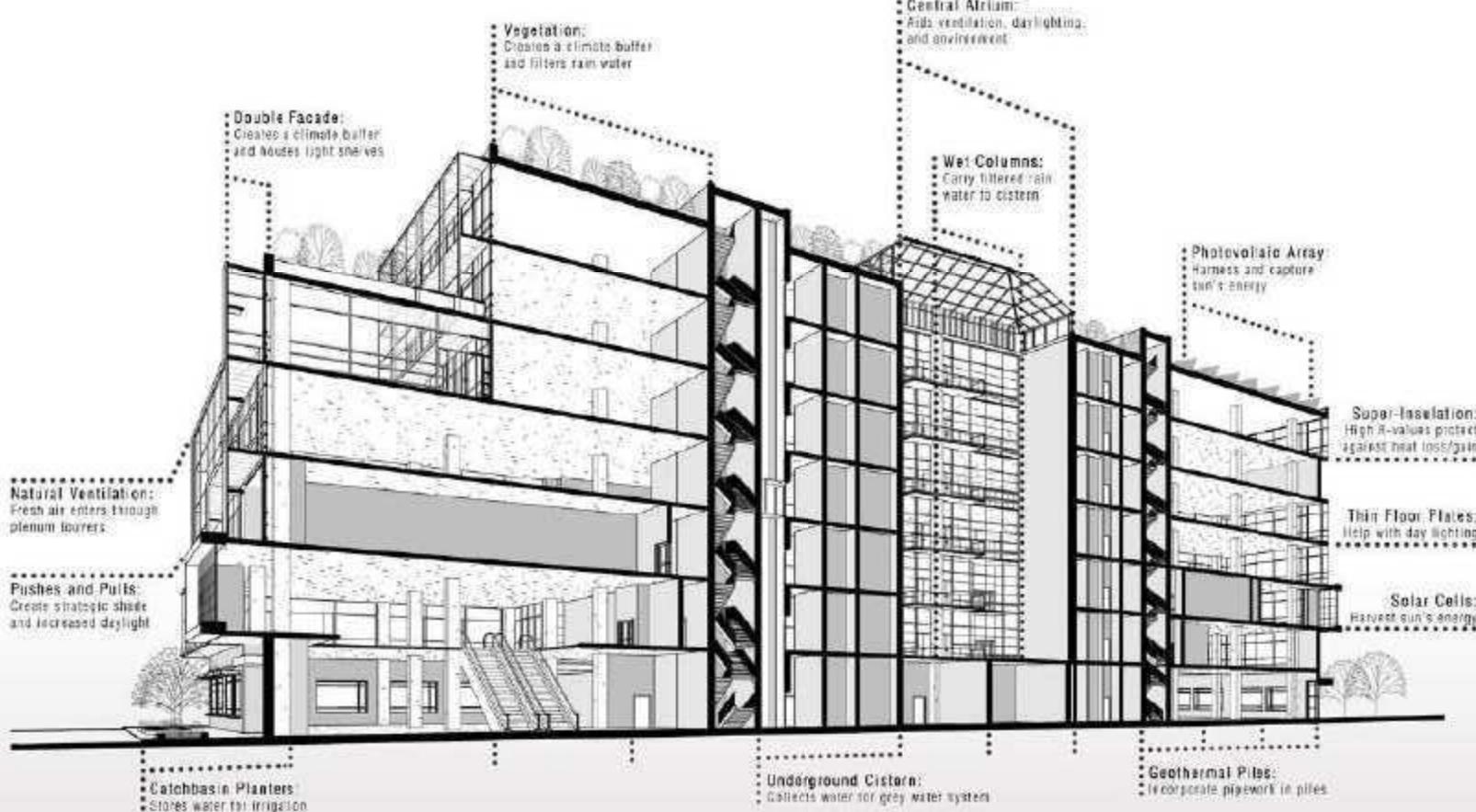
The frost-free period in the area lasts from 175 to 220 days, or approximately half the year. The ground on and near the site slopes from between 0 and 8 percent, and is relatively flat.

**Statement of Intent:**

The Yards Waterfront area of Washington D.C. is one of rich cultural history and promising redevelopment. Exciting changes are occurring and new constructions are being developed in the best interests of both the inhabitants and the environment. The goal for the project is to develop an environmentally responsible office complex which suitably responds to the needs of the leasing clients, the Yards/Waterfront community, and the Anacostia Waterfront Initiative, while integrating the ideals of Forest City Washington's master plan. It is the intention of the design team to create an architectural icon of sustainability which will enhance the energy and dynamic of the culturally historic Yards Waterfront area.

Sustainable Strategies:

The diagram below depicts some of the major architectural strategies used to increase the sustainability and efficiency of the building design. Other smaller scale strategies also exist, such as the use of low-flow toilets, waterless urinals, passive grey water filtering, and efficient LED lighting. Bike storage and community showers were added to the ground floor to encourage alternative transportation, and a translucent panel attached to the cistern allows passersby on the western facade to see rainwater collection in action.

**Integration Consultants:**

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Matthew Setzkorn
Structural System:
Jim Stadleman
Mechanical System:
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**Tingey Place
Office Complex**

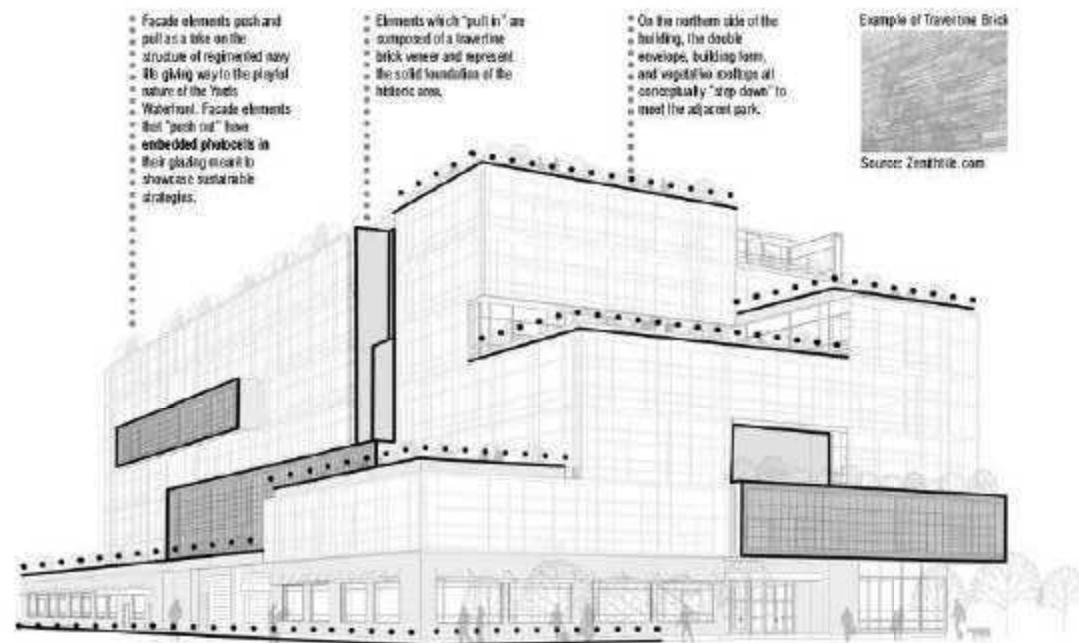
The Yards | AW
200 Fourth Street
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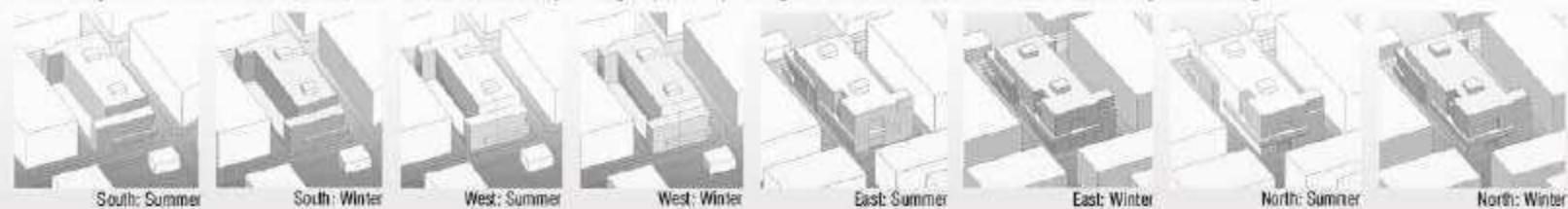


Architectural Concept and Implementation:

The Yards Waterfront area of Washington D.C. has a strong cultural and historical presence. The Anacostia river and the Navy Yards, as well as the existence of several historic buildings, create a rich and dynamic environment which is now once again thriving thanks to the new developments by the Anacostia Waterfront Initiative and Four City Washington. To honor these significant characteristics of the contextual area, the design team has developed a strategy for representing and honoring these key concepts while suitably responding to the needs of the immediate and surrounding site. Sustainability and efficiency were also important factors in the decision-making process throughout.



Preliminary Solar Access Studies: Autodesk V-Ray studies were done early on using the preliminary building form to assess the solar conditions of the site with regard to the design.



Building Efficiency:

The overall efficiency of the building in terms of its sustainability and ability to successfully meet the needs of its occupants is a largely important principle of the building's design. Design decisions in each of the major areas were made with this end goal of sustainability and efficiency in mind.

Water Efficiency:

Low-flush toilets, waterless urinals, rainwater filtration, rainwater harvesting, cisterns, grey water system, catch basin planters

Material Efficiency:

Low VOC, recycled materials, photovoltaic and VIG (new technologies), super insulating materials

Reuse Efficiency:

Rainwater harvesting, recycled materials, energy transfer/sharing through condenser loop, form work recycling

Solar Efficiency:

Solar arrays on roof, photovoltaic in one glazing condition, insulated against solar gain, double facade climate buffer, integrated shades

HVAC Efficiency:

Geothermal piles integrated into deep foundation, system reduces need for boiler and chiller, natural ventilation through louvred plenum

Electrical Efficiency:

Low-wattage LED lighting, narrow floor plates, central atrium, and increased glazing to increase day lighting and reduce electrical need, open work zone lighting on photocell sensors, dual lighting levels in multiple areas

Integration Consultants:

Design Architect:
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Integration
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Jim StadlemanInterior System:
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Brief Case Studies

HSBC Corporate Headquarters:

Program:
Office Space
Size:
182,000 SF, 4.5 stories
Area:
Lancaster County, South Carolina

HSBC Headquarters is a Class A building located in the Greater Charlotte metropolitan area. The \$30 million facility represents the company's flagship for sustainability and LEED qualification in North America.

Synthesis | Sustainable Features:

- Rain gardens to collect irrigation water
- Site work to minimize runoff during storms
- Lighting that does not project into the night sky
- Water efficient plumbing fixtures
- Energy efficient air conditioning systems
- Excellent IAQ [proper outdoor air distribution]
- High level of thermal comfort [automated]
- 90% of occupants have a view of the outdoors
- 10% of the building is recycled material
- 20% of the building is made from local products
- Reflective landscaping reduces heat build-up
- Materials used have low or no VOCs



Image:

Front entrance of the HSBC Headquarters building in Lancaster County, South Carolina

Influence on Design:

HSBC's building implements a number of sustainable strategies that were easily incorporated in this design to increase efficiency, demonstrate environmental responsibility. These features include water efficient plumbing, such as low-flow, dual flush toilets and waterless urinals, rainwater collection by way of a cistern, and minimizing water runoff. In the 4k Office Suite, materials were chosen with environmental consciousness. Flooring and other elements were selected with low embodied energies, low environmental impact, and no VOCs.

DeSoto Building | LRS Architects:

Program:
Office Space for Architecture Firm
Size:
68,000 SF [17,608 SF designed on 3rd floor]
Area:
Portland, Oregon

This existing space was renovated in downtown Portland and was selected for its great location. The building takes up a half block along the Eastern edge of the Pearl District and the North Park Blocks and the Western edge of Old Town

Synthesis | Sustainable Features:

- High ceilings, large windows for day lighting
- Internal shear walls at core [maximize daylight]
- Individual offices are at internal locations
- Conference room has rolling walls for flexibility
- HVAC system: occupancy and CO₂ sensors
- Individually zoned offices
- 99% of spaces have daylight & views
- 42% water use savings due to fixture choices
- Bike storage/showers promote alternative transit
- Low partitions/open floor plan for exterior views
- 49% of all materials regionally manufactured
- Daylight sensors adjust indirect lighting
- Occupancy sensors provided [private offices]



Image:

Flex space in the DeSoto building has abundant day lighting and glass partitions

Influence on Design:

LRS Architect's ideas are well suited for the 4k Office Suite, and building as a whole. As a result of this case study, bike storage and showers were added to the building's ground level, shear walls were internalized, and window area and floor-to-ceiling heights were increased to allow additional daylight. In the 4k space, lighting was designed with the sun's path in mind and wired to photo sensors which will turn off unneeded lights during the day. Offices are individually zoned for increased efficiency, and the open work zone is free of private offices and partitions.

In-Depth Case Studies

Debris Headquarters:

1991-1997
Berlin, Germany
Renzo Piano/Christoph Kohlbecker

Description and Intent:

The Debris building's main goal was to create a sustainable, user-friendly building. Methods for implementing this include concepts for the improvement of the micro climate [roof gardens, rainwater recycling, etc.]

Quick Facts:

Size: 21 stories
Plan: Slab, tower, and courtyard
Use: Office
Site Description: Potsdamer Platz
Glass and Glazing: Double Skin Facade
Cladding: Terracotta and Glass screens
Shading Devices: Sliding louver blinds installed in front of the inner facade
HVAC Strategy: 50% Natural/50% Mechanical

Site and Climate:

The Potsdamer Platz redevelopment renewed a historic piece of Berlin. Berlin is situated in the temperate zone. The average temperature is about 50°F and the city mostly experiences cool weather.

Systems:

The west, north and south facades are double curtain walls, with an outer, unsealed wall of louvered glass blades, controlled by sensors which rotate the blades. The eastern side has two tightly packed layers. The outer is terra cotta panels which act as fixed shading devices. The inner wall is identical to that of the other inner wall. [additional information on facade omitted for brevity].

Integration:

The louvered glass's automation shields from the elements while passively heating the interior. Users can open office windows without cold air rushing into the building, as the outer wall creates a thermal buffer-zone. In warmer times, the glass louvers open automatically by way of thermal sensors. As they open, they allow heat to be expelled from the building rapidly, allowing more natural ventilation to enter. During warm nights, the louvers open fully to expel the solar heat collected throughout the day.

Additional Control:

In areas of which generate heat during warm months, chilled ceilings are used to cool the area. Furthermore, the narrow floor-plates are beneficial for mechanical air-conditioning, as smaller volumes of air are more economically feasible to control.

Water Management:

The building makes efficient use of the rainwater it collects to irrigate landscaping and flush toilets. The design is reported to save around 20,000 cubic meters of water a year.

Bio-Climatic:

Desks are no more than 25 ft from a window. Shallow floors are used throughout the building, and are enabled via the central atrium. The adjacent offices benefit from this relationship, as they have light coming from both sides, making the consumption of light/ventilation considerably low.

Performance:

Natural ventilation is used for around 50% of the year, an outstanding amount for a building in a northern climate. Furthermore, there is a 50% reduction in the energy consumption of the building and 70% reduction in the emission of carbon dioxide due to the aforementioned details.



Image:

Piano's Debris Head-quarters in Berlin, Germany utilizes a double facade and rainwater catchment to reduce mechanical systems and enhance the building's aesthetic.

Influence on Design:

Piano's building embodies many of the goals for this building. Plus that a double skin facade, rainwater collection, cistern storage, and natural ventilation can be successfully integrated in an office building in a moderate climate encouraged the pursuit of these strategies.

Tingey Place
Office Complex

The Yards | AW
200 Fourth Street
Washington, D.C.

Design Team:
Thomas Chesnes
Melanie Paasikoski

Ground Source Heat Pump Case Studies:

Ramada Inn Geneva, New York

Description and Intent:

The intention for this project was to provide a system that would dramatically decrease the operational costs of the hotel by using a renewable source for heating, cooling, and water heating.

Quick Facts:

Program: 149 room lake front hotel with a ground source heat pump.
Building Size: 100,000 SF; 6 stories
Ventilation: 2 Total Heat Recovery
Fresh Air Flow: 10,000 cfm
Space Cond: 198 Heat Pumps (.75-5 ton units)
Water Heating: (4) 10 ton Water heating pumps
Loop Pumps: 2 staged, 1 backup, sized at 50 hp
North. power: .317hp/ton with variable drives
Ground Loop: 198 Piles, 85' deep, 33,660 ft of pipe; 120 Bores, 138' deep, 33,120 ft of pipe

Technical Data:

The Ramada Inn in Geneva NY employs ground source heat pumps to heat and cool the building. The ground loop is partially incorporated into the building's structural pilings and a heat pump water heating system is integrated into the ground loop of the space conditioning system. The ground loop was installed in both the pilings of the foundation and also in a conventional bore field. About half of the ground loop heat exchanger is installed in the building pilings.

Heat extraction performance was better for the pilings at least in part because the building tended to shelter the pilings from ambient conditions. Additionally, variable speed loop pumping dramatically reduced system energy use by 92% compared to a conventional constant speed pumping system. Overall, this system demonstrates the performance benefits of geothermal heat pump systems and shows how the integration of water heating into the system enhances system performance and reduces first costs.

Advantages:

GHP systems offer the advantage of lower operating and maintenance costs compared to conventional HVAC systems. A geothermal heat pump system simplifies the water loop heat pump system by eliminating or minimizing the cooling tower and boiler, thereby reducing maintenance costs, minimizing the floor space requirements for the central plant room, and further improving system efficiency. All heat is rejected to or absorbed from the ground loop heat exchanger. The building-wide, integrated water loop also offers the ability for system integration and heat recovery, which can improve overall system efficiency and reduce installation costs. The water loop can be used as a heat source for heat pumps that provide domestic or service water heating.

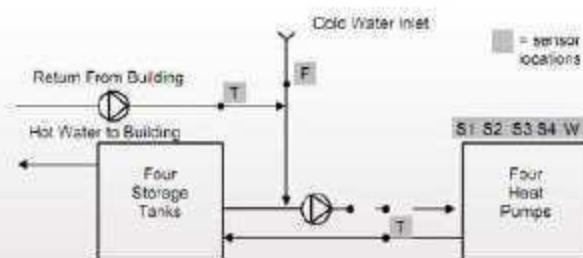


Figure 6. Schematic of the Domestic Hot Water System at Geneva Lakefront Hotel

Paragon Centre Allentown, Pennsylvania

Description and Intent:

The Paragon Centre, an 80,000 sq. ft. office condominium in Allentown, Pa., represents a showcase of innovative energy-efficient technologies. It's the largest commercial office project in the region to employ a GeoExchange system for space conditioning.

Quick Facts:

Program: Office condominium
Building Size: 80,000 square ft; 4 stories
Insulation: R19 in walls, R24 in roof; double-pane, argon-filled, low emissivity
Cooling Load: 200 ton
Space Cond: 77 units ranging from 1 to 4 tons
Loop Pumps: Variable Speed, 15 hp
Ground Loop: 88 fully cased, 125 ft. deep, 11,000 lin. ft.

Technical Data:

The four-story complex incorporates energy-saving strategies like variable-speed pump drives, exhaust air heat recovery, occupancy sensors to control lighting, and low emissivity windows. Saved energy translates to lower operating costs and diminished emissions, aiding the environment. The attraction of geothermal systems centers on low operating costs for heating and cooling. Total energy consumption for the year ending August 1996 amounted to \$0.69 per sq. ft. This compares well with the Department of Energy's national figure of \$1.20 per sq. ft. Additionally, the system is friendly to the environment, reducing emissions.

Energy Use:

The building is essentially an all-electric facility, with only a small amount of gas used for cooking in the kitchen. On an annual basis, HVAC (loop pumps and space conditioning heat pumps) accounted for only 3.5 kWh/ft² or 21% of the total facility energy use. Water heating energy use accounted for another 8% of facility energy use on an annual basis. The loop pumps accounted for only 2% of total facility energy use and 11% of total HVAC energy use.

Rain Water Harvesting Case Study:

Ruppert Landscape Lilburn, Georgia facility

Intention:

Rainwater is fresh water that is normally in abundant supply, and is not "grey water" or "recycled water." Rainwater harvesting systems collect, convey and store precipitation for non-potable applications [toilet flushing, cooling tower make-up, outdoor irrigation systems]. In addition to using rainwater to reduce potable water use, rainwater harvesting systems also reduce storm water runoff, a major environmental concern. Rapidly flowing water may overwhelm storm water systems, creeks and stream banks, and cause erosion and ongoing ecological degradation. Capturing rainwater also reduces pressure on municipal water supplies and the associated higher costs to consumers.

Technical Data:

The Ruppert system collects rainwater from a 5,000 square foot area of the building roof and the surrounding paved surface areas. The rainwater is channeled into a 10,000 gallon above ground collection cistern. The rainwater harvesting system works in conjunction with a groundwater well using pumps, float valves, and back flow preventers to makeup water supplies from the well when lack of rainfall prevents the cistern from filling with harvested rainwater. The harvested water is used to irrigate the 1.5 acre landscaped grounds and a 5,000 square foot commercial plant nursery. The cistern is plumbed into the outdoor spigots and harvested water is used to clean the truck fleet and the building exterior. Indoor water use continues to tie into city water supplies.

The Ruppert cistern is located about twenty-five feet from the building and adjacent to the nursery and landscaped grounds to reduce the distance water is conveyed. An above ground cistern was installed to ease the load on the pump by placing the cistern as high as practicable. Above ground cisterns are also less costly to install than underground storage systems. Since this system is only for outdoor use, minimal filtration is required. Filters were installed at the downspouts to remove debris and dust from the captured rainwater before it goes into the cistern. The clean rainwater and fresh well water do not require treatment or disinfection.



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Code Analysis

General Information:

The District of Columbia adopts the International Codes (I-Codes) published by the International Code Council (ICC), and the National Electric Code (NEC) published by the National Fire Protection Association (NFPA), subject to any changes, deletions and/or additions to the I-Codes or the NEC. The I-Codes are a complete set of comprehensive, coordinated building safety and fire prevention codes that have been adopted in fifty states and the District of Columbia. [For the purposes of this project, the OBC will govern].

Applicable Building Use Groups

OBC 322.1

B: Business: Intended for office, professional or service transactions

M: Mercantile: Buildings and structures for the displays or sale of merchandise

Allowable Heights & Building Areas

OBC 503.1

Type 1B Construction

OBC T.503

B: Business

M: Mercantile

Height: 11 stories

Height: 11 stories

Area: Unlimited

Area: Unlimited

General Building Limitations

D.C. Zoning

Max Building height: 110'

Mixed Use and Occupancy

OBC 508.1

Where a building contains two or more occupancies or uses, the building or portion thereof shall comply with the applicable provisions below.

OBC 508.3

Each portion of a building shall be individually classified in accordance with Section 302.1 and shall comply with Table 508.3.

Fire Separation

OBC 508.2

Room or Area	Separation/Protection
Hazardous Areas	1 hr or sprinkler
Bathrooms	1 hr or sprinkler
Storage Room	1 hr or sprinkler
Waste Room	1 hr or sprinkler
Emergency Power System	1 hr

Required Separation of Occupancies [hrs]

Table 508.3.3

No fire separation is required between occupancies B and M.

Construction Classification

OBC 602.1

Buildings and structures erected shall be classified in one of the five construction types defined in Sections 602.2-602.5. Building elements shall have a fire-resistance rating not less than that specified in Table 601 (Table 602 for ext. walls).

OBC 602.2

Types I and II construction are those types in which the building elements listed in Table 601 are of noncombustible materials, except as permitted in Section 603 or elsewhere in the OBC.

Fire-Resistance Rating Requirements for Building Elements [hrs]

Table 601

Building Element	Type IB
Structural Frame	2½
Reinforcing Metals	
Exterior	2
Interior	2½
Nonbearing Walls	0
Floor Construction*	2
Roof Construction*	1½

Maximum Floor Area Allowances per Occupant

Table 1004.1.1

Function of Space | SF per occupant

Business Areas	100 gross
Locker Rooms	50 gross
Mercantile (upper floors)	50 gross
Mercantile (grade floors)	30 gross
Storage/Shipping areas	300 gross

Egress Width Per Occupant Served

Table 1005.1

Occupancy E/M | With Sprinkler System
Stairways: 0.2' inches per occupant

Other spaces: 0.15' inches per occupant

Min. Exits per Occupant Load

Table 1019.1

Occupant Load | Exits per story
1-500 2
501-1000 3

Exit Travel Distance

Table 1016.1

Occupancy | With Sprinkler System
M 250
S 300

Corridor Fire-Resistance Rating

Table 1017.1

Occupancy | Load Served | W/ Sprinkler System
M/E 30 0

Minimum Plumbing Facilities

OBC 2902.1

Plumbing fixtures shall be provided for the type of occupancy and in their minimum number given below.

Minimum Number of Req'd Fixtures

Table 2902.1

Water Closets, Lavatories, Showers

Use Grp.	Min. Females	Min. Males	Max. Females
B	1.25 times 50	1.40 times 50	NA
M	1.50 times	1.80 times	NA

Fountains, Service Sinks

Use Grp.	Min. Females	Min. Males
B	1.00	1
M	1.00	1

Building Code Strategy

All applicable building codes have been considered and executed throughout the design process. These include, but are not limited to: fire and life safety requirements, egress requirements (number of exits and travel distances), ADA accessibility guidelines, mechanical, electrical, and plumbing requirements, building occupancy, and construction type.

Number of Exits Determined by Occupant Load and Separation Determined by 1/3 Diagonal of the Space

Level 3: Spec. Offices



Level 2: Retail and Spec. Offices



Level 1: Retail



BOMA Utilization | Efficiency

Site	
Lot Size	46,644 NSF
Footprint	43,458 NSF
Site Utilization	93.2 %



| Level 1 | [Retail]

Circulation	3,702 NSF
Service	8,988 NSF
Core	1,091 NSF
Gross	43,458 GSF
Net Usable	29,679 NSF
Floor Utilization	68.3 %

| Level 2 | [Mixed Use]

Circulation	6,541 NSF
Service	2,956 NSF
Core	1,091 NSF
Gross	37,870 GSF
Net Usable	26,487 NSF
Floor Utilization	69.9 %

| Level 3 | [Speculative Suites]

Circulation	4,902 NSF
Service	1,340 NSF
Core	1,091 NSF
Gross	35,956 GSF
Net Usable	26,480 NSF
Floor Utilization	73.7 %

| Level 4 | [Prime Tenant]

Circulation	0 NSF
Service	0 NSF
Core	1,091 NSF
Gross	33,343 GSF
Net Usable	30,686 NSF
Floor Utilization	92.0 %

| Level 5 | [Prime Tenant]

Circulation	0 NSF
Service	0 NSF
Core	1,091 NSF
Gross	32,758 GSF
Net Usable	30,101 NSF
Floor Utilization	91.9 %

| Level 6 | [Prime Tenant]

Circulation	0 NSF
Service	0 NSF
Core	1,091 NSF
Gross	29,135 GSF
Net Usable	26,478 NSF
Floor Utilization	90.9 %

| Level 7 | [Prime Tenant]

Circulation	0 NSF
Service	0 NSF
Core	1,091 NSF
Gross	29,109 GSF
Net Usable	26,452 NSF
Floor Utilization	90.9 %

| Total |

Gross	241,623 GSF
Net Usable	196,363 NSF

Bldg Utilization 81.3 %

Rentable Program Breakdown

| Level 1 |

Retail	28,852 SF
Retail Tenant 1	14,777 SF
Retail Tenant 2	1,874 SF
Retail Tenant 3	1,874 SF
Retail Tenant 4	10,327 SF
Speculative	0 SF
Prime Tenant	0 SF

| Level 2 |

Retail	9,459 SF
Retail Tenant 4	9,459 SF
Speculative	14,995 SF
Speculative Tenant 1	9,050 SF
Speculative Tenant 2	1,260 SF
Speculative Tenant 3	3,180 SF
Speculative Tenant 4	1,905 SF
Prime Tenant	0 SF

| Level 3 |

Retail	0 SF
Speculative	24,507 SF
Speculative Tenant 6	4,215 SF
Speculative Tenant 7	5,848 SF
Speculative Tenant 8	2,027 SF
Speculative Tenant 9	1,584 SF
Speculative Tenant 10	1,961 SF
Speculative Tenant 11	4,261 SF
Speculative Tenant 12	4,613 SF
Prime Tenant	0 SF

| Level 4 |

Retail	0 SF
Speculative	0 SF
Prime Tenant	28,428 SF

| Level 5 |

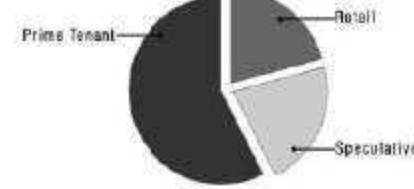
Retail	0 SF
Speculative	0 SF
Prime Tenant	27,824 SF

| Level 6 |

Retail	0 SF
Speculative	0 SF
Prime Tenant	24,167 SF

| Level 7 |

Retail	0 SF
Speculative	0 SF
Prime Tenant	24,208 SF



| Program Totals |

Retail	38,041 SF
Target	40,000 SF
Speculative	39,502 SF
Target	40,000 SF
Prime Tenant	104,627 SF
Target	100,000 SF
Total Rentable	182,170 SF
Target	180,000 SF

Building Efficiency:

The building's utilization [BOMA rating] is well above the target of 75%. This shows that its design is both efficient and responsible.

Rather than wasting space on gratuitous spaces, the building maintains a strategic layout with enough intriguing elements (triple height entries, a rainwater cistern, bike storage/showers, and a core atrium) to keep the users interest. Further visual/architectural elements on the facade and accessible roof terraces create intrigue without sacrificing efficiency.

Program Breakdown:

The program is split primarily by level. Retail is housed on the first and second levels; speculative spaces are on the second and third levels, and the remaining 4 floors hold prime tenant spaces exclusively. Totals for these three types of rentable areas are incredibly close to the requested square footages, and the sum is only off by an excess of 1.2%.

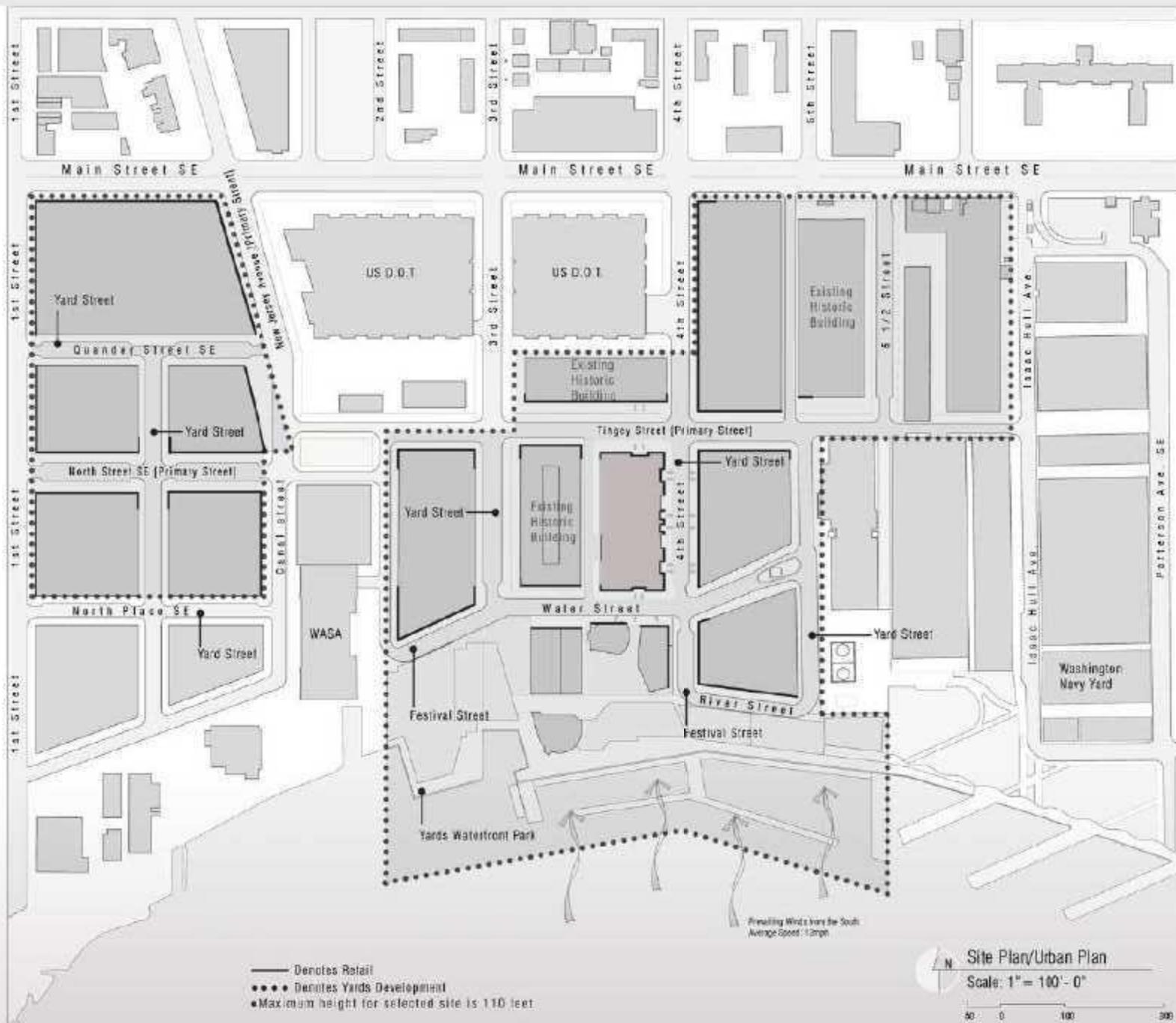
Integration
Consultants:

Design Director
Charles Frederick
TIAAC Systems
Matthew Setzkorn
Electrical System
Jim Stadleman
Structural System
Hollie H. Becker

Tingey Place
Office Complex

The Yards | AW
200 Fourth Street
Washington, D.C.

Design Team:
Thomas Chesnes
Melanie Paasikoski



Integration Consultants:

Design Director:
Charles Frederick
TIAAC Systems
Matthew Setzkorn
(Executive Director)
Jim Stadelman
(Structural Engineer)
Hollie H. Becker

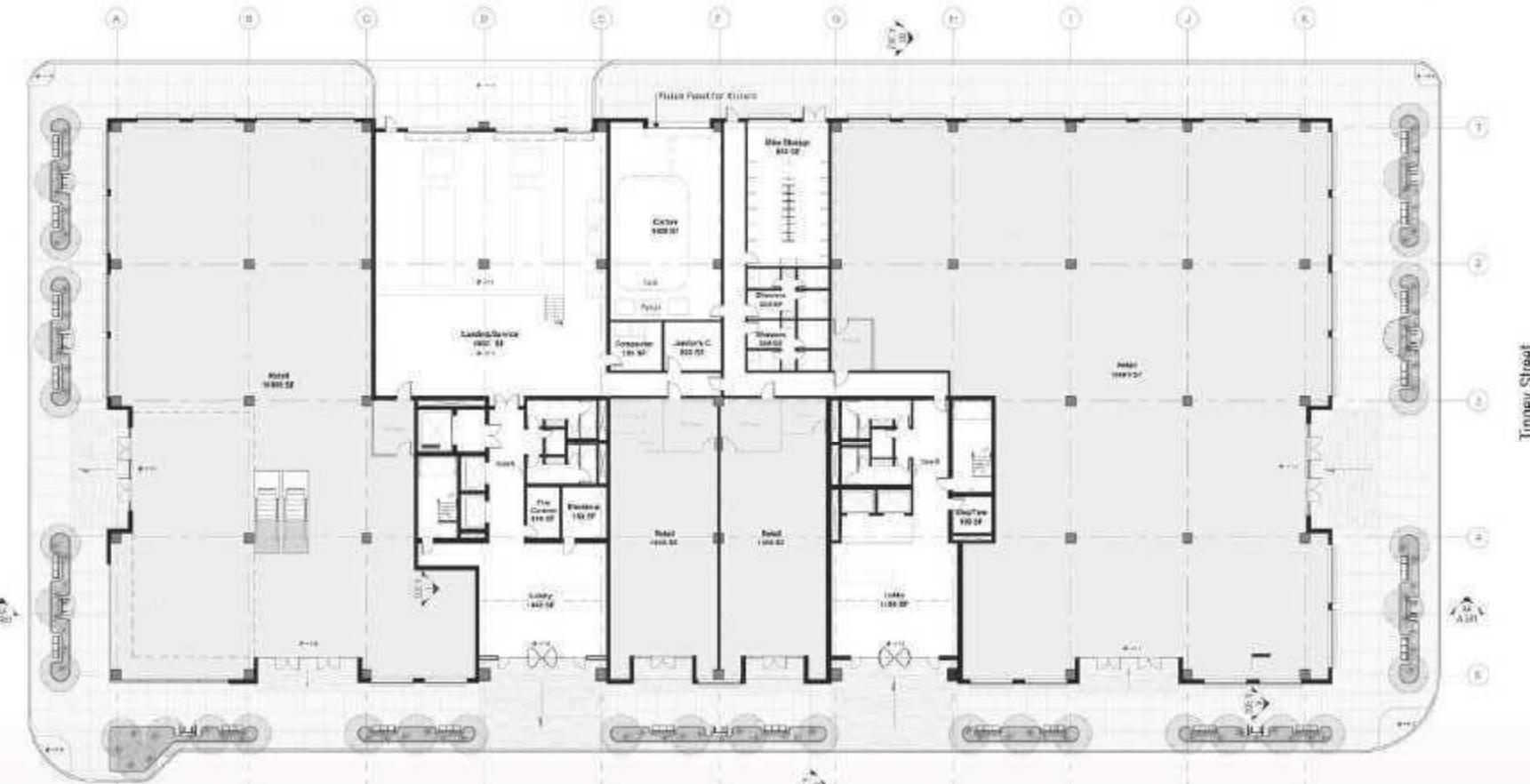
Tingey Place Office Complex

The Yards | AW
200 Fourth Street
Washington, D.C.

Design Team:
Thomas Chesnes
Melanie Paasikoski

Urban Plan:

Based on the Four City Washington Master Plan, the urban plan for the building is divided into four zones: curb, seating, pedestrian, and building. Our seating zone has street trees with planters that collect and store excess rainwater, and bike racks to encourage sustainable transport.



Ground Level/Urban Plan

Scale: 1" = 20'-0"

0 10 30 60

- All vertical shafts are fire/life rated.
- Most Metal/Euro beams and Fresh Strength are 1 hr fire rated.
- All ramped entries are within the ADAAG 1:12 slope limit.

Integration
Consultants:

Design Interns:
Charles Frederick
HVAC Systems:
Matthew Setzkorn
(Structural Systems)
Jim Stadler
(Electrical Systems)
Hollie H. Becker

Tingey Place
Office Complex

The Voids | AWI
200 Fourth Street
Washington, D.C.

Design Team:
Thomas Cheesne
Melanie Panagos



Integration Consultants:

Design Director:
Charles Frederick

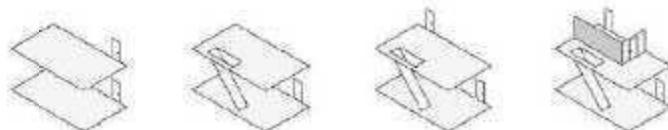
MEPAC Systems:
Matthew Setzkorn

Structural System:
Jim Stadleman
Architectural System:
Hollie H. Becker

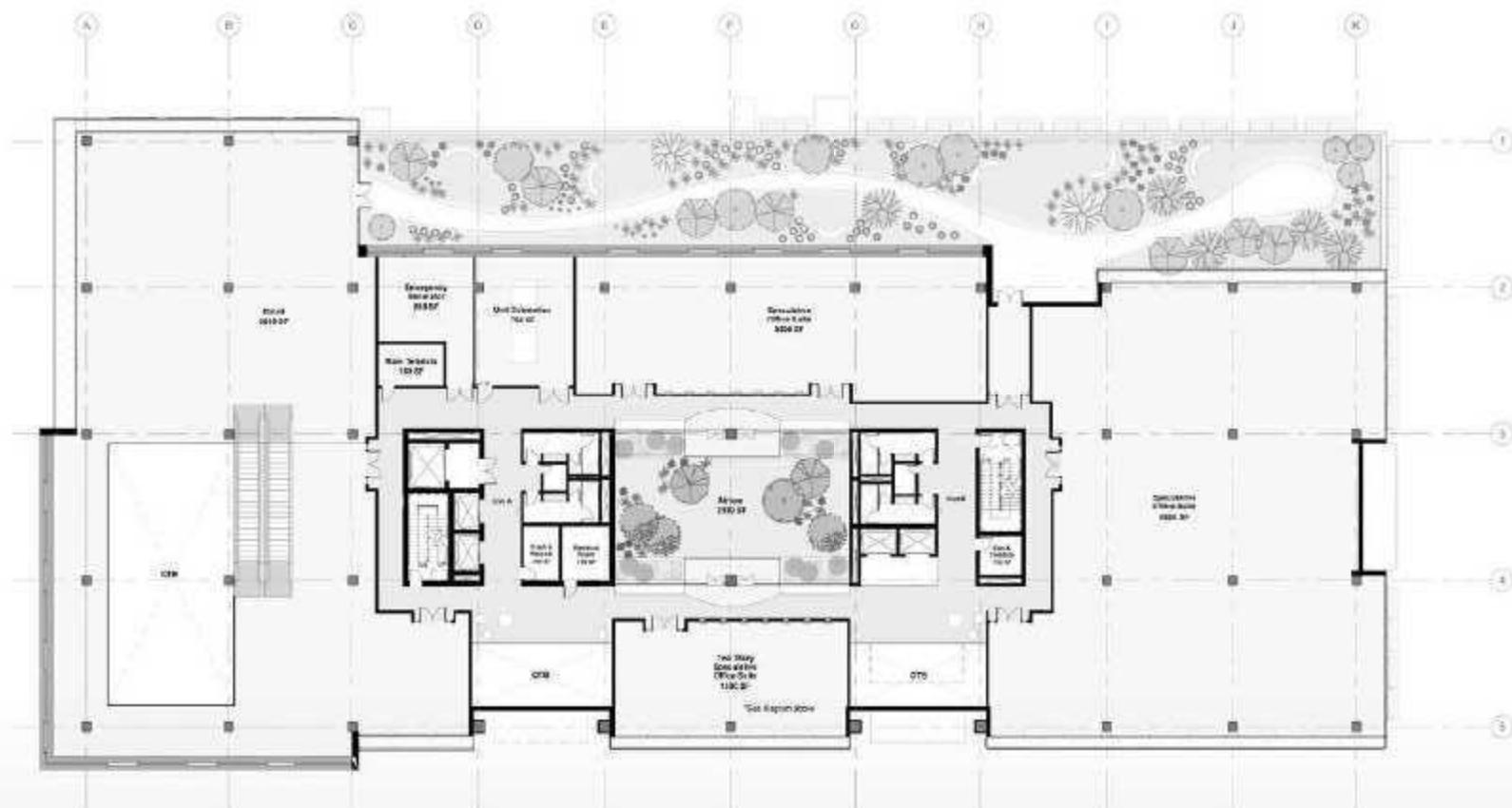
Tingey Place Office Complex

The Yards | AW
200 Fourth Street
Washington, D.C.

Design Team:
Thomas Chesnes
Melanie Paasikoski



Two Story Office Suite Layout Options



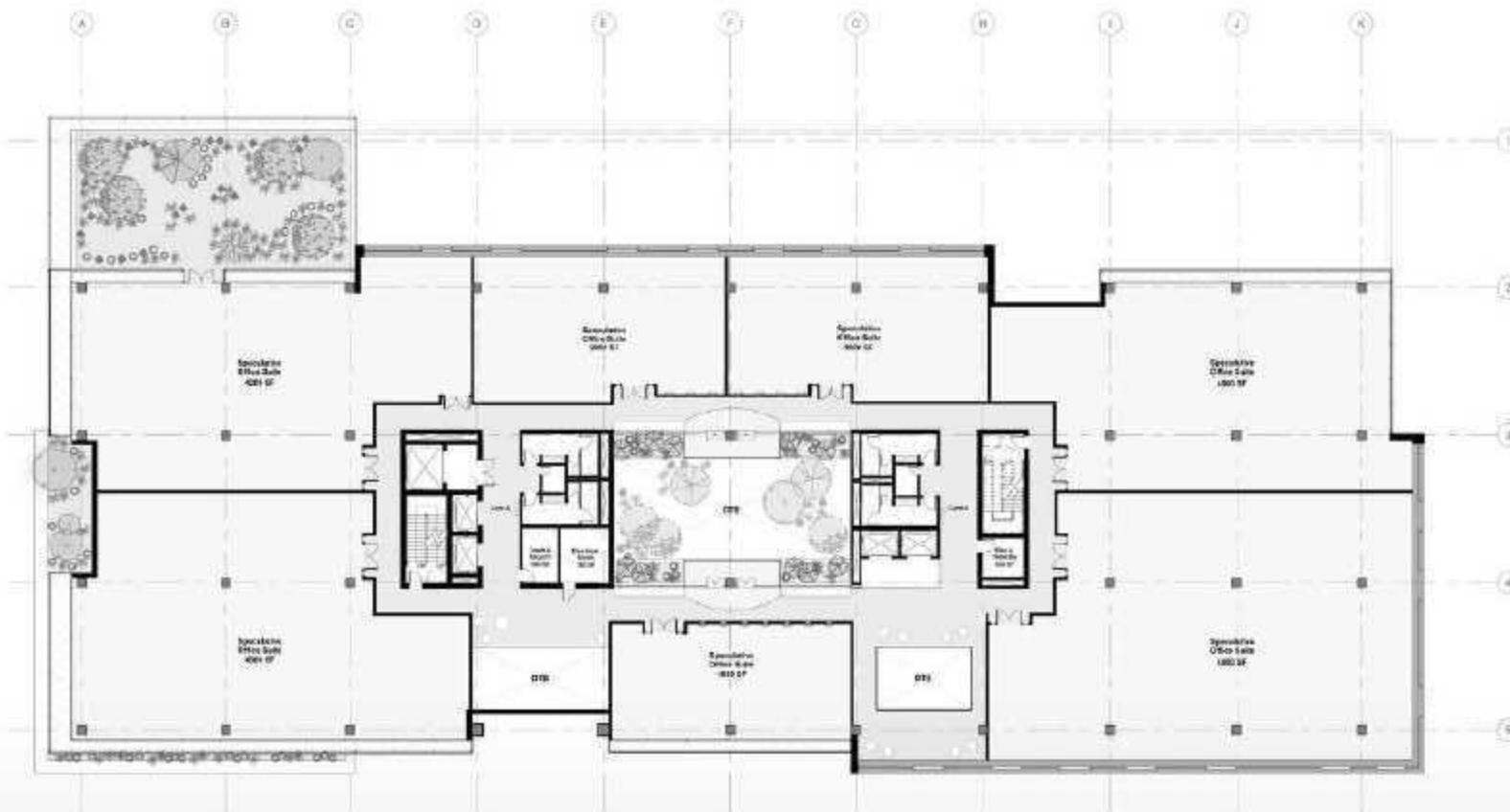
Level 2 Floor Plan
Scale: 1" = 20'-0"

0 10 20 30 40

- All vertical shafts are 2hr fire rated
- Main Mech/Elec rooms and Trash Storage are 1 hr fire rated
- Two means of egress provided for spaces with occupancy load greater than 50
- Where 2 exits are required, doors are spaced a distance apart greater than 1/3 the diagonal of the space



Alternative Speculative Office Layouts



- All vertical shafts are 2 hr fire rated
- Main Mesh/Elev. rooms and Trash Storage are 1 hr fire rated
- Restrooms maintain a 3 ft turning radius and each have one accessible stall

N Level 3 Floor Plan

Scale: 1" = 20'-0"

0 10 20 30 40

Integration
Consultants:

(Design Manager)

Charles Frederick

(MEP System)

Matthew Setzkorn

(Structural System)

Jim Stadleman

(Structural System)

Hollie H. Becker

Tingey Place
Office Complex

The Yards | AW
200 Fourth Street
Washington, D.C.

(Design Team)
Thomas Chesnes
Melanie Paasikoski


**Integration
Consultants:**
(Design Manager)
Charles Frederick(MEAC System)
Matthew Setzkorn(Electrical System)
Jim Stadleman

(Structural System)

Hollie H. Becker
**Tingey Place
Office Complex**
The Yards | AW
200 Fourth Street
Washington, D.C.(Design Team)
Thomas Chesnes
Melanie Paasikoski

N Level 4 Floor Plan

Scale: 1" = 20'-0"

0 10 20 30 40 50

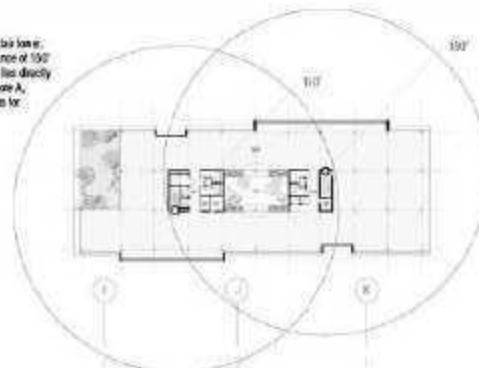
- All vertical shades are 2hr fire rated.
- Main Mech/Elec rooms and Trash Storage are 1 hr fire rated.
- Vegetative areas are used for either visual or physical access for those both within the building and on the street.





Standpipe Diagram:

Standpipes are located in each slab layer, being within the maximum distance of 100' apart. The fire command center lies directly to the right of the stand pipe in Core A, making for quick and easy access for firemen.



Level 5 Floor Plan

Scale: 1" = 20'-0"

0 10 20 30 40

**Integration
Consultants:**

(Design Manager)
Charles Frederick

(MEP/AC Systems)
Matthew Setzkorn

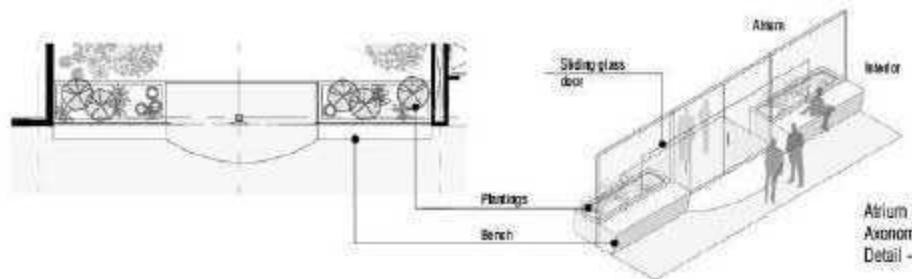
(Structural System)
Jim Stadlerman

(Structural System)
Hollie H. Becker

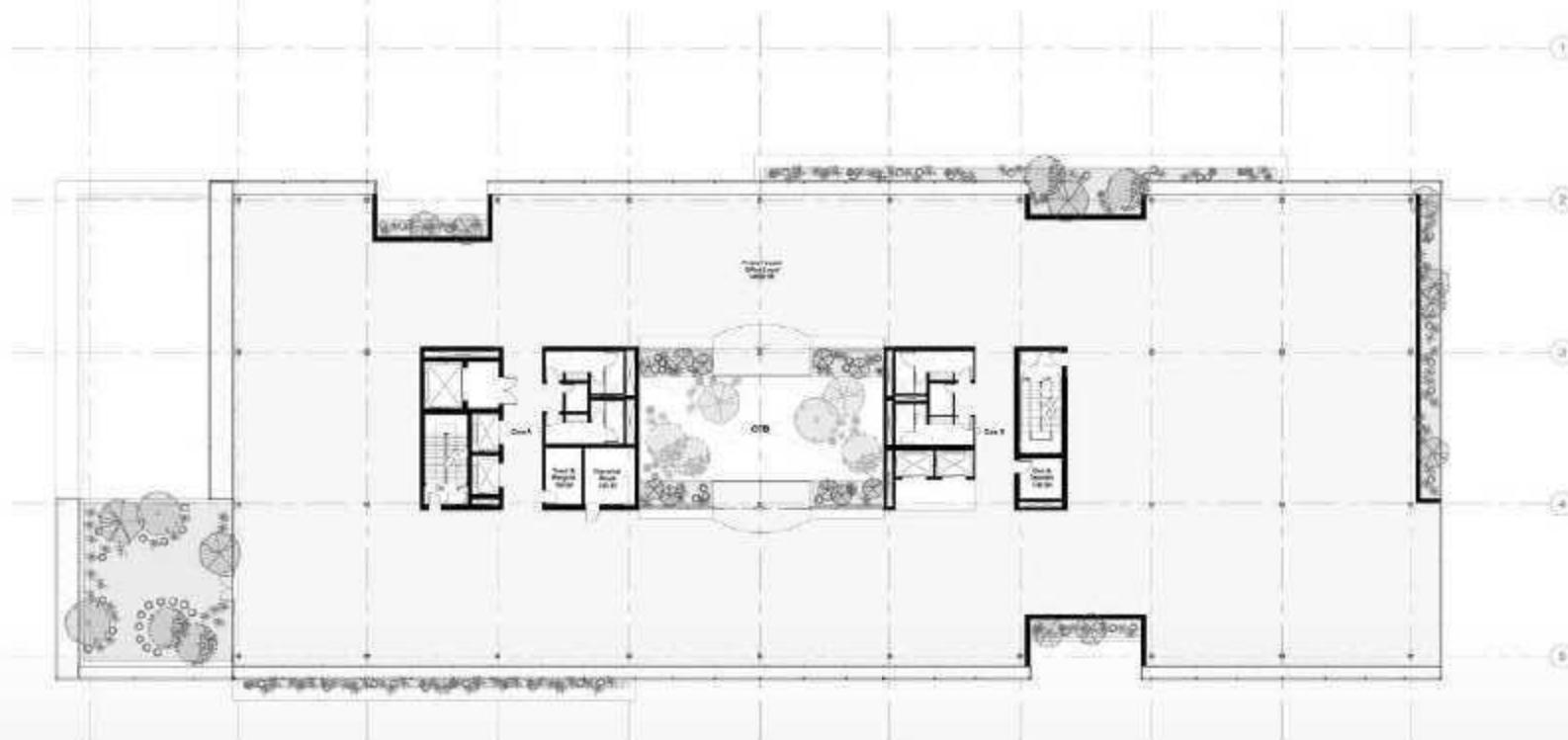
**Tingey Place
Office Complex**

The Yards | AW
200 Fourth Street
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Thomas Chesnes
Melanie Paasikoski



**Atrium Entry
Architectural
Detail - NTS**



Level 6 Floor Plan

Scale: 1" = 20'-0"



- All vertical shafts are 2 hr fire rated.
 - Main Mesh/Euro rooms and Trash Storage are 1 hr fire rated.
 - The atrium extends through all stories and epic floors, providing light, ventilation, and connection to registration.
 - Focus of subdivision on space reuse, atrium doors swing out onto balconies. On prime floors they slide open to better connect occupants with nature.

**Tingey Place
Office Complex**

The Yards | AW
200 Fourth Street
Washington, D.C.

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Melanie Panissoz



Integration Consultants:

Design Architect:
Charles Frederick

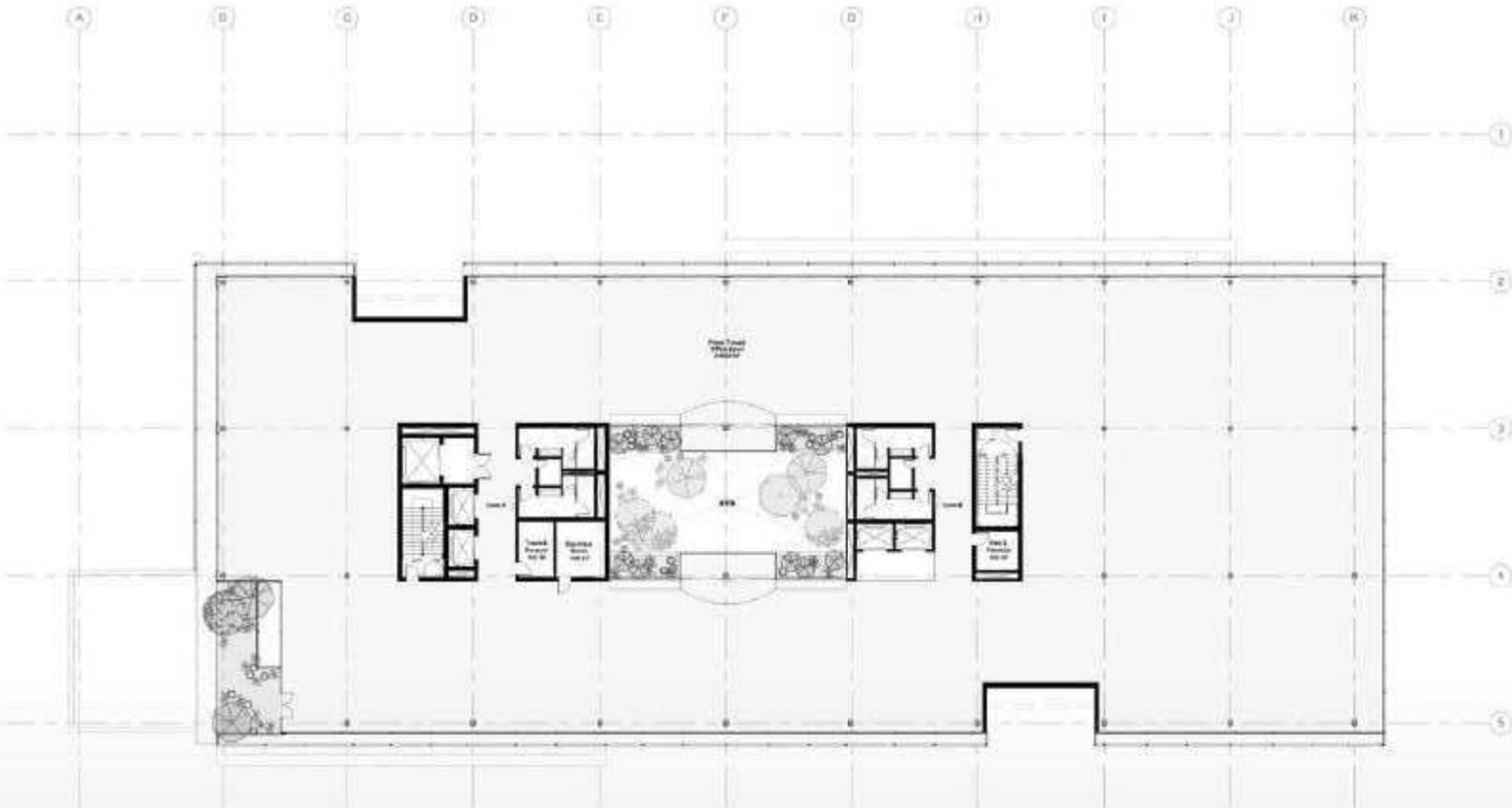
MEPAC System:
Matthew Setzkorn

Structural System:
Jim Stadleman
Brickwork System:
Hollie H. Becker

Tingey Place Office Complex

The Yards | AW
200 Fourth Street
Washington, D.C.

Design Team:
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Melanie Paasikoski



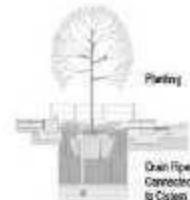
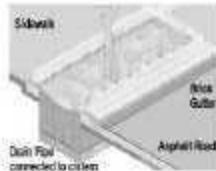
N
Scale: 1" = 20'-0"

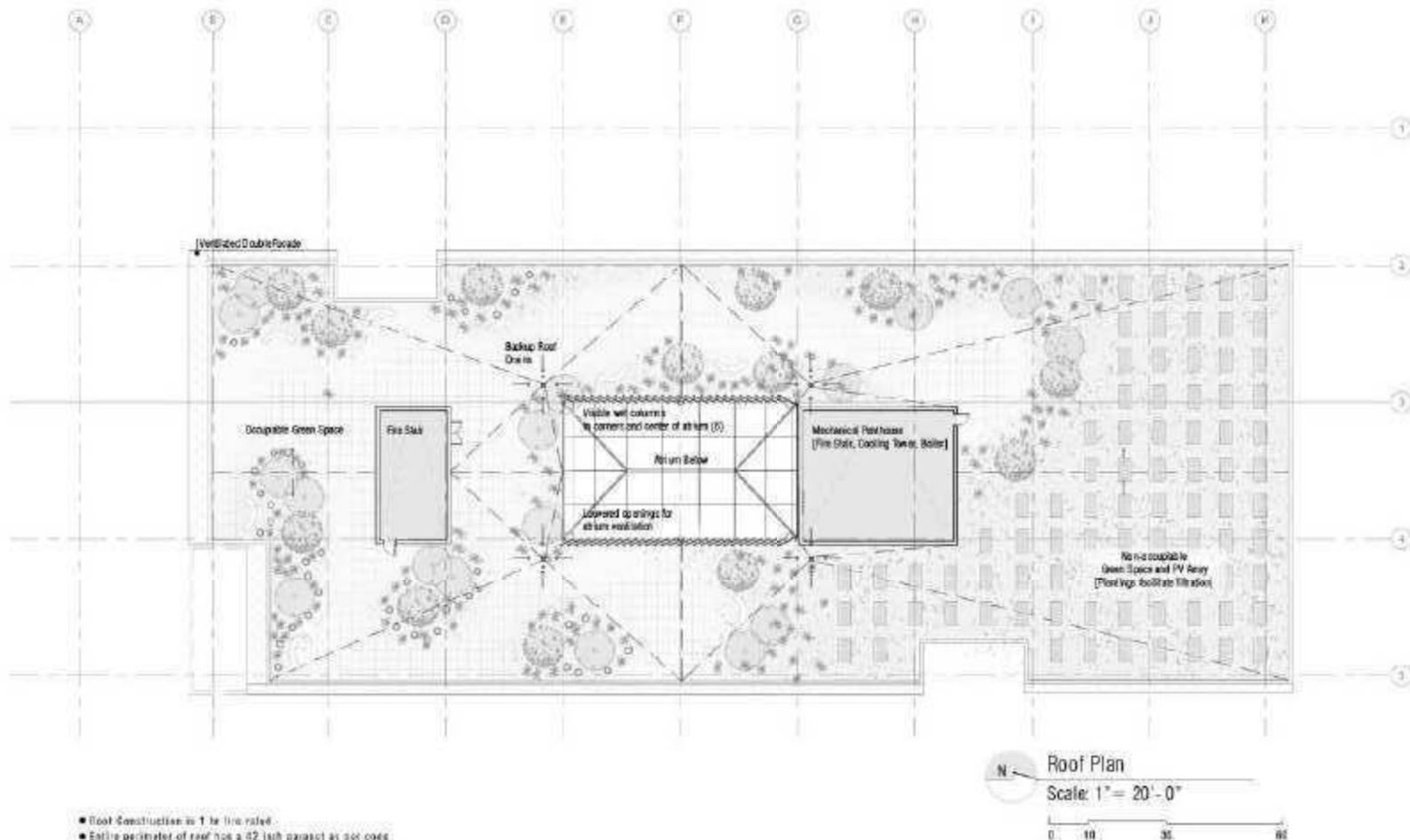
0 10 20 30 40

- All vertical shafts are 2hr fire rated
- Main Mech/Elec rooms and Trash Storage are 1 hr fire rated
- On upper floors, the building's floor plate steps back to allow more green space and a less imposing southern front

Side Walk Catch Basins:
Catch basins are incorporated into the sidewalk settings. Similar to a green roof, these plantings drain in certain locations underneath the building, which is then used for non-potable applications.

Source: The Voids Design Guidelines





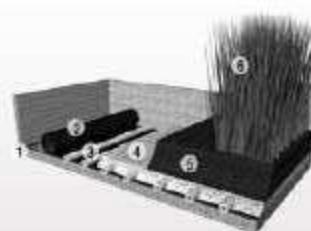
- Roof Construction is 1 hr fire rated.
- Entire perimeter of roof has a #2 inch parapet as set code.

The roof of the building has been designed to be a partially occupiable green roof and PV solar array. As a sustainable strategy, the green roof construction will facilitate drainage, filtration, water catchment, as well as provide added insulation for the spaces below and the PV array will collect solar energy used to reduce the electrical load.

As rain water collects on the planted surface, it filters through the growing medium and gravel into PVC drainage pipes. Excess water that is not absorbed by the indigenous plantings is collected by the drainage pipes and stored in a cistern located on the first level. Excess rain water travels down wet columns located along the atrium and allows building patrons to witness the water catchment as it occurs. This excess water will then be used for non potable applications such as irrigation and toilet flushing. In the event that the green roof draining and system system were to become over saturated, standard back up root drains are in place. The occupiable portion of the green roof provides a connection to the adjacent park along the southern edge of the building.

Intensive Green Roof Construction

1. Structural Concrete Roof
2. Waterproofer Tap with Root Barrier
3. PVC Drainage Pipe
4. Gravel for Drainage and Filtration
5. Fertilized Soil
6. Indigenous Plant Life



Source: www.greenroofs.com

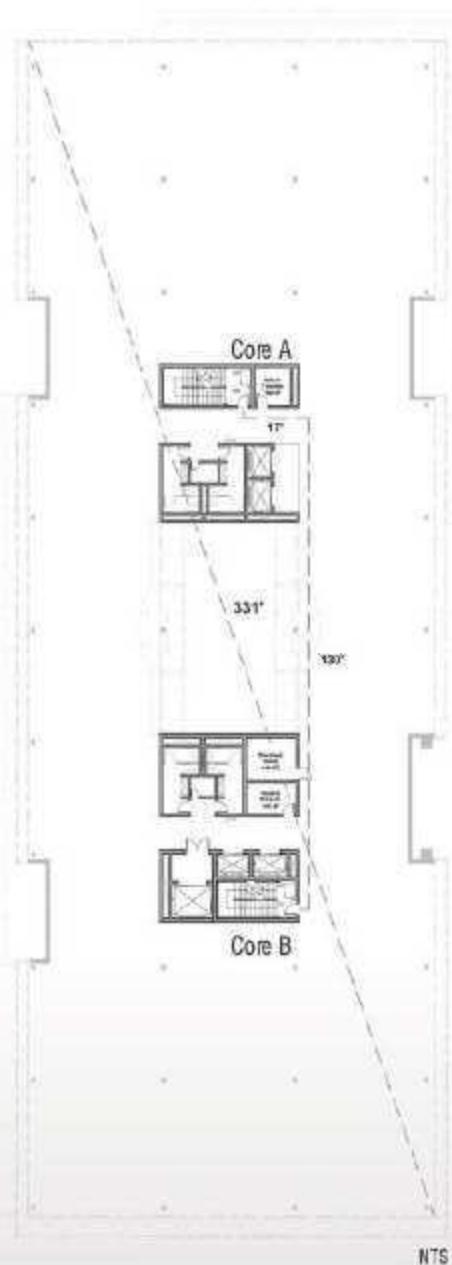
Integration Consultants

Geosynthetic
Charles Frederick
(HVAC systems)
Matthew Setzekorn
(Structural Analysis)
Jim Stadleman
(Electrical Systems)
Hollee H. Becker

Tingey Place Office Complex

The Yards | AWI
200 Fourth Street
Washington, D.C.

[Design Team]
Thomas Chesnes
Melanie Panusas

**Core Elements**

- ① Plumbing Chase [2hr rated]
- ② Mechanical Chase [2hr rated]
- ③ Men's Rest Room
- ④ Women's Rest Room
- ⑤ Passenger Elevator [2hr rated]
- ⑥ Freight Elevator [2hr rated]
- ⑦ Elec. and Teledata Room
- ⑧ Trash and Recycling Room [1hr rated]
- ⑨ Storage Room [1hr rated]
- ⑩ Standpipe
- ⑪ Area of Refuge
- ⑫ Main Electric Panel Room

Building Cores:

The building cores are spaced such that the distance between them is greater than the distance of 1/3 the diagonal of the building (minimum separation of exits in a building with an automatic sprinkler system according to CBC Section 1015.21.)

Both cores serve both the prime and speculative office spaces. The cores connect both lobby spaces to each core via four elevators (two in each core) and two fire stairs (one in each core.) Each fire stair houses an area of refuge for one wheelchair per landing in accordance with OBC Section 1007.

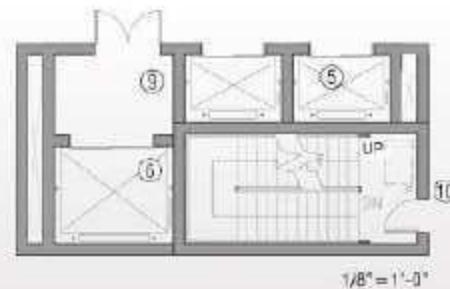
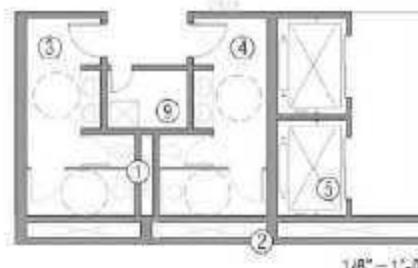
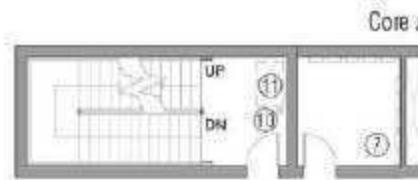
Both cores also house electrical rooms, as well as mechanical and plumbing chases. Each core houses both men's and women's rest rooms in order to reduce travel distance. These rest rooms are ADA accessible and meet the requirements of Table 2902.1.

Core [Exit] Separation

Diagonal Dimension: 331'

Min. Separation of Exits: $331/3=110'$

Distance between Exits: 147'

**Integration Consultants:**

(Lead Integrator)
Charles Frederick

(HVAC Systems)
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(Structural System)
Jim Stadelman

(Electrical System)
Hollie H. Becker

**Tingey Place
Office Complex**

The Yards | AWI
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(Design Team)
Thomas Cheesne
Melanie Panattoni

Integration
Consultants:

(Design Director)

Charles Frederick

(MEP/C Systems)

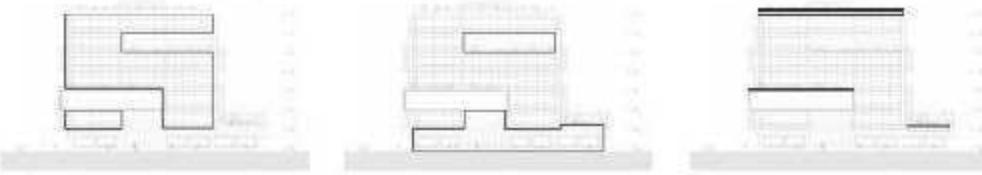
Matthew Setzkorn

(Structural System)

Jim Stadleman

(Structural System)

Hollie H. Becker



Curtain Wall Facade:

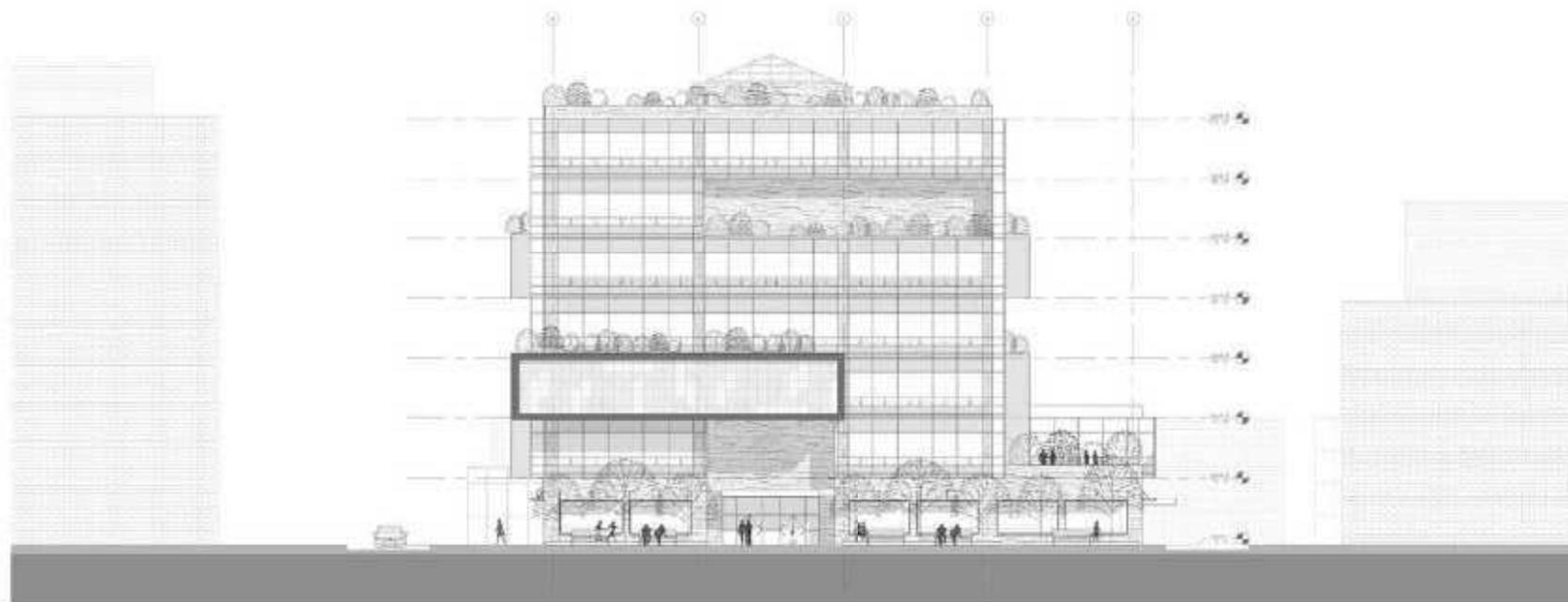
These portions of the facade are composed of a traditional curtain wall facade with operable windows offset 2.5' from floor level. The eastern, western, and southern facades also have a double envelope here.

Stone Facade:

Strong stone articulations help to give the building its historic character and articulate main entries vertically. Horizontal bands serve to balance the building's overall composition.

Green Space:

A main feature of the building's exterior is its abundant plant life. Irrigated through use of a grey water system, the vegetation helps provide occupants with a visual and physical connection to nature.



The northern facade of the building serves to preserve the urban edge that is presented along Tingey Street. Following the concept of regmentation set forth by the history of the U.S. Naval yards, this is the most structured facade of the building, and adheres strictly to the grid set by the column bays. The building begins disintegrating into a more playful form as it moves toward the waterfront park on the opposite facade. Stone defines the retail level on the street, and a single curtain wall system defines the urban edge of the rest of the building.

North Elevation

Scale: 1" = 20'-0"

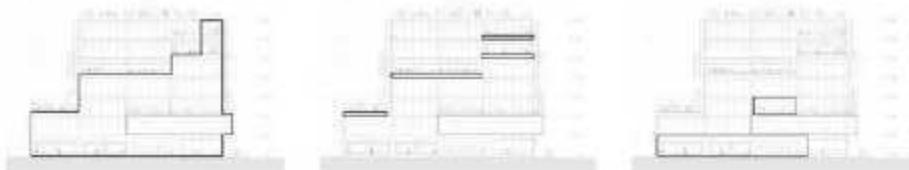
0 10 20 30 40

Tingey Place
Office Complex

The Yards | AW
200 Fourth Street
Washington, D.C.

(Design Team)
Thomas Chesnes
Melanie Paasikoski

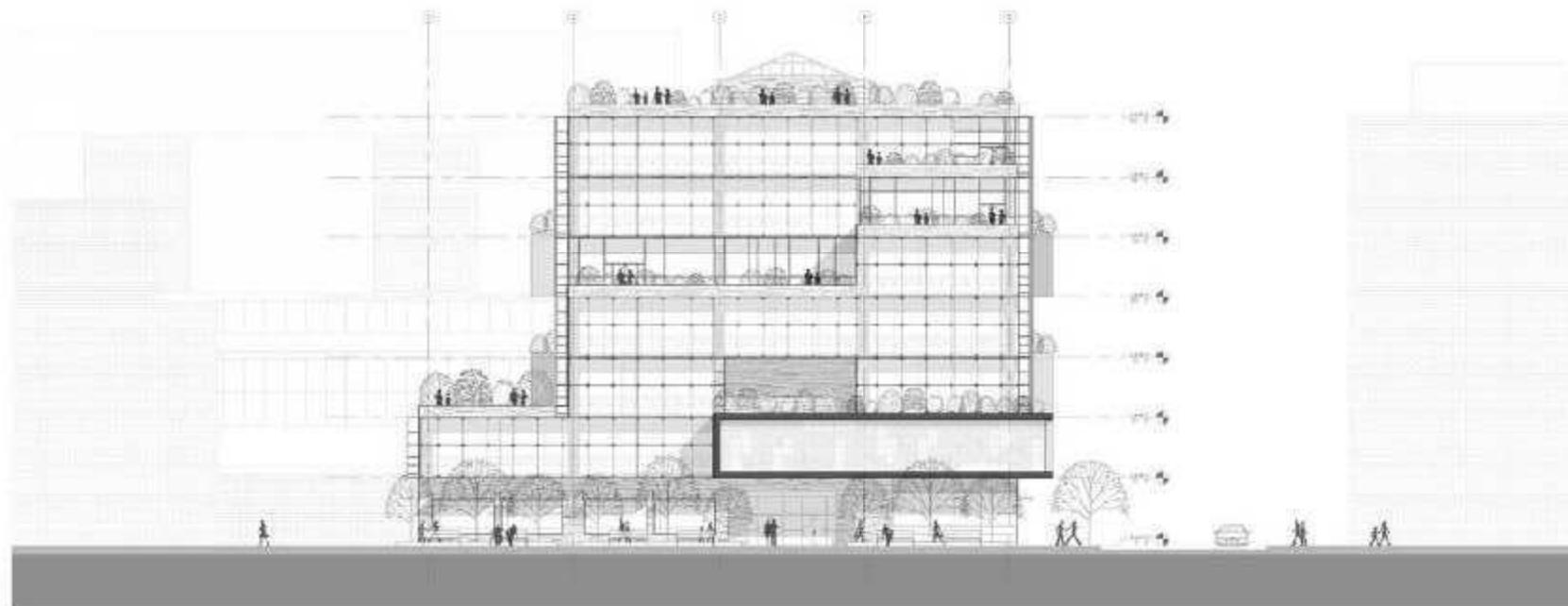
North Elevation
A.201

**Integration
Consultants:**Design Director:
Charles FrederickMEAC Systems:
Matthew Setzkorn(Structural System):
Jim Stadleman(Structural System):
Hollie H. Becker

Disintegration Into Park
The building's southern edge diminishes as it approaches Water Street, stepping down to meet the scale of the waterfront and Yards Park.

Occupiable Green Spaces
Several of the elevated vegetative zones are accessible and occupiable to either patrons, speculative tenants, or prime tenants depending on the floor.

Stone Facades
The stone facade provides a historic feel and helps to articulate both storefront and entry.



The southern facade is the most dynamic of the four facades. Acting upon the concept of disintegration into the adjacent park, the facade steps down from the top most level through a series of terraced green roofs to figuratively meet the adjoining park. Each terrace level on the Water Street elevation is accessible from the office and retail levels, creating a visual and social connection between the building, park, and activity along the main festival street. The main building entrance on the Water Street elevation is articulated through a solid vertical stone element, which cuts through the double facade, creating a strong presence.

South Elevation

Scale: 1" = 20'-0"

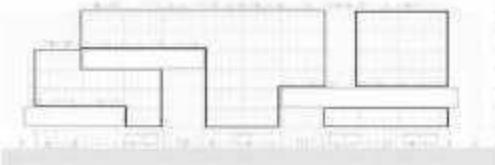
0 10 30 60

**Tingey Place
Office Complex**The Yards | AW
200 Fourth Street
Washington, D.C.Design Team:
Thomas Chesnes
Melanie PaasikosSouth Elevation
A.202



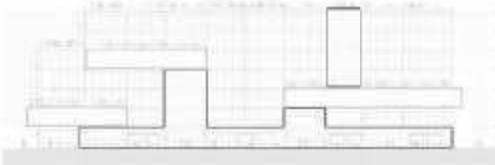
Vertical stone element - Cladding Options

Possible options considered for the stonework. In the vertical monolithic elements are shown above. The design selected was a random course travertine brick, depicted on the right.



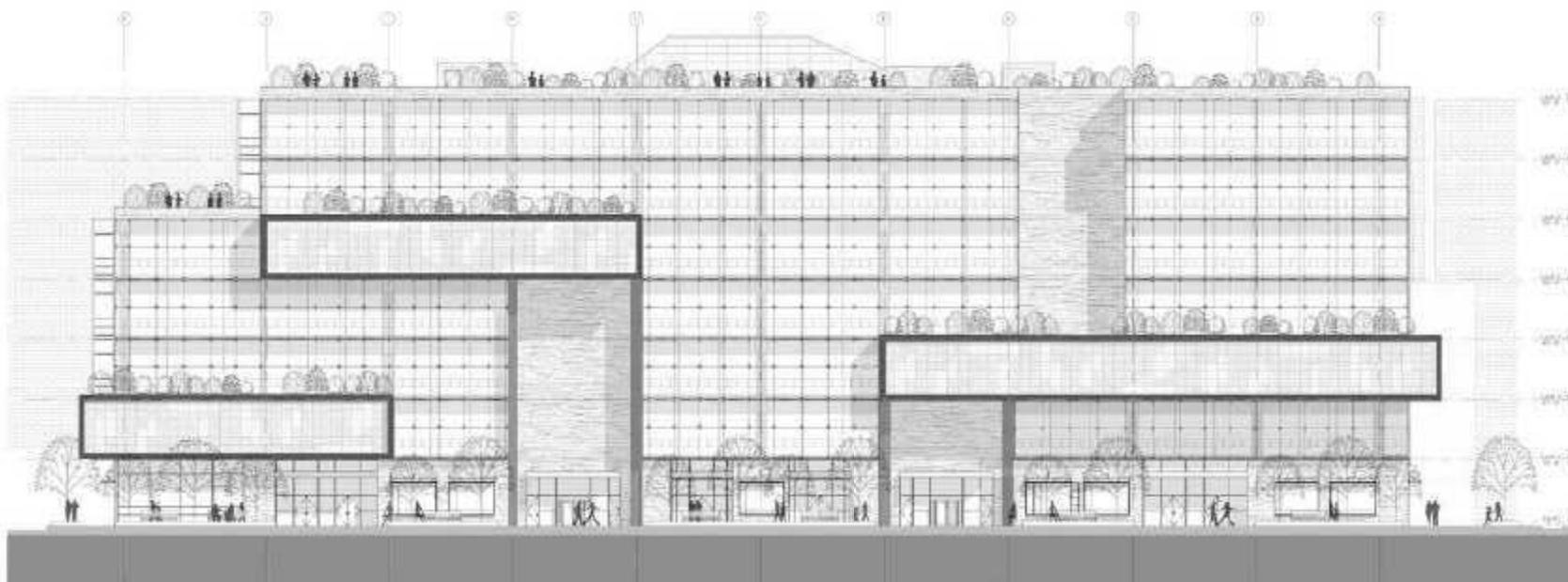
Double Skin Façade

Each elevation [north not included] has a distinct cavity depth in its double envelope. The southern facade is the deepest of the three, and the eastern and western facades have approximately 4 feet of internal space. This allows adequate room for maintenance and cleaning, climatic buffering, and shading/light shelves.



Stone Façade

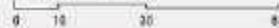
As on other elevations, these stone panels are clad in random course travertine brick. Their distinct material and size proportion grounds the building in its historic setting. They also serve to denote entries and balance the visual weight of the facade.



The eastern facade of the building is a composition of double facade, stone vertical elements, and projecting photovoltaic glass sections. The vertical stone elements serve to articulate the main building entrances and provide visual distinction from the building's double facade. The internal glazing is comprised of triple pane glass with a Low-E coating. Three instances of PV glass extend from the building and showcase this sustainable strategy in an aesthetic way. Vegetative roofs planted the tops of these protrusions provide a pleasing focal point from both the exterior and interior of the building.

East Elevation

Scale: 1" = 20'-0"

Integration
Consultants:Design Intern:
Charles FrederickMEAC Intern:

Matthew Setzkorn

Design Intern:

Jim Stadlerman

Structural Intern:

Hollie H. Becker

Tingey Place
Office Complex

The Yards | AW
200 Fourth Street
Washington, D.C.

Design Team:
Thomas Chesnes
Melanie Paasikos

**Integration
Consultants:**Design Director:
Charles Frederick

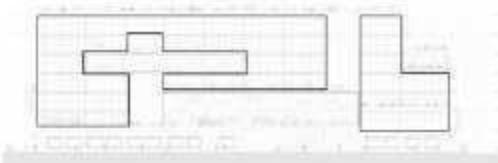
MEAC Systems:

Matthew Setzkorn

(Electrical System)

Jim Stadleman

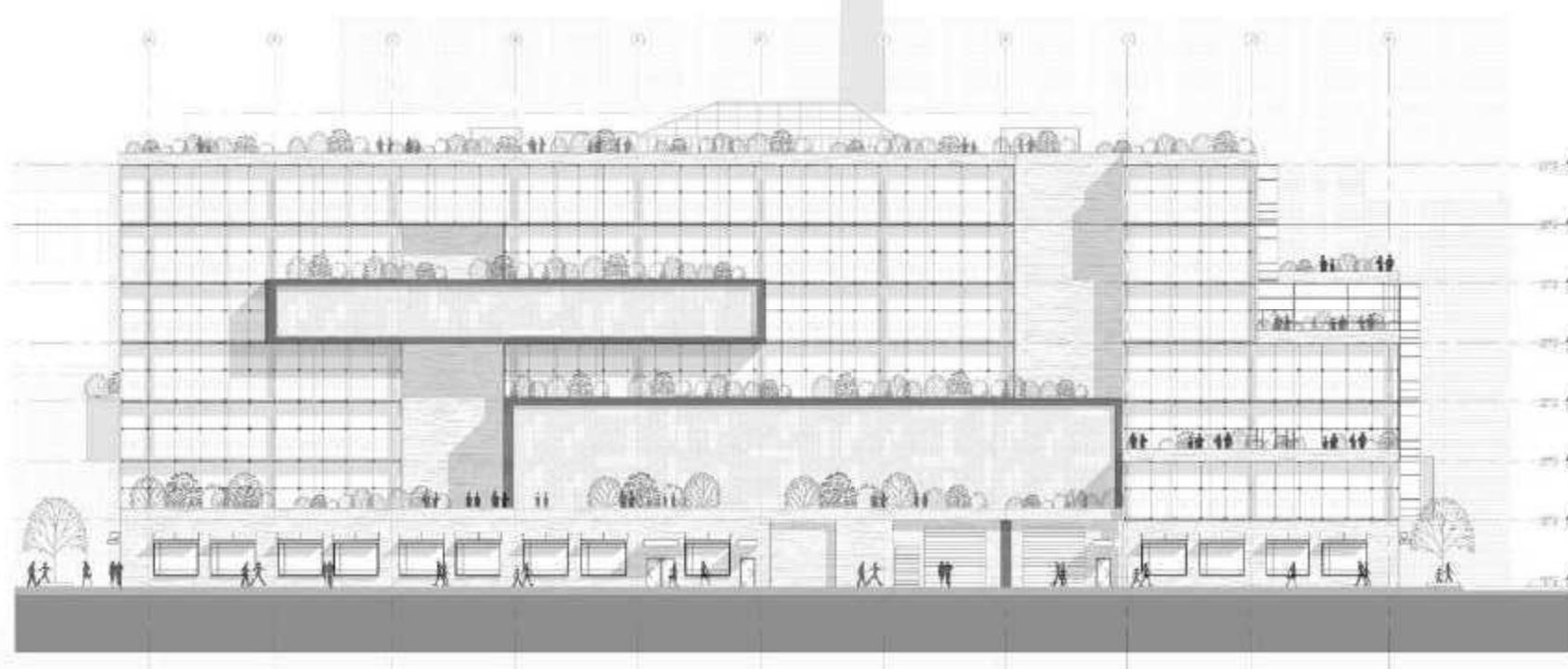
(Structural System)

Hollie H. Becker**Double Skin Facade:**

The double envelope makes up a large portion of the east and west facades and acts as a buffer zone to insulate the building in terms of both climate and sound. Light shelves housed in the interstitial space bounce visible light while diffusing harmful UV rays.

**Occupiable Public Green Space:**

This tract of vegetation/urban space was designed as an attached element to the double-height retail space. This allows public access during business hours, and creates a unique space for visitors to observe the river view or have lunch.



The western facade features an occupiable green space that is accessible to the public from the retail level on the second floor. This green space creates a strong connection between the activity on street level, the activity occurring on the terraced public space, and activity within the building itself. A double facade on the main portion of the building creates a thermal barrier which helps to reduce extremes in heating and cooling loads within the building. The double facade also aids in natural ventilation strategies, as well as provides an interesting aesthetic in contrast to the strong vertical solid elements used to structure the surface.

West Elevation

Scale: 1" = 20'-0"

0 10 20 30 40 50 60

**Tingey Place
Office Complex**The Yards | AWI
200 Fourth Street
Washington, D.C.Design Team:
Thomas Chesnes
Melanie PaasikosWest Elevation
A.204



Level 7:	Prime Office Suite
Level 6:	Prime Office Suite
Level 5:	Prime Office Suite
Level 4:	Prime Office Suite
Level 3:	Speculative Suites
Level 2:	Speculative/Retail
Level 1:	Mixed-Use Retail



- All vertical shafts are 2 hr fire rated
- Mail, Mech/Elec rooms and Trash Storage are 1 hr fire rated
- Floor construction and supporting beams and joists are 2 hr fire rated
- Roof construction and supported beams and joists are 2 hr fire rated
- Structural frame is 2 hr fire rated

Longitudinal Section

Scale: 1" = 20'-0"

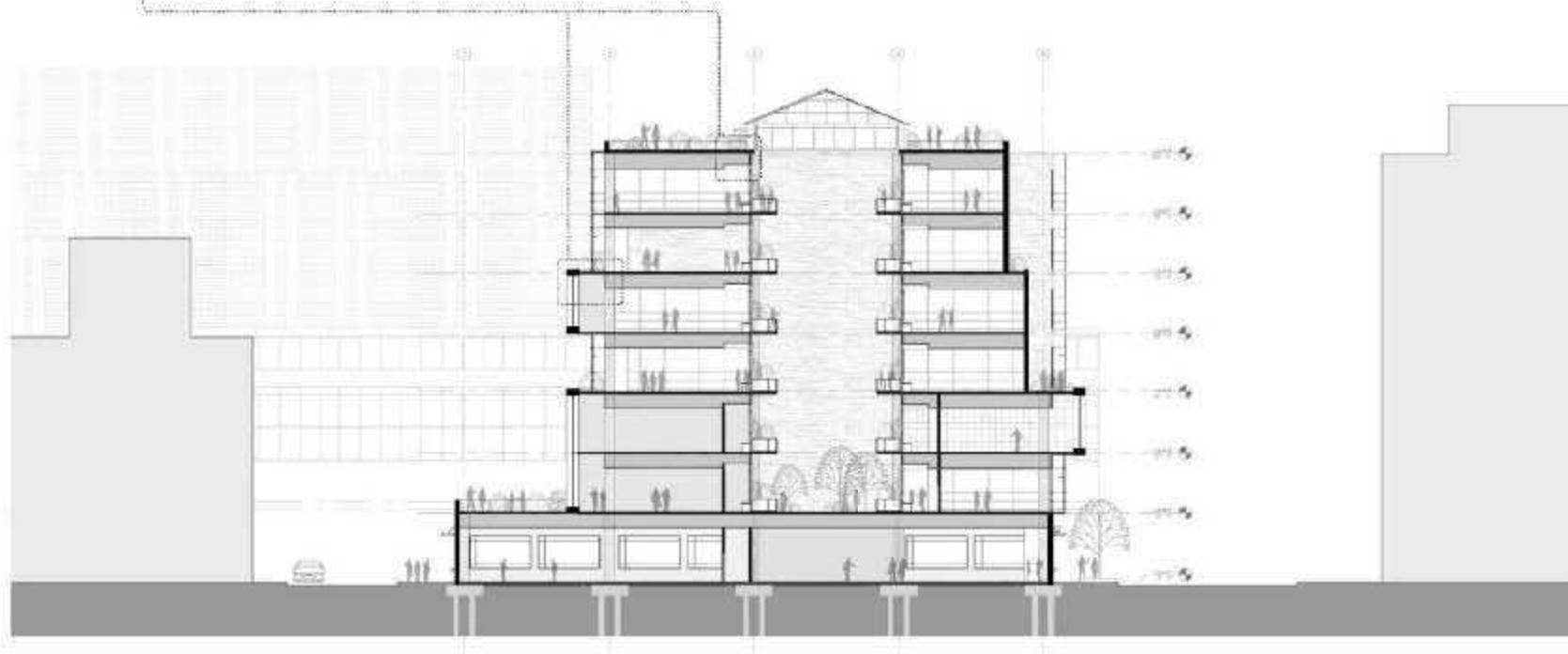
0 10 20 30 40

Tingey Place
Office ComplexThe Yards | AW
200 Fourth Street
Washington, D.C.Design Team:
Thomas Chesnes
Melanie PaasikosSection AA
A.301



Level 7:	Prime Office Suite
Level 6:	Prime Office Suite
Level 5:	Prime Office Suite
Level 4:	Prime Office Suite
Level 3:	Speculative Suites
Level 2:	Speculative/Retail
Level 1:	Mixed-Use Retail

The interstitial plenum height shrinks to increase head height near PV glass pop outs and at the lobby entries. This helps to demonstrate the significance of these areas both sustainably and architecturally.



- All exterior walls are 2 hr fire rated
- Main Mechanical rooms and Trash Storages are 1 hr fire rated
- Floor construction and supporting beams and joists are 2 hr fire rated
- Roof construction and supporting beams and joists are 2 hr fire rated
- Structural frame is 2 hr fire rated

Transverse Section

Scale: 1" = 20'-0"



Tingey Place Office Complex

The Yards | AW
200 Fourth Street
Washington, D.C.

Design Team:
Thomas Chesnes
Melanie Paasikoski



Integration Consultants:

Design Manager:
Charles Frederick

Mechanical System:
Matthew Setzkorn

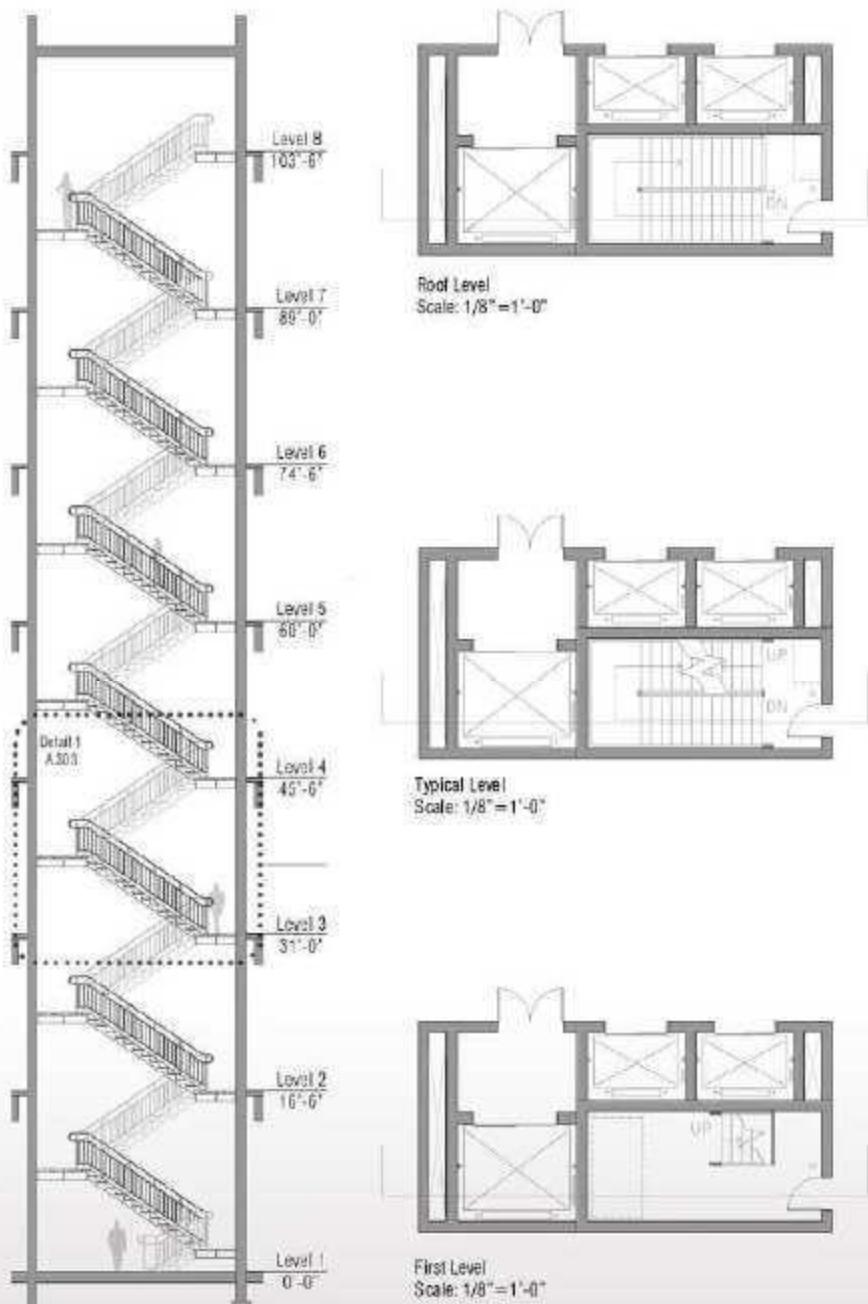
Electrical System:
Jim Stadleman
Structural System:
Hollie H. Becker

Tingey Place Office Complex

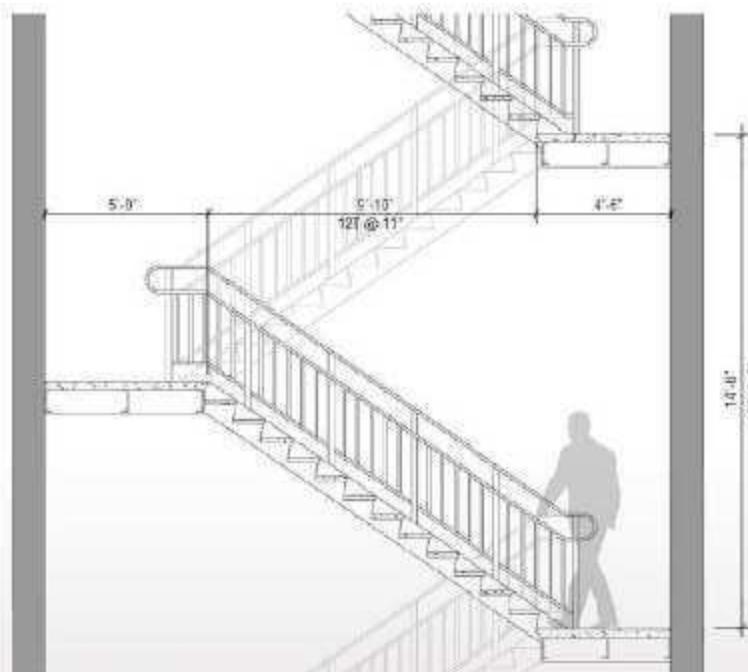
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200 Fourth Street
Washington, D.C.

Design Team:
Thomas Chesnes
Melanie Paasikoski

**Stair Detail
A.303**



Stair Detail 2
Scale: 1"-0"



Stair Detail 1
Scale: 1/8" = 1'-0"

Stair Sections and Details:

Each core hosts a stair tower, used primarily as a means of egress and vertical transport supplemental to the elevators. Each stair tower has a standpipe for the fire department to connect hoses in the event of a building fire. Areas of refuge for disabled persons are located at each landing. Because the building has a higher floor to floor height on the ground level, a short run of additional stairs exists on this level (as depicted in the overall stair section).

Relevant Code:

OBC 1007.3: Exit stairway shall have a clear width of 48 in
OBC 1007.6: Area of refuge shall be at minimum 301x493 in
NEC 1008.2: Minimum head-room clearance of 80 inches
OBC 1009.3: Riser height max 7 in, Tread depth min. 11 in

Integration
Consultants:

Design Director:

Charles Frederick

HVAC System:

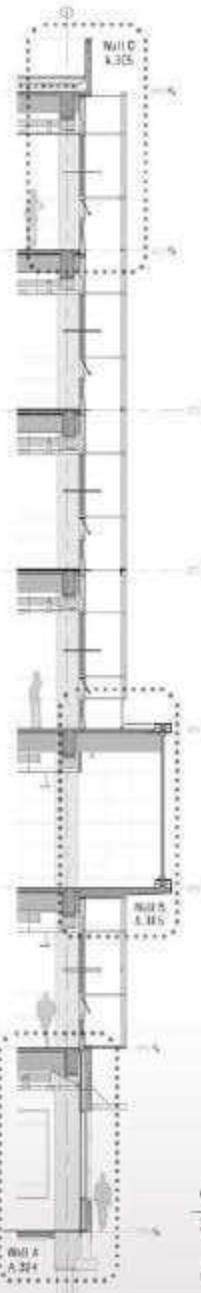
Matthew Setzkorn

(Electrical System:

Jim Stadleman

(Structural System:

Hollie H. Becker

Tingey Place
Office ComplexThe Yards | AW
200 Fourth Street
Washington, D.C.Design Team:
Thomas Chesnes
Melanie Paasikos

Wall Mechanics:

The following three wall sections depict typical wall constructions found in the building. Slight variations exist with regard to double envelope cavity thickness, percent glazing, etc. There are also solid brick areas which follow the construction of Wall Section A.

Vacuum-Glazing Panels:

Heat is conducted by three modes, conduction, convection, and radiation. A vacuum prevents conduction and convection, and a reflective coating serves to reflect radiated heat. The Georgia VIG (vacuum-insulated glass) works the same way, with a vacuum between two panes of glass, and a low-E coating to prevent radiant heat from escaping. This type of glazing can also be produced with a layer of thin-film photovoltaic cells, which is the type of glazing found in Wall Section B.

Sources: New Generation of Architectural Glazing by Skinner, www.enr.com/glass/glazing.htm

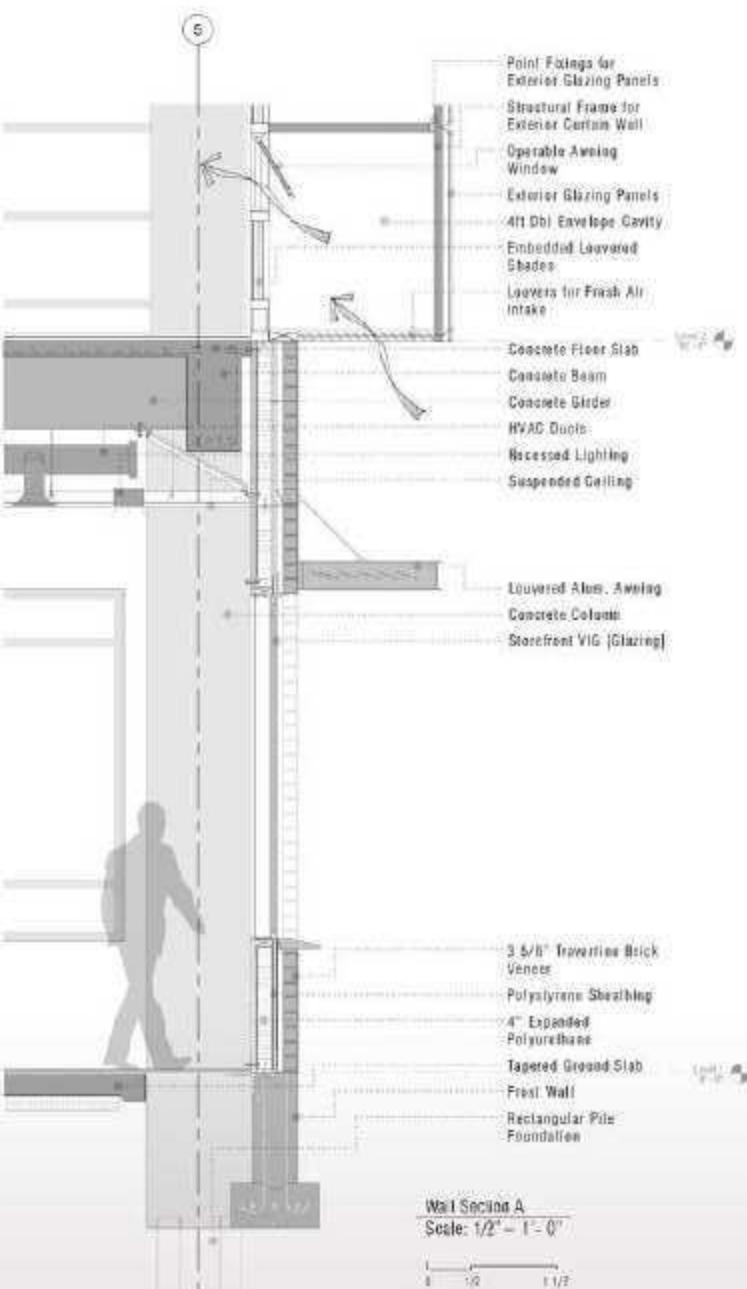
- Structural frame is 2hr fire rated for all wall sections
- Floor Construction is 2 hr fire rated for all wall sections
- Roof Construction is 2 hr fire rated for all wall sections

R Values for Wall Composition A:

Outside Air Film:	0.17
Common Brick Veneer:	0.80
2 Inch Air Space:	1.00
1 Inch Ext. Polyisobutylene Sheathing:	5.00
Vapor Permeable Felt:	0.06
4 Inch Expanded Polyurethane:	25.0
Vapor Permeable Building Felt:	0.06
Fiberboard Sheathing:	2.28
Inside Air Film:	0.60

Total R Value: 35.05
(VIG panels with a low-e coating are R-13)

Sources: Architectural Graphic Standards by Rilem, www.enr.com/glass/glazing.htm





Integration Consultants:

Design Director:
Charles Frederick

HVAC System:
Matthew Setzkorn

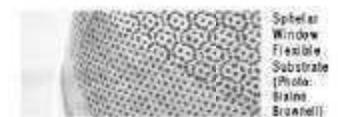
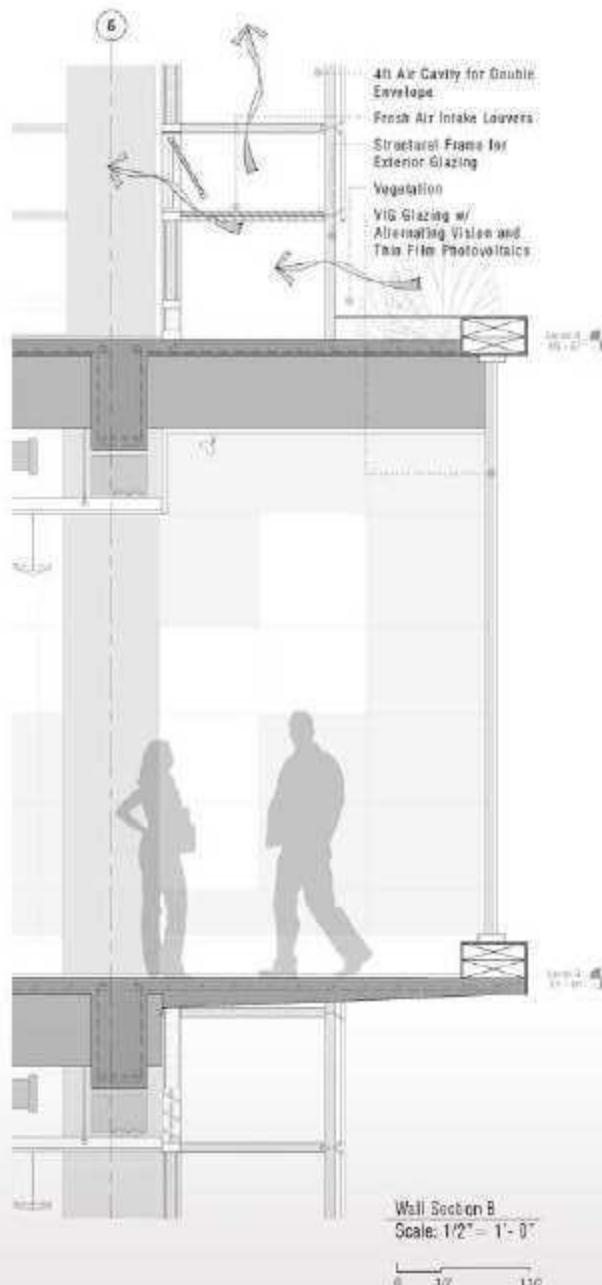
Structural System:
Jim Stadelman

Structural System:
Hollie H. Becker

Tingey Place Office Complex

The Yards | AW
200 Fourth Street
Washington, D.C.

Design Team:
Thomas Chesnes
Melanie Paasikoski



Building Integrated Photovoltaics:

Unlike conventional photovoltaics, Sphelar® is a family of tiny, spherical solar cells, designed to absorb sunlight passively at any angle. Spherical cells even optimize the use of reflected and indirect light, and have been shown to convert energy with close to 20% efficiency – beyond most flat photovoltaic technologies. For this reason, Spherical cells were selected for integration with the Guardian VIG glazing in Wall Section B.

Sources: www.guardianig.com; www.lysim.com

R Values for Wall Composition B:

Outside Air Film:	0.17
Vacuum Glazing:	18.0
w/ thin-film photovoltaic cells:	
Inside Air Film:	0.68

Total R Value: 18.85

[VIG is integrated with a glazing unit and a third layer of glass, adding R-5 to the overall insulating value]

Sources: Architectural Graphic Standards; www.com

R Values for Wall Composition C:

Vision:

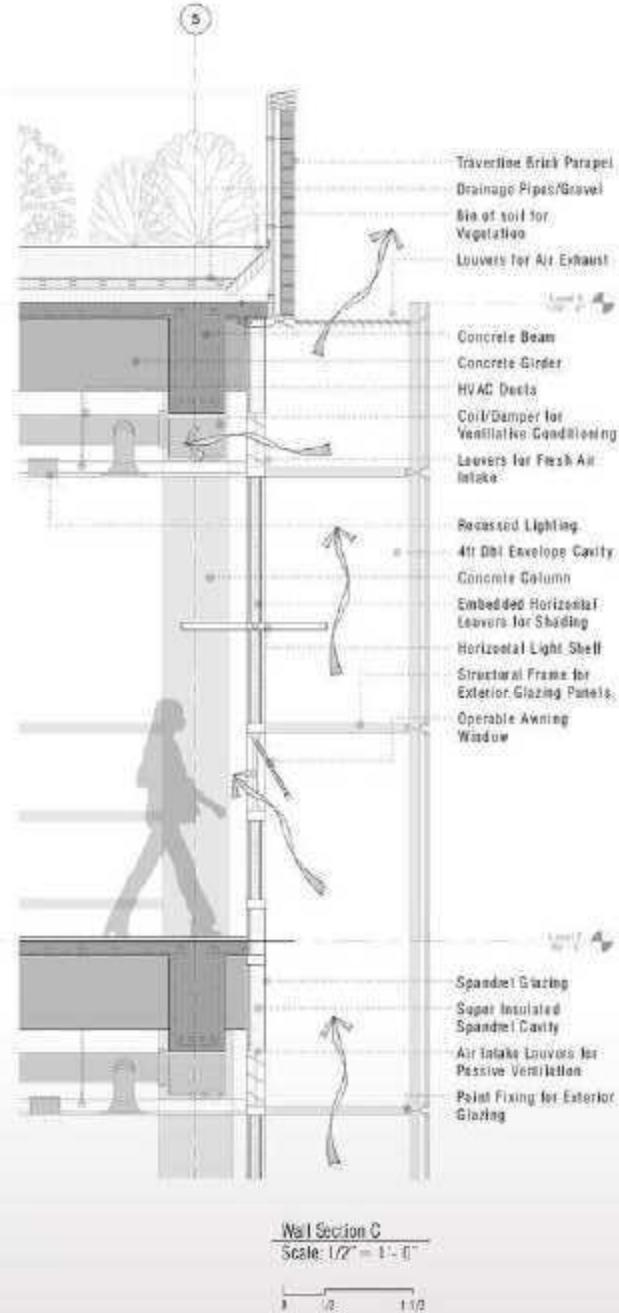
Outside Air Film:	0.17
1/4 inch Solar Control Glass:	2.70
4ft Air Space:	12.0
Vacuum Insulated Glazing:	13.0
Inside Air Film:	0.68
Total R Value:	28.55

Spandrel:

Outside Air Film:	0.17
1/4 Inch Solar Control Glass:	2.70
4ft Air Space:	12.0
Vacuum Insulated Glazing:	13.0
4 inch Expanded Polyurethane:	25.0
Vapor Permeable Building Film:	0.06
Fiberboard Sheathing:	2.28
Inside Air Film:	0.68
Total R Value:	55.89
Ave. Total R Value:	42.22

[VIG with a low-e coating provides an R-13]

Sources: Architectural Graphic Standards;
www.windowsource-nl.com



**Integration
Consultants:**Design Director:
Charles FrederickMEP System:
Matthew SetzkornStructural System:
Jim StadlemanBuilding System:
Hollie H. Becker**Tingey Place
Office Complex**The Yards | AWI
200 Fourth Street
Washington, D.C.Design Team:
Thomas Chesnes
Melanie Paasikoski**Double Envelope Facade Overview:**

The double-skin curtain wall first appeared in the Steiff Factory in Giengen, Germany in 1903. Over the last 100+ years, the double envelope facade has been refined and progressed to a degree of almost unparalleled environmental advantage. At its most basic definition, a double facade is a pair of glass skins separated by an air corridor. The main layer of glass serves as a part of a conventional structural wall or curtain wall and is usually insulating, while the additional layer is typically single glazing. The air space between works insulate against temperature extremes and sound transmission. Variations in materiality, cavity spacing, glass composition, and cardinal position have implications with regards to the facade's overall success.

Typical Advantages of a Double Envelope:

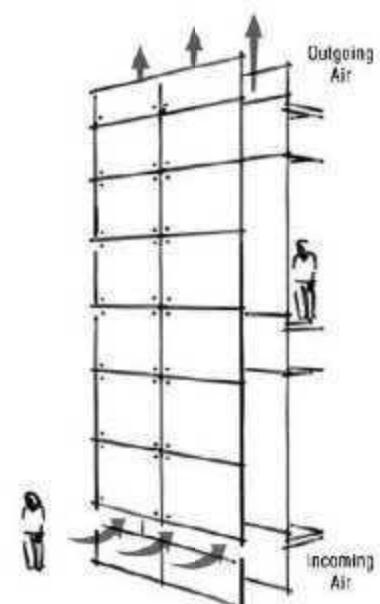
- Interior facade windows can be opened, which enables natural ventilation and night cooling
- Cavity forms a thermal buffer zone to reduce heat loss in the winter
- Improves sound insulation by 5 to 30 decibels
- Protected place to mount shading and daylight-enhancing devices
- Shelter from wind, rain, and snow

Double Envelope Type: Shaft Facade:

In a building-high double-skin facade, the cavity is not separated at each story, instead it extends over the whole height of the building. The basic idea of a building-high cavity is that air that accumulates at the top of the air space between the two layers is likely to get hot on sunny days. Openings in the outer skin and at the roof edge siphon out the warm air, while cooler replacement air is drawn from near the base of the building. This double envelope type, however, is not without its problems [difficult natural ventilation and noise pollution between levels]. This differs from a story-high double facade which has air channels separated horizontally at each intermediate floor and increased natural ventilation. This project utilizes a shaft facade, which is a combination of a building-high cavity and a story-high cavity and has the benefits of both. The full-height cavity forms a central vertical shaft for exhaust air, and story-high cavities on the sides of the shaft draw in exhaust air to this shaft.

Advantage of the Shaft Facade:

- Outer skin protects inner envelope
- Sun blinds are protected from elements [cheaper] and limit incoming solar radiation
- Improved sound insulation [especially since inlets are placed at spandrel]
- Improved security
- Natural window ventilation is possible
- Buoyancy in the shaft ensures natural ventilation even with little airflow outside

**Double Envelope Facade Diagram:**

The above diagram depicts a simplified version of the facade conditions. Air comes into the facade through the lower inlet and is exhausted from louvers at the roof level.



Point Fixing Example



Tempered Safety Glass



Frame Structure



Integrated Sealed-in Blinds

The Air Cavity:**Cavity Thicknesses:**

North Facade: N/A [no double-envelope]

South Facade: 6ft

West Facade: 4ft

East Facade: 4ft

Minimum cavity thickness is dependent on proper width for cavity maintenance and cleaning. All cavities are equipped with a service platform.

Cavity Description:

The air cavity is closed at the top and bottom with operable louvers. These louvers are closed in the winter to form a thermal buffer, and open during the summer months to cool down by way of the stack effect. Light shelves are mounted within the cavity.

Support Structures:**Secondary Structure:**

A frame structure supports the load of the double-envelope facade. The horizontal profiles of the frame are bolted to the inner envelope, and the frame itself handles the wind load, dead load of the glass, and service live load. The glass is supported from four sides, so its deflection is insignificant. This type of frame has an advantage over a bracket frame due to its smaller bending moment.

This structure is made of stainless steel, which makes up for its higher initial construction costs with a long life period and low maintenance costs.

Tertiary Structure:

Point fixings with drilled holes carry the glass panes that make up the exterior curtain wall. Intermediate pads prevent contact between metal and glass panels.

Glazing Materials:**Interior Facade:**

The inner facade is composed of vacuum insulated glazing panels with super insulated spandrel sections. Venetian blinds are embedded within the inner glazing.

Exterior Facade:

Tempered safety glass is used on the exterior to resist heat flow and fire. [Study of Current Structures in Double Skin Facades by Sim Utlu](#)

**Life Safety Plan:**

Typical Speculative Floor Plan
Not to Scale.

**Life Safety Plan Legend:**

- 2A10BC Rated Fire Extinguisher
- Exit Sign with Accompanying bin, Directional Arrows and Emergency Lights
- Fire Stair with Area of Refuge

Life Safety Plan:

All egress distances to a common path of travel and decision point are maintained at less than 100' ft from the extents of the space as per the Ohio Building Code.

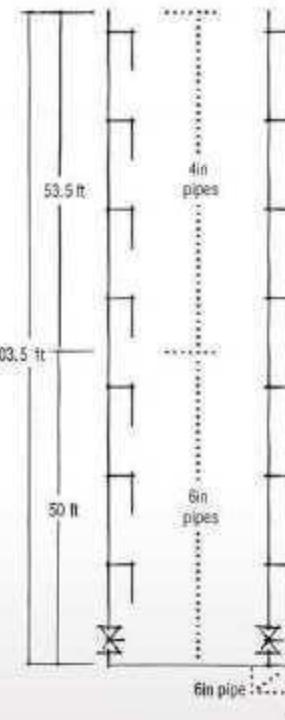
Standpipe locations are designed, as per OBC, to have full coverage, with less than a 150' radius of coverage from each standpipe.

2A10BC rated fire extinguishers are placed with a travel distance of less than 75' ft to assist in the extinguishing of smaller building fires.

Pressurized stair towers and a smoke ventilation system for the atrium, as well as areas of refuge in the stair towers, and an automatic sprinkler system, all help to make the building safer for the occupants within it.

Fire Stair Separation Distance:

According to the Ohio Building Code section 1015.2.1, stairs must be a minimum of 1/3 the distance of the diagonal apart. Fire stairs in the building are well over this minimum.

**Standpipe Diagram and System Sizing:**

Standpipes in each fire stair assist the fire department in the event of an emergency. These pipes connect to firemen's hoses and supply water with which to combat fires. All pipes for the fire suppression system are 6 inches in size up to a height of 50 feet. Pipes above 50 feet are 4 inch in diameter.

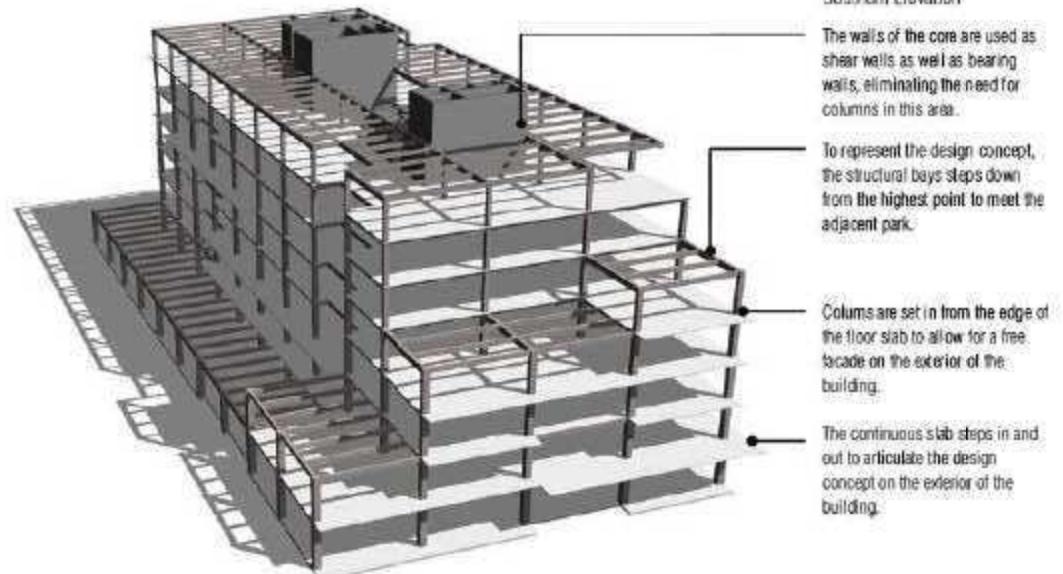
Integration Consultants:

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MEPAC Systems
Matthew Setzkorn
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Jim Stadleman
(Structural System)
Hollie H. Becker

**Tingey Place
Office Complex**

The Yards | AWI
200 Fourth Street
Washington, D.C.

Design Team:
Thomas Chesnes
Melanie Paasikoski



Structural Model

Southern Elevation

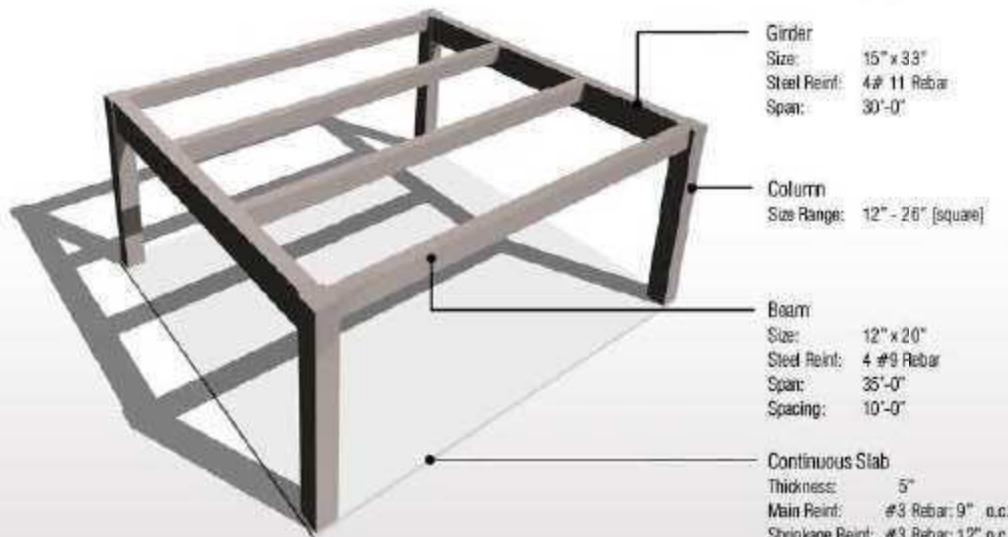
The walls of the core are used as shear walls as well as bearing walls, eliminating the need for columns in this area.

To represent the design concept, the structural bays steps down from the highest point to meet the adjacent park.

Columns are set in from the edge of the floor slab to allow for a free facade on the exterior of the building.

The continuous slab steps in and out to articulate the design concept on the exterior of the building.

Typical Bay Layout



Structural Concept and Overview

Concept Integration:

The structural design of the project largely facilitates the execution of the design intent. The rhythmic repetition of the structural grid speaks to the rigidity of the historic naval yards. Conversely, the playful pushing and pulling of the form within select bays provides a notion of flexibility and compromise, as the grid makes concessions to accommodate the more expressive elements of the form. The inspiration for this approach comes from the Historic Naval District changing and adapting to align itself with the new growing Waterfront area. On the southern facade, the structural bays disintegrate, diminishing the scale of the building on the southern front and providing a visual connection to the adjacent park.

To further integrate the structural rhythm with the architectural aesthetic, window bays, spandrel, and mullion placement is based on the structural bay. Columns are inset from the facade to allow more subtlety to this correlation.

Structural Overview:

The project utilizes a regular, orthogonal structural grid with 30 foot by 35 foot structural bays. 12in by 20in beams are spaced 10 feet on center and span 35 feet. The pushing and pulling of these bays is in 5 foot increments, which means little change to the structure. The floor plates are composed of 5 inch one way continuous slabs which double as the webs for the T-Beams holding up each floor. Columns are tapered to save size and materials, and range from 26in on the ground floor to 12in on the 7th floor. The core walls are solid bearing walls, and act as shear walls to resist lateral and seismic forces. Because these walls are bearing, there is no need for columns within the core. The entire structure is supported by deep rectangular piles, which are well suited for the high water table on-site. Integrated in these piles are fluid-filled pipes used to assist in the sustainable heating and cooling of the building by way of a ground source or geothermal heat pump system.

Code Requirements:

- 1604.8.2 Concrete and Masonry walls shall be anchored to floors, roofs, and other structural elements
- 1605.1-3 Load Combinations (consulted)
- 1606.1-2 Dead loads shall be considered permanent loads and are calculated based on materials.
- 1607.1 Uniformly Distributed Live Loads: 100psf [highest of all load conditions]
- 1607.9.1 LL Reduction Factor = $0.08(0.25 + 12/L)^{1/3}$ tribArea $^{1/3}$ [must be at least half LL]
- 1610.1 Basement, foundation, and retaining walls shall be designed to resist lateral soil loads.
- 1611.1 Each portion of a roof shall be designed to sustain the load of rain water that will accumulate on it if the primary drainage system for that portion is blocked.
- 1612.1 For buildings in flood hazard areas shall be designed and constructed to resist the effects of flood hazards and flood loads.
- 1613.1 Every structure shall be designed and constructed to resist earthquake motions (ASCE 7).

Integration Consultants:

Design Architect:
Charles Frederick
MEAC System:
Matthew Setzkorn
Electrical System:
Jim Stadleman
Structural System:
Hollie H. Becker

Tingey Place Office Complex

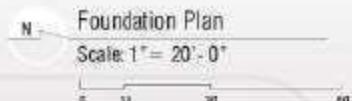
The Yards | AW
200 Fourth Street
Washington, D.C.

Design Team:
Thomas Chesnes
Melanie Paasikoski



Foundation Plan

Scale: 1" = 20'-0"



**Tingey Place
Office Complex**

The Yards | AW
200 Fourth Street
Washington, D.C.

Design Team:
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Melanie Paasikoski

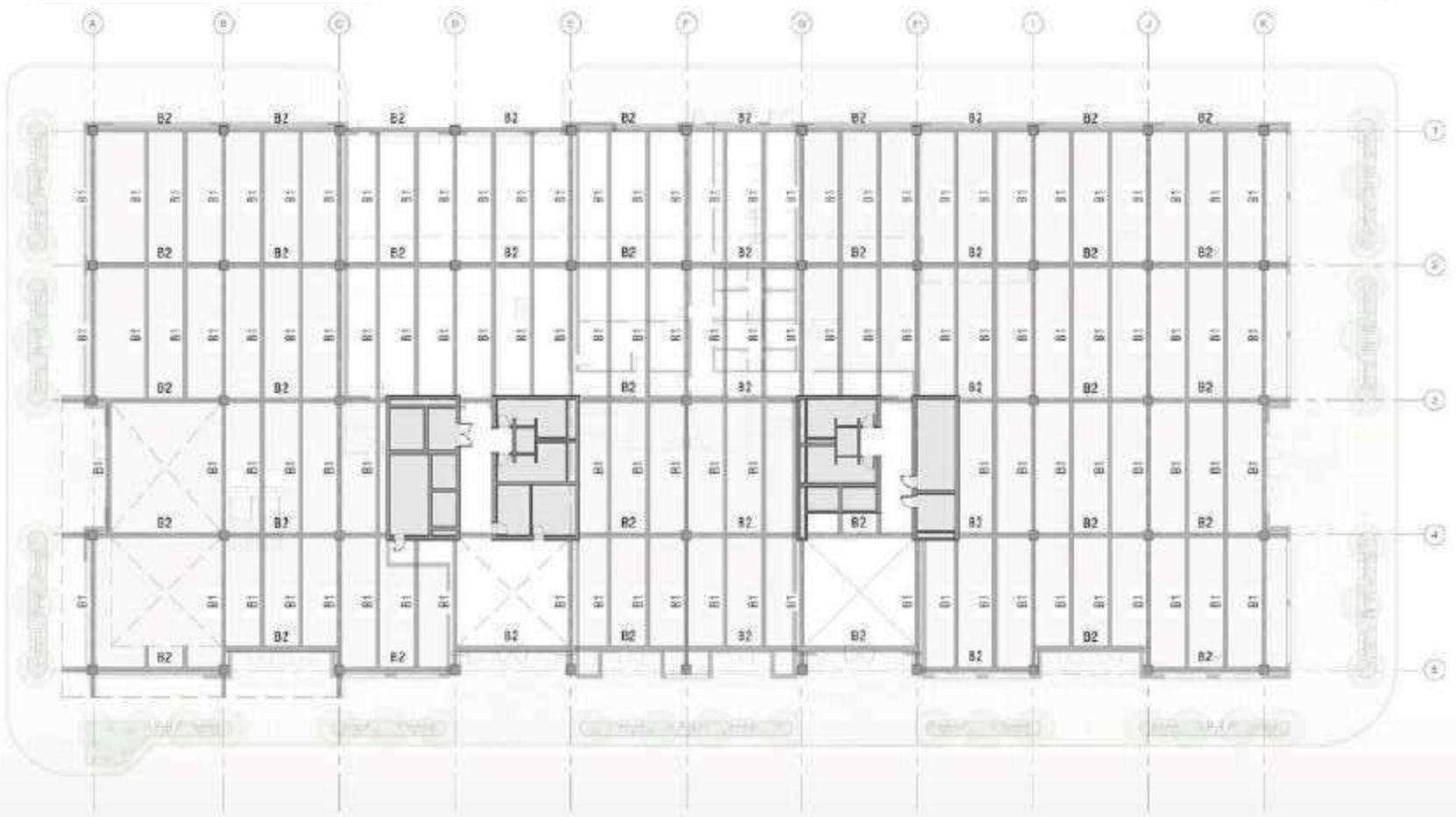
Foundation Plan
S.101



Integration Consultants:
Design Integration: Charles Frederick
(HVAC Systems)
Matthew Setzkorn
(Structural Systems)
Jim Stadlerman
(Drainage Systems)
Holley H. Becker

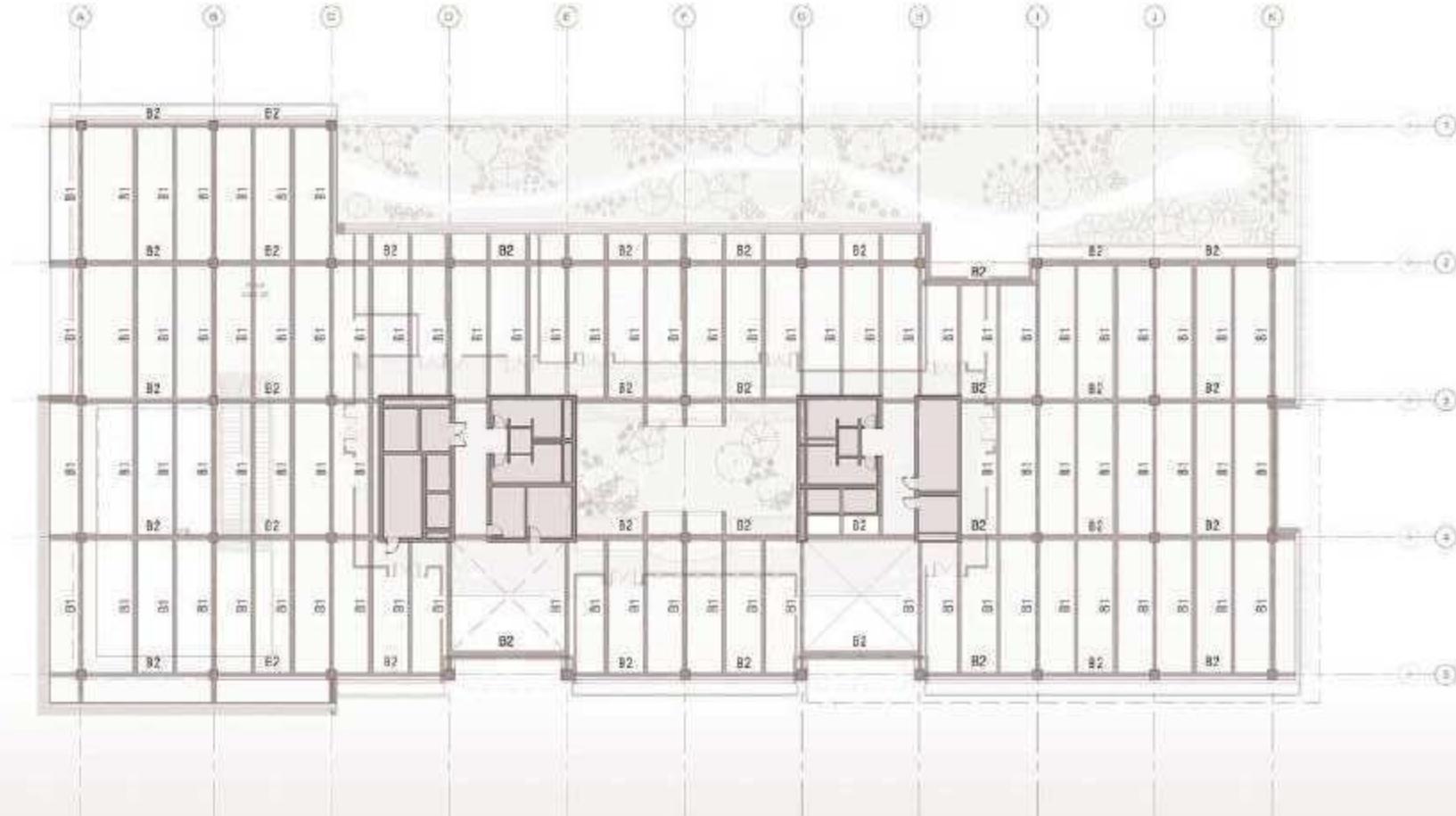
Tingey Place
Office Complex
The Yards (AWI)
200 Fourth Street
Washington, D.C.

Design Team:
Thomas Chesnes
Melanie Panoutsos



Level 1 Framing Plan
Scale: 1" = 20'-0"

Beam 1: 12" x 20", 4 #9 rebars, #3 stirrups
Beam 2: 15" x 33", 4 #11 rebars, #3 stirrups

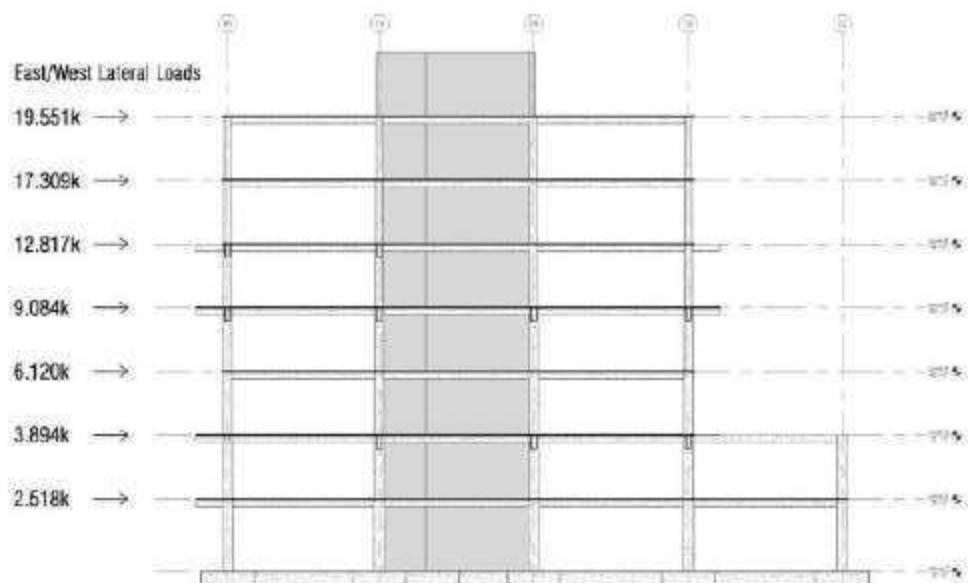
Integration
Consultants:

Design Architects
 Charles Frederick
 HVAC Systems
 Matthew Setzkorn
 Electrical Systems
 Jim Stadlerman
 Structural Systems
 Hollie H. Becker

Tingey Place
Office Complex

The Yards | AWI
 200 Fourth Street
 Washington, D.C.

Design Team
 Thomas Chenes
 Melanie Paalsetos

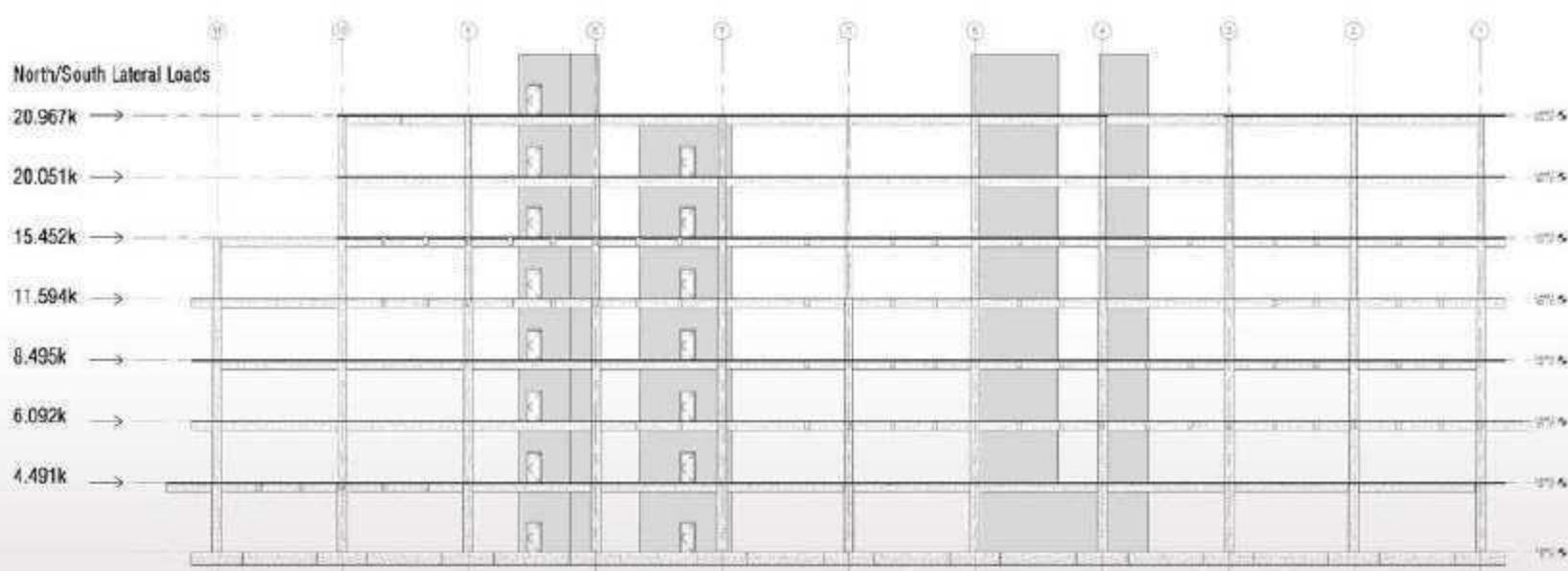


Framing Elevations Lateral Loads: Wind and Seismic

The building is constructed using a regular orthogonal grid of 30' by 35' bays. Shear walls, shown in grey, resist lateral forces generated by wind and seismic loads. Shear walls are embedded within the core of the building and are used as bearing walls which enclose core elements and join to the rest of the structure.

Total Lateral Forces:

E/S			W/E			
Level	Wind Loads Seismic	Total Lateral	Level	Wind Loads Seismic	Total Lateral	
Roof	2.784	16.182	Roof	20.945	15.182	19.551 kip/ea/wall
7	5.090	14.661	7	2.548133	14.561	17.309 kip/ea/wall
6	5.180	10.273	6	2.541169	10.213	12.817 kip/ea/wall
5	4.031	6.163	5	2.401891	6.163	9.084 kip/ea/wall
4	4.663	3.632	4	2.288254	3.632	6.120 kip/ea/wall
3	4.213	1.773	3	2.115171	1.773	3.894 kip/ea/wall
2	3.869	0.621	2	1.865363	0.621	2.518 kip/ea/wall



Integration Consultants:

Design Manager:
Charles Frederick

MEP System:
Matthew Setzkorn

Structural System:
Jim Stadleman
Structural System:
Hollie H. Becker

Tingey Place Office Complex

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Washington, D.C.

Design Team:
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Melanie Paasikoski

Integration
Consultants:

Design Manager:

Charles Frederick

MEAC Structural

Matthew Setzkorn

(Design Lead)

Jim Stadleman

(Structural Support)

Hollie H. Becker

Tingey Place
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200 Fourth Street
Washington, D.C.Design Team:
Thomas Chesnes
Melanie Paasikos

Structural Design Calculations:

The design of the building's structural components was done in accordance with the Ohio Building Code (OBC) and the American Concrete Institute (ACI). All major aspects of the structural design were discussed with the structural consultant during the schematic design phase to ensure that a well developed and suitable structure would be produced at the final stages of the design. For each structural component, a typical element was designed and checked along the way by the structural consultant.

Deep Pile Foundation Design:

The building's concrete structure is supported by rectangular precast concrete piles. Deep pile foundation is a suitable selection for poor or unstable soil conditions and high water tables. These foundations penetrate through upper layers of incompetent soil and transfer loads to bearing soil or rock deeper within the earth.

Square, concrete piles with prestressing, are driven into the earth rather than drilled or pouted, usually in clusters of 2 to 25. These are then joined at the top by a reinforced concrete pile cap which evenly distributes the load of the column among the piles.

The use of precast piles boasts high load capacities, a lack of corrosion or decay, and a relative economy of cost over other types of piles.

Simplified Pile Design:

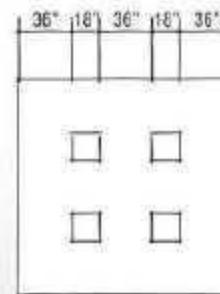
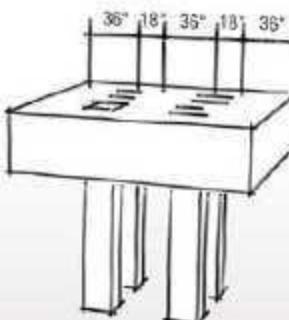
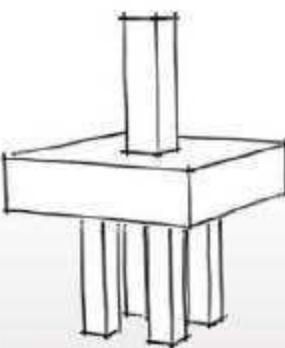
Pile design was based off of a simplified Microsoft Excel sheet prepared by the structural consultant.

P _u :	1739.6 kips.	[total load on grade beam]
# of Piles:	33 in.	[estimated number of piles]
P:	434.91 kips.	[load per piles]
L:	0 kips.	[load based length]
M _x :	0 k-ft.	[moment about x]
M _y :	0 k-ft.	[moment about y]

Pile width [in]	10	12	14	16	18	20	22	24
fpc [ksi]	0.772	0.723	0.817	0.829	0.75	0.809	0.765	0.803
t [in]	2.887	3.464	4.042	4.619	5.2	5.774	6.351	6.929
A [in ²]	100	144	196	256	324	400	484	576
I [in ⁴]	833	1728	3201	5461	8748	13333	19521	27648
P _a [k]	5144.16	7409.49	10080.15	13165.10	16668.99	20572.63	24898.63	29625.52
kL/r	0	0	0	0	0	0	0	0
M [k-ft]	0	0	0	0	0	0	0	0
M _a [k-ft]	47250.21	61666.93	129713.53	193641.40	275652.12	378192.83	503300.56	653519.72
P/P _a + M/M _a	0.08	0.06	0.04	0.03	0.03	0.02	0.02	0.01
fpc + P/A ± M/s	5.12	3.74	3.04	2.53	2.09	1.90	1.66	1.56
	5.12	3.74	3.04	2.53	2.09	1.90	1.66	1.56
	0	0	0	0	0	0	0	0
	1	1	1	1	0	0	0	0
	0	0	0	0	0	0	0	0
	1	1	1	1	0	0	0	0
Acceptable?	no good	no good	no good	no good	okay	okay	okay	okay

Pile Cap:

Each pile cap joins 4 piles, each 18 inch square. There is 36 inch spacing (twice the dimension of the pile) which surrounds each pile on all four sides. This creates a 12 foot by 12 foot pile cap which will hold a column in its center.



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(Structural System)
Hollie H. Becker

Tingey Place
Office Complex

The Yards | AW
200 Fourth Street
Washington, D.C.

Design Team:
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Melanie Paasikoski

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Slab Design:

The slab is designed as a continuous, 1 way concrete slab which is later utilized as the flange for the T-Beams.

Dead Load:	0.073 ksf	[slab weight + factor of safety]
Live Load:	0.1 ksf	[based on Ohio Bdg Code]
f'c:	4 ksi	[compressive strength]
f'y:	60 ksi	[yield stress]
b:	12 in.	[based on 12 in. span]
h:	5 in.	[assumed value]
L:	12 ft.	[distance between beams]
W:	0.287 kft	[total factored load]
c:	3.88 in.	[less bar diameter and cover]

Location	Moment	M _a	k	p	A _s	*A ₉ *
pos end	wL ² /14	21.17	0.1302	0.0022	0.103	0.108
pos int	wL ² /16	18.53	0.1139	0.0019	0.089	0.108
neg intend	wL ² /10	28.64	0.1823	0.0031	0.145	0.108
neg int	wL ² /11	26.95	0.1657	0.0028	0.132	0.108
neg end	wL ² /24	12.35	0.0760	0.0013	0.063	0.108

Slab Specifications:

Thickness: 5 inches
Main Rebar: #3's at 9" o.c.
Shrinkage Rebar: #3's at 12" o.c.

Slab Sketch:



Beam Design for Flexure [Typical]:

Beams within the structural system were designed as T-beams which utilize the floor slab as their flange.

bw:	12 in	[width of the web]
h:	20 in	[height of web]
Dead Load:	260 ksf	[beam weight + factor of safety]
Live Load:	0.1 ksf	[based on Ohio Building Code]
f'c:	4 ksi	[compressive strength of concrete]
f'y:	60 ksi	[yield stress]
L:	35 ft	[beam span]
W:	1,912 kft	[total factored load]
assumed d:	17 in	[less bar diameter, stirrup, and cover]
b:	92 in	[lesser of three expressions]
pMin:	1700.85 k-ft	[practical moment strength]
k:	0.1468	[coefficient of resistance]
p:	0.00260	[reinforcement ratio]
Φ:	0.9	
A _s :	3.9 in ²	[required area of reinforcement]
actual:	17.42 in ²	[less bar diameter, stirrup, and cover]
A _{smin} :	0.68 in ²	[less than 3.91 in ² so beam is ok]
Use:	4 #9's for steel reinforcement (As = 4.0 in ²)	

Beam Design for Shear [Typical]:

The beam was then checked to see where steel could be reduced at the ends to save on construction costs.

A _v :	22 in ²	[assume a #3 stirrup]
W:	30.68k	[ultimate shear]
q _{v0} :	19.83k	[shear resisted by concrete alone]
q _{v0} /2:	9.91k	
s:	8.71 in	[minimum spacing]
Use:	#3 stirups @ 8" o.c. 0 < x < 10.66 and 24.14 < x < 35	

Development Length for Beam [Typical]:

The beam was then checked to see what length would be required to ensure no slippage between the concrete and steel.

ID:	71.15	[dependent on type of concrete]
y _f , y _s :	1	[reinforcing, coating, and size factors]
C _b :	1.28	[spacing factor]
d _b :	1.126 in ²	[bar diameter]
L _d :	65.66 in.	[development length]

Use a hook to meet development length:
L_d: 14.27 in. [Development length with a hook]

Beam Deflection:

Beams were checked for both immediate and long term deflection.

ACI Table 9.5A:

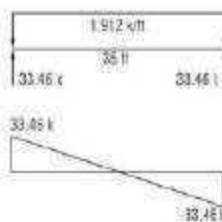
Deflection is not necessary where $(L/21) < \delta_t = h$
 $(35)(12)/21 = 20$ which is equal to h

No Deflection calculation necessary

Bar Cutoffs:

Since the beams have only 1 row of steel, bar cutoffs are not necessary.

Loading Conditions:



Beam Loading:
Combination of live load and weight of the beam

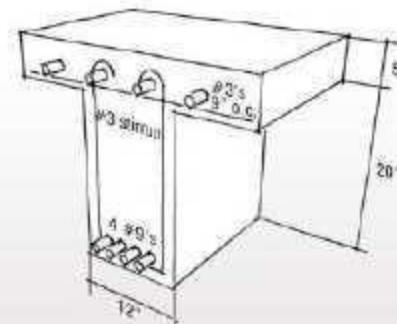


Moment Diagram:
Determined by area under the slope

Beam Specifications:

Dimensions: 12x20 inches
Reinforcement: 4 #9 rebar
(As = 4.0 in²)

Beam Sketch:





Structural Design Calculations

The design of the building's structural components was done in accordance with the Ohio Building Code (OBC) and the American Concrete Institute (ACI). All major aspects of the structural design were discussed with the structural consultant during the schematic design phase to ensure that a well developed and suitable structure would be produced at the final stages of the design. For each structural component, a typical element was designed and checked along the way by the structural consultant.

Girder Design for Flexure [Typical]:

This typical girder within the structural system was designed as a rectangular beam.

bw:	15 in.	[width of the web]
h:	33 in.	[height of web]
W _u :	.62 k/ft	[weight of girder]
P _u :	66.92 kips	[point loads from beams]
M _t :	733.95 k-ft	[total moment]
F' _c :	4 ksi	[compressive strength of concrete]
f' _y :	60 ksi	[yield stress]
L:	30 ft.	[girder span]
r _{q'd} k:	0.7033	[required coefficient of resistance]
r _{q'd} p:	0.0133	[required reinforcement ratio]
r _{q'd} A _s :	6.1 in ²	[required area of reinforcing steel]
A _{smin} :	1.50 in ²	[must be less than r _{q'd} A _s]
Actual A _s :	30.56 in ²	[greater than est. A _s]
Check A _s :	2.05 in.	[OK]

Use 4 #11's ($A_s = 6.24 \text{ in}^2$)

Girder Design for Shear [Typical]:

The girder was then designed for shear to size stirrups at their minimum spacing.

A _v :	.22 in ²	[assume a #3 stirrup]
V _u :	74.62 k	[ultimate shear]
qV _c :	43.49 k	[shear resisted by concrete alone]
qV _c /2:	21.74 k	
V _s :	73.61 k	[shear provided by reinforcement]
S _{crit} :	9.24 in.	[spacing required for critical steel]
S _{min} :	17.0 in.	[minimum spacing]
d/2:	15.28 in.	[half the depth of the beam]
s:	9.24 in.	[governing spacing, round down]
Use:	#3 stirrups at 9° o.c. where $0 < x < 10$ and $20 < x < 30$	

Development Length for Girder [Typical]:

The girder was then checked to see what length would be required to ensure no slippage between the concrete and steel.

ID:	71.15	[dependent on type of concrete]
y ₁ , y ₂ , y ₃ :	1	[reinforcing, coating, and size factors]
C _{fr} :	1.28	[spacing factor]
d _b :	1.41 in ²	[bar diameter]
L _d :	58.8 in.	[development length]

Use a hook to meet development length:

L_{d,h}: 17.84 in. [Development length with a hook]

Girder Deflection:

Girders were checked for both immediate and long term deflection to ensure that the girder does not deflect past allowable limits.

n:	3.044	[modular ratio]
y:	11.34 in.	[distance to neutral axis]
I _{cr} :	25835.5 in ⁴	[clocking moment of inertia]
I _g :	44971.25 in ⁴	[gross area moment of inertia]
I _n :	474 in ⁴	[compressive strength]
M _{cr} :	12014.4 in	[clocking moment]
W _u :	0.515 k/ft	[unfactored load]
M _a :	8726.54 in	[maximum moment]
M _{cr/M_a} :	0.1479	[ratio]
I _e :	25856.34 in ⁴	[effective moment of inertia]
Δ _i :	0.10085 in.	[immediate deflection]
ε:	2	[time dependent factor]
Δ _{LT} :	0.3019 in.	[long term deflection]

Allowable Deflections:

The following are the allowable deflections based on the ACI Table 9.5(b):

L/180	2.0 in. > 0.10 in	Acceptable Deflection
L/300	1.0 in. > 0.10 in	Acceptable Deflection
L/480	0.75 in. > 0.30 in	Acceptable Deflection
L/240	1.50 in. > 0.30 in	Acceptable Deflection

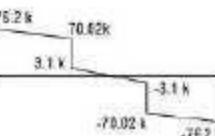
Bar Cutoffs:

Since the beams have only 1 row of steel, bar cutoffs are not necessary. The steel will run the entire length of the girder.

Loading Conditions:



Beam Loading:
Combination of beam's point loads and weight of girder



Shear Diagram:
Max/Min are reactions from Beam Loading

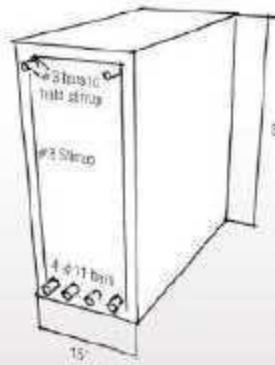


Moment Diagram:
Determined by area under the slope

Girder Specifications:

Dimensions:	14x25 inches
Reinforcement:	6 #9's
A_s :	6.24 in ²

Girder Sketch:



Integration Consultants:

Design Manager:
Charles Frederick
ITAC System:
Matthew Setzkorn
(Structural System)
Jim Stadleman
(Structural System)
Hollie H. Becker

Tingey Place Office Complex

The Yards | AW
200 Fourth Street
Washington, D.C.

Design Team:
Thomas Chesnes
Melanie Paasikoski

Integration
Consultants:

Design Director:

Charles Frederick

Structural Engineer:

Matthew Setzkorn

(Previous student)

Jim Stadleman

(Previous student)

Hollie H. Becker

Tingey Place
Office ComplexThe Yards | AW
200 Fourth Street
Washington, D.C.Design Team:
Thomas Chesnes
Melanie Paasikos

Column Design [Typical Interior]:

At the request of the structural consultant, calculations for column sizing were done by hand. Each column is designed as a reinforced square which tapers inward from the ground to the roof to conserve concrete, steel, and space within the building.

Given:

I'c:	4ksi	[compressive strength of concrete]
fy:	60ksi	[yield stress of concrete]
Slab h:	5 in.	[thickness of slab]
B1 b:	12 in.	[width of beam]
B1 h:	20in.	[height of beam]
B1 span:	35ft.	[span of beam]
B1 #:	4	[number of beams per bay]
B2 b:	14 in.	[width of girder]
B2 h:	25in.	[height of girder]
B2 span:	30ft.	[span of girder]
B2 #:	2	[number of girders per bay]

Preparatory Calculations:

$$\text{trib. area: } 1050\text{ft}^2 \quad [\text{trib. area} = (\text{B1span})(\text{B2span})] \\ \quad [\text{trib. area} = (35\text{ft})(30\text{ft})]$$

$$\text{Live Load: } 105k \quad [\text{Live Load} = (0.1)(\text{trib. area})] \\ \quad [\text{Live Load} = (0.1)(1050\text{ft}^2)]$$

$$\text{LLred: } 52.5k \quad [\text{LLred} = \text{LL} \cdot 25 + 12 / (\text{Ic} \cdot \text{trib. area})^{0.5}] \\ \quad [\text{LLred} = 105k \cdot 25 + 12 / (4 \cdot 1050\text{ft}^2)^{0.5}] \\ \quad [\text{LLred} = 45.5k] \\ \quad [\text{LLred}_1 = (0.5)(\text{LL})] \\ \quad [\text{LLred}_2 = (0.5)(105k)] \\ \quad [\text{LLred}_3 = 52.5k] \\ \quad [\text{LLred} \text{ is greater of LLred}_1, \text{LLred}_2]$$

$$\text{Dead Load: } 10.5k \quad [\text{Dead Load} = (0.1)(\text{trib. area})] \\ \quad [\text{Dead Load} = (0.1)(1050\text{ft}^2)]$$

$$\text{Slab DL: } 65.6k \quad [\text{Dead Load} = (0.15)\text{h} / 12 / (\text{trib. area})] \\ \quad [\text{Dead Load} = (0.15)(5/12)(1050\text{ft}^2)]$$

$$\text{B1 DL: } 35k \quad [\text{Dead Load} = (0.15)(b_1 / 12)(h / 12)(\text{span})^{(0.5)}] \\ \quad [\text{Dead Load} = (0.15)(12 / 2)(20 / 12)(35 / 4)]$$

$$\text{B2 DL: } 21.9k \quad [\text{Dead Load} = (0.15)(b_1 / 12)(h / 12)(\text{span})^{(0.5)}] \\ \quad [\text{Dead Load} = (0.15)(14 / 2)(25 / 12)(30 / 2)]$$

$$\text{DL}_{\text{sum}}: \quad 133k \quad [\text{Dead Load}_{\text{sum}} = \text{(sum of all dead loads)}] \\ \quad [\text{Dead Load}_{\text{sum}} = (10.5k + 65.6k + 35k + 21.9k)]$$

Factored Load per Level:

$$\text{Load/Level: } 243.6k \quad [\text{Factored load/level} = (1.6)(\text{LL}) + (1.2)(\text{DL})] \\ \quad [\text{Factored load/level} = (1.6)(52.5k) + (1.2)(133k)]$$

Column Root to Level 7:

$$\text{Fit-to-Fit: } 14.5ft \\ \text{P}_u: \quad 243.6k \quad [\text{Initial load per level (first level calculated)}] \\ \text{Trial Size: } 12 \times 12 \quad [\text{dimensions}] \\ \text{Ag: } 144\text{in}^2 \quad [\text{gross area}] \\ \text{Ast: } 5.32\text{in}^2 \quad [\text{area of steel - 8 #8's}] \\ \text{qPn: } 440.8k \quad [\text{qPn} = (0.8)(65)(.85^2 f_c(Ag-Ast) + (f_y * Ast))] \\ \quad [\text{qPn} = (0.8)(65)(.85^2(144-5.32) + (60 * 5.32))] \\ \quad \text{qPn is greater than P}_u, \text{ so this column size works.} \\ \text{Col Wt: } 2.18k \quad [\text{Col Wt} = (.15)(\text{Ag}/144)(\text{Fit-to-fit})] \\ \quad [\text{Col Wt} = (.15)(144/144)(14.5)]$$

Column Level 7 to Level 6:

$$\text{Fit-to-Fit: } 14.5ft \\ \text{P}_u: \quad 489.8k \quad [\text{P}_u = (2)(\text{load/level}) + (1.2)(\text{previous col. wt.})] \\ \quad [\text{P}_u = (2)(243.6) + (1.2)(2.18)] \\ \text{Trial Size: } 13 \times 13 \quad [\text{dimensions}] \\ \text{Ag: } 169\text{in}^2 \quad [\text{gross area}] \\ \text{Ast: } 9.48\text{in}^2 \quad [\text{area of steel - 12 #8's}] \\ \text{qPn: } 577.8k \quad [\text{qPn} = (0.8)(65)(.85^2 f_c(Ag-Ast) + (f_y * Ast))] \\ \quad [\text{qPn} = (0.8)(65)(.85^2(169-9.48) + (60 * 9.48))] \\ \quad \text{qPn is greater than P}_u, \text{ so this column size works.} \\ \text{Col Wt: } 2.58k \quad [\text{Col Wt} = (.15)(\text{Ag}/144)(\text{Fit-to-fit})] \\ \quad [\text{Col Wt} = (.15)(169/144)(14.5)]$$

Column Level 6 to Level 5:

$$\text{Fit-to-Fit: } 14.5ft \\ \text{P}_u: \quad 736.3k \quad [\text{P}_u = (3)(\text{load/level}) + (1.2)(\text{previous col. wt.})] \\ \quad [\text{P}_u = (3)(243.6) + (1.2)(2.18 + 2.55)] \\ \text{Trial Size: } 16 \times 16 \quad [\text{dimensions}] \\ \text{Ag: } 256\text{in}^2 \quad [\text{gross area}] \\ \text{Ast: } 12.8\text{in}^2 \quad [\text{area of steel - 16 #8's}] \\ \text{qPn: } 823.4k \quad [\text{qPn} = (0.8)(65)(.85^2 f_c(Ag-Ast) + (f_y * Ast))] \\ \quad [\text{qPn} = (0.8)(65)(.85^2(256-12.8) + (60 * 12.8))] \\ \quad \text{qPn is greater than P}_u, \text{ so this column size works.} \\ \text{Col Wt: } 3.86k \quad [\text{Col Wt} = (.15)(\text{Ag}/144)(\text{Fit-to-fit})] \\ \quad [\text{Col Wt} = (.15)(256/144)(14.5)]$$

Column Level 5 to Level 4:

$$\text{Fit-to-Fit: } 14.5ft \\ \text{P}_u: \quad 984.7k \quad [\text{P}_u = (4)(\text{load/level}) + (1.2)(\text{previous col. wt.})] \\ \quad [\text{P}_u = (4)(243.6) + (1.2)(2.18 + 2.55 + 3.06)] \\ \text{Trial Size: } 19 \times 19 \quad [\text{dimensions}] \\ \text{Ag: } 361\text{in}^2 \quad [\text{gross area}] \\ \text{Ast: } 12.6\text{in}^2 \quad [\text{area of steel - 16 #8's}] \\ \text{qPn: } 1009.1 \quad [\text{qPn} = (0.8)(65)(.85^2 f_c(Ag-Ast) + (f_y * Ast))] \\ \quad [\text{qPn} = (0.8)(65)(.85^2(361-12.6) + (60 * 12.6))] \\ \quad \text{qPn is greater than P}_u, \text{ so this column size works.} \\ \text{Col Wt: } 5.48k \quad [\text{Col Wt} = (.15)(\text{Ag}/144)(\text{Fit-to-fit})] \\ \quad [\text{Col Wt} = (.15)(361/144)(14.5)]$$

Column Level 4 to Level 3:

$$\text{Fit-to-Fit: } 14.5ft \\ \text{P}_u: \quad 1234.9k \quad [\text{P}_u = (5)(\text{load/level}) + (1.2)(\text{previous col. wt.})] \\ \quad [\text{P}_u = (5)(243.6) + (1.2)(2.18 + 2.55 + 3.06 + 5.45)] \\ \text{Trial Size: } 21 \times 21 \quad [\text{dimensions}] \\ \text{Ag: } 441\text{in}^2 \quad [\text{gross area}] \\ \text{Ast: } 15.8\text{in}^2 \quad [\text{area of steel - 20 #8's}] \\ \text{qPn: } 1244.7 \quad [\text{qPn} = (0.8)(65)(.85^2 f_c(Ag-Ast) + (f_y * Ast))] \\ \quad [\text{qPn} = (0.8)(65)(.85^2(441-15.8) + (60 * 15.8))] \\ \quad \text{qPn is greater than P}_u, \text{ so this column size works.} \\ \text{Col Wt: } 6.66k \quad [\text{Col Wt} = (.15)(\text{Ag}/144)(\text{Fit-to-fit})] \\ \quad [\text{Col Wt} = (.15)(441/144)(14.5)]$$

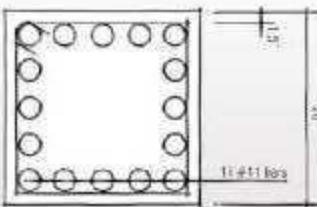
Column Level 3 to Level 2:

$$\text{Fit-to-Fit: } 14.5ft \\ \text{P}_u: \quad 1486.4k \quad [\text{P}_u = (6)(\text{load/level}) + (1.2)(\text{previous col. wt.})] \\ \quad [\text{P}_u = (6)(243.6) + (1.2)(2.18 + 2.55 + 3.06 + 5.45 + 6.66)] \\ \text{Trial Size: } 23 \times 23 \quad [\text{dimensions}] \\ \text{Ag: } 529\text{in}^2 \quad [\text{gross area}] \\ \text{Ast: } 18.96\text{in}^2 \quad [\text{area of steel - 24 #8's}] \\ \text{qPn: } 1493.3 \quad [\text{qPn} = (0.8)(65)(.85^2 f_c(Ag-Ast) + (f_y * Ast))] \\ \quad [\text{qPn} = (0.8)(65)(.85^2(529-18.96) + (60 * 18.96))] \\ \quad \text{qPn is greater than P}_u, \text{ so this column size works.} \\ \text{Col Wt: } 7.89k \quad [\text{Col Wt} = (.15)(\text{Ag}/144)(\text{Fit-to-fit})] \\ \quad [\text{Col Wt} = (.15)(529/144)(14.5)]$$

Column Level 2 to Level 1:

$$\text{Fit-to-Fit: } 16.5ft \\ \text{P}_u: \quad 1739.8k \quad [\text{P}_u = (7)(\text{load/level}) + (1.2)(\text{previous col. wt.})] \\ \quad [\text{P}_u = (7)(243.6) + (1.2)(2.18 + 2.55 + 3.06 + 5.45 + 6.66 + 7.89)] \\ \text{Trial Size: } 26 \times 26 \quad [\text{dimensions}] \\ \text{Ag: } 676\text{in}^2 \quad [\text{gross area}] \\ \text{Ast: } 18.96\text{in}^2 \quad [\text{area of steel - 24 #8's}] \\ \text{qPn: } 1753.2 \quad [\text{qPn} = (0.8)(65)(.85^2 f_c(Ag-Ast) + (f_y * Ast))] \\ \quad [\text{qPn} = (0.8)(65)(.85^2(676-18.96) + (60 * 18.96))] \\ \quad \text{qPn is greater than P}_u, \text{ so this column size works.} \\ \text{Col Wt: } 11.8k \quad [\text{Col Wt} = (.15)(\text{Ag}/144)(\text{Fit-to-fit})] \\ \quad [\text{Col Wt} = (.15)(676/144)(16.5)]$$

Ground Level Column:



Column Reinforcing Design [Typical Interior]:

At the request of the structural consultant, calculations for column sizing were done by hand. Each column is designed as a reinforced square which tapers inward from the ground to the roof to conserve concrete, steel, and space within the building.

Givens:

I _c :	4ksi [compressive strength of concrete]
f _y :	60ksi [yield stress of concrete]
Slab thickness:	5 in. [thickness of slab]
B1 b:	12 in. [width of beam]
B1 h:	20in. [height of beam]
B1 span:	35ft. [span of beam]
B1 #:	4 [number of beams per bay]
B2 b:	14 in. [width of girder]
B2 h:	25in. [height of girder]
B2 span:	30ft. [span of girder]
B2 #:	2 [number of girders per bay]

Preparatory Calculations:

$$\text{Trib. area: } 1050\text{ft}^2 \quad [\text{Trib. area} = (B1\text{span})(B2\text{span})] \\ \quad [\text{Trib. area} = (35)(30)]$$

$$\text{Live Load: } 105k \quad [\text{Live Load} = (0.1)(\text{Trib. area})] \\ \quad [\text{Live Load} = (0.1)(1050\text{ft}^2)]$$

$$\text{LLred: } 52.5k \quad [\text{LLred} = LL(25+12)/f_c^2(\text{Trib. area})^2] \\ \quad [\text{LLred} = 105k/(25+12)/(4 \cdot 1050\text{ft}^2)^2] \\ \quad [\text{LLred} = 45.6k] \\ \quad [\text{LLred}_2 = (.5)(\text{LL})] \\ \quad [\text{LLred}_2 = (.5)(105k)] \\ \quad [\text{LLred}_2 = (52.5k)] \\ \quad [\text{LLred}_2 \text{ is greater than LLred}_1, \text{ LLred}_1]$$

$$\text{Dead Load: } 10.5k \quad [\text{Dead Load} = (.01)(\text{Trib. area})] \\ \quad [\text{Dead Load} = (.01)(1050\text{ft}^2)]$$

$$\text{Slab DL: } 65.8k \quad [\text{Dead Load} = (.15)(w/2)(\text{Trib. area})] \\ \quad [\text{Dead Load} = (.15)(5/12)(1050\text{ft}^2)]$$

$$\text{B1 DL: } 35k \quad [\text{Dead Load} = (.15)(b/12)(h/12)(\text{span})(#)] \\ \quad [\text{Dead Load} = (.15)(1/2/12)(20/12)(35)(4)]$$

$$\text{B2 DL: } 21.9k \quad [\text{Dead Load} = (.15)(b/12)(h/12)(\text{span})(#)] \\ \quad [\text{Dead Load} = (.15)(14/12)(25/12)(30)(2)]$$

$$\text{DL}_\text{sum: } 133k \quad [\text{Dead Load}_\text{sum} = \text{sum of all dead loads}] \\ \quad [\text{Dead Load}_\text{sum} = (10.5 + 65.8k + 35k + 21.9k)]$$

Factored Load per Level:

$$\text{Load/Level: } 243.6k \quad [\text{Factored load/level} = (1.6)(\text{LL}) + (1.2)(\text{DL})] \\ \quad [\text{Factored load/level} = (1.6)(52.5k) + (1.2)(133k)]$$

Column Reinforcing:

Using the previous column calculations to size the area of the column, the following calculations are used to choose longitudinal steel, tie reinforcement and spacing.

Column Root to Level 7:

Fir-to-Fir:	14.5ft
Col. Size:	12'x12'
f _{Pc} :	246.95k [$\phi P_c = 8(0.65)A_g(85f'_c)(1-\rho_g)$]
f _{Ps} :	-3.25 [$\phi P_s = P_u - \rho_f P_c$]
A _{st} :	use min [$A_s/(8(0.65)f_y)$]
Steel:	4 # 5 min [$A_{st} = 1.24\text{in}^2$]
Tie spacing:	16" min [$s < 48(\text{tie bar dia.})$ or 16(long bar dia.) or least dim]
Use #4 tie @ 16"	
Clear spacing:	1.25 < 6 OK [(13-3-2*0.5-4*1.61)/4]

Column Level 6 to Level 7:

Fir-to-Fir:	14.5ft
Col. Size:	13'x13"
f _{Pc} :	280.83k [$\phi P_c = 8(0.65)A_g(85f'_c)(1-\rho_g)$]
f _{Ps} :	199.98 [$\phi P_s = P_u - \rho_f P_c$]
A _{st} :	6.41in ² [$A_s/(8(0.65)f_y)$]
Steel:	8 # 9 [$A_{st} = 8\text{in}^2$]
Tie spacing:	16" [$s < 48(\text{tie bar dia.})$ or 16(long bar dia.) or least dim]
Use #4 tie @ 16"	
Clear spacing:	1.25 < 6 OK [(13-3-2*0.5-4*1.61)/4]

Column Level 5 to Level 6:

Fir-to-Fir:	14.5ft
Col. Size:	16"x16"
f _{Pc} :	439.93k [$\phi P_c = 8(0.65)A_g(85f'_c)(1-\rho_g)$]
f _{Ps} :	297.44 [$\phi P_s = P_u - \rho_f P_c$]
A _{st} :	9.53in ² [$A_s/(8(0.65)f_y)$]
Steel:	8 # 10 [$A_{st} = 10\text{in}^2$]
Tie spacing:	20.32" [$s < 48(\text{tie bar dia.})$ or 16(long bar dia.) or least dim]
Use #4 tie @ 20"	
Clear spacing:	1.73 < 6 OK [(16-3-2*0.5-4*1.27)/4]

Column Level 4 to Level 5:

Fir-to-Fir:	14.5ft
Col. Size:	19'x19"
f _{Pc} :	619.10k [$\phi P_c = 8(0.65)A_g(85f'_c)(1-\rho_g)$]
f _{Ps} :	365.61 [$\phi P_s = P_u - \rho_f P_c$]
A _{st} :	11.72in ² [$A_s/(8(0.65)f_y)$]
Steel:	8 # 11 [$A_{st} = 12.5\text{in}^2$]
Tie spacing:	22.56" [$s < 48(\text{tie bar dia.})$ or 16(long bar dia.) or least dim]
Use #4 tie @ 23.0"	
Clear spacing:	2.43 < 6 OK [(19-3-2*0.5-4*1.61)/4]

Slenderness - Check for Minimum Column Dimension:

$$174\text{in}(1\text{in}-1\text{in}) \cdot \sin(\text{slab}) - 20\text{in}(\text{beam}) = 149\text{in} = 12.42\text{ft} \\ h = (.5)(12.42)(12/2)(3/2)/22 = 11.7\text{in}$$

h is less than the smallest column, 12in, so the columns are OK.

Column Level 3 to Level 4:

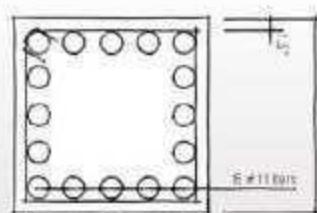
Fir-to-Fir:	14.5ft
Col. Size:	21'x21"
f _{Pc} :	756.30k [$\phi P_c = 8(0.65)A_g(85f'_c)(1-\rho_g)$]
f _{Ps} :	478.55 [$\phi P_s = P_u - \rho_f P_c$]
A _{st} :	15.34in ² [$A_s/(8(0.65)f_y)$]
Steel:	12 # 11 [$A_{st} = 18.7\text{in}^2$]
Tie spacing:	22.56" [$s < 48(\text{tie bar dia.})$ or 16(long bar dia.) or least dim]
Use #4 tie @ 23.0"	
Clear spacing:	2.43 < 6 OK [(21-3-2*0.5-4*1.61)/4]

Column Level 2 to Level 3:

Fir-to-Fir:	14.5ft
Col. Size:	23'x23"
f _{Pc} :	907.21k [$\phi P_c = 8(0.65)A_g(85f'_c)(1-\rho_g)$]
f _{Ps} :	579.24 [$\phi P_s = P_u - \rho_f P_c$]
A _{st} :	18.57in ² [$A_s/(8(0.65)f_y)$]
Steel:	12 # 11 [$A_{st} = 18.7\text{in}^2$]
Tie spacing:	22.56" [$s < 48(\text{tie bar dia.})$ or 16(long bar dia.) or least dim]
Use #4 tie @ 23.0"	
Clear spacing:	2.98 < 6 OK [(23-3-2*0.5-4*1.61)/4]

Column Level 2 to Level 1:

Fir-to-Fir:	16.5ft
Col. Size:	26"x26"
f _{Pc} :	1159.31k [$\phi P_c = 8(0.65)A_g(85f'_c)(1-\rho_g)$]
f _{Ps} :	580.32 [$\phi P_s = P_u - \rho_f P_c$]
A _{st} :	18.60in ² [$A_s/(8(0.65)f_y)$]
Steel:	12 # 11 [$A_{st} = 18.7\text{in}^2$]
Tie spacing:	22.56" [$s < 48(\text{tie bar dia.})$ or 16(long bar dia.) or least dim]
Use #4 tie @ 23.0"	
Clear spacing:	3.73 < 6 OK [(26-3-2*0.5-4*1.61)/4]

Ground Level Column:

Column reinforcing decreases with each increase in building level.

**Tingey Place
Office Complex**

The Yards | AW
200 Fourth Street
Washington, D.C.
Principal Structural Engineer
Jim Stadleman
Structural Assistant
Hollie H. Becker

Design Team:
Thomas Chesnes
Melanie Paasikoski

Wind Loads:

50 mph [Design Wind Speed for Washington D.C.]

North/South

	Lvl 1 Bay	Typ Bay	# Shear Walls	N/S	Case 4	Design Factor
v	217 ft	N	217 ft			Capacity II (ASCE T-1804)
h	10.3 ft	n	14.5 ft	E/S	0.8	Snow Wind/Searcic Factor: 1
area	5231.5 ft ²	area	4566.5 ft ²	Eq/Sk	1.1	Importance Factor: 1

(ASCE 7-17) (ASCE T-6-11)

Level	Height (z) ft	K _z	Q _z	Q ₀	P	A _{NSB}	F	Load per Wall
Roof	103.5	1.00	1.00	20.71	20.71	15.15	1378.95	22.28
1	93	1.00	0.96	19.84	20.71	10.03	2157.92	43.12
6	74.5	1.00	0.91	16.63	20.71	15.02	2157.92	41.44
5	63	1.00	0.85	17.63	20.71	14.30	2157.92	39.46
4	45.5	1.00	0.79	16.03	20.71	13.55	2157.92	37.30
3	31	1.00	0.71	14.64	20.71	12.51	2157.92	34.51
2	15.5	1.00	0.60	12.49	20.71	11.25	2157.92	30.06

(ASCE 16-13 Case 3)

West/East

	Lvl 1 Bay	Typ Bay	# Shear Walls	N/S	WE (Case 4)
v	147 ft	N	147 ft		
h	10.3 ft	n	14.5 ft	E/S	0.62

(ASCE 7-17 Case 4)

Level	Height (z) ft	K _z	Q _z	Q ₀	P	A _{NSB}	F	Load per Wall
Roof	103.5	1.00	1.00	20.71	20.71	15.15	1378.95	22.28
1	93	1.00	0.96	19.84	20.71	10.03	2157.92	43.12
6	74.5	1.00	0.91	16.63	20.71	15.02	2157.92	41.44
5	63	1.00	0.85	17.63	20.71	14.30	2157.92	39.46
4	45.5	1.00	0.79	16.03	20.71	13.55	2157.92	37.30
3	31	1.00	0.71	14.64	20.71	12.51	2157.92	34.51
2	15.5	1.00	0.60	12.49	20.71	11.25	2157.92	30.06

(ASCE 16-13 Case 3)

Total Lateral Forces:

Level	Wind Loads Seismic	Total Lateral
Roof	2,784	18,182
1	5,390	14,661
6	5,180	10,273
5	4,931	9,663
4	4,663	8,832
3	4,319	7,779
2	3,869	6,622

Level	Wind Loads Seismic	Total Lateral
Roof	1,26845	18,182
1	2,64023	14,661
6	2,54416	10,273
5	2,42091	9,663
4	2,28257	8,832
3	2,11611	7,779
2	1,885363	6,622

(ASCE 7-17 Total)

Location of shear walls embedded within the building core

Seismic Loads

Site Class I

S ₀	0.163 [ASCE 7-16 Eq 7-2-1-14]
S ₁	0.05
P ₀	1.6 [IRC Table 1615.1.1]
P ₁	2.4 [IRC Table 1615.1.2]
S _(S)	0.1832
S _(I)	0.03
R	5.5 [IRC Table 1617.6.2]
I(E)	1 [IRC Table 1604.6]
C ₀	0.02973
C ₁	0.01 [IRC]
C ₂	0.01394 [IRC]
C ₃	0.013194
C ₄	1.7 [ASCE 12-4-1]
C ₅	0.02 [ASCE 12-4-2]
X	0.75 [Shear Wall]
H ₀	103.5 [Height in ft]
T ₀	0.648865 [Structure period]
T ₁	1.03276 [Structural period]
H	1.035 [Interacted]

[Mipped Spectral Acceleration for short period]
[Mipped Spectral Acceleration for 1 sec period]
[Site Coefficient]

W Calculations for walls/floor

W/Wall [Shear Walls]	
I	435 ft
W	633 ft
r	34.5 ft
H	0.15 kip
W/Wall	780,4375 kips

W/Floor [Typical Level]

Total Area	46510 ft ²
dead load	0.01 kip
Wt of Beam	8.75 k
# Beams	103
Total Wt of Bms	927.5 k
Wt of Girder	15,468.73 k
# Girders	39
Total Wt of G	593,427.5 k
Wt of Slab	0.0625 kip
Wt Floor	3103,925 k

Level	W/Floor	w/Wall	Wx	h	t	M ₀	Cx	V	F _z	Load per Wall
Roof	3048.95	84.22	4358.17	103.5	10712.25	4588189.07	0.325	448.038	145.458	16,182 k
7	3963.95	758.44	4752.39	86.0	7621.00	37643681.19	0.262	448.093	117.285	14,660 k
6	3938.95	758.44	4752.39	74.5	5550.25	26378952.80	0.183	448.093	82.182	10,272 k
5	3943.95	758.44	4752.39	80.0	3830.00	1710464.00	0.119	448.093	53.303	6,662 k
4	3963.95	758.44	4752.39	45.5	2603.25	3638625.40	0.066	448.093	30.654	3,838 k
3	3963.95	758.44	4752.39	31.0	961.00	4561045.79	0.032	448.093	14.229	1,778 k
2	3079.37	758.44	4067.80	0.0	272.25	1287309.23	0.011	448.093	3.377	0.622 k

2# = 9.5
3# = 247.774689 / x_{AS}
No Shear ReinforcingDesign for Flexure:
Mu = 66036.15417 kip-in
P = 0.5508-Sq_{AS}
A_s = 11,750 ft²
ASR = 3.84 ft²
USE = 0.90 USE_{AS}
USE = 11,750 ft²
USE = 12 #9's TotalDesign for Flexure:
Mu = 77412.2246 ft²
I = 0.10(32004)
P = 0.001
A_s = 4.97 ft²
ASR = 0.76 ft²
USE = 0.90 USE_{AS}
USE = 4.97 ft²

Use 5 #9's Vertical Reinforcing for flexure at each end

Use 6 #9's Vertical Reinforcing for flexure at each end

Lateral Analysis

Shear walls, which double as bearing walls, constructing the core, resist lateral forces. Using the Ohio Building Code and the ASCE charts, wind and seismic loads were calculated for both the north/south and the west/east directions. These loads were then used to calculate shear forces and determine the amount of reinforcing needed to ensure that the building is protected against lateral forces.

30'-6" with 5#9's (round to 6#9's)



12'-0" with 6#9's

Integration
Consultants:

Design Team:

Charles Frederick

TIAAC Systems

Matthew Setzkorn

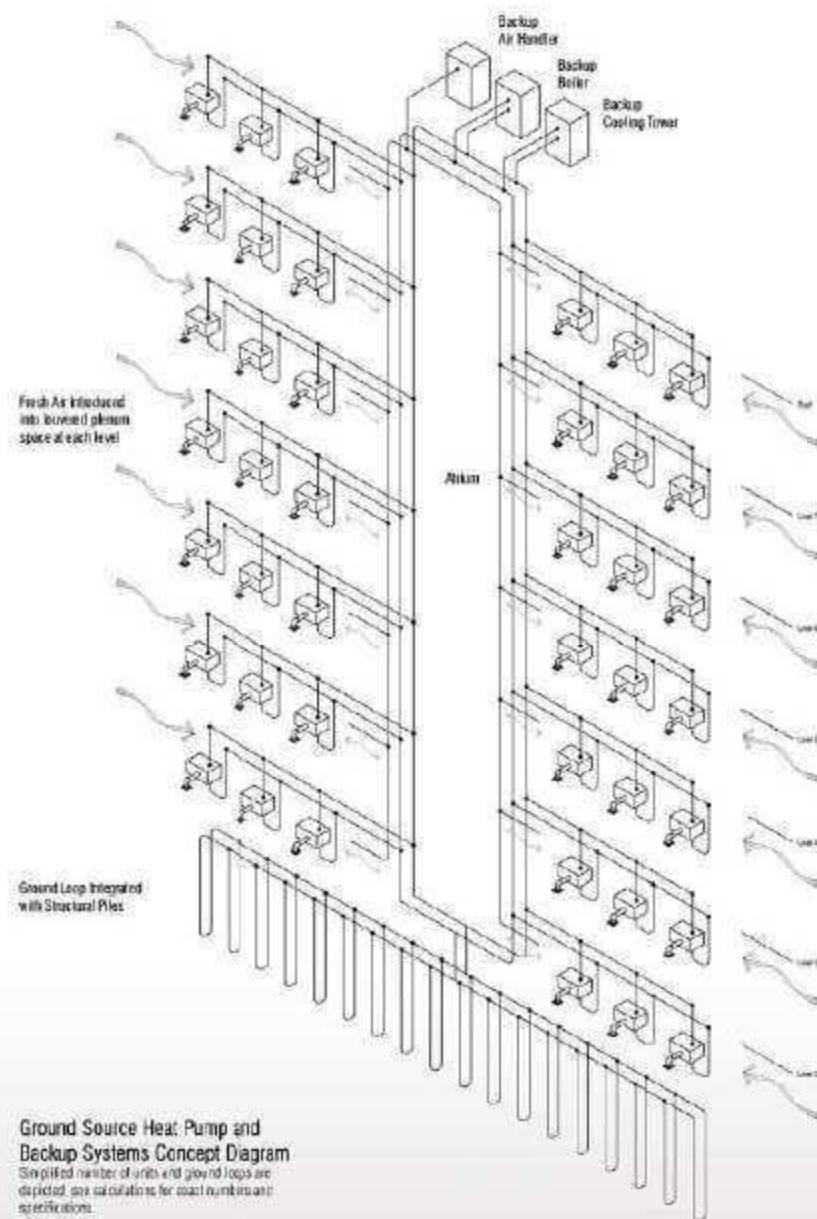
Structural System:

Jim Stadleman

Structural System:

Hollie H. Becker

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Office ComplexThe Yards | AW
200 Fourth Street
Washington, D.C.Design Team:
Thomas Chesnes
Melanie Paasikoski



Mechanical Concepts and Overview:

The project uses a Ground-Source Heat pump as its primary means of heating and cooling. A typical ground source heat pump system offers the advantage of lower operating and maintenance costs compared to conventional HVAC systems. This setup is similar to a water-source heat pump, but eliminates (or greatly reduces in size) the cooling tower and boiler, thereby reducing maintenance costs, minimizing space requirements, and further improving system efficiency. All heat is rejected to or absorbed from the ground loop heat exchanger. In this particular project, the ground loop will be integrated into the pilings. This method has been found to have better heat transfer performance than the conventional bore field, especially in the winter when heat is extracted from the ground. Heat extraction performance is better when utilizing the pilings at least in part because the building tends to shelter the pilings from ambient conditions.

The building-wide, integrated water loop also offers the ability for system integration and heat recovery, which can improve overall system efficiency and reduce installation costs. The water loop can be used as a heat source for heat pumps that provide domestic or service water heating. The GHP system includes an integrated heat pump water heating system that recovers heat rejected to the loop for service water heating.

The system consists of heat pumps stored in the building's ceiling plenum which, combined with heat exchangers, connect into the condenser water loop. Each heat pump serves a zone of between 1500 and 2000 square feet in size. Exceptions to this are made so that private offices can be on their own temperature control zones. A smaller scale boiler and a minimally sized cooling tower are housed on the roof level as back-up for the ground-source system, ensuring that the water temperature is always within proper limits [35° to 85°]. In the winter, air is heated at the perimeter while being conductively cooled in the core. Energy is transferred through the condenser loop, making each process more efficient.

For proper ventilation, outside air is brought in per floor through the use of louvers in the plenum. This incoming air is partially buffered by the outer layer of the double facade, but each inlet also has a coil with a damper as a backup for times when the air may need to be conditioned. All duct work is insulated to protect against vibration and minimize sound transfer. The boiler room and main electrical rooms are vented to the exterior for easy exhaust. Bathrooms within the core are exhausted through a vertical chase or stack vent within a common wall.

Integration Consultants:

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HVAC System
Matthew Setzkorn
Electrical System
Jim Stadleman
Structural System
Hollie H. Becker

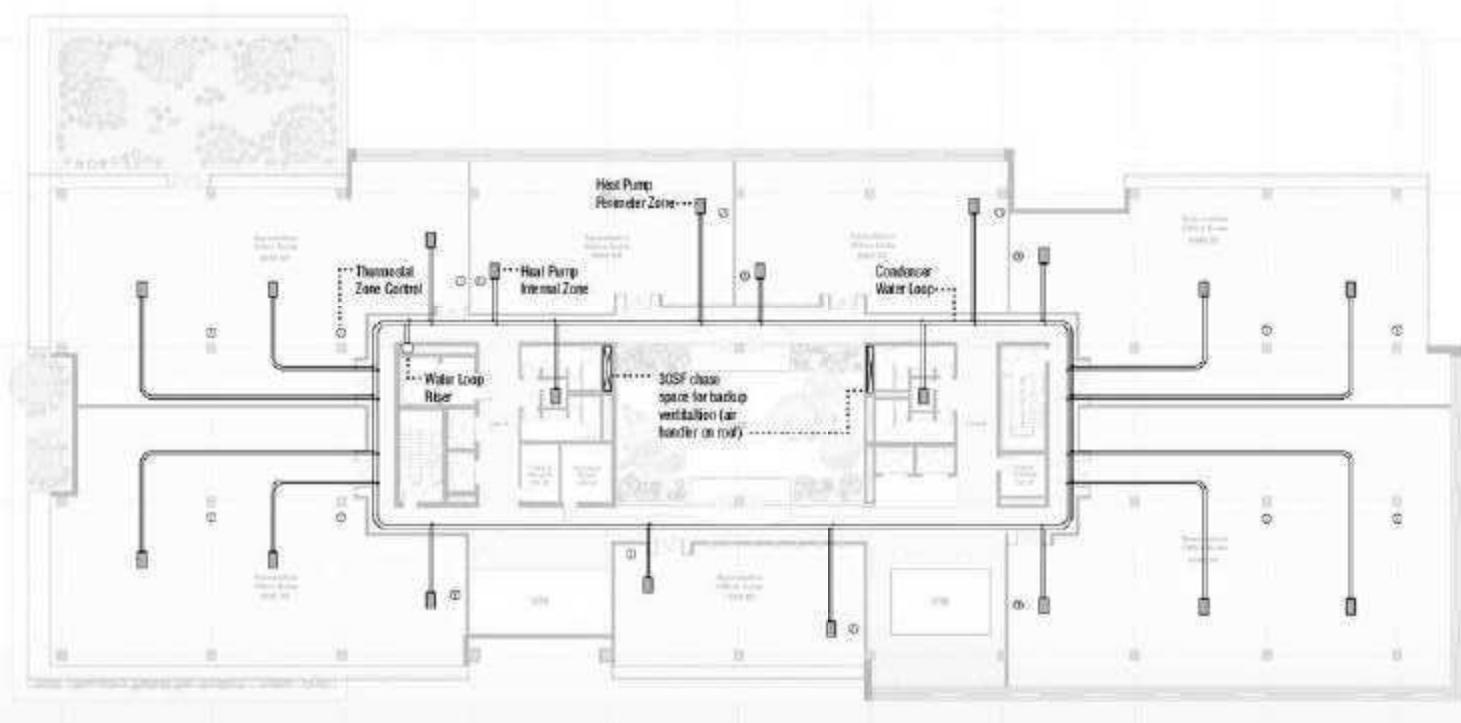
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The Yards | AW
200 Fourth Street
Washington, D.C.

Design Team:
Thomas Chesnes
Melanie Paasikoski

**HVAC Mechanical Layout for Speculative Office Floor:**

Each speculative office suite has a varying number of heat pumps depending on the size and envelope conditions of the suite. Heat pumps range from 1 to 13 tons in size. These have been positioned strategically so that each heat pump serves an area less than 1200 square feet. Each floor is naturally ventilated through louvers in the plenum. A coil and damper is positioned behind each louver so that the fresh air can be conditioned when needed.



- All vertical shafts are 2hr fire rated
- Back walls and heat pumps are insulated to protect against vibration and minimize noise
- All heat pumps are suspended from the ceiling plenum and have a height of 22 inches

HVAC Typ. Spec Plan

Scale: 1" = 20'-0"

N

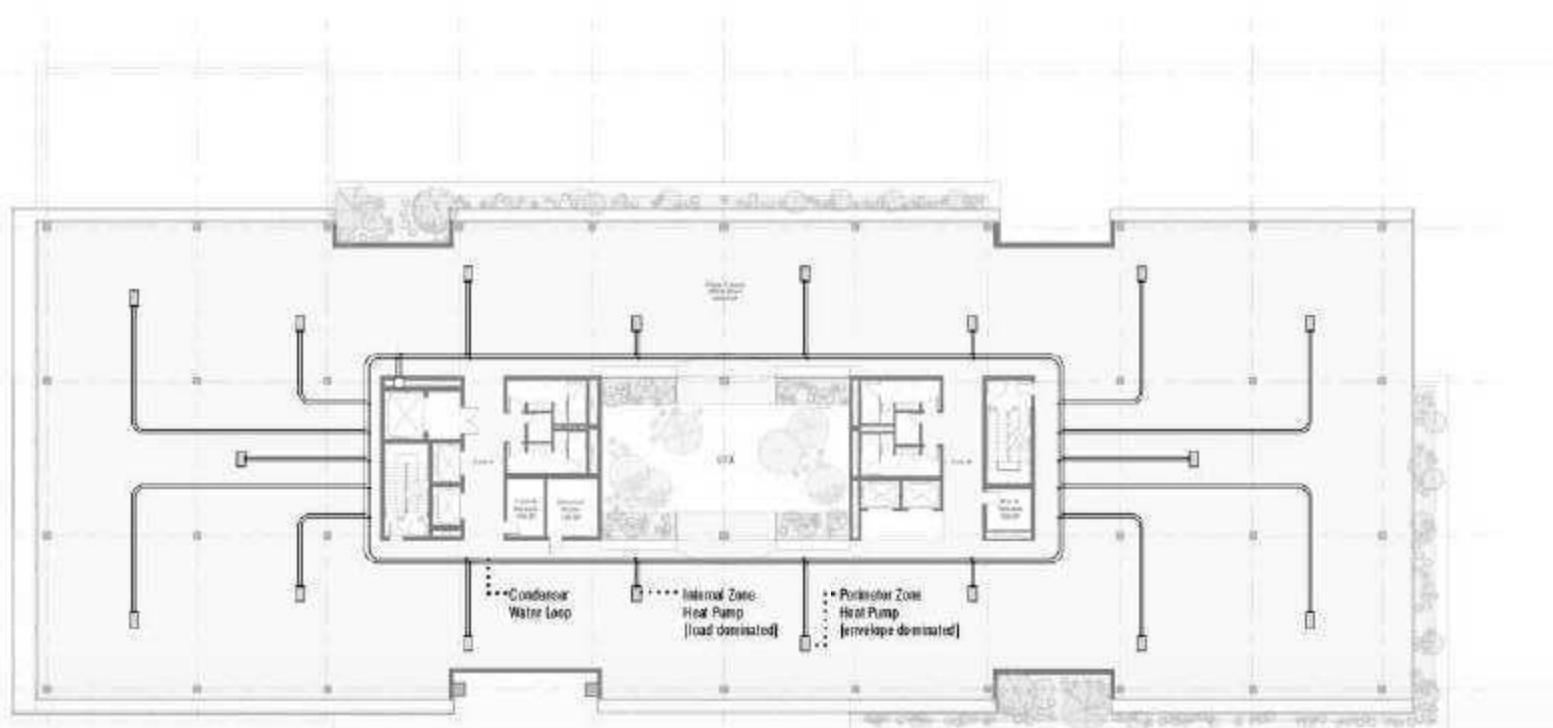
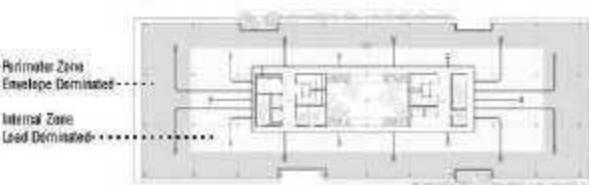
**Tingey Place
Office Complex**

The Yards | AW
200 Fourth Street
Washington, D.C.

Design Team:
Thomas Chesnes
Melanie Paasikos

**HVAC Mechanical Layout for Prime Floor:**

Each prime tenant floor has a total of 16 heat pumps, averaging 5.25 tons in size. These have been positioned strategically so that each heat pump serves an area of about 1700 square feet. They have also been staggered to allow heating and cooling to be more evenly distributed where it is needed based on the conditions of the space. Each floor is naturally ventilated through louvers in the plenum. A coil and damper is positioned behind each louver so that the fresh air can be conditioned when needed.



- All vertical ducts are 2hr fire rated.
- Duct work and heat pump are insulated to protect against vibration and minimize noise.
- All heat pumps are suspended from the ceiling plenum and have a height of 22 inches.

HVAC Typical Prime Plan

Scale: 1" = 20'-0"

**Tingey Place
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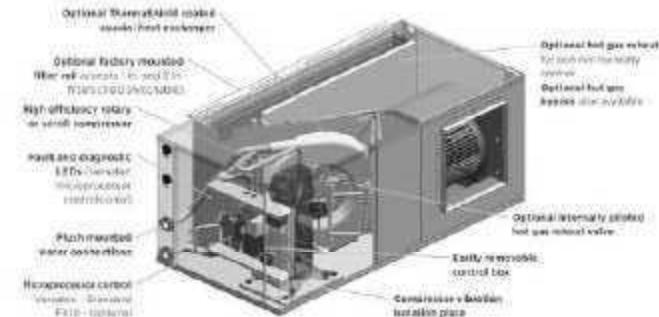
Heat Pump Sizing:

Heat pumps were sized according to glass and wall conditions for each building face. Occupants, lighting, equipment and solar conditions were also taken into account. Prime spaces are sized for equal heat pump sizing and number of units per floor. Spec levels are sized per office suite. Listed below are the specifications for the selected heat pump, which is manufactured by Versatec and comes in a series of different sizes.

Typical Prime Levels 4-7: Selected Water Source Heat Pump

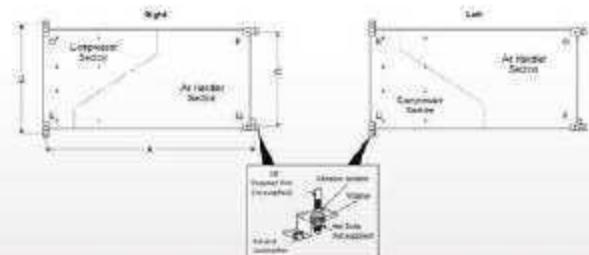
The Versatec Ultra Series: Horizontal Cabinet

Versatec Ultra Horizontal units are available in seven cabinet sizes. The cabinets are designed for high efficiency, maximum flexibility, and primary servicing from the front.



Four blower deck options are available. Factory or field conversion option of end or side discharge using switchable access panels and a factory only option of true left or right return air coil.

Hanger Bracket Locations for Selected Heat Pump:



Source: Versatec Ultra Commercial Specification Catalog

Typical Prime Levels 4-7: HVAC System Sizing [Heat Pumps]

Material Description:

Glass Conditions	R-Value	U-Value	Area North	Area South	Area East	Area West	Total Area
Single Façade	18.9	0.053	955.5	0.0	0.0	0.0	955.5
Double Façade	20.0	0.035	0.0	955.5	2227.9	2266.4	5489.8
Solar Glass	16.9	0.053	0.0	0.0	0.0	0.0	0.0

Wall Conditions:

Wall Conditions	R-Value	U-Value	Area North	Area South	Area East	Area West	Total Area
Full Wall	35.1	0.029	0.0	0.0	739.5	739.5	1479.0
Studwall	55.9	0.018	513.0	513.0	1192.3	1220.6	3439.0

Cooling Loads:

Envelope

Glazing	$Q(g) = U(g) \times A(g) \times \Delta T$
Walls	$Q(w) = U(w) \times A(w) \times \Delta T$
Outdoor air sensible	$Q_{\text{gas}} = \text{CFM} \times 1.065 \times \Delta T$
Outdoor air latent	$Q_{\text{lat}} = \text{CFM} \times 68 \times \Delta T$

Internal Gains

People	142500.0 btu/hr	500btu/person
Lights	55400.4 btu/hr	0.58 w/sf
Reciprocals	97242.0 btu/hr	1.0 w/sf
Solar (North)	21021.0 btu/hr	$Q(g_n) = 22 \times A(g_n)$
Solar (South)	39175.5 btu/hr	$Q(g_s) = 41 \times A(g_s)$
Solar (East)	45785.5 btu/hr	$Q(g_e) = 21 \times A(g_e)$
Solar (West)	512149.1 btu/hr	$Q(g_w) = 224 \times A(g_w)$

Total Cooling Load

1088583.5 btu/hr

89.0 tons

Per Floor

Total Cooling Load

7480084.5 btu/hr

623.3 tons

Per Building

Heating Loads:

Envelope

Glazing	$Q(g) = U(g) \times A(g) \times \Delta T$
Walls	$Q(w) = U(w) \times A(w) \times \Delta T$
Outdoor air sensible	$Q_{\text{gas}} = \text{CFM} \times 1.065 \times \Delta T$

Total Heating Load

198616.4 btu/hr

1.6 tons

Per Floor

Total Heating Load

1390314.5 btu/hr

115.9 tons

Per Building

Selected System:

VERSATEC ULTRA SERIES

Model No.	70	Total Units per Prime Level	17
Btuh	63000 btuh	Total Btuh per Prime Level	1071000 btuh
Tons	5.25 tons	Total Tons per Prime Level	89.25 tons
Flow Rate	2100 cfm		
Energy Star	16 gpm		
	yes		

Integration Consultants:

Design Manager:
Charles Frederick

HVAC Systems:
Matthew Setzkorn

Electrical Systems:
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Structural Systems:
Hollie H. Becker

Tingey Place Office Complex

The Yards | AW
200 Fourth Street
Washington, D.C.

Design Team:
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**Total Cooling Load for Mechanical System:**

Total Cooling Load	1068583.5 btu/hr	Per Floor
Total Cooling Load	89.0 tons	
Total Cooling Load	7480084.5 btu/hr	Per Building
Total Cooling Load	623.3 tons	

Total Heating Load for Mechanical System:

Total Heating Load	198616.4 btu/hr	Per Floor
Total Heating Load	16.6 tons	
Total Heating Load	1390314.5 btu/hr	Per Building
Total Heating Load	115.9 tons	

Cooling Tower System Sizing and Specifications:

Trane: Series Quiet Cooling Tower

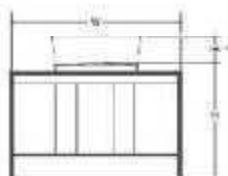
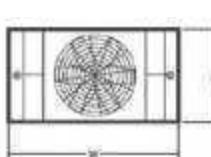
Tower Model: T08407

Tons: 338-690 Tons

Length: 11'-11" Width: 21'-0" Height: 12'-0"

Notes: Two-story modular cells

Velocity recovery air cylinders equipped on some models in this size

**Backup System Sizing**

Because the water loop draws its energy from geothermal piles incorporated into the building's foundation, the boiler and cooling tower are simply back up systems. Each has been sized for the total cooling and heating loads of the building, and can be used in the rare event that the ground loop cannot provide 100% of the cooling or heating energy needed to condition the building.

The boiler and cooling tower are located in the mechanical penthouse on the roof level. Louvered openings allow proper ventilation necessary for this equipment.

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**Tingey Place
Office Complex**The Yards | AW
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Electrical Equipment Sizing

Retail Space Loads:

Lighting	38311 SF x 2.5 W/SF = 95777.50	Watts
Devices	38311 SF x 0.9 W/SF = 34479.90	Watts
HVAC	38311 SF x 5.5 W/SF = 210710.5	Watts
Misc.	38311 SF x 1.4 W/SF = 53635.40	Watts
	Subtotal = 394633.3	Watts

Speculative Office Suite Loads:

Lighting	38315 SF x 3.0 W/SF = 114945.0	Watts
Devices	38315 SF x 2.0 W/SF = 76630.00	Watts
HVAC	38315 SF x 4.7 W/SF = 180099.5	Watts
Misc.	38315 SF x 1.2 W/SF = 45978.00	Watts
	Subtotal = 417633.5	Watts

Prime Office Space Loads:

Lighting	104627 SF x 3.0 W/SF = 313881.0	Watts
Devices	104627 SF x 2.0 W/SF = 209254.0	Watts
HVAC	104627 SF x 4.7 W/SF = 491746.9	Watts
Misc.	104627 SF x 1.2 W/SF = 125552.4	Watts
	Subtotal = 1140434.0	Watts

Conveying Equipment:

Elevators 6 x 49634 Watts = 297804 Watts

Primary Electrical Spaces

Second Level - Not to Scale

- Main Electrical Room [Unit Sub-Station]
- Emergency Generator Room
- Main Teledata Room
- Freight Elevator
- Electrical Room/Electrical Closet
- Incoming Electric
- Incoming Teledata

Total Energy for Unit Substation Sizing:

2250.475 KW

Transformer:

2500 KVA Transformer

Generator:

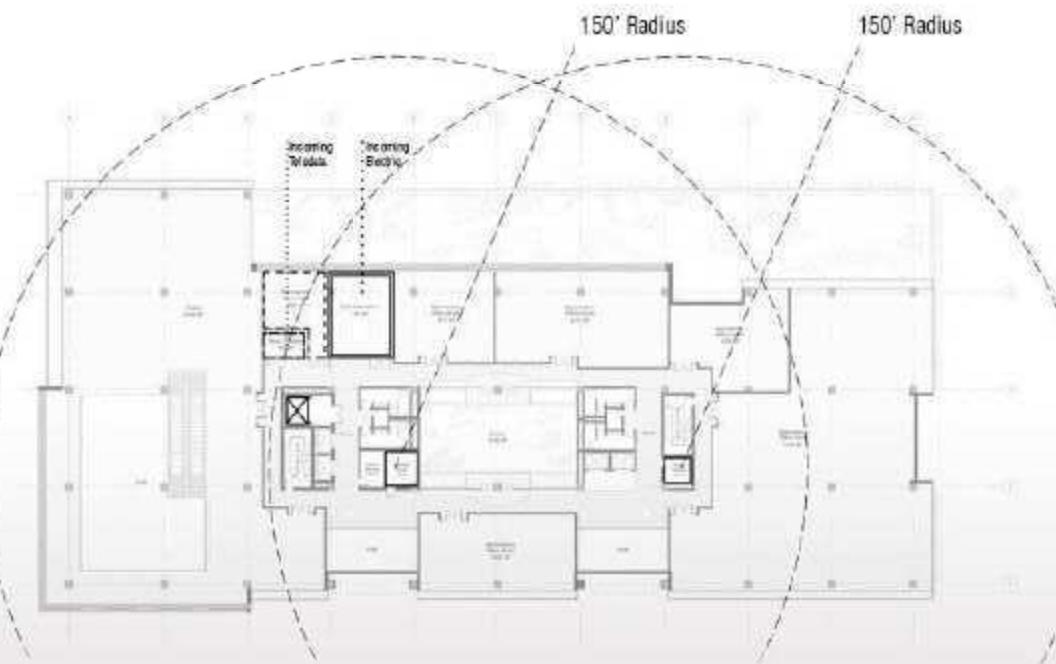
250 KW, 480/277 V, 3 Phase, 4 Wire Unit

Automatic Transfer Switch:

600 Amp, 480/277 Volt, 3 Phase, 4 Wire Unit

Electrical Overview:

The building's main electrical spaces [unit sub-station, emergency generator, and main teledata room] are all located on the second floor along an exterior wall. These spaces, though typically found on the first level or in the basement, have been moved to the second floor because the site is within a floodplain. Incoming power and teledata is fed to these rooms from the western side of the building. This is an ideal spot for incoming service, as it is within the site's service corridor and the lines will not have to travel far [saving money and electricity]. Electrical panel rooms and closets are located on each floor, providing retail, speculative, and prime office tenants adequate access to panels and meters. These electrical rooms and closets are spaced such that no part of the building falls outside of a 150' distance from an electrical room or closet.



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Melanie Padaloski

General Notes:

1. The work required under this section shall consist of all labor, materials, equipment, temporary power, accessories, etc. required for a complete working electrical system.
2. Electrical, mechanical, structural, and architectural drawings, as well as all specifications are a part of the contract documents. The contractor shall be responsible for complete familiarity with all project documents. Coordinate work with all trades during construction.
3. The electrical drawings show the general location, arrangement, and extent of work to be done. The exact sizes, locations, and arrangements are subject to the actual field conditions.
4. Discrepancies between electrical, mechanical, and architectural contract drawings or specifications shall be brought to the attention of the architect prior to final submission.
5. The contractor shall secure and pay for all local and state official permits, licenses, and inspections - required by laws of the covering bodies for electrical work.
6. The contractor shall comply with all local and state codes and ordinances. The Life Safety Code, National Electric Code, and Ohio Basic Building Code shall be observed as a minimum requirement for all electrical work. No extra compensation will be allowed for any changes necessary for code compliance.
7. The contractor shall submit to the architect [G] six sets of detailed, dimensioned shop drawings covering all electrical wiring devices, panel boards, circuit breakers, lighting fixtures, etc. No equipment shall be ordered or fabricated until such shop drawings have final acceptance. Shop drawings not stamped with contractors approval will be returned for resubmission.
8. The final locations of all equipment, outlets, etc. are subject to reasonable changes by the architect/owner before roughing-in at no additional cost.
9. Temporary telephone and electrical service, lighting, and related wiring shall be provided by electrical contractor to OSRA requirements for the use of all trades during construction, all 120 volt, single phase 15 and 20 ampere receptacle outlets used by workmen shall be protected by a Ground Fault Interrupter.
10. Provide all cutting and patching required for installation of electrical work. Such cutting and patching shall be by skilled mechanics in the trade.
11. Authorized representatives of the architect and the owner shall have access to and privilege of inspecting all work and materials as work progresses. These representatives shall have authority to approve or reject work or materials, using drawings, specifications, notes, and good engineering practices as the basis for approval or rejection.
12. Test for grounds, short circuits, and proper function of all equipment after installation is complete. Faults in the insulation shall be corrected.
13. Demonstrate to the owners satisfaction the proper operation of each of the systems comprising this contract before final payment.
14. A minimum of one set of record drawings shall be given to the architect or owner at the completion of the work. These drawings shall show exact equipment, conduit, and wiring locations and shall indicate the "as-built" condition.
15. Contractor shall guarantee all workmanship and materials and the successful operation of all equipment and apparatus installed for a period of one year after final acceptance of the entire work by the owner, and shall guarantee to repair or replace at his/her own expense any part of the apparatus which may show defective during that time provided such defect is, in the opinion of the architect, due to imperfect material or workmanship and not to carelessness or improper use.
16. At all times keep premises and building in neat and orderly condition. Follow explicitly any instructions of owner's representative. Upon completion of work this contractor shall thoroughly clean all apparatus furnished by him. The brevity of this specification shall not be construed as relieving the contractor of his responsibility to perform all work in a first class workmanlike manner, fully complying with all applicable codes. The site shall be cleaned on a daily basis with all debris being removed from the site daily.

One Line Symbols

	Circuit Breaker
	Fuse
	Non-Fused Switch
	Transformer
	AC Motor
	Three phase magnetic motor starter
	Heavy duty disconnect switch
	Conduit concealed in ceiling or wall
	Conduit turned up
	Conduit turned down
	Conduit changing elevations

Electrical Abbreviations

A	Amperes
ATS	Automated Transfer Switch
AWG	American Wire Gauge
AHU	Air Handling Unit
BRKR	Breaker
CKT	Circuit
CB	Circuit Breaker
DISC	Disconnect Switch
ELEC	Electrical/Electric
EXP	Explosion Proof
GFI	Ground Fault Interrupter
GND	Ground
HP	Horsepower
IG	Isolated Ground
KV	Kilovolts
KVA	Kilovolt-Amperes
KW	Kilowatts
LIG	Lighting
LRA	Locked Rotor Amps
LV	Low Voltage
MTR	Motor
MCB	Main Circuit Breaker
MCC	Motor Control Center
NEC	National Electric Code
NF	Non-Fused
PNL	Panel
PVC	Polyvinyl Chloride
RECEPT	Receptacle
W	Watt
XFRMR	Transformer

Fire Alarm Symbols

	Fire alarm control panel
	Fire alarm manual pull station
	Area smoke detector

Lighting Fixture Symbols

	Fluorescent Pendant Light
	Halogen track lighting
	6.75" Recessed LED downlight
	4.5" Recessed LED downlight
	Ext sign/emergency lighting

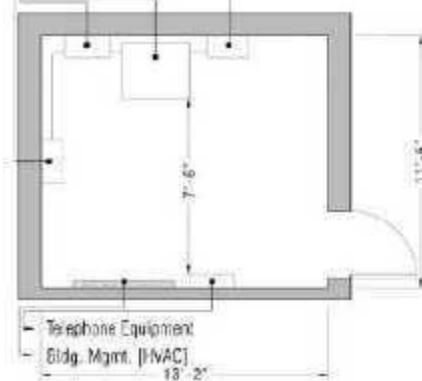
Power Plan Symbols

	Switch - 20 Amps; 120/277 volt rated, single pole
	Duplex receptacle with cover plate
	Telodata port
	Home run to panel
	Panel name and circuit number
	Photocell
	Quadruple receptacle in desk with cover plate

**Typical Electrical Room [Prime]:**

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

- 480/277V Lighting Panel
- 480/277V Bus Duct
- 480-208/120V Transformer
- 280/120V Receptacle Panel

**Typical Electrical Room [Spec]:**

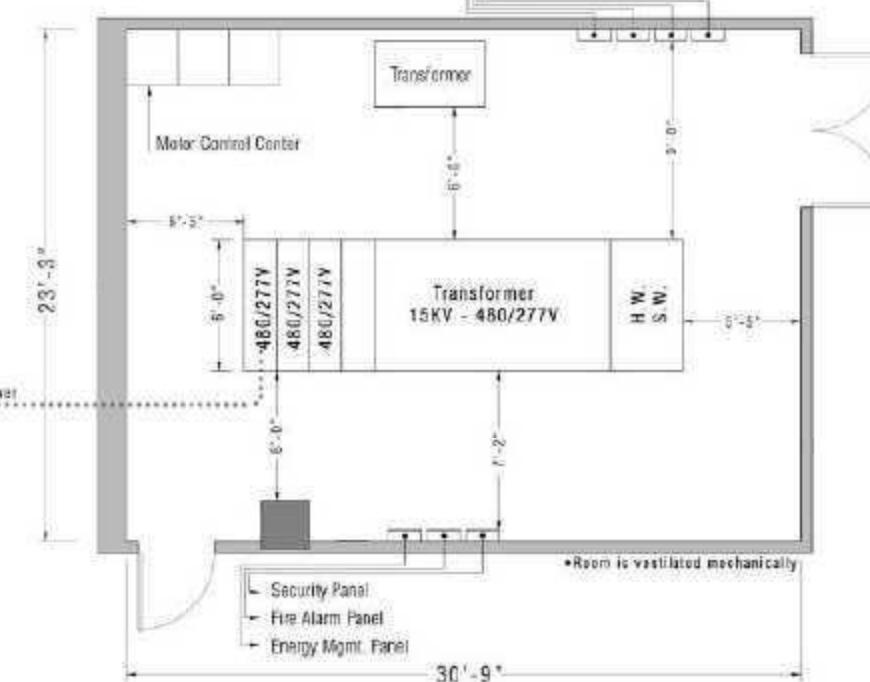
Scale: 1/4" = 1'-0"

- 480/277V Lighting Panel
- 480/277V Bus Duct
- 480-208/120V Transformer
- 280/120V Receptacle Panel

**Unit Sub-Station Plan [Main Electrical Room]:**

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

- 208/120V Dist. Panel
- 208/120V Recept. Panel
- 480/277V Power Panel
- 480/277V Lighting Panel

**Electrical Rooms:**

The main electrical room (which houses the unit sub-station), the emergency generator room, and the main teledata room are located on the second level. All electrical rooms provide ample clearance around the equipment for adequate work space and safety. In case of an emergency, two exits provide egress from the main electrical room. To allow easy access to the main electrical room, 4' wide double doors are located adjacent to the freight elevator. This allows equipment to be easily moved in and out of the space. Electrical rooms and closets are located on each floor and provide access to panels and meters.

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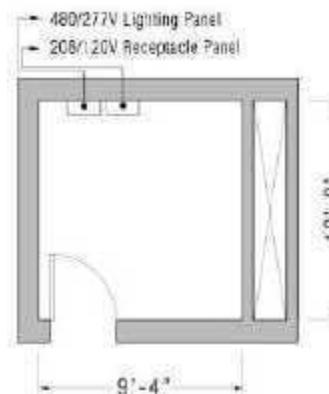
**Tingey Place
Office Complex**

The Yards | AWI
200 Fourth Street
Washington, D.C.

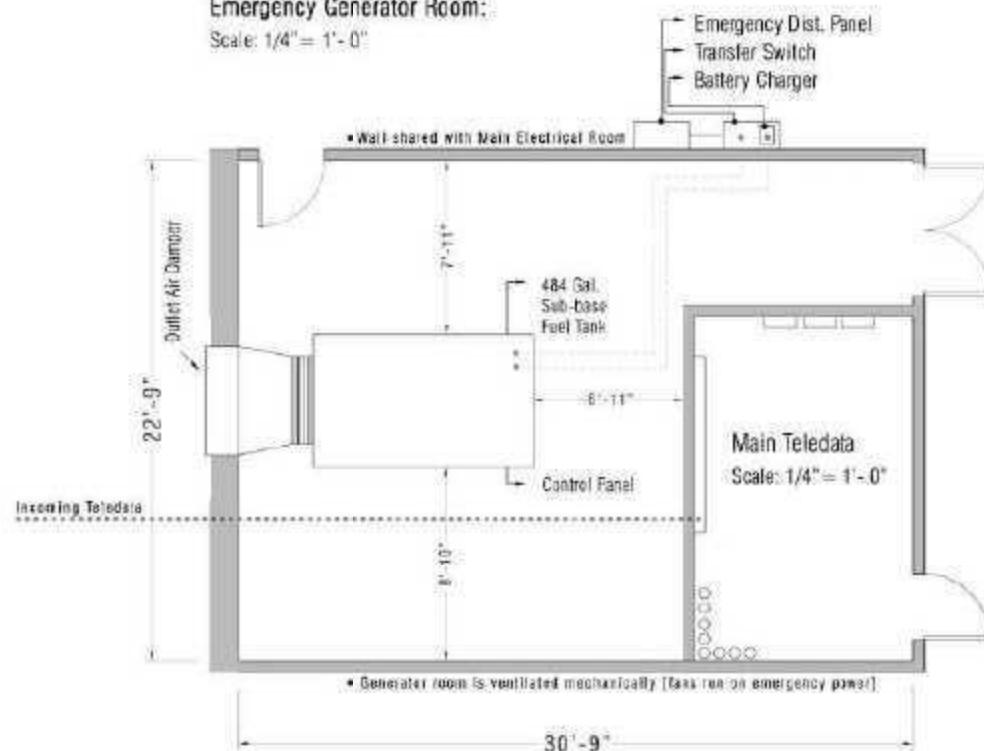
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**Typical Electrical Closet:**

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

**Emergency Generator Room:**

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

**Fire Command Center:**

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

**Electrical Rooms:**

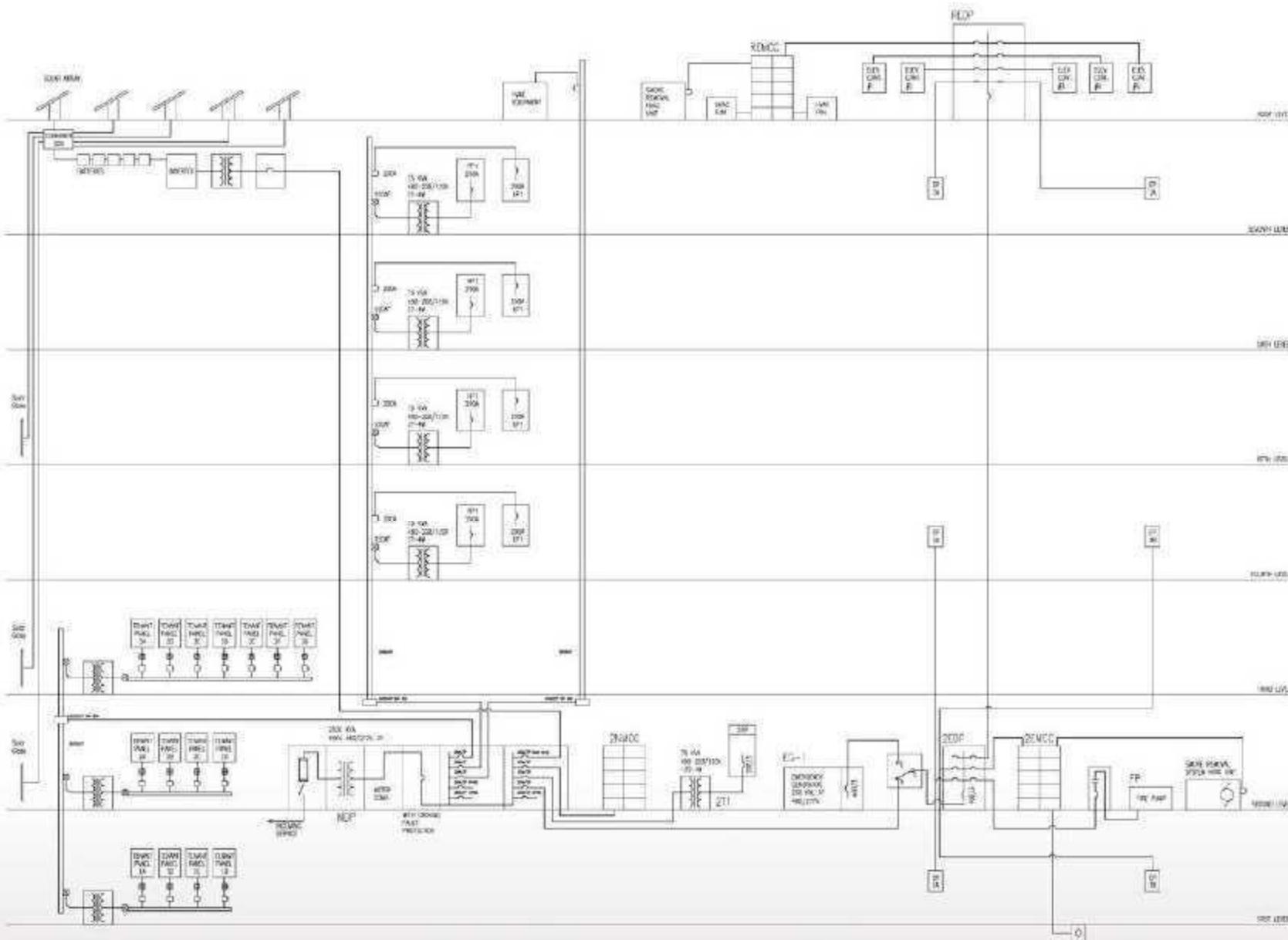
The emergency generator room and main teledata room are located on the second level. The fire command center, however, is placed on the first level off the main lobby which provides easy access for emergency personnel in the event of an emergency.

The emergency generator room is placed along the periphery of the building in order to allow the generator to exhaust to the exterior.



Equipment can be moved into place using the freight elevator. The diagram shows that proper turning radii have been accommodated for.

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Electrical One Line Diagram

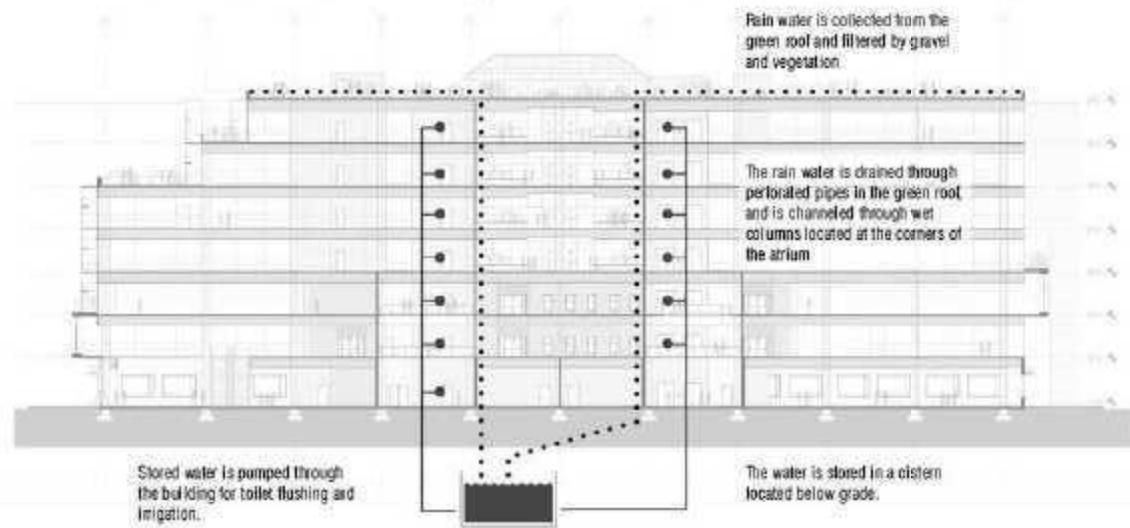
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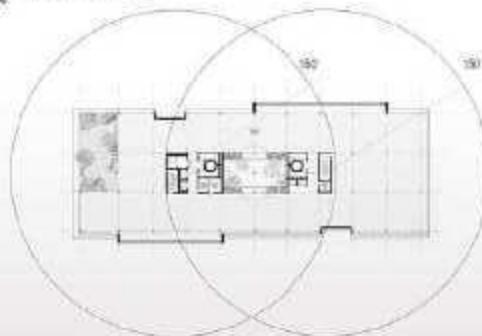
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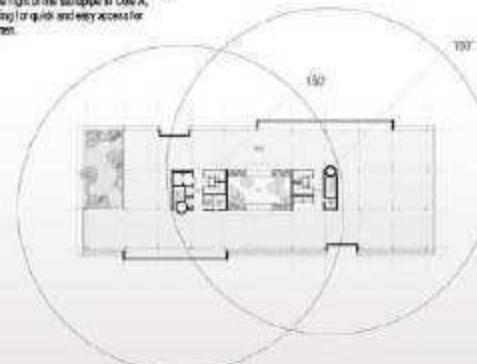
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Rest Room Location Diagram
Men's and women's rest rooms are located in each core, ensuring that the maximum travel distance to any rest room is less than 150'. All rest rooms meet ADA accessibility standards.



Standpipe Diagram
Standpipes are located in each stair tower, set into within the minimum distance of 150' apart. The fire command center resides directly to the right of the standpipe in Core A, making for quick and easy access for them.



Plumbing Description and Concepts:

The building's plumbing system draws from two main sources for supply water. Water used for faucets, drinking fountains, showers, and the building's fire suppression system is supplied by the District of Columbia Water and Sewer Authority. Second, water used for flushing toilets and irrigation is supplied by rainwater that is collected and stored in a cistern located beneath the building's first floor.

By collecting and storing rainwater through the building's green roof system, the amount of city water used for building services is greatly reduced. Also, the water catchment system collects excess rainwater that would typically be diverted to the city's storm water system. This process can be visualized through a translucent panel near the bike storage/shower entrance.

In addition to cutting the cost of building services, this system greatly reduces the impact of the building on the local water source and reduces the amount of combined sewer overflows (CSOs), which are a significant issue in the area.

Water Reducing Techniques:

Aside from the water catchment system used for the collection of grey water, low-flush 1.28 gallon toilets and water-less urinals are employed in all rest rooms throughout the building. By using these water reducing techniques, the retained rainwater is able to flush 100% of the toilets within the building.

Rest Room Layout:

Rest rooms are stacked vertically for ease of construction and are located within the building's cores. Because of the length of the building there are two sets of rest rooms on each level which ensures that a rest room is less than 150' from any point in the building. Toilets and faucets are arranged along shared plumbing walls, and ADA requirements (including mounting heights and turning radii) are met within each rest room.

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Plumbing Supply System Description:

Each floor houses two sets of rest rooms. Due to the length of the building, this is necessary to keep travel distance to a rest room under 150' from any point in the building. Each women's rest room contains 2 lavatories, 1 low-flush water closet, and 1 ADA accessible low-flush water closet. Each men's rest room contains 2 lavatories, 1 waterless urinal, and 1 ADA accessible low-flush water closet. Each floor has 4 drinking fountains and 2 service sinks. The first level has an additional 2 lavatories and 6 showers located near the bike storage room. Each speculative office spans on the second and third floors contains one additional lavatory for office use.

Plumbing Supply Calculations:

	WC	Closets	Lavatories	Dinking Fountains	Service Sink	Showers
Floor Level 1	6	2	12	4	2	6
Spec Level 2-3	12	4	28	8	4	0
Prime Levels 4-7	24	8	38	16	8	0
Total	42	14	70	28	14	6

	WC	Closets	Lavatories	Dinking Fountains	Service Sink	Showers
WSFU	5	3	15	0.15	2.25	3
WSFU Total	210	42	105	7	31.5	18

Total WSFU

107.7

Fathomed Future: 7th Floor Rest. (Require 20 psi)

Development Length: 734 (distance to tenth floor)

Equivalent Length: 117 (1/2 Development Length)

Total Equivalent Length: 351' (Dev length + Equiv. Length)

Pressure Loss:

Due to Friction: 17.5 psi (log(10*length / 1000) * 0.07)

Due to Gravity: 38.9 psi (Vertical distance / 4133 * 0.07)

Total Pressure Loss: 56.00 psi (Friction + gravity + noise + backflow + remote stored)

Water main Pressur: 80 psi

Pressure Drop: 3.15 psi (80 - psi / 100 / Equivalent length)

PUMP SIZE: 3.15 psi at 107.7 gpm

PIPE SIZE: 2.5" diameter pipe at 8 ft/s

Cistern Sizing

Approximate # fixtures/persons*

*Reduction due to waterless urinals

Gallons per flush: 1.28 gal

Approximate # fixtures

Gallons used per day (gpd)

Cistern sized for 90 days: 151,280 gal

Use 170,000 gallon cistern

Rainwater Catchment Area

IMEBB Fig. 20.5)

Average Rainfall: 41.00 in

Gallons used per year (gpd x 260 work days)

Area required for water catchment: 24,000 ft²Horizontal Rain Surface: 29,000 ft²

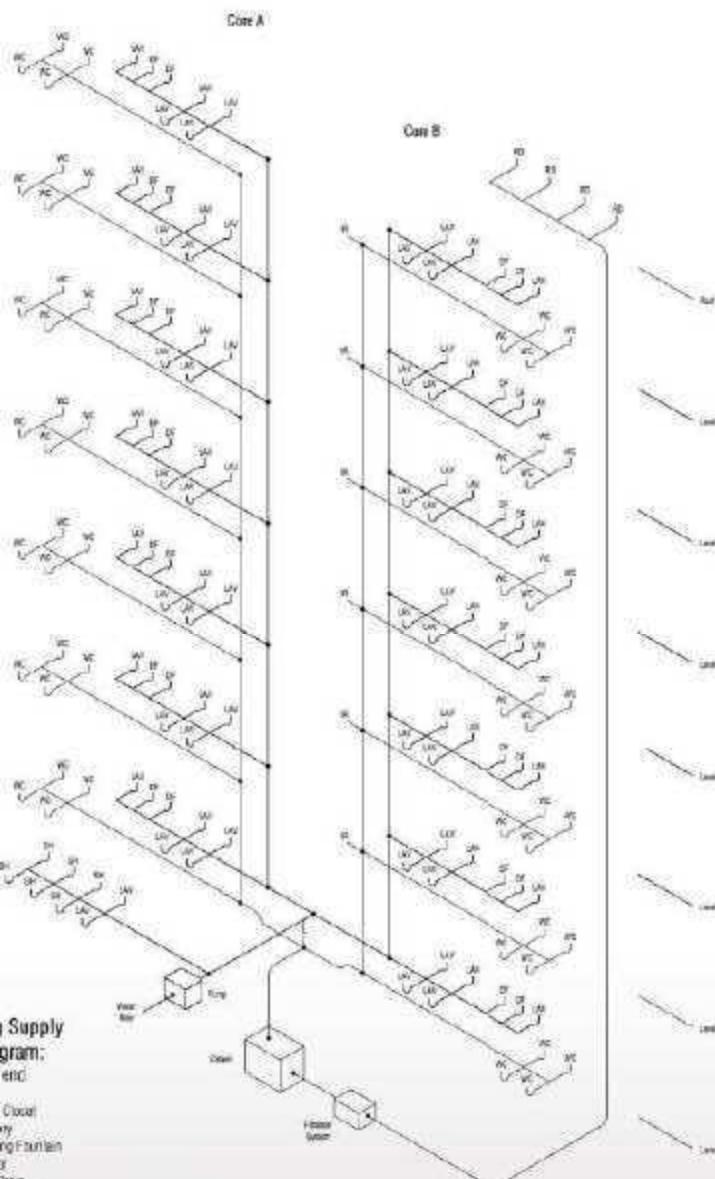
Percent roof area required for catchment: 82%

By using 82% of the roof surface for water catchment and a cistern sized for a three month dry spell, enough rain water can be collected to flush 100% of the toilets in the building.



Plumbing Supply
Riser Diagram:
Symbol Legend:

- WC Water Closet
- LAV Lavatory
- DF Drinking Fountain
- SH Shower
- RD Foot Drain
- IR Irrigation Hookup



**Plumbing Waste System Description**

The drain-waste-vent system removes sewage and grey water from a building and vents the gases produced by waste. Waste is produced at fixtures such as toilets, sinks, and showers and exits the fixture through a trap, which is a closed section of pipe that always contains water. All fixtures contain traps to prevent gases from backing up into the building. Through traps, all fixtures are connected to waste lines, which in turn take waste to a soil stack, which extends from the building up to and out at the next level. Waste is removed from the building through building drain pipes and is taken to the public sewer main.

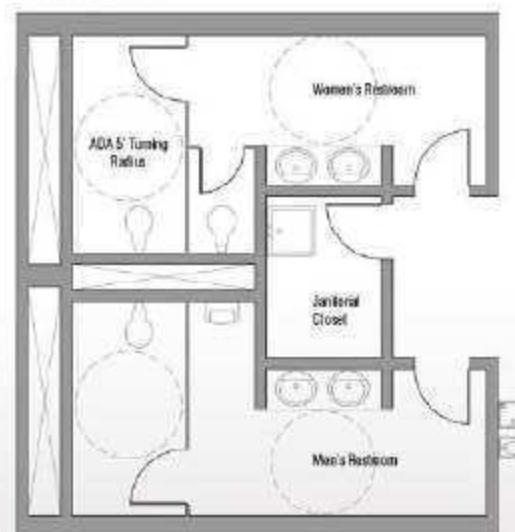
	Water Closets	Urinals	Laundries	Drinking Fountains	Service Sink	Showers
Bas Level 1	6	2	12	4	2	6
Spec Levels 2-3	12	4	26	8	4	6
Prime Levels 4-7	24	6	30	16	8	6
Total	42	14	70	28	14	6

	Water Closets	Urinals	Laundries	Drinking Fountains	Service Sink	Showers
DFU	4	2	1	0.5	2	2
DFU Total	168	28	30	14	28	12

Total DFU 320
Total DFU per typ. Branch 22

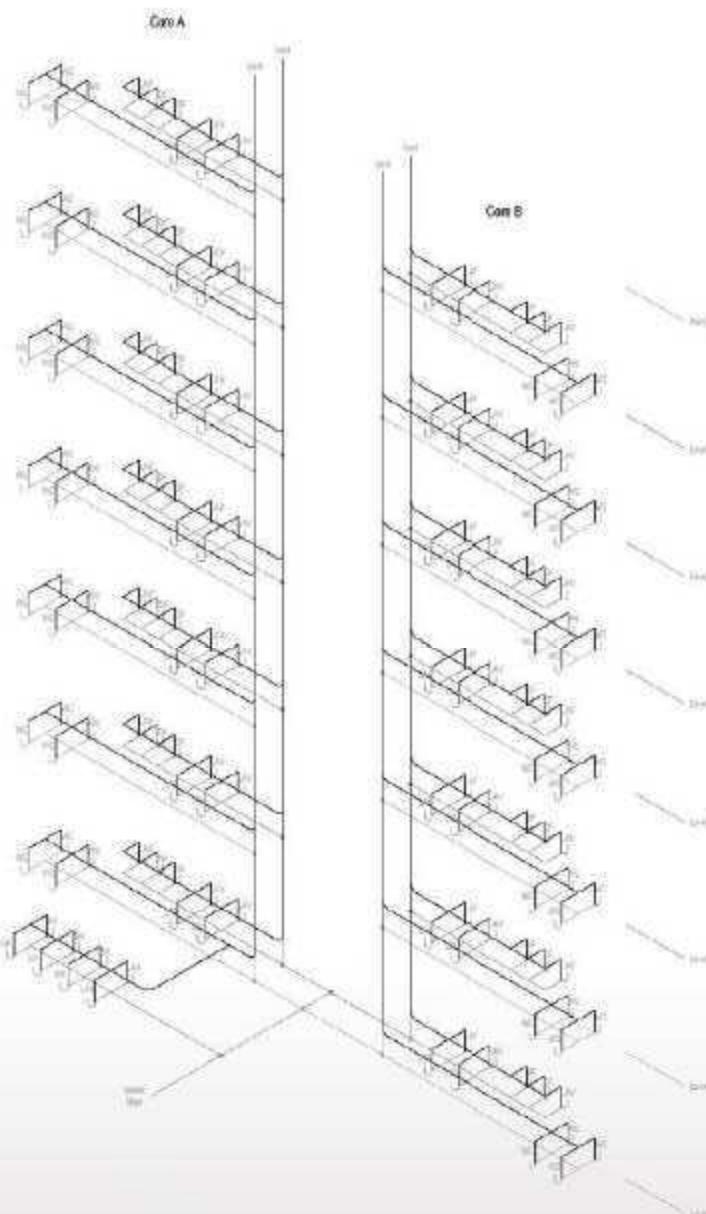
Sizing:
Branch Drainage Pipes: 4" @ 1.04% slope
Soil Stack Pipe Diameter: 4"
Stack Vent Diameter: 4"

Typical Bathroom Layout
Scale: 1/4" = 1'-0"



Stack and Drainage Riser Diagram
Symbol legend

- WC Water Closet
- LAV Lavatory
- DF Drinking Fountain
- SH Shower
- RD Roof Drain
- R Irrigation Header

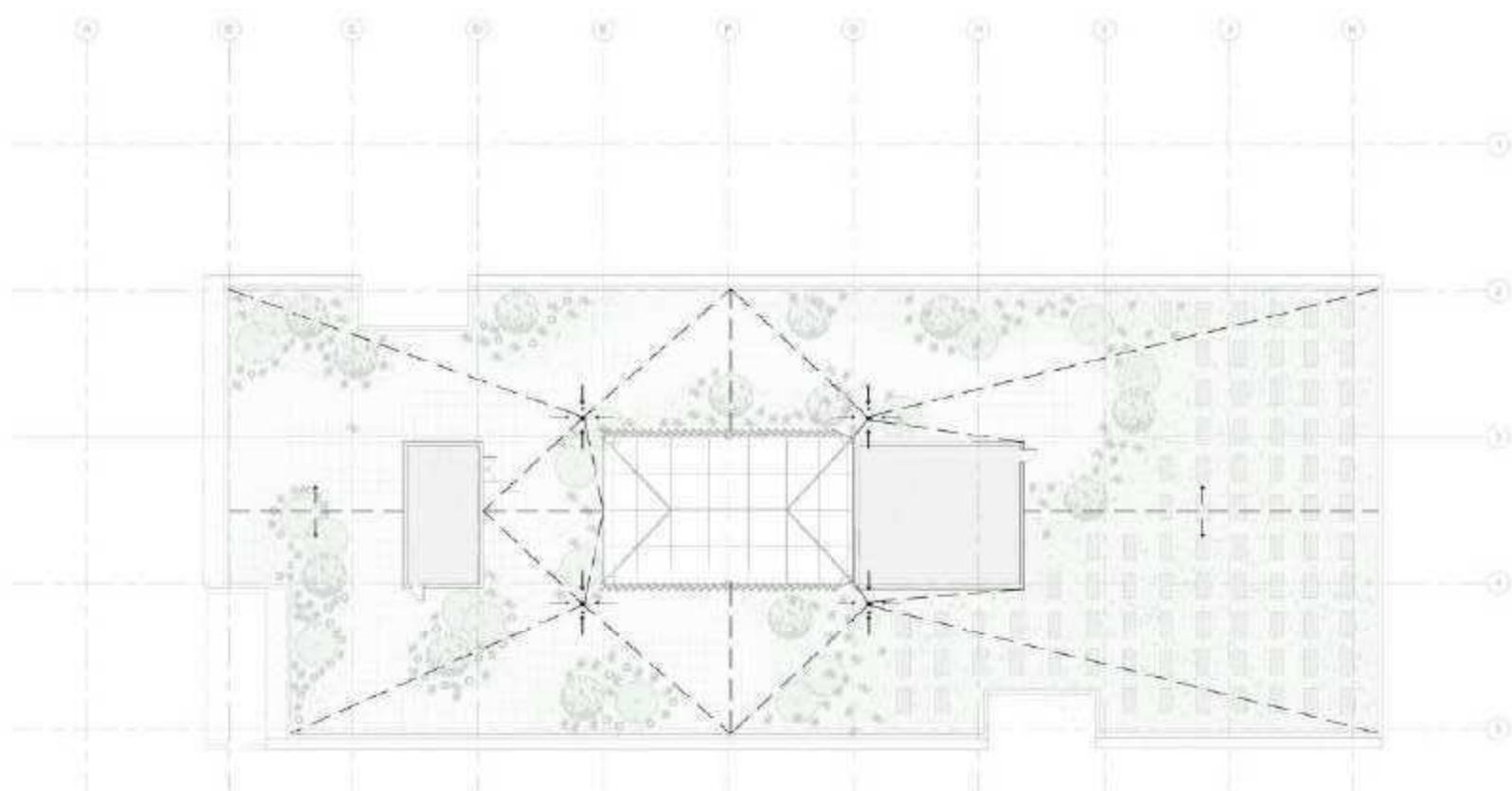
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- Roof Construction is 1 hr fire rated.
- Entire perimeter of roof has a #2 inch parapet as soil core.

The roof of the building has been designed as a partially occupiable green roof with a PV solar array where closed to occupants. To increase sustainability, the construction of the vegetative roof is designed to facilitate drainage, insulation, and water catchment, as well as to provide added insulation for the spaces below. The PV array will collect solar energy used to reduce the electrical load.

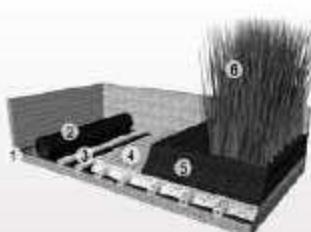
As rain water collects on the planned surface, it filters through the growing medium and gravel into PVC drainage pipes. Excess water that is not absorbed by the indigenous plantings is collected by the drainage pipes and stored in a cistern located on the first level. Excess rain water travels down wet columns located along the storm and allows building gallons to witness the water catchment as it occurs. This excess water will then be used for non-potable applications such as irrigation and toilet flushing. In the event that the green roof draining and cistern system were to become oversaturated, standard back-up roof drains are in place.

N
Backup Roof Drain Plan
Scale: 1" = 20'-0"

0 10 20 30 40

Intensive Green Roof Construction:

1. Structural Concrete Roof
2. Waterproofer Tape and Root Barrier
3. PVC Drainage Pipe
4. Gravel for Drainage and Filtration
5. Fertilized Soil
6. Indigenous Plant Life



Source: <http://www.greenroofs.com>

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Flooring Materials:

- Bamboo
- Cork
- Hardwood

Flooring materials were chosen with both the aesthetic and the environment in mind.

Key Plan

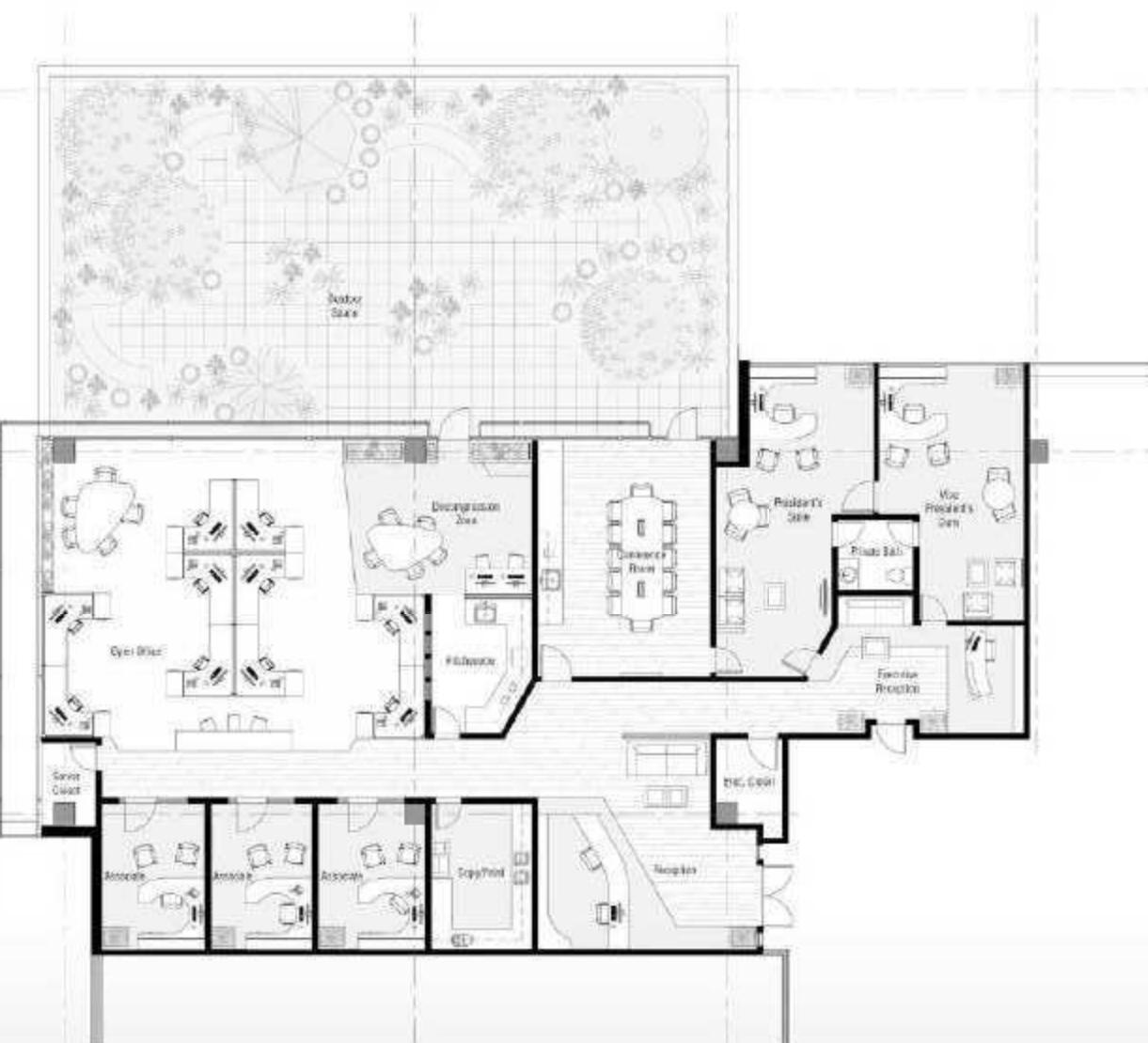
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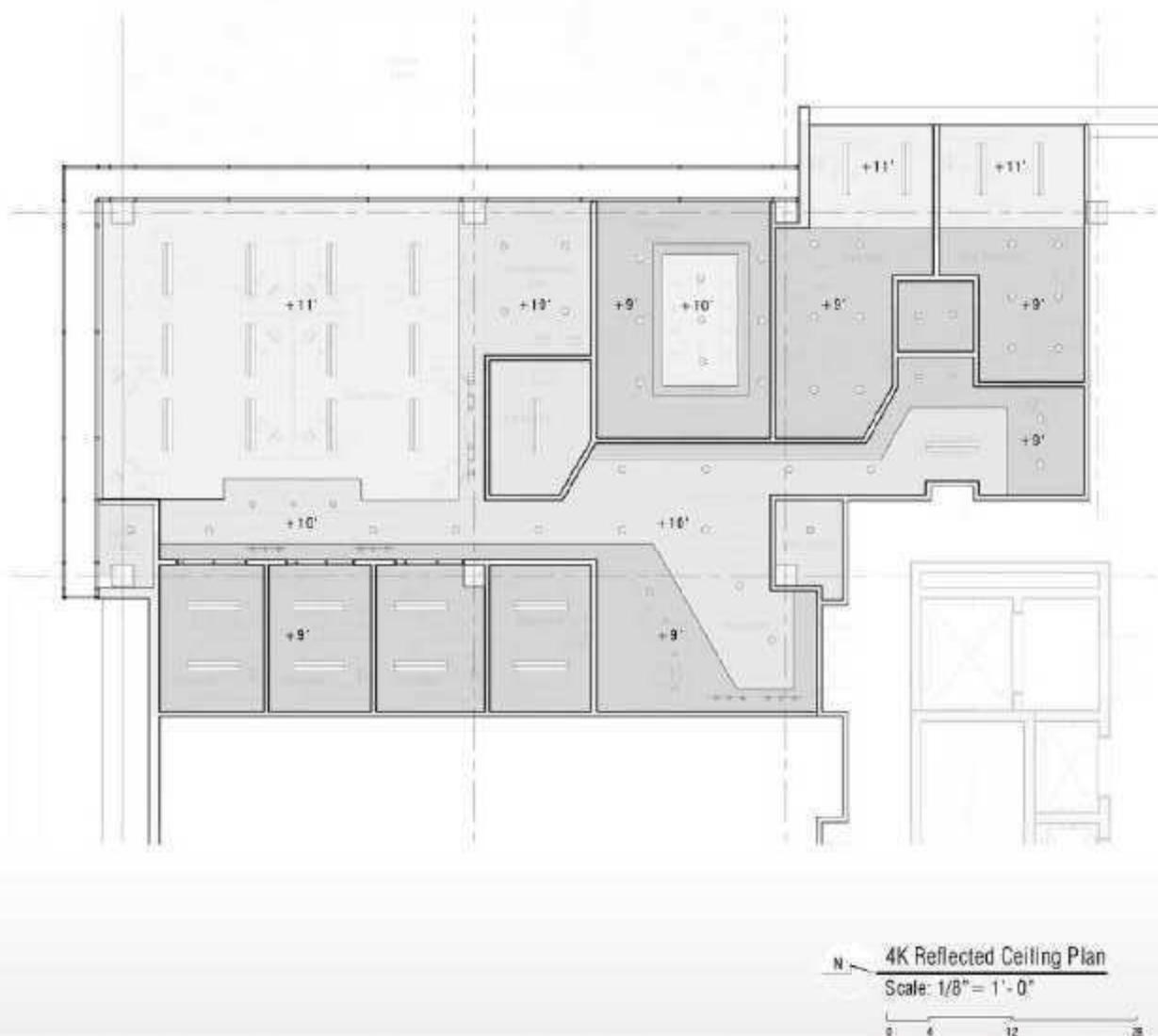


- Conference room located near main entrance and presidential suites for easy access.
- The 4K Office Suite has access to a private garden space, which overlooks the waterwall and Yards Park.
- The Decompression zone serves as a relaxing area for employees on break, and hosts all entrances to the exterior space.

N - 4K Plan

Scale: 1/8" = 1 - 0"

0 4 12 20

**4k Office Suite Sections**

The 4k Office suite is composed of numerous spaces with varying identities, created partly through the strategic use of shifts in ceiling height. Ceilings are higher in the open work zone to give a more open feel and to increase the amount of daylight entering the space. In more private areas, the ceiling steps down to create an intimate feel and an increased sense of privacy.

Ceilings vary not only by height but also by materiality. For example, the recessed portion of ceiling in the conference room is constructed of tilted frosted glass panels in 2 ft squares, while the rest of the ceiling in that space is gypsum painted white. This light color helps with illuminance levels in the space. Scott changes are used in this space to conceal uplighting, and in other instances to denote entries throughout the suite. Track lighting is used to illuminate artwork and wall wash accent walls in the president's office, main lobby, hallway, and open work area. Lastly, pendant lights in the open work zone are mounted parallel to the southern glazing. Photo sensors monitor daylight levels and are used automatically switch off extraneous light in the daytime.



Example of Ceiling Style in Conference Room

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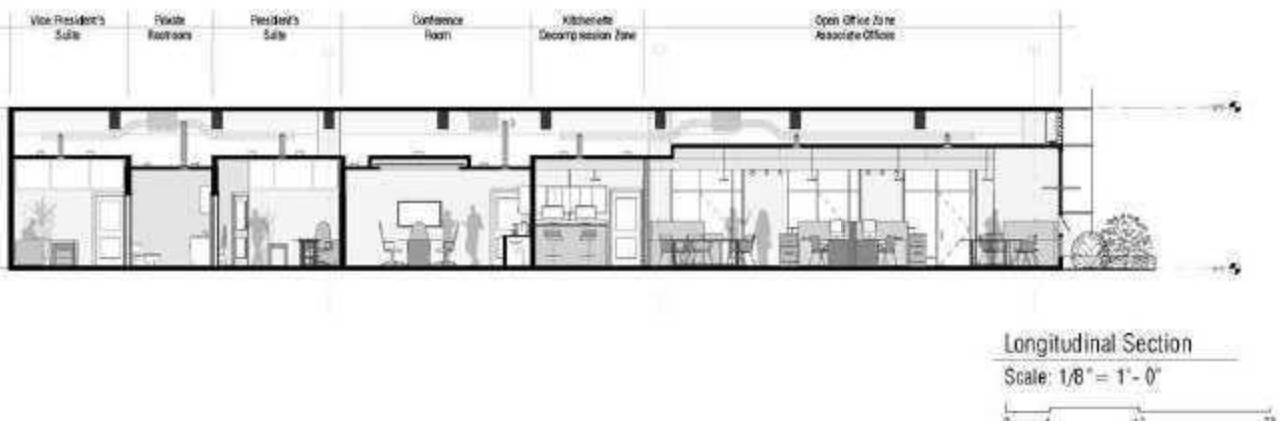
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Wind diagram

Louvres in the interior layer of the southern facade's double envelope open in suitable weather to bring fresh air through the plenum. This is a passive system when the air temperature is warm enough, but a backup exists for inclement weather. When fresh air must be conditioned, a coil/damper system exists to handle this task.

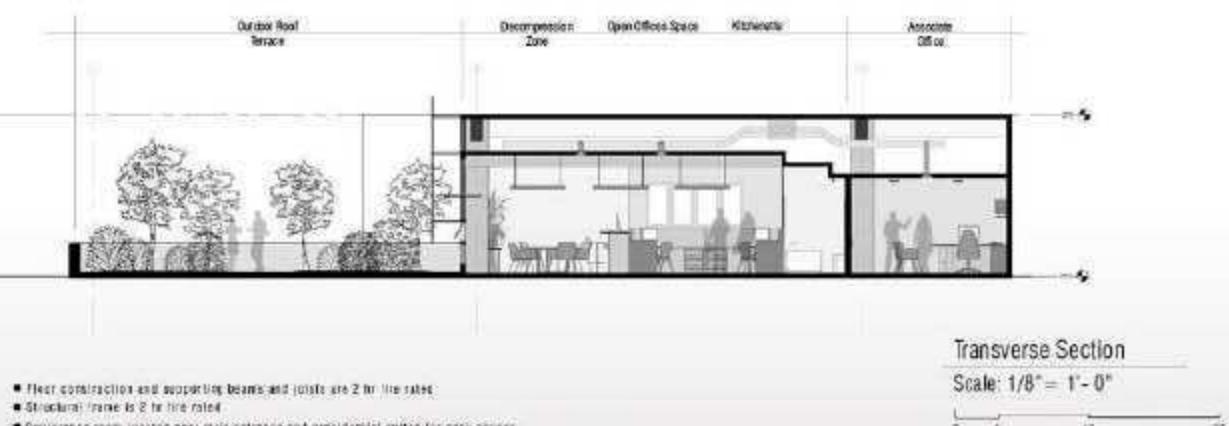


4k Office Suite Sections

The 4k Office suite is designed to create a sense of openness and a relaxed atmosphere for those working within while maintaining a sense of privacy with regards to incoming visitors. This is accomplished through strategic use of low walls and partitions, regulation, and shifts in ceiling height. Ceilings are higher in the open work zone to give a more open feel and to increase the amount of daylight entering the space. In more private areas, the ceiling drops down to create an intimate feel and an increased sense of privacy.

The president and vice president share a private jack-and-jill style bathroom embedded between their two offices and have a separate exit which allows them to leave the premises without being seen. Clerestories in these office spaces help to bring borrowed daylight into the executive reception area.

Adjacent to both the kitchenette and the open work zone, a decompression area exists for employees to relax on their lunch break. Here, they can enjoy their lunch, read, or check their facebook or personal email. This area also contains the entrance to the open roof garden, a quiet, reflective place for employees to read, chat, or take in the view of the river/park.



- Floor construction and supporting beams and joists are 2 hr fire rated.
- Structural frame is 2 hr fire rated.
- Conference room located near main entrance and presidential suites for easy access.
- The 4k Office Suite has access to a private garden space, which overlooks the Washington and Yards Park.
- The Decompression Zone serves as a relaxing area for employees to break and hosts an entrance to the outdoor space.

4K Office Suite Lighting Schedule

Image	Symbol	Cp Dist.	# Lamps & Type	Lamp Envelope	Lamp Watts	Fixture Watts	Volts	Mfg Catalog #	Diffusing Lens	Description	Mounting	Features	Remarks	
	A		Globe, 12V MR16 Halogen 50W Max. Line Voltage	N/A	50W	15W	120V	Philips Lightolier F3168	Al2040P2 Series	Tengen Edge Holder 12v MR16, phosphor-coated fixture, white insulation finish, 12v low voltage halogen socket with mid-point contact base, remote switch	Back-Mounting, horizontal or vertical	Extremely minimal striking profile, easy installation and achieves horizontal distance.		
	B		LED MR	N/A		10W	120V	Philips Lightolier C416030CLW	Warmwhite reflector, self-Baffled	Calora LED Downlight, 4.5" Aluminous Housing, Philips (LED, 300 lumens), Wide Beam, Dimming Compatible	Recessed, Ceiling, Mount			
	C		Recessed LED	1160, 1105AH H-2, H-3, 1172W, 1173B	120W	20W	120V	Philips Lightolier 1101L6030CLW	Frosted Diffuser	1121-1122, 1134, 1171H, 1172H, 1190	634 ft-hr/GFPM-8 K6-LED	Recessed, Ceiling, Mount, flame-inhibited	Lightstar LED provides energy efficient products and replace traditional sources to light fixture or its energy.	
	D		Linear Fluorescent Slotted Top Reflector	18	32W	32W	120V	Philips Lightolier 61189741A	Slotted Aluminum Diffuser	Energy-Eff-1, 1 Light 18' linear Energy Saving, aluminum fixture, 48" long, G	Cable Suspended Ceiling Mount on 48" T-Grid system	Highly efficient, dedicated luminaire combination for maximum per watt in integrated suspended.	Can dim to 5%; Energy Smart lighting, battery pack option.	
	E		2 Lamps PL Type Photocell		1W	1W	120V	Philips Lightolier 61518WAEFH		MII series exit, heavy duty steel finished in aluminum powder paint, scratch and abrasion resistant, 6 inch letters with full length directional arrows	Mounting, Emergency, & Photocell	Available with optional side mounted PAR38, European models, UL923 Listed	Exceeds UL requirements, battery life of 5 years.	

Source: www.lightolier.com

4K Office Suite Panel Schedule

Panel Designation: 3A			Location:			Utility Closet			KVA Connected Phase %		
Mounting Surface:			DME 101			40E 101			KVA Connected Phase %		
Bus Rating: 100A			KVA Connected Load:			22.318			61.509		
MCB or MCB: MCB			KVA Demand Load:			21.309			38.148		
Voltage: 208V/120V-3ph-4w			Mcb A.G.C. Rating:			10000			KVA Connected Phase %		
Circuit	Notes	Distribution	KVA	Circuit Breaker	Ground Breaker	KVA	Notes	Circuit			
			L76 RECP H/M/C MSC	AMP/POLE PH AMP/POLE	MISC HVAC RECP L76						
1		Exec Conference/Kitchen/Access-A-20	1.1	20/1 A	20/1	1.2	President/Bathroom-PWR	GPO	1		
3		Open Zins/Associate Lobby-H-13	1.1	20/1 B	20/1	1.4	Vice Pres/Sec Lobby-PWR	GPO	4		
6		Ceiling Dedicated	1.8	20/1 C	20/1	1.1	Carterson/Wifther-PWR	GPO	8		
7		Me & Lobby/Eas Closer-PWR	1.2	20/1 A	20/1	1.1	Asst. Zins 1-PWR	GPO	8		
9		Assst. Zins 2/Copy-PWR	1.2	20/1 B	20/1	1.5	Cables in Center 1-PWR	GPO	10		
11		Cubicles/Dekkers en Left-PWR	1.4	20/1 C	20/1	1.0	Cables in Center 2-PWR	GPO	11		
13		Cubicles at Rm Off-PWR	1.5	20/1 A	20/1	0.8	Cable Under in Kitchen-Dedicated	GPO	14		
15	GFCI	Minimarie-Dedicated	1.0	20/1 B	20/1	0.8	Cable Under in Con-Dedicated	GPO	16		
17	GPO	Undercounter Refrigerator-Dedicated	0.5	20/1 C	20/1	1.0	Ceremony Table in Desk-PWR	GPO	18		
19		Spiral		20/1 A	20/1		Spiral	GPO	20		
21	GPO	Exhaust Fan in Kitchen-Dedicated	0.5	20/2 B	20/2		Spiral	GPO	22		
23	GPO	Exhaust Fan in Bathroom-Dedicated	0.5	20/2 C	20/2		Spiral	GPO	24		
TOTALS			2.2 0.6 3.0 1.0		0.0 0.0 10.5 0.0			TOTALS			
Load Summary											
Load	KVA Conn	Demand Factors	KVA Demand								
Lighting	3.2	1/1000W (1/2 THE REST)	1.020								
Receptacles	13.1	NCC	19.1								
HVAC	0.0	0.75	0.0								
Misc	1	0.6	0.6								
Total	22.313		21.309								
Ampers	61.948736		59.148 X 1.25 = 73.935								

Lighting and Power Strategies:

All lamps and fixtures within the 4K Office Suite were selected with both efficiency and aesthetics in mind. Low-wattage LED and fluorescent lamps provide a high degree of efficiency and a substantial amount of light with minimal use of electricity.

Four fixture types within the office suite produce differing levels of layered lighting and create a pleasing combination of ambient, task, and decorative lighting.

The general loading for the 4K Office Suite was designed so that lighting and receptacles are on separate circuits, and dedicated circuits are used for larger appliances within the space. Circuits with receptacles within six feet of water or in a kitchen are GFCI protected [NEC 210.8].

Overall loads are balanced on each phase within GFCI. Spare circuits are remaining for renovations or additional needs.

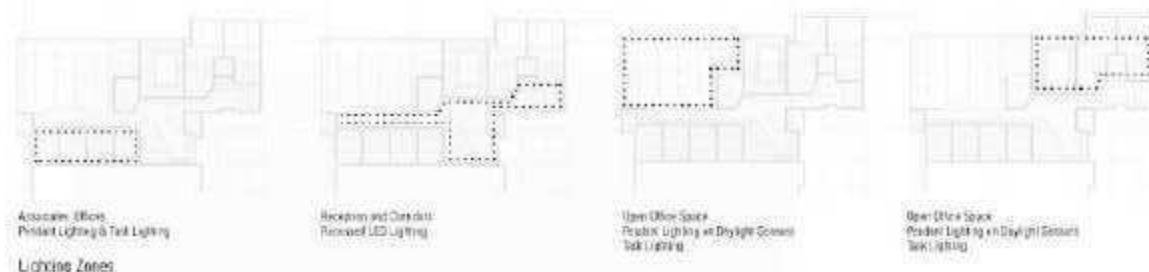
Integration Consultants

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Tingey Place
Office Complex

The Yards (AWI
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Office ComplexThe Yards | AWI
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Washington, D.C.(Design Team)
Thomas Chesnes
Melanie Panutes

Lighting Fixtures:

- LED Recessed Cans
- Halogen Track Lighting
- Fluorescent Pendants
- Emergency Lighting/Exit Signs

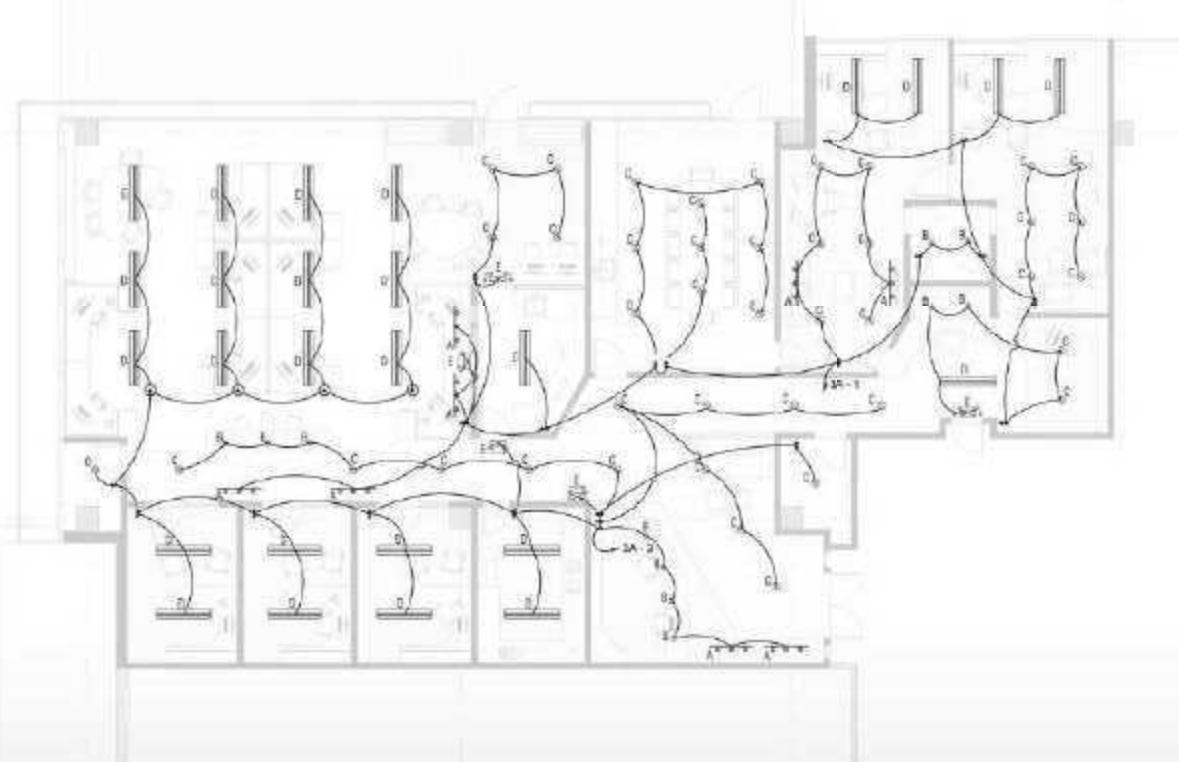
4k Lighting Strategy:

Lighting fixtures and lamps within the 4k office space were chosen with function, aesthetics, and sustainability in mind.

Corridors and reception areas, which are located deeper within the space, are lit by recessed LED lighting fixtures. These fixtures dynamically light the space and create interest through layered lighting and wall washing.

The open office space, executive office suites, and associates offices are primarily day lit. Backup pendant lights, for use when day lighting does not provide sufficient illumination, operate on photo-sensors and can be automatically dimmed or switched fully on or off.

With the use of efficient LED and fluorescent lamps, the space achieves a power density of 0.52 watts/sf which uses 47% less power than the ASHRAE 90.2004 standard.



- Power density = 0.52 watts/sf
- Lighting fixtures were selected and levels within the 4k space range from 40-50 foot candles, which is recommended for office environments.

4K Lighting Plan

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

**Integration
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Electrical Assumptions:

- Individual Receptacles are assumed to be 200 Watts.
- Double Receptacles are assumed to be 500 Watts.
- Dedicated Cubicle Receptacles are assumed to be 500 Watts
- Receptacles near water utilize GFCI Devices
- 6-8 Receptacles are placed on each circuit
- 2-3 Dedicated Cubicle Receptacles are placed on each circuit

Electrical Symbols:

	Receptacle (Duplex)
	Receptacle in Desk (Quad)
	Telodata Port / Receptical
	Home Run
3A-10	Panel Name - Circuit No.

4k Power Plan Strategy:

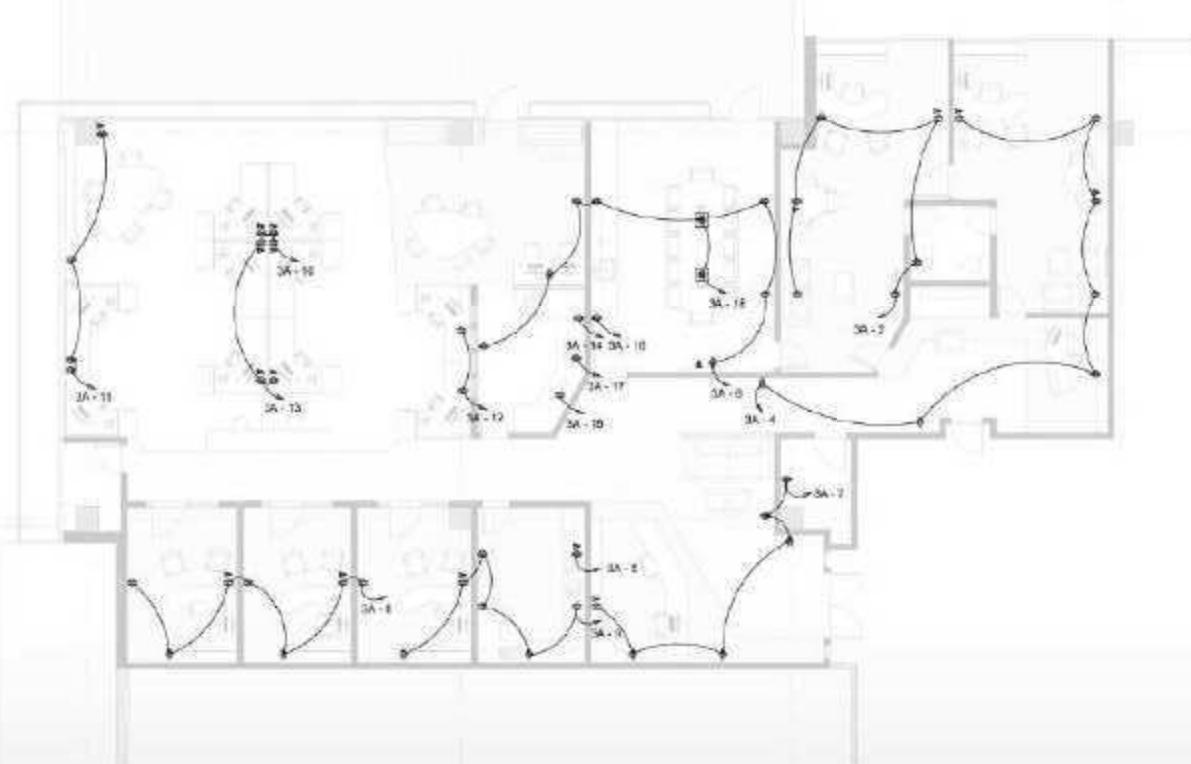
Receptacles are distributed among circuits depending on proximity and loading. Circuits are loaded with 6-8 receptacles (200 watts each).

The receptacles used for the copier, coffee makers, under cabinet refrigerator, and microwave are placed on dedicated circuits.

Receptacles located near water, such as those located within the kitchenette and executive rest room, utilize residual current devices (ground fault circuit interrupters) which disconnect the circuit whenever an imbalance in the electrical current is detected. This provides an added level of safety to receptacles located near a water source.

Receptacles are placed adjacent to all telodata ports for the power needs of telodata equipment (phones, computers, etc.)

Each space contains 3-5 receptacles, allowing for flexibility in equipment and furniture layout. Receptacles for laptop power are mounted in the conference table desk.

**4K Power Plan**

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

0 4 8 12 16 20

**Tingey Place
Office Complex**The Yards | AWI
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Thomas Chesnes
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Design Director:
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Tingey Place
Office Complex

The Yards | AW
200 Fourth Street
Washington, D.C.

Design Team:
Thomas Chesnes
Melanie Paasikoski

Zone 1-2 Layout/Sizing
4kM.101

Material Description

Item	Value	U-Value	Area North	Area South	Area East	Area West	Total Area
Steel Condensate	10.9	0.032	0.0	0.0	0.0	0.0	0.0
Single Glazing	29.6	0.081	0.0	0.0	0.0	0.0	0.0
Double Glazing	10.9	0.032	0.0	0.0	0.0	0.0	0.0
Steel Glass	10.9	0.032	0.0	0.0	0.0	0.0	0.0
Wind Coefficients	0.4-0.6	U-Value	Area North	Area South	Area East	Area West	Total Area
Full Wind	30.1	0.025	174.0	174.0	174.0	174.0	174.0
Spiraling	16.9	0.018	0.0	0.0	0.0	0.0	0.0

Cooling Load

Envelope

Glass	30.0 m²/k	$Q_{\text{G}} = U_{\text{G}} \times A_{\text{G}} \times \Delta T$	Ductwork: Average	11000.0
Walls	161.3 m²/k	$Q_{\text{W}} = U_{\text{W}} \times A_{\text{W}} \times \Delta T$	Design load	12.0
Windows or skylights	388.2 m²/k	$Q_{\text{W}} = U_{\text{W}} \times A_{\text{W}} \times \Delta T$	Design High	95.3 kg/s
Doors or trim	388.6 m²/k	$Q_{\text{D}} = U_{\text{D}} \times A_{\text{D}} \times \Delta T$	Design Low	13.0 kg/s
Interior Gains			Interior Trim (D)	12.0 kg/s
People	6000.0 m²/k	50000.0 person	Interior Trim (A)	72.0 kg/s
Lights	336.2 m²/k	1000.0	AT Summer	20.0 kg/s
Peripherals	5800.0 m²/k	1000.0	AT Winter	55.0 kg/s
Skin (North)	0.0 m²/k	$Q_{\text{S}} = U_{\text{S}} \times A_{\text{S}} \times \Delta T$	CTW	100.0 kg/s
Skin (South)	0.0 m²/k	$Q_{\text{S}} = U_{\text{S}} \times A_{\text{S}} \times \Delta T$	CTW	0.0 kg/s
Skin (East)	0.0 m²/k	$Q_{\text{S}} = U_{\text{S}} \times A_{\text{S}} \times \Delta T$	CTW	0.0 kg/s
Skin (West)	0.0 m²/k	$Q_{\text{S}} = U_{\text{S}} \times A_{\text{S}} \times \Delta T$	CTW	0.0 kg/s

Total Cooling Load: 22115.7 m²/k

Total Cooling Load: 1.9 tons

Heating Load

Envelope

Glass	30.0 m²/k	$Q_{\text{G}} = U_{\text{G}} \times A_{\text{G}} \times \Delta T$	Model No.	24
Walls	161.3 m²/k	$Q_{\text{W}} = U_{\text{W}} \times A_{\text{W}} \times \Delta T$	Size	25000.0 ft²
Windows or skylights	388.2 m²/k	$Q_{\text{W}} = U_{\text{W}} \times A_{\text{W}} \times \Delta T$	Flow	2.0 tons
Doors or trim	388.6 m²/k	$Q_{\text{D}} = U_{\text{D}} \times A_{\text{D}} \times \Delta T$	Flow Rate	300.0 ft³/s
Total Heating Load	3374.8 m²/k		Energy Star	6.300
Total Heating Load	0.4 tons		Energy Star	yes

Selected System:

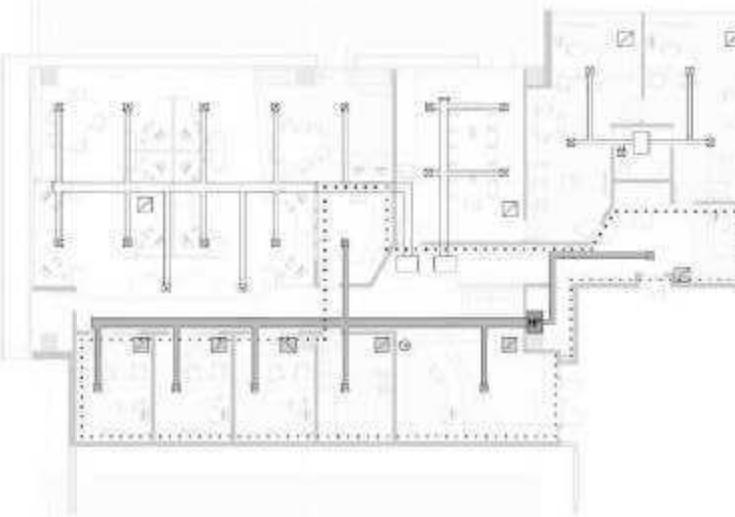
VERSATEC ULTRA SERIES

Model No.	24
Size	25000.0 ft²
Flow	2.0 tons
Flow Rate	300.0 ft³/s
Energy Star	6.300

HVAC Zone 1

Heat Pump and Ductwork Layout

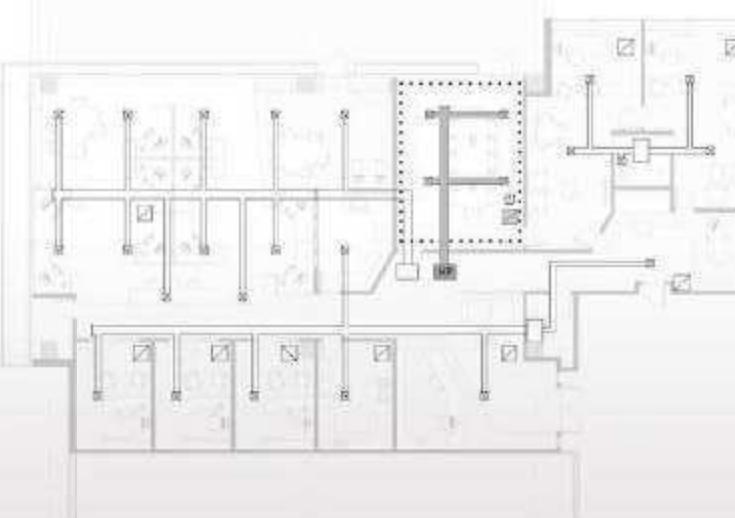
Not to Scale



HVAC Zone 2

Heat Pump and Ductwork Layout

Not to Scale



Material Description

Item	K-Value	U-Value	Area North	Area South	Area East	Area West	Total Area
Steel Condensate	10.9	0.032	0.0	0.0	0.0	0.0	0.0
Single Glazing	16.3	0.081	0.0	0.0	0.0	0.0	0.0
Double Glazing	29.6	0.032	0.0	0.0	0.0	0.0	0.0
Steel Glass	10.9	0.032	0.0	0.0	0.0	0.0	0.0
Wind Coefficients	0.4-0.6	U-Value	Area North	Area South	Area East	Area West	Total Area
Full Wind	30.1	0.025	174.0	174.0	174.0	174.0	174.0
Spiraling	16.9	0.018	0.0	0.0	0.0	0.0	0.0

Cooling Load

Envelope

Glass	121.3 m²/k	$Q_{\text{G}} = U_{\text{G}} \times A_{\text{G}} \times \Delta T$	Square footage	400.0 sf
Walls	30.1 m²/k	$Q_{\text{W}} = U_{\text{W}} \times A_{\text{W}} \times \Delta T$	Design load	12.0
Windows or skylights	1913.9 m²/k	$Q_{\text{W}} = U_{\text{W}} \times A_{\text{W}} \times \Delta T$	Design High	53.0 kg/s
Doors or trim	1999.2 m²/k	$Q_{\text{D}} = U_{\text{D}} \times A_{\text{D}} \times \Delta T$	Design Low	19.0 kg/s
Interior Gains			Interior Trim (D)	12.0 kg/s
People	6000.0 m²/k	50000.0 person	AT Summer	20.0 kg/s
Lights	301.1 m²/k	1000.0	AT Winter	55.0 kg/s
Peripherals	5800.0 m²/k	1000.0	CTW	100.0 kg/s
Skin (North)	0.0 m²/k	$Q_{\text{S}} = U_{\text{S}} \times A_{\text{S}} \times \Delta T$	CTW	0.0 kg/s
Skin (South)	0.0 m²/k	$Q_{\text{S}} = U_{\text{S}} \times A_{\text{S}} \times \Delta T$	CTW	0.0 kg/s
Skin (East)	0.0 m²/k	$Q_{\text{S}} = U_{\text{S}} \times A_{\text{S}} \times \Delta T$	CTW	0.0 kg/s
Skin (West)	0.0 m²/k	$Q_{\text{S}} = U_{\text{S}} \times A_{\text{S}} \times \Delta T$	CTW	0.0 kg/s

Total Cooling Load: 40249.3 m²/k

Total Cooling Load: 4.1 tons

Heating Load

Envelope

Glass	307.7 m²/k	$Q_{\text{G}} = U_{\text{G}} \times A_{\text{G}} \times \Delta T$	Model No.	44
Walls	76.3 m²/k	$Q_{\text{W}} = U_{\text{W}} \times A_{\text{W}} \times \Delta T$	Size	50000.0 ft²
Doors or trim	489.4	$Q_{\text{D}} = U_{\text{D}} \times A_{\text{D}} \times \Delta T$	Flow	1.2 tons
Total Heating Load	5344.7 m²/k		Flow Rate	650.0 ft³/s
Total Heating Load	0.4 tons		Energy Star	12.000

Selected System:

VERSATEC ULTRA SERIES

Model No.	44
Size	50000.0 ft²
Flow	1.2 tons
Flow Rate	650.0 ft³/s
Energy Star	12.000

Integration
Consultants:

Design Director:
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(Electrical Systems)
Jim Stadleman
(Structural Systems)
Hollie H. Becker

Tingey Place
Office Complex

The Yards (AW)
200 Fourth Street
Washington, D.C.

Design Team:
Thomas Chesnes
Melanie Paasikoski

Material Description:

Material Condition	R-Value	U-Value	Area North	Area South	Area East	Area West	Total Area
Single-Façade	16.5	0.023	0.0	0.0	0.0	0.0	0.0
Double-Façade	25.5	0.035	0.0	0.0	0.0	0.0	0.0
Solar Glass	11.5	0.033	0.0	221.3	221.3	0.0	0.0
Wall Conditions	R-18.8	0.018	Area North	Area South	Area East	Area West	Total Area
Full Wall	33.1	0.021	0.0	0.0	0.0	0.0	0.0
Studwall	55.1	0.018	0.0	0.0	0.0	0.0	0.0

Cooling Load:

Envelope:

Glass	245.2 (sq ft)	$Q_{\text{g}} = U(\text{g}) \times A_{\text{g}} \times \Delta T$	Square footage	7900 sf
Walls	852.7 (sf/wall)	$Q_{\text{w}} = U(\text{w}) \times A_{\text{w}} \times \Delta T$	Design Temp	80
Outer Air Infiltration	1936.1 (sf/wall)	$Q_{\text{ai}} = C_{\text{ai}} \times A_{\text{ai}} \times \Delta T + A_{\text{ai}} \times \Delta T$	Design High	530 deg F
Outer Air Infiltration	1025.1 (sf/wall)	$Q_{\text{ai}} = C_{\text{ai}} \times A_{\text{ai}} \times \Delta T + A_{\text{ai}} \times \Delta T$	Design Low	100 deg F
Interior Gains			Interior Temp (x)	120 deg F
People	4000.1 (sf/wall)	50000 Btu/h per person	Interior Temp (y)	120 deg F
Lights	1454.7 (sf/wall)	0.58 A _l	AT summer	71.0 deg F
Resistive	2558.1 (sf/wall)	1.8 A _r	AT winter	65.0 deg F
Exterior (North)	8.1 (sf/wall)	$Q_{\text{ext}} = A_{\text{ext}} \times \Delta T + A_{\text{ext}} \times \Delta T$	SPF	650 cm
Exterior (South)	8.1 (sf/wall)	$Q_{\text{ext}} = A_{\text{ext}} \times \Delta T + A_{\text{ext}} \times \Delta T$		
Exterior (East)	8.1 (sf/wall)	$Q_{\text{ext}} = A_{\text{ext}} \times \Delta T + A_{\text{ext}} \times \Delta T$		
Exterior (West)	8.1 (sf/wall)	$Q_{\text{ext}} = A_{\text{ext}} \times \Delta T + A_{\text{ext}} \times \Delta T$		

Total Cooling Load:

Wintertime Cooling Load:

Heating Load:

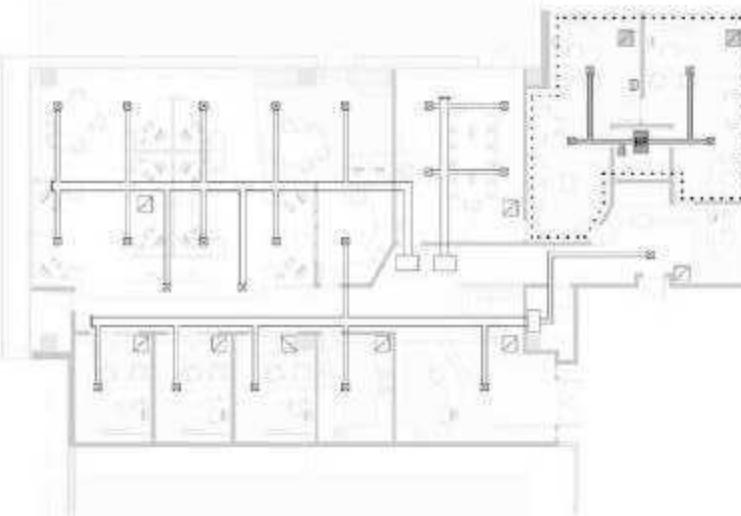
Envelope:

Glass	621.4 (sf/wall)	$Q_{\text{g}} = U(\text{g}) \times A_{\text{g}} \times \Delta T$	Mod. No.	15
Walls	184.7 (sf/wall)	$Q_{\text{w}} = U(\text{w}) \times A_{\text{w}} \times \Delta T$	Btu	16000 btu
Outer Air Infiltration	4807.3 (sf/wall)	$Q_{\text{ai}} = C_{\text{ai}} \times A_{\text{ai}} \times \Delta T + A_{\text{ai}} \times \Delta T$	Tons	1.2 tons
Wintertime Heating Load:	9053.2 (sf/wall)	Per Floor	Refr. Rate	3000 cm
Total Heating Load:	0.4 tons		Energy Star	Y/N

HVAC Zone 3:

Heat Pump and Ductwork Layout:

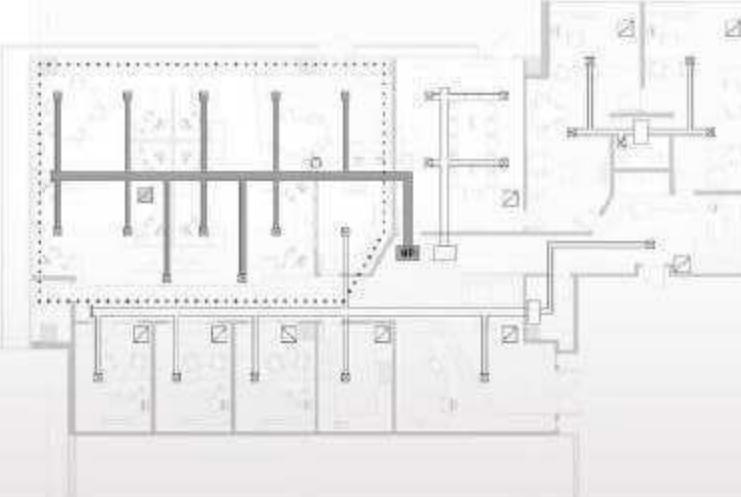
Not to Scale



HVAC Zone 4:

Heat Pump and Ductwork Layout:

Not to Scale



Material Description:

Material Condition	R-Value	U-Value	Area North	Area South	Area East	Area West	Total Area
Single-Façade	16.5	0.023	0.0	0.0	0.0	0.0	0.0
Double-Façade	25.5	0.035	361.8	361.8	361.8	361.8	905.5
Solar Glass	11.5	0.033	0.0	0.0	0.0	0.0	0.0
Wall Conditions	R-18.8	0.018	Area North	Area South	Area East	Area West	Total Area
Full Wall	33.1	0.021	0.0	0.0	0.0	0.0	0.0
Studwall	55.1	0.018	0.0	0.0	0.0	0.0	0.0

Cooling Load:

Envelope:

Glass	821.5 (sf/wall)	$Q_{\text{g}} = U(\text{g}) \times A_{\text{g}} \times \Delta T$	Square footage	1900 sf
Walls	251.7 (sf/wall)	$Q_{\text{w}} = U(\text{w}) \times A_{\text{w}} \times \Delta T$	Design Temp	70
Outer Air Infiltration	3411.8 (sf/wall)	$Q_{\text{ai}} = C_{\text{ai}} \times A_{\text{ai}} \times \Delta T + A_{\text{ai}} \times \Delta T$	Design High	530 deg F
Outer Air Infiltration	3670.0 (sf/wall)	$Q_{\text{ai}} = C_{\text{ai}} \times A_{\text{ai}} \times \Delta T + A_{\text{ai}} \times \Delta T$	Design Low	100 deg F
Interior Gains			Interior Temp (x)	120 deg F
People	8000.0 (sf/wall)	50000 Btu/h per person	Interior Temp (y)	120 deg F
Lights	2954.4 (sf/wall)	0.58 A _l	AT summer	71.0 deg F
Resistive	2118.0 (sf/wall)	1.8 A _r	AT winter	65.0 deg F
Exterior (North)	8.1 (sf/wall)	$Q_{\text{ext}} = A_{\text{ext}} \times \Delta T + A_{\text{ext}} \times \Delta T$	SPF	650 cm
Exterior (South)	14759.6 (sf/wall)	$Q_{\text{ext}} = A_{\text{ext}} \times \Delta T + A_{\text{ext}} \times \Delta T$		
Exterior (East)	8.1 (sf/wall)	$Q_{\text{ext}} = A_{\text{ext}} \times \Delta T + A_{\text{ext}} \times \Delta T$		
Exterior (West)	12697.0 (sf/wall)	$Q_{\text{ext}} = A_{\text{ext}} \times \Delta T + A_{\text{ext}} \times \Delta T$		

Total Cooling Load:

Wintertime Cooling Load:

Heating Load:

Envelope:

Glass	1719.5 (sf/wall)	$Q_{\text{g}} = U(\text{g}) \times A_{\text{g}} \times \Delta T$	Mod. No.	15
Walls	261.7 (sf/wall)	$Q_{\text{w}} = U(\text{w}) \times A_{\text{w}} \times \Delta T$	Btu	16000 btu
Outer Air Infiltration	4625.8 (sf/wall)	$Q_{\text{ai}} = C_{\text{ai}} \times A_{\text{ai}} \times \Delta T + A_{\text{ai}} \times \Delta T$	Tons	1.2 tons
Wintertime Heating Load:	10895.9 (sf/wall)	Per Floor	Refr. Rate	3500 cm
Total Heating Load:	6.0 tons		Energy Star	Y/N

Selected System:

EVAPORATOR CONVENTIONAL

Mod. No.

15

Btu

16000 btu

tons

Refr. Rate

15.3 tons

cm

5839 cm

Energy Star

Y/N

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Office Complex

The Yards | AWI
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Melanie Panutes

Duct Sizing
4kM.103

CFM/Supply:

	1	2	3	4	5	6	7	8	9	10	11	12
Zone 1	114	219	141	457	571	688	810					
Zone 2	400	800	1200	700	500	2400	2500	2917	3030	1750	4167	4500
Zone 3	100	200	300	400	500	2500	2917	3030	1750	4167	4500	5000
Zone 4	417	832	1250	1000	2400	2500	2917	3030	1750	4167	4500	5000

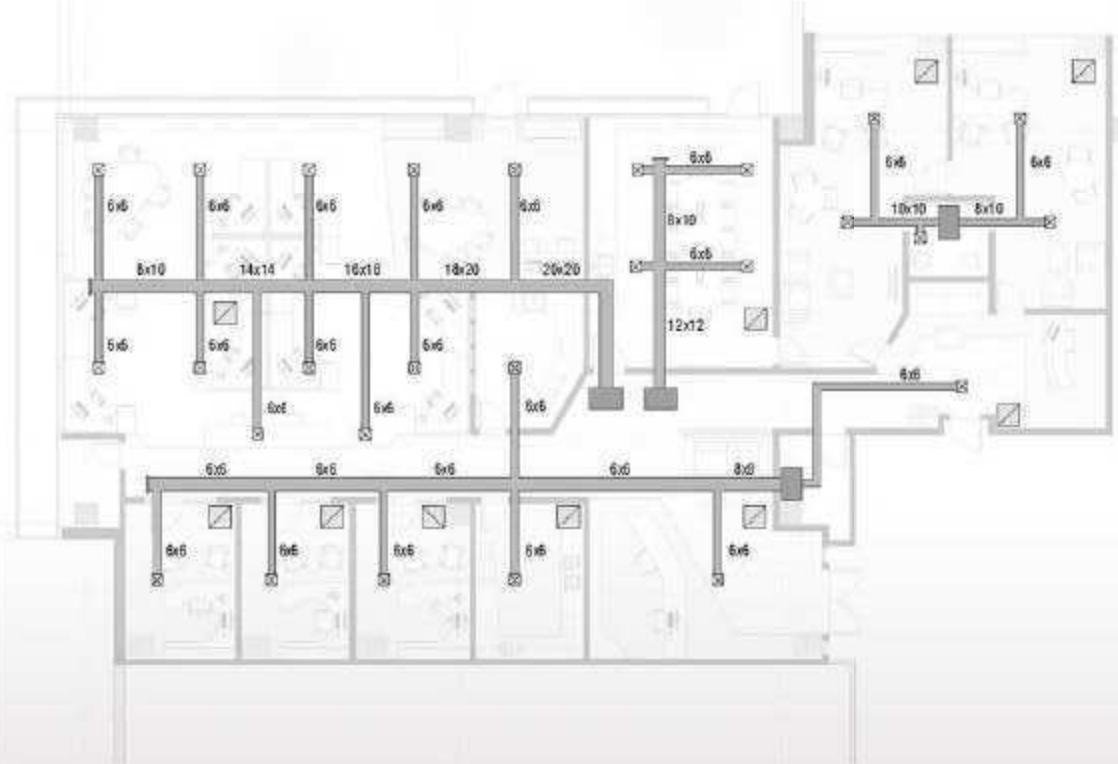
Duct Sizing:

	1	2	3	4	5	6	7	8	9	10	11	12
Zone 1	9	19	28	38	47	56	65	74	83	90	100	112
	6x6	6x6	6x6	6x6	7x7	8x8						
Zone 2	33	66	95	122								
	6x6	8x10	10x10	12x12								
Zone 3	8	16	25	33	41							
	6x6	8x10	10x10	12x12	12x14							
Zone 4	34	67	103	137	171	206	230	274	305	343	377	411
	6x6	8x10	10x12	12x12	14x14	16x16	16x16	16x18	16x18	18x20	20x20	20x22

Zone Data:

Room	Area	CFM	min # of supplies	Actual # of supplies
Zone 1	1700	800.0	1.9	7
Zone 2	400	1600.0	3.7	4
Zone 3	750	500.0	1.2	5
Zone 4	1500	5000.0	11.6	12

All Zones Rec'd:
Max Airflow Supply: 30 430 cfm



Duct Sizing within the 4k Office Suite:

Ducts were sized within the 4k Office Suite using the cfm data from the mechanical system sizing. Number of supplies per zone were calculated and placed strategically with regard to furniture layout and perimeter/envelope conditions.

One return vent is positioned for each enclosed space or open area; and exhaust to the plenum where the return air mixes with the fresh air.

All ducts are insulated to protect against vibration, and heat loss.

N 4K Duct Sizing Plan

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

8 4 12 20

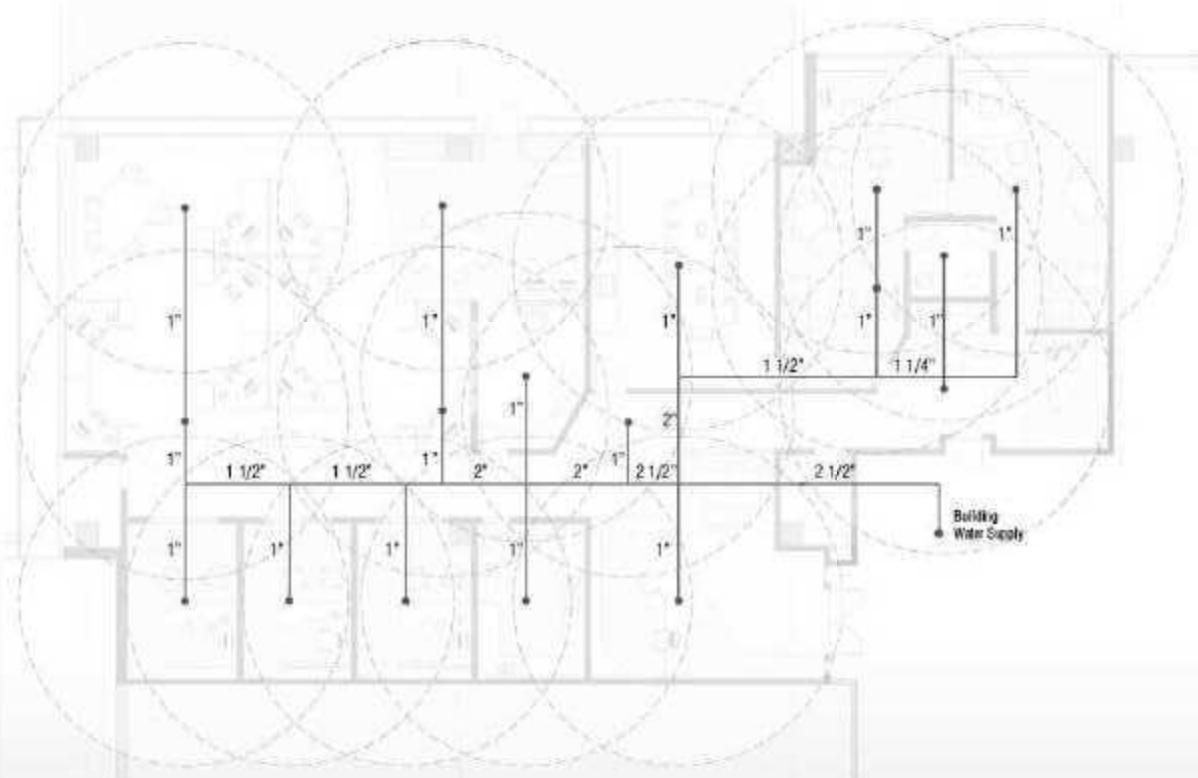
(Design Team)
Thomas Chesnes
Melanie Panutes

**Sprinkler Pipe Sizing:**

The sprinkler system has been designed for light hazard [NFPA 13: office use]. Sprinkler coverage diameter is 15' and steel pipe sizing is determined by the following chart.

Pipe Size No. of heads Total Water Flow Rate

1"	2	$Q = k(p)^{1/2}$	$p = 15\text{psi}$
1 1/4"	3	$Q = 2.8(15)^{1/2}$	$k = 2.8$
1 1/2"	5		
2"	10	$Q = 10.84 \text{ gpm}$	
2 1/2"	30		
3"	60	$10.64 \times 17 \text{ sprinkler heads} = 184.28 \text{ gpm total}$	



- Sprinkler head spacing: 15' diameter.
- Sprinkler head type: Recessed pendant.

4K Sprinkler Strategy:

As in the entire building, the 4K office suite is fully sprinkled. Sprinkler heads are spaced a distance apart using a 15' coverage diameter, and are subsequently positioned for 100% coverage.

The fire detection and suppression system is a fully automated wet system.



Selected Sprinkler Head:
Model No. F1PR
Recessed Pendant
K Factor = 2.8

All fire suppression system components comply with NFPA Standard 13.

Integration Consultants:

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4K Sprinkler Plan

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

0 4 8 12 16 20