

January 30, 2015

ENERGY MODELING OF THE MANHATTAN WEST NORTH TOWER NEW YORK CITY

BASED ON SET ISSUED FOR BUILDING PERMIT, JANUARY 30, 2015

Submitted by:

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TABLE OF CONTENTS

REPORT OVERVIEW.....	1
COMPARISON OF DESIGN BUILDING AND NYCECC 2011 CODE BASELINE	2
SCHEDULES FOR OCCUPANCY, LIGHTING AND EQUIPMENT.....	11
APPENDIX A - UTILITY RATES	21

REPORT OVERVIEW

The Manhattan West North Tower is a core and shell office building located in New York City, with approximately 1.85 million ft² and 69-stories, plus a mechanical bulkhead and basement floors.

The following two energy models were created using the DOE2.1E simulation program:

- The Design Energy Model based on the Issued For Building Permit Set dated January 30th, 2015
- The Code Baseline using the New York City Energy Conservation Code 2011 (based on the 2010 NYS Energy Construction Conservation Code, Section 506 with LL 48/10 & LL 1/11).

It is important to note that in the NYS Energy Code, the fan power, expressed in W/cfm, is a mandatory provision. The W/cfm limit may not be exceeded for any fan. Exterior lighting also falls under the category of mandatory provisions.

This report refers solely to compliance in reference to the energy cost of the design vs. the energy cost of the Energy Code baseline. Mandatory provisions have to be met by the design team.

The table below summarizes the annual energy use and cost for the Design and Code Baseline:

	Annual Energy Cost [\$]	Annual Regulated Energy Cost [\$]	Regulated Savings Vs. Code Case [\$]	Regulated Savings Vs. Code Case [%]	Energy Code Compliance With Regard to Energy Cost [Yes/No]
2011 NYC Energy Code Baseline	\$7,529,703	\$5,462,609			
Proposed Design	\$6,727,070	\$4,837,925	\$624,684	11.44%	Yes

Regulated energy cost excluded plug loads, elevators, escalators, kitchen uses, appliances, computers, printers, copiers and other office equipment, as well as process loads.

Note on Actual Energy Use

This report is developed for the purpose of determining code compliance. Actual energy use and cost will be greater, since the modeling rules do not account for many real-life issues, such as three-dimensional heat loss at the envelope, piping heat loss, quality of construction, equipment functionality, building operation and other factors.

COMPARISON OF DESIGN BUILDING AND NYCECC 2011 CODE BASELINE

The following table shows the comparison of the Proposed Design Case and the 2011 NYC Energy Code (based on the 2010 NYS Energy Conservation Code and NYC LL 48/10 & LL 1/11):

Proposed Design	CODE Baseline: NYCECC 2011 (based on ECCCNYC 2010 + LL 48/10 and LL 1/11)	Reference Drawing / Document
Wall, Above Grade Glass spandrel curtain wall (<u>Walls B1 and B3</u>): <ul style="list-style-type: none"> 1-1/4" Insulated glazing unit 3-11/16" Air space 4" Semi-rigid insulation with R-4.2/inch and vertical mullions 5'-0" O.C., horizontal mullions 18'-4.5" O.C. U-factor = U-0.179 (based on THERM analysis) Storefront curtain wall (<u>Wall B2</u>): <ul style="list-style-type: none"> 1-5/16" Semi-rigid insulation with R-4.2/inch and vertical mullions 10'-0" O.C., horizontal mullions 1'-4" O.C. 1/2" Steel plate Air space 1/2" Steel plate U-factor = U-0.890 (based on THERM analysis) Concrete Masonry Unit wall (<u>Wall B4</u>): <ul style="list-style-type: none"> 8" Concrete masonry unit, fully grouted 1 3/8" Semi-rigid insulation with R-4.2/inch 5/8" Gypsum board U-factor = U-0.128 	Wall, Above Grade <ul style="list-style-type: none"> U-factor = U-0.064 (Steel framed) U-factor = U-0.104 (Mass wall, non-residential) 	EN-200, Issued for Building Permit, January 30, 2015 EN-200, Details 5, 6 EN-200, Detail 3 EN-200, Detail 4

<p>Vertical Glazing</p> <p>Glazing area = 67% of exterior façade area</p> <p>Typical tower glazing</p> <ul style="list-style-type: none"> • U-0.45 (unit); curtain wall with thermally broken aluminum frame • U-0.29 (center of glass) • SHGC = 0.29 • Visible transmittance = 41% <p>Lobby glazing</p> <ul style="list-style-type: none"> • U-1.06 (unit); curtain wall with thermally broken aluminum frame • U-1.0 (center of glass) • SHGC = 0.88 • Visible transmittance = 80% 	<p>Vertical Glazing</p> <p>Glazing area = 40%</p> <ul style="list-style-type: none"> • U-factor = U-0.50 (Metal framing; curtain wall/storefront) • SHGC = 0.40 	<p>EN-200, EN-201, EN-202, Issued for Building Permit, January 30, 2015</p>
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<p>Roof</p> <p>Tower roof (<u>Roof A2</u>):</p> <ul style="list-style-type: none"> • Concrete pavers • Air space • 5" Extruded polystyrene insulation • Roofing membrane • 9" Concrete slab • Metal deck • U-factor = U-0.036 • Roof albedo - reflectivity of 0.3 <p>Plaza roof (<u>Roof A1</u>):</p> <ul style="list-style-type: none"> • 2" Stone paving • 3" Mortar setting bed • 7" Extruded polystyrene insulation • 6" Concrete slab • 1/2" Extruded polystyrene insulation • 10" Concrete slab • Metal deck • U-factor = U-0.025 • Roof albedo - reflectivity of 0.3 	<p>Roof</p> <ul style="list-style-type: none"> • U-factor = U-0.048 (Insulation entirely above deck) • Roof albedo - reflectivity of 0.3 	<p>EN-200, Issued for Building Permit, January 30, 2015</p> <p>EN-200, Detail 6</p> <p>EN-200, Detail 2</p>
<p>Wall, Below Grade</p> <ul style="list-style-type: none"> • C-factor = C-0.550 	<p>Wall, Below Grade</p> <ul style="list-style-type: none"> • C-factor = C-1.140 	<p>EN-200, Issued for Building Permit, January 30, 2015</p> <p>Detail 1</p>
<p>Slab-On-Grade Floors</p> <ul style="list-style-type: none"> • F-factor = F-0.460 	<p>Slab-On-Grade Floors</p> <ul style="list-style-type: none"> • F-factor = F-0.730 	<p>EN-200, Issued for Building Permit, January 30, 2015</p> <p>Detail 1</p>

Opaque Door <ul style="list-style-type: none">U-factor = U-0.7 (Swinging)	Opaque Door <ul style="list-style-type: none">U-factor = U-0.7 (Swinging)																																															
Lighting Power Density <table><tr><th>Space</th><th>LPD (W/ft²)</th></tr><tr><td>Lobby</td><td>0.47</td></tr><tr><td>Mechanical</td><td>0.28</td></tr><tr><td>Electrical</td><td>0.22</td></tr><tr><td>EMR</td><td>0.29</td></tr><tr><td>Corridor</td><td>0.39</td></tr><tr><td>Storage Active</td><td>0.35</td></tr><tr><td>Stair</td><td>0.30</td></tr><tr><td>Elevator Lobby</td><td>0.55</td></tr><tr><td>Restrooms</td><td>0.52</td></tr><tr><td>Lockers</td><td>0.47</td></tr><tr><td>Parking</td><td>0.30</td></tr><tr><td>IT rooms</td><td>0.47</td></tr><tr><td>BOH Office</td><td>0.75</td></tr></table> <u>Tenant Fit-out per ASHRAE 90.1-2010 (New Energy Code that will apply to all tenants)</u> <table><tr><td>Office - Enclosed</td><td>1.11</td></tr><tr><td>Office - Open Plan</td><td>0.98</td></tr><tr><td>Retail</td><td>1.68</td></tr></table>	Space	LPD (W/ft²)	Lobby	0.47	Mechanical	0.28	Electrical	0.22	EMR	0.29	Corridor	0.39	Storage Active	0.35	Stair	0.30	Elevator Lobby	0.55	Restrooms	0.52	Lockers	0.47	Parking	0.30	IT rooms	0.47	BOH Office	0.75	Office - Enclosed	1.11	Office - Open Plan	0.98	Retail	1.68	Lighting Power Density <table><tr><th>LPD (W/ft²)</th><th>Space Classification</th></tr><tr><td>1.0</td><td>Office</td></tr><tr><td>0.3</td><td>Parking Garage</td></tr></table> <u>Tenant Fit-out</u> <table><tr><td>1.11</td><td>Office - Enclosed</td></tr><tr><td>0.98</td><td>Office - Open Plan</td></tr><tr><td>1.68</td><td>Retail - Sales Area</td></tr></table>	LPD (W/ft²)	Space Classification	1.0	Office	0.3	Parking Garage	1.11	Office - Enclosed	0.98	Office - Open Plan	1.68	Retail - Sales Area	EN-100 series, Issued for Building Permit, January 30, 2015
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Lighting Control <u>Core & Shell:</u> Occupancy sensors in restrooms, storage, IT rooms and stairwells, BOH offices.	Lighting Control No occupancy sensors, except for conference rooms without multi-scene controls, BOH offices < 250 ft²	EN-100 series, Issued for Building Permit, January 30, 2015																																														

Plug-in office equipment Computers, monitors, printers, copiers will have standard efficiency <table><tr><td><u>Space</u></td><td><u>EPD (W/ft²)</u></td></tr><tr><td>Open Office</td><td>1.5</td></tr><tr><td>Enclosed Office</td><td>1.5</td></tr><tr><td>Lobby</td><td>0.5</td></tr><tr><td>Mechanical</td><td>0.25</td></tr><tr><td>Electrical</td><td>5</td></tr><tr><td>Elevator Machine Room</td><td>10</td></tr><tr><td>IT Rooms</td><td>10</td></tr><tr><td>Data Center</td><td>30</td></tr><tr><td>Meet Me Rooms</td><td>5</td></tr><tr><td>Retail</td><td>0.5</td></tr></table>	<u>Space</u>	<u>EPD (W/ft²)</u>	Open Office	1.5	Enclosed Office	1.5	Lobby	0.5	Mechanical	0.25	Electrical	5	Elevator Machine Room	10	IT Rooms	10	Data Center	30	Meet Me Rooms	5	Retail	0.5	Plug-in office equipment Same as Design.	
<u>Space</u>	<u>EPD (W/ft²)</u>																							
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Lobby	0.5																							
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Electrical	5																							
Elevator Machine Room	10																							
IT Rooms	10																							
Data Center	30																							
Meet Me Rooms	5																							
Retail	0.5																							
High efficiency elevators with regenerative braking (savings of 25%)	Same as Design																							
Outside Air Offices 20 cfm per person Corridors 0.06 cfm per square foot. Lobby 11 cfm per person Retail 16 cfm per person	Outside Air Same as Proposed Case																							
Outside Air The outside air is heated by purchased steam. It is provided separately to air handling units on each floor.	Outside Air The outside air is provided separately as Design	Issued for Building Permit, January 30, 2015 Sheet # 502.00																						

<p>Office Floors Water-cooled, packaged DX units with variable air volume system. Minimum supply air temperature is 49F with warmest control.</p> <p>System fan power w/cfm is as per New York State Code Table 503.2.10.1</p> <p>VAV boxes have minimum turn down ratio of 35%.</p> <p>Perimeter fan powered boxes with ECM motors.</p> <p>DX compressors with 0.85 kW/ton.</p> <p>DX units equipped with water-side economizers.</p>	<p>Office Floors <u>System 2 - VAV with reheat</u></p> <ul style="list-style-type: none"> • Fan Control: VAV • Minimum supply air temperature is 55F with warmest control. • System fan power w/cfm same as Design • Cooling Type: Chilled water • Heating Type: Purchased steam • VAV minimum flow setpoint of 0.4 cfm/ft² of the floor area 	<p>Issued for Building Permit, January 30, 2015</p> <p>Sheet # 505.00</p>
<p>Lobby Water-cooled, packaged DX units with variable air volume system. Minimum supply air temperature is 49F with warmest control.</p> <p>System fan power w/cfm is as per New York State Code Table 503.2.10.1</p> <p>VAV boxes have minimum turn down ratio of 50%.</p> <p>Lobby has fan powered boxes with ECM motors.</p> <p>DX compressors with 0.85 kW/ton.</p> <p>DX units equipped with water-side economizers.</p>	<p>Lobby <u>System 7 - VAV with reheat</u></p> <ul style="list-style-type: none"> • Fan Control: VAV • Minimum supply air temperature is 55F with warmest control. • System fan power w/cfm same as Design. • Cooling Type: Chilled water • Heating Type: Purchased steam • VAV minimum turn down ratio (M-C-R) of 50% 	<p>Issued for Building Permit, January 30, 2015</p> <p>Sheet # 505.00</p>

EMR Rooms 'B' System type: Fancoil units <ul style="list-style-type: none"> Fan Control: Constant volume System fan power w/cfm as per New York State Code Table 503.2.10.1. Cooling Type: Chilled water Heating Type: Purchased steam 	EMR Rooms 'B' <u>System 7 – Four Pipe Fan Coil</u> <ul style="list-style-type: none"> Fan Control: Constant volume System fan power w/cfm same as Design. Cooling Type: Chilled Water Heating Type: Purchased Steam 	Issued for Building Permit, January 30, 2015 Sheet # 505.00
Data, Meetme, IT Rooms, EMR 'A' <ul style="list-style-type: none"> Fan Control: Constant volume System fan power w/cfm is as per New York State Code Table 503.2.10.1. Cooling Type: Water Cooled DX units; Cooling efficiency (EER) = 12.1 Heating Type: Purchased steam 	Data, Meetme, IT Rooms, EMR 'A' <u>System 7 – Four Pipe Fan Coil</u> <ul style="list-style-type: none"> Fan Control: Constant volume System fan power w/cfm same as Design. Cooling Type: Chilled Water Heating Type: Purchase steam 	Issued for Building Permit, January 30, 2015 Sheet # 505.00
Parking Garage CO sensors in parking garage. The fans operate for ten hours per day. The parking garage is not heated.	Parking Garage Same as Design.	Issued for Building Permit, January 30, 2015 Sheet # 501.00
Mechanical Areas Constant volume system. Heating is provided by purchased steam Cooling by air cooled packaged DX units (Cooling SEER= 13.0). Cooling setpoint is high, so there is no cooling load.	Mechanical Areas Constant volume system. Heating is provided by purchased steam Cooling same as Design	Issued for Building Permit, January 30, 2015 Sheet # 504.00
Steam heat with condensate recovery (4% heat recovered)	Steam heat without condensate heat recovery.	

Hot water pumps : <ul style="list-style-type: none"> • Hot water supply temperature = 180 °F • Hot water return temperature = 130 °F • Hot water supply temperature reset <ul style="list-style-type: none"> ○ 180 °F at 20 °F and below ○ 150 °F at 50 °F and above ○ Ramped linearly between 180 °F and 150 °F at temperature between 20 °F and 50 °F • 33 W/gpm (based on 150 feet head and 85% pump efficiency) • VFD (w/ 30% minimum turndown ratio) • Premium efficiency motors 	Hot water pumps : <ul style="list-style-type: none"> • Hot water supply temperature = 180 °F • Hot water return temperature = 130 °F • Hot water supply temperature reset <ul style="list-style-type: none"> ○ 180 °F at 20 °F and below ○ 150 °F at 50 °F and above ○ Ramped linearly between 180 °F and 150 °F at temperature between 20 °F and 50 °F • Same as Design • VFD (w/ 30% minimum turndown ratio) • NEMA Standard efficiency motors 	Issued for Building Permit, January 30, 2015 Sheet # 500.00
Cooling tower <ul style="list-style-type: none"> • Five Cells (One Standby) • Entering temperature = 95 °F • Leaving temperature = 85 °F • Wet bulb outdoor air = 75 °F • The cooling tower fan has variable frequency drive with minimum turn down ratio of 50% 	Cooling tower <ul style="list-style-type: none"> • Five cells (one Standby) • Entering temperature = 95 °F • Leaving temperature = 85 °F • Wet bulb outdoor air = 75 °F • The cooling tower fan has two speed drive 	Issued for Building Permit, January 30, 2015 Sheet # 500.00
Condenser water pumps <ul style="list-style-type: none"> • Primary pumps: 44 W/gpm • Secondary Pumps: 22 W/gpm • Tertiary Pumps: 22 W/gpm • Premium efficiency motors 	Condenser water pumps <ul style="list-style-type: none"> • Same as Design • NEMA Standard efficiency motors 	Issued for Building Permit, January 30, 2015 Sheet # 500.00

Chillers Chillers serve the EMR <ul style="list-style-type: none"> • Five 60-ton modular multi-stack chillers with efficiency of 0.822 kw/ton • 250 ton single-effect absorption chiller using heat recovered from co-generation plant • Pumps with VFD (w/ 30% minimum turndown ratio) 	Chillers Chillers serve the entire building <ul style="list-style-type: none"> • Seven 750-ton electric centrifugal chillers with efficiency of 0.576 kw/ton at ARI conditions • Pumps same as Design 	Issued for Building Permit, January 30, 2015 Sheet # 500.00
Service Water Heating <ul style="list-style-type: none"> • Electric DHW heaters 	Service Water Heating <ul style="list-style-type: none"> • Electric DHW heaters 	
Electric Cogeneration Plant (Microturbines) <ul style="list-style-type: none"> • Electric Generation Capacity = 1200 KW • Electric Generation Efficiency =29.90% • Thermal Efficiency = 32.0% • Heat recovered from cogeneration plant is used by a 250 ton single-effect absorption chiller. • Electric generation mode is track electric • Heat recovered from cogeneration plant is also used for service hot water heating and space heating. 	Electric Cogeneration Plant No cogeneration plant.	Issued for Building Permit, January 30, 2015 Sheet # 600.00
Premium efficiency motors for fans	NEMA Standard Efficiency motors for fans	

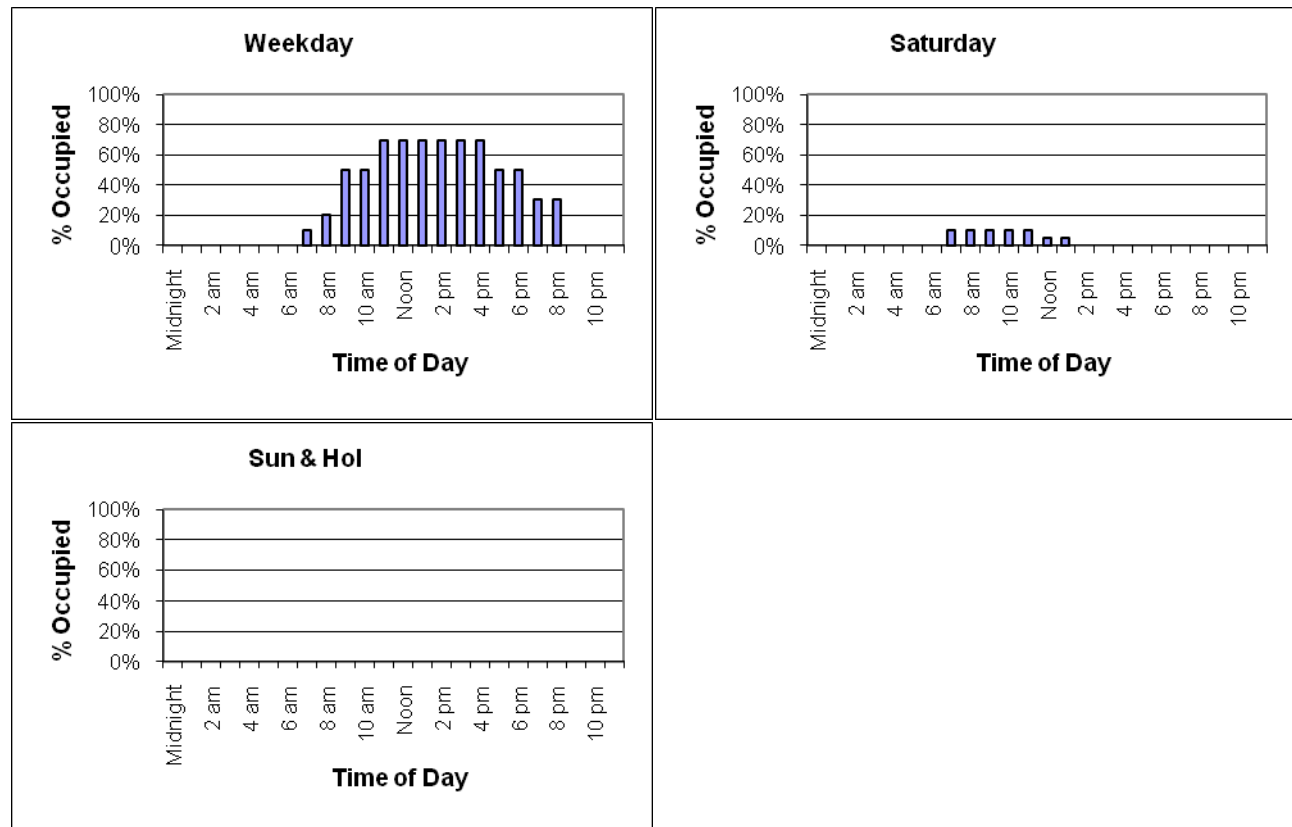
SCHEDULES FOR OCCUPANCY, LIGHTING AND EQUIPMENT

Occupancy Patterns

Space Type	Occupancy Density	Schedule
Open Office	140 ft ² /person	Office occupancy
Enclosed Office	140 ft ² /person	Office occupancy
Lobby	50 ft ² /person	Corridor occupancy
Mechanical	5000 ft ² /person	Mechanical occupancy
Electrical	5000 ft ² /person	Mechanical occupancy
Corridor	140 ft ² /person	Corridor occupancy
Elevator Lobby	140 ft ² /person	Corridor occupancy
Restrooms	140 ft ² /person	Corridor occupancy
Stairwells	140 ft ² /person	Corridor occupancy
Lockers	140 ft ² /person	Corridor occupancy
Parking	5000 ft ² /person	Corridor occupancy
IT Rooms	5000 ft ² /person	Mechanical occupancy
Retail	50 ft ² /person	Retail occupancy

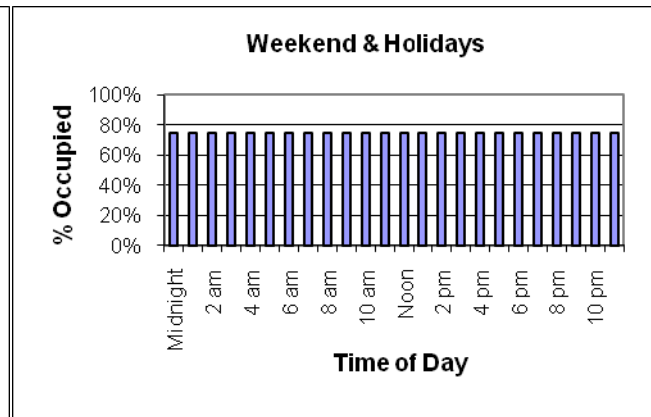
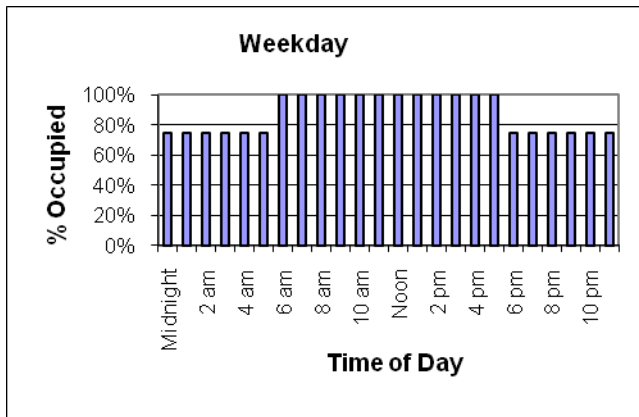
Corridor occupancy

Schedule thru December 31

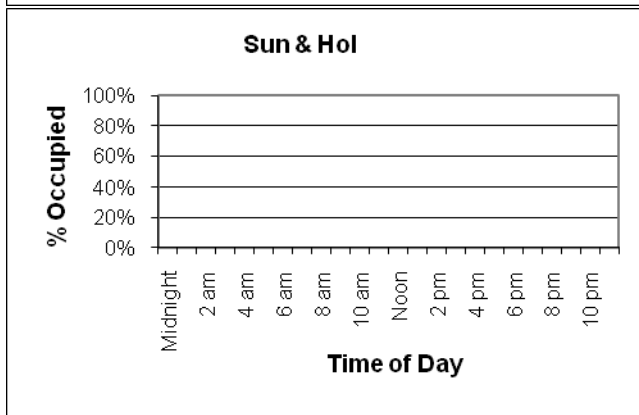
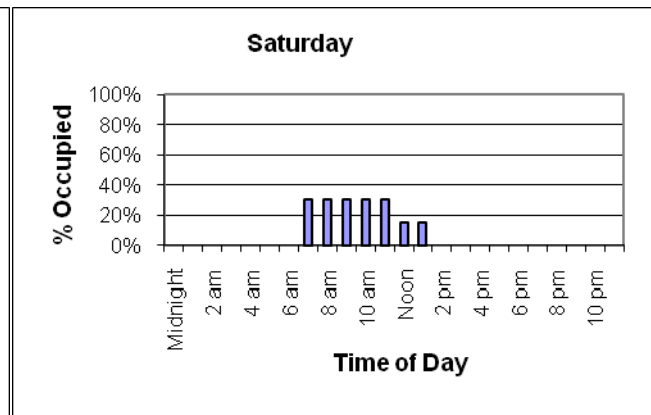
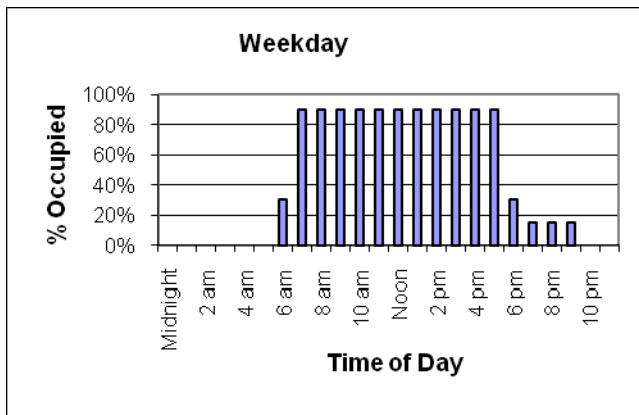


Mechanical occupancy

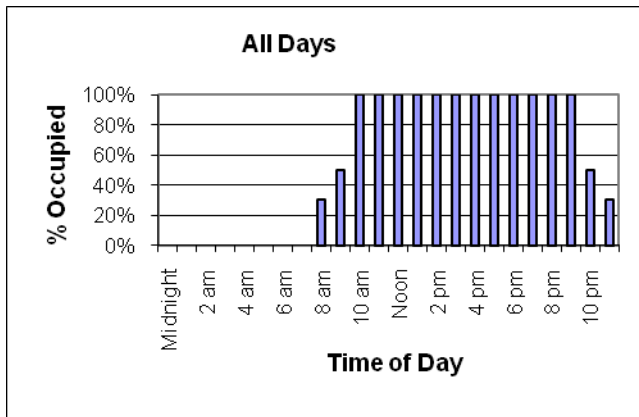
Schedule thru December 31



Office occupancy
Schedule thru December 31



Retail occupancy
Schedule thru December 31

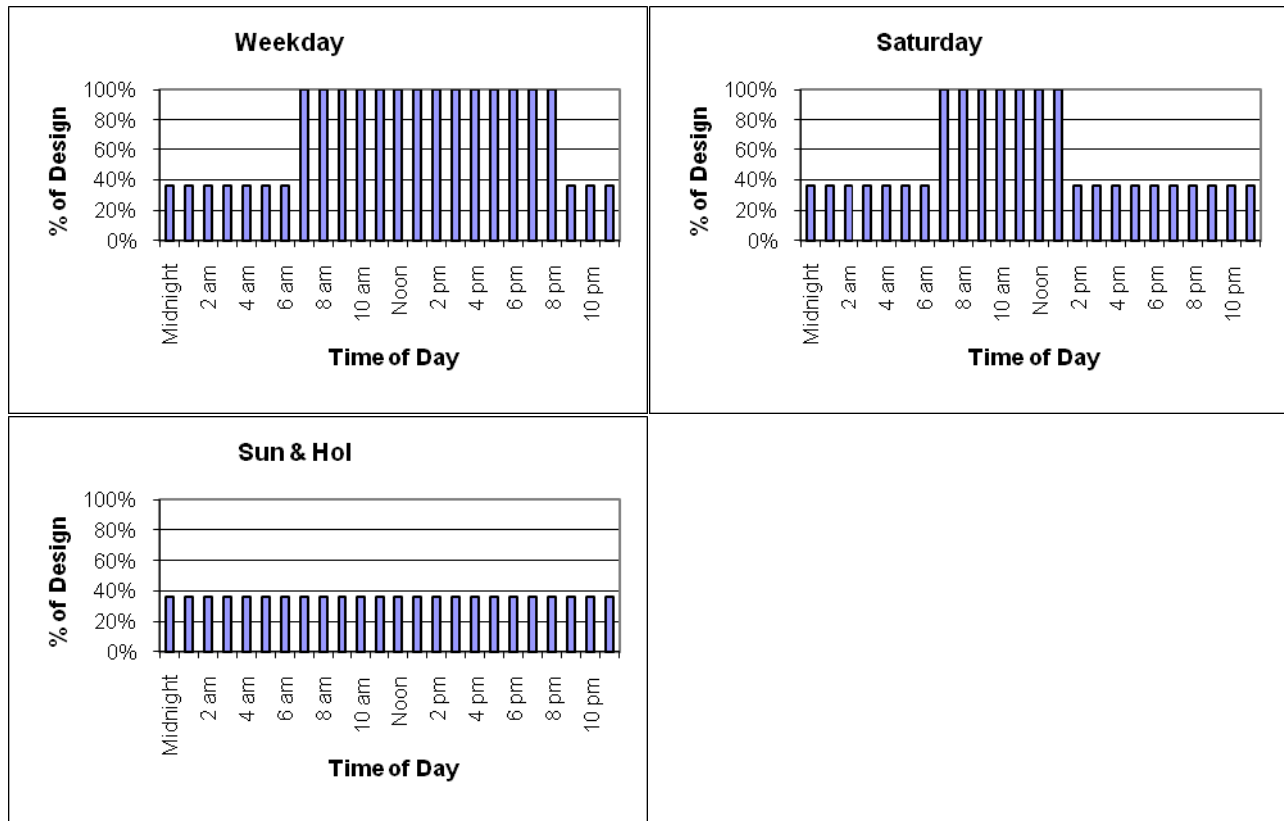


Lighting Use Patterns

Space Type	Lighting Power Density	Schedule
Open Office (tenant)	0.98 W/ft ²	Office lighting
Enclosed Office (tenant)	1.11 W/ft ²	Office lighting
Lobby	0.47 W/ft ²	Lobby lighting
Mechanical	0.28 W/ft ²	Mechanical lighting
Electrical	0.22 W/ft ²	Mechanical lighting
EMR	0.29 W/ft ²	Mechanical lighting
Corridor	0.39 W/ft ²	Corridor lighting
Elevator Lobby	0.55 W/ft ²	Corridor lighting
Restrooms	0.52 W/ft ²	Core lighting
Stairwells	0.30 W/ft ²	Stair lighting
Storage	0.35 W/ft ²	Core lighting
Lockers	0.47 W/ft ²	Corridor lighting
Parking	0.30 W/ft ²	Corridor lighting
IT rooms	0.47 W/ft ²	Mechanical lighting
Retail	1.68 W/ft ²	Retail lighting

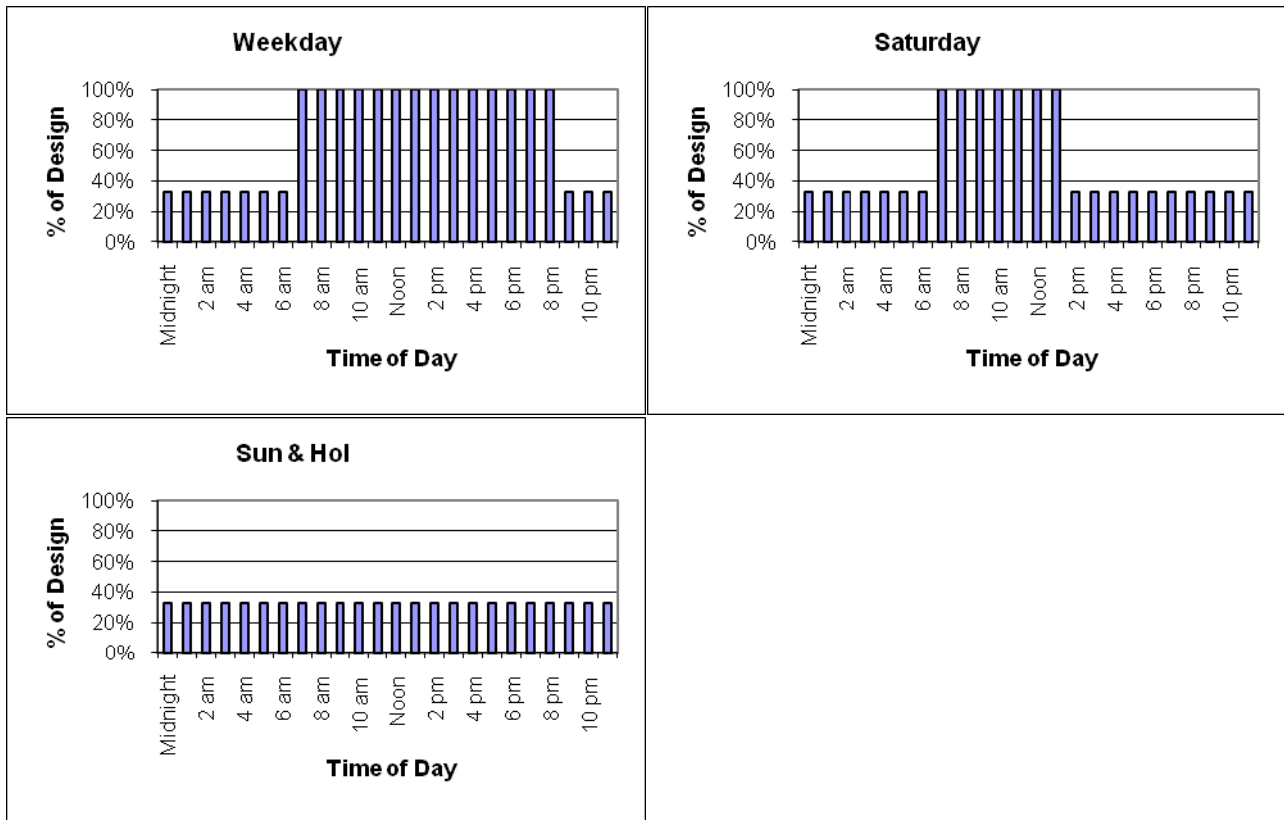
Core lighting

Schedule thru December 31

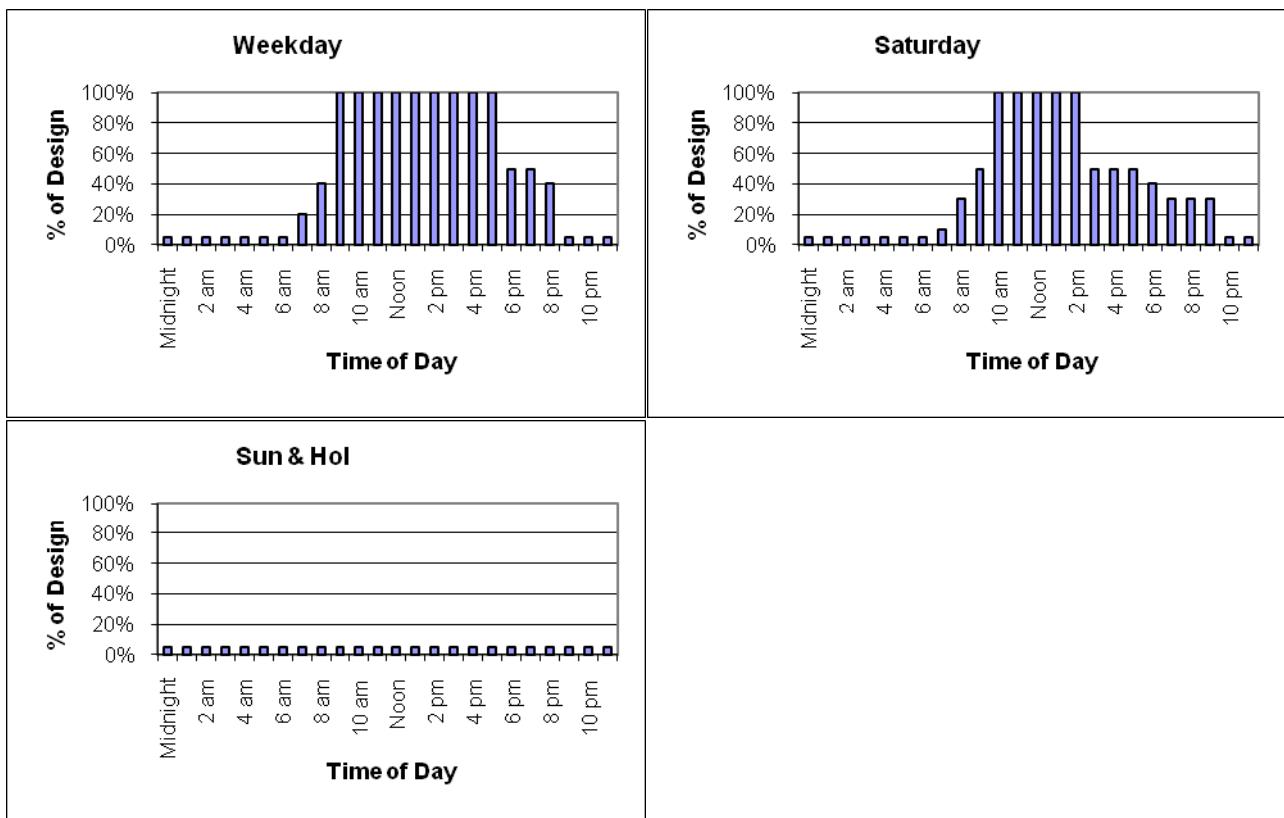


Corridor lighting

Schedule thru December 31

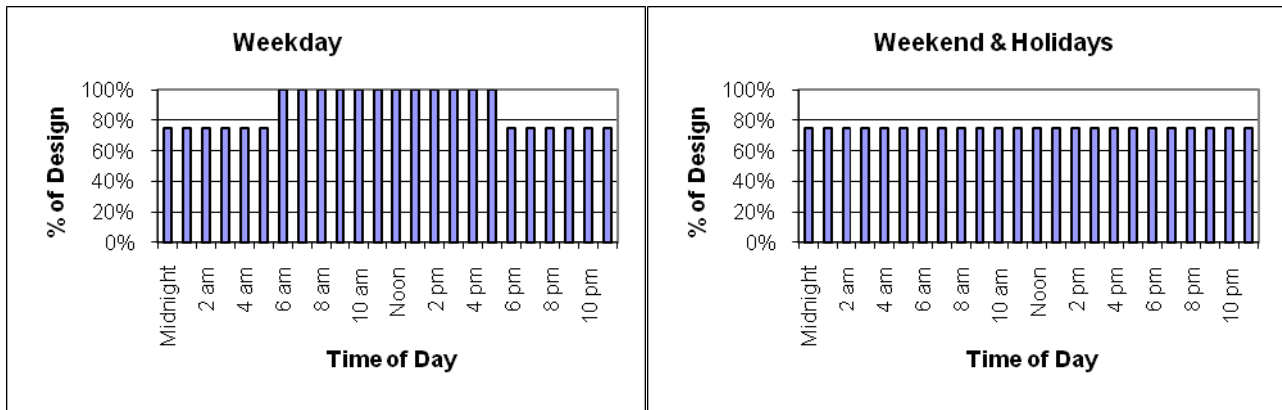


Lobby lighting
Schedule thru December 31



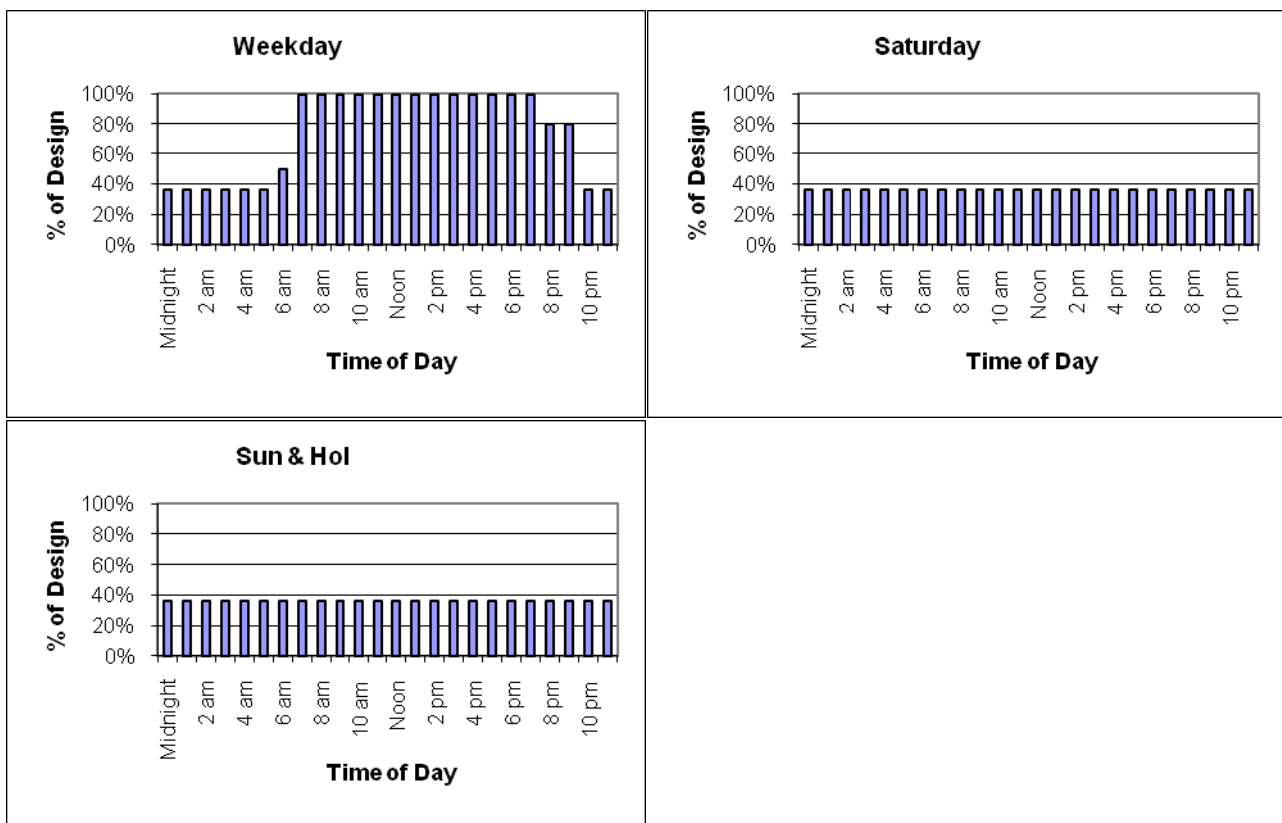
Mechanical lighting

Schedule thru December 31



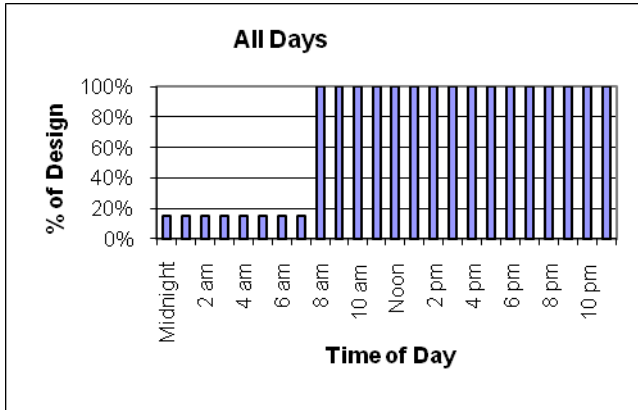
Office lighting

Schedule thru December 31



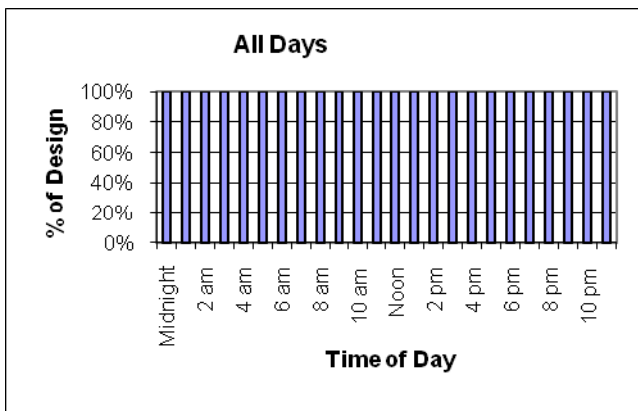
Retail lighting

Schedule thru December 31



Stair lighting

Schedule thru December 31

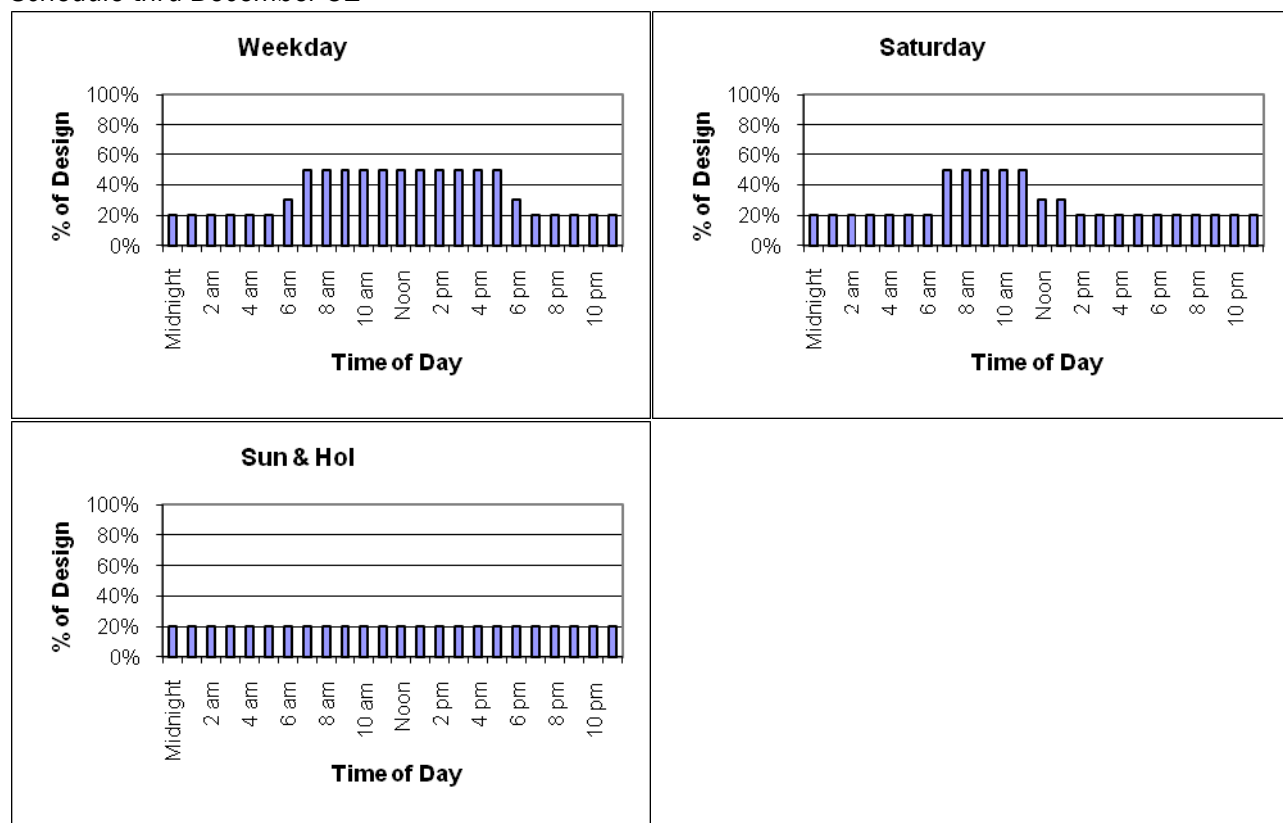


Equipment Use Patterns

Space Type	Equipment Power Density	Schedule
Open Office	1.5 W/ft ²	Office equipment
Enclosed Office	1.5 W/ft ²	Office equipment
Lobby	0.5 W/ft ²	Lobby equipment
Mechanical	0.25 W/ft ²	Mechanical equipment
Electrical	5 W/ft ²	Mechanical equipment
Elevator Machine Room	10 W/ft ²	Mechanical equipment
IT Rooms	10 W/ft ²	Mechanical equipment
Data Center	30 W/ft ²	Mechanical equipment
Meet Me Rooms	5 W/ft ²	Mechanical equipment
Retail	0.5 W/ft ²	Retail equipment

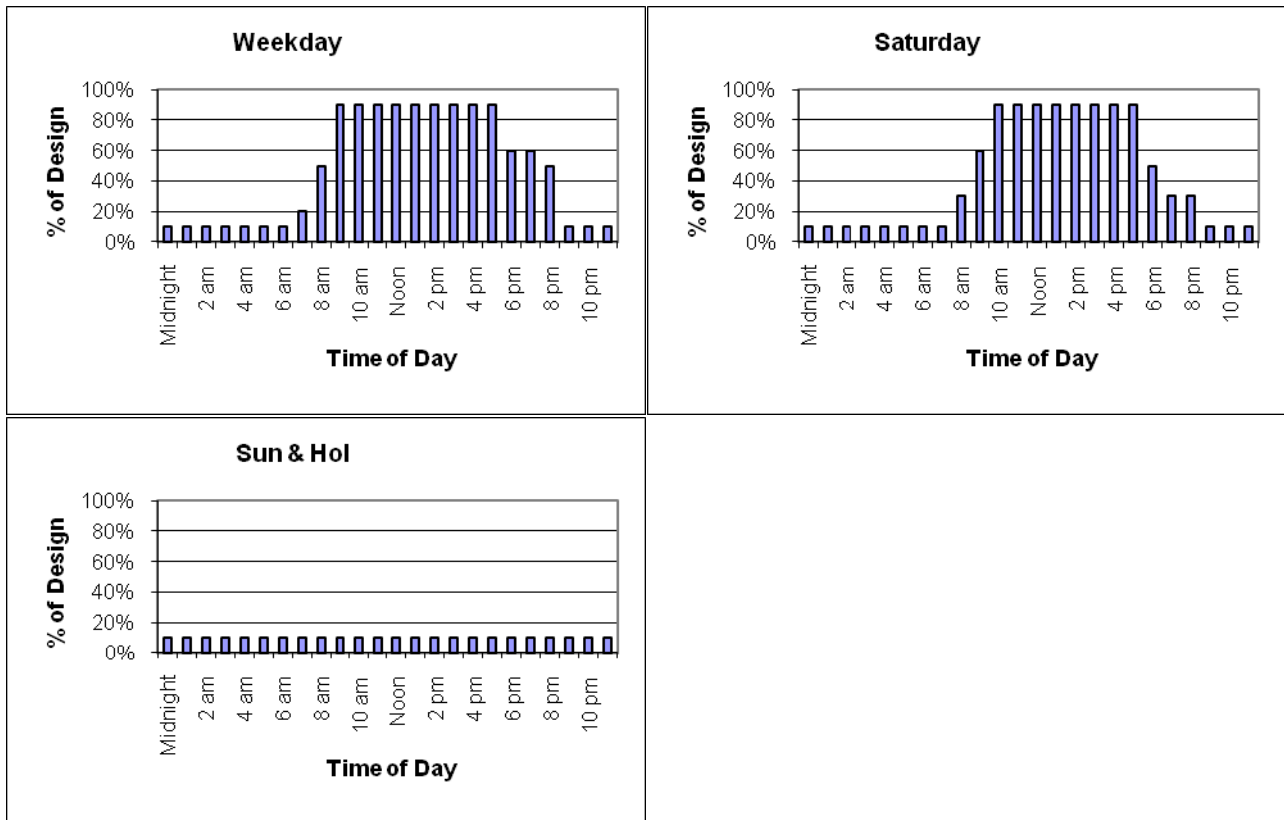
Office equipment

Schedule thru December 31

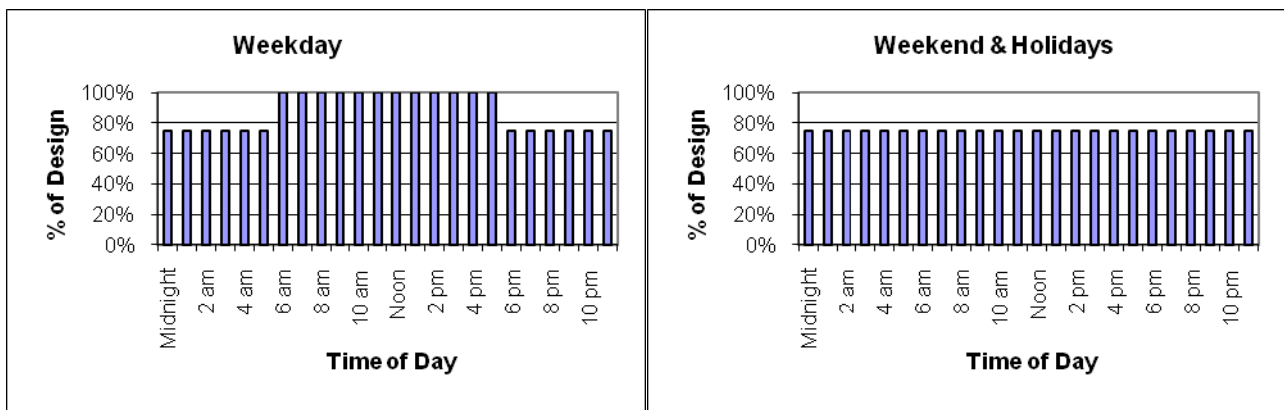


Lobby equipment

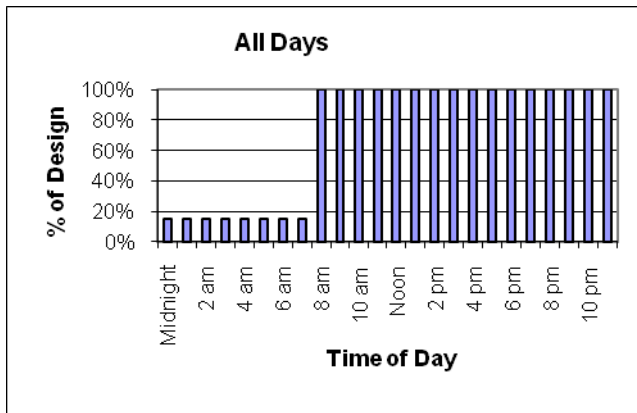
Schedule thru December 31



Mechanical equipment
Schedule thru December 31



Retail equipment:
Schedule thru December 31



APPENDIX A - UTILITY RATES

The energy model uses the following utility rates to calculate the building's energy cost.

1.1. Electricity

ConEdison PSC-10, SC-9, Rate II (General Large > 1,500 kW monthly demand), low tension

NY Sales Tax: 8.875

Time Period	Demand Charge			Energy Charge	
	M-F, 8am-6 pm <i>per kW</i>	M-F, 8am-10pm <i>per kW</i>	All hours <i>per kW</i>	M-F 8am-10pm <i>per kWh</i>	Other hours <i>per kWh</i>
January	\$24.87	\$19.41	\$7.71	\$0.0958	\$0.0783
February	\$22.89	\$17.43	\$5.73	\$0.0983	\$0.0905
March	\$22.89	\$17.43	\$5.73	\$0.1103	\$0.0985
April	\$22.89	\$17.43	\$5.73	\$0.1054	\$0.0924
May	\$32.84	\$27.38	\$15.68	\$0.0999	\$0.0844
June	\$57.06	\$40.03	\$24.16	\$0.1300	\$0.0970
July	\$57.06	\$40.03	\$24.16	\$0.0975	\$0.0653
August	\$57.06	\$40.03	\$24.16	\$0.0776	\$0.0550
September	\$57.06	\$40.03	\$24.16	\$0.1049	\$0.0883
October	\$32.84	\$27.38	\$15.68	\$0.0734	\$0.0596
November	\$24.87	\$19.41	\$7.71	\$0.1086	\$0.0946
December	\$24.87	\$19.41	\$7.71	\$0.0741	\$0.0650

1.2. Steam

DES Steam Rate

NY Sales Tax: 8.375%

Month	Per MMBTU
January	\$17.708
February	\$22.922
March	\$21.704
April	\$22.422
May	\$18.843
June	\$18.377
July	\$11.265
August	\$12.594
September	\$8.965
October	\$12.780
November	\$16.483
December	\$23.915

1.3. Gas

ConEdison PSC-9 Gas, Rider H Rate I (Distributed Generation Rule for less than 5,000 kW)

NY Sales Tax: 8.875 %

Time Period	Energy Charge	
	Monthly Charge	Energy Charge <i>per therm</i>
January	\$420.588	\$0.9065
February	\$420.573	\$0.9065
March	\$420.420	\$0.8125
April	\$421.305	\$0.8250
May	\$421.470	\$0.6100
June	\$421.320	\$0.6515
July	\$421.371	\$0.6515
August	\$421.236	\$0.6675
September	\$421.359	\$0.6675
October	\$421.230	\$0.6900
November	\$420.753	\$0.8805
December	\$420.564	\$0.8805