

AC 2009-477: EVALUATING EXISTING BUILDINGS FOR GREEN BUILDING STANDARDS: A SENIOR PROJECT

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Introduction

Traditional building practices often overlook the interrelationships between a building, its components, its surroundings and its occupants. Typical buildings consume more of our resources than necessary, negatively impact the environment, and generate a large amount of waste. In United States residential and commercial buildings together use one-third of all the energy consumed, and two-thirds of all electricity used.

Further, buildings are a major source of the pollution that causes urban air quality problems, and the pollutants that contribute to climate change. They account for 49 percent of sulfur dioxide emissions, 25 percent nitrous oxide emissions, and 10 percent of particulate emissions, all of which damage urban air quality. Buildings produce 35 percent of the country's carbon dioxide emissions – the chief pollutant for climate change (1).

A team of a student and a faculty member from ----- department of ----- -- evaluated some of the representative floors (building were chosen at random based on accessibility) according to the following green building characteristics against Commercial Interior (CI) standards of US Green Building Standard:

1. Sustainable Sites: This will include erosion control, alternative transportation, storm water management, light pollution reduction etc.
2. Water Efficiency: This will include discharge water, water efficient landscaping, innovative waste water technologies, water use reduction etc.
3. Energy and atmosphere: this may include energy performance, ozone protection, renewable energy, sustainable building cost impacts etc.
4. Materials and resources: This will include source reduction and waste management, construction, demolition, and renovation waste management, toxic material source reduction, use of alternative materials, sustainable cleaning products, etc.
5. Indoor Environmental Quality: This will include outside air introduction and exhaust systems, environmental tobacco smoke control, asbestos removal, PCB removal, outdoor air delivery monitoring , indoor chemical and pollutant source control, thermal comfort, day lighting, green cleaning etc.

Objectives

The objectives of this report were to introduce applied research to undergraduate students and to find out if the existing buildings may satisfy general acceptance standard of green buildings with reasonable upgrade. We used LEED –CI (LEED- Commercial Interior) standard to evaluate five existing building floors.

Description of the Areas/Floors

1. Citigroup River Plaza – floor being evaluated- 5th floor , floor use – office interiors, total area being evaluated – 22,000 square feet, year of construction – 1985, existing LEED certification – none, last time the floor being renovated – 2004.
2. Maimonides Medical Center – floor being evaluated – 6th floor, floor use – surgery bed unit (in patient), total area being evaluated – 10,000 square feet, year of construction - 2005, existing LEED certification – none, last time the floor being renovated – 2005.
3. 99 High Street – floor being evaluated – 1st floor, floor use – office interiors, total area being evaluated – 5,000 square street, year of construction – 1949, existing LEED certification – none, last time the floor being renovated – 2006.
4. 909 Third Avenue – floor being evaluated – 18th floor, floor use – office interiors, total area being evaluated – 29,800 square feet, year of construction – 1968, existing LEED certification – none, last time the floor being renovated – 2005
5. 111 Wall Street - floor being evaluated – 24th floor, floor use – office interiors, total area being evaluated – 45,000 square feet , year of construction -1950, existing LEED certification – none, last time the floor being renovated – 2005

Evaluations of the Floors

Citigroup River Plaza

Sustainable Sites – The floor being evaluated has not been located in a LEED certified building and modification is possible. So, no credit could be earned in the site selection category. After researching town records, it was found that this building was not developed on designated Brownfield. No known soil contaminants for this site. The building has a conventional roof with an estimated run-off coefficient of 0.95. Rain water from the roof drains down to lower level of the parking garage then pumped out to the city sewer system designated for storm water. There is no pervious paving or walkways observed. The building has more than 50% imperviousness. This building does not have storm water treatment system. The building could introduce a storm water retention basin to collect storm water and re-use for non-potable uses. A mechanical treatment system could remove the suspended soils and phosphorous. The building has an underground parking facility that can accommodate more than 50% of the occupants' vehicles. The building has EPMD system with Solar Reflective Index of -1. The building utilizes a building management system for lighting control. The building does not have a permanent site irrigation system for landscaping. The building does not use any methods to reduce the use of municipality provided potable water for building sewage conveyance. This building does not have on-site renewable energy system. However, this building has a system to re-use condensate return from base building system to re-heat glycol for snow and ice melting for the lobby exterior paving. The building is located within one half mile of ten of the basic services (bank, library, post office etc.). The building is located within one half mile of a commuter rail and is located within one fourth mile of two or more public bus lines. This building does have storage and bicycle

racks for employees. However, there are no changing rooms for employees other than facility maintenance staff. Constructing of locker rooms with showers is possible. The parking garage located in the building does not have priority parking for the car poolers, but could be arranged.

Water Efficiency

It was estimated about 100 people work on this floor. It appears water fixtures in men's and women's room are older and does not satisfy Energy Policy Act of 1992. However this could be achieved within reasonable cost.

Energy and Atmosphere

The building does have commissioning process in place. The building has minimum base line HVAC, lighting, plumbing and electrical standards that must be followed. During 2004 renovation the energy efficiency was upgraded to ASHRAE standard 90.1-2004. No CFC refrigerant equipment is used HVAC & R system. There is no daylight responsive control in all regularly occupied spaces within 15 feet of windows and under glass skylights. There is no data available to show that energy performance in either lighting or HVAC is optimized. No energy star equipment has been used (although energy star equipment could replace the existing units as they reach their useful life). The building does not have enhanced commissioning, but could be achieved within reasonable time. The energy costs are paid by the tenant and not included in the base rent. There is no green power usage in the building.

Materials and Resources

The floor provides some means of collecting recyclables but lacks central collection location. The building does not have policy of minimum lease of ten years. The building has a strict policy to maintain as much of the existing no-shell, non-structural components in place during any type of renovation. The building does not have a construction waste management plan or policy. The building does resource re-use policy, but it could be verified if it satisfy 10% threshold. There is no policy on recycled (content) materials. Determination could not be made if furniture materials are manufactured within 500 miles of the building. It does not use rapidly renewal materials. Determination could not be made if certified woods are used in this building.

Indoor Environmental Air Quality

HVAC system is designed and maintained as per ASHARE 62.1-2004 and use outside air as per the standard. The building has a strict smoking policy in and around the building. The building does not have outside air delivery monitoring system. The building does not have increased ventilation beyond ASHARE 62.1-2004 requirements. Indoor air quality management during construction could not be verified. There is no monitoring of low emitting materials uses. Indoor chemical and pollutant source control could be achieved easily. Lighting controllability is present. Temperature and ventilation control is available. Daylight and views are plenty for this building.

Maimonides Medical Center

Sustainable Sites – The floor being evaluated has not been located in a LEED certified building and modification is possible. So, no credit could be earned in the site selection category. After researching town records, it was found that this building was not developed on designated Brownfield. No known soil contaminants for this site. The building has a metal barrel corrugated roof with an estimated run-off coefficient of 0.95. Rain water from the roof drains down to lower level of the parking garage then pumped out to the city sewer system designated for storm water. There is no pervious paving or walkways observed. The building has more than 50% imperviousness. This building does not have storm water treatment system. The building could introduce a storm water retention basin to collect storm water and re-use for non-potable uses. A mechanical treatment system could remove the suspended soils and phosphorous. The building has an underground parking facility that can accommodate more than 50% of the occupants' vehicles. The building's metal roof has a Solar Reflective Index of .61. Since the building is a 24 hour healthcare facility currently it does not meet the maximum luminance level. The building does not have a permanent site irrigation system for landscaping. The building does not use any methods to reduce the use of municipality provided potable water for building sewage conveyance. This building does not have on-site renewable energy system. However, this building has a system to re-use condensate return from base building system to re-heat glycol for snow and ice melting for the lobby exterior paving. The building is located within one half mile of ten of the basic services (bank, library, post office etc.). The building is located within one half mile of a commuter rail and is located within one fourth mile of two or more public bus lines. This building does have storage and bicycle racks for employees. There are changing rooms for employees of the hospital. The parking garage located in the building does not have priority parking for the car poolers, but could be arranged.

Water Efficiency

Estimated occupancy of this floor is 125 people. It appears water fixtures in men's and women's room are older and does not satisfy Energy Policy Act of 1992. However this could be achieved within reasonable cost.

Energy and Atmosphere

The building does have commissioning process in place. The building has minimum base line HVAC, lighting, plumbing and electrical standards that must be followed. During 2005 construction the energy efficiency met ASHRAE standard 90.1-2004. No CFC refrigerant equipment is used HVAC & R system. There is no daylight responsive control in all regularly occupied spaces within 15 feet of windows and under glass skylights. There is no data available to show that energy performance in either lighting or HVAC is optimized. No energy star equipment has been used (although energy star equipment could replace the existing units as they reach their useful life). The building does not have enhanced commissioning, but could be achieved within reasonable time. The energy costs are paid by the tenant and not included in the base rent. There is no green power usage in the building.

Materials and Resources

The floor provides some means of collecting recyclables but lacks central collection location. The building does not have policy of minimum lease of ten years. The building has a strict policy to maintain as much of the existing no-shell, non-structural components in place during any type of renovation. The building does not have a construction waste management plan or policy. The building does resource re-use policy, but it could be verified if it satisfy 10% threshold. There is no policy on recycled (content) materials. Determination could not be made if furniture materials are manufactured within 500 miles of the building. It does not use rapidly renewal materials. Determination could not be made if certified woods are used in this building.

Indoor Environmental Air Quality

HVAC system is designed and maintained as par ASHARE 62.1-2004 and use outside air as par the standard. The building has a strict smoking policy in and around the building. The building does not have outside air delivery monitoring system. The building does not have increased ventilation beyond ASHARE 62.1-2004 requirements. Indoor air quality management during construction could not be verified. There is no monitoring of low emitting materials uses. Indoor chemical and pollutant source control could be achieved easily. Lighting controllability is present. Temperature and ventilation control is available. Daylight and views are plenty for this building.

99 High Street

Sustainable Sites – The floor being evaluated has not been located in a LEED certified building and modification is possible. So, no credit could be earned in the site selection category. After researching town records, it was found that this building was not developed on designated Brownfield. No known soil contaminants for this site. The building has a conventional roof with an estimated run-off coefficient of 0.95. Rain water from the roof drains down to lower level of the parking garage then pumped out to the city sewer system designated for storm water. There is no pervious paving or walkways observed. The building has more than 50% imperviousness. This building does not have storm water treatment system. The building could introduce a storm water retention basin to collect storm water and re-use for non-potable uses. A mechanical treatment system could remove the suspended soils and phosphorous. The building has an underground parking facility that can accommodate more than 50% of the occupants' vehicles. The building has EPMD system with Solar Reflective Index of -1. The building utilizes a building management system for lighting control. The building does not have a permanent site irrigation system for landscaping. The building does not use any methods to reduce the use of municipality provided potable water for building sewage conveyance. This building does not have on-site renewable energy system. However, this building has a system to re-use condensate return from base building system to re-heat glycol for snow and ice melting for the lobby exterior paving. The building is located within one half mile of ten of the basic services (bank, library, post office etc.). The building is located within one half mile of a commuter rail and is located within one fourth mile of two or more public bus lines. This building does not have storage and bicycle racks for employees. There is no parking garage located in the building. However, most of the people uses public transportation.

Water Efficiency

It was estimated about 100 people work on this floor. It appears water fixtures in men's and women's room are older and does not satisfy Energy Policy Act of 1992. However this could be achieved within reasonable cost.

Energy and Atmosphere

The building does have commissioning process in place. The building has minimum base line HVAC, lighting, plumbing and electrical standards that must be followed. During 2005 renovation the energy efficiency was upgraded to ASHRAE standard 90.1-2004. No CFC refrigerant equipment is used HVAC & R system. There is no daylight responsive control in all regularly occupied spaces within 15 feet of windows and under glass skylights. There is no data available to show that energy performance in either lighting or HVAC is optimized. No energy star equipment has been used (although energy star equipment could replace the existing units as they reach their useful life). The building does not have enhanced commissioning, but could be achieved within reasonable time. The energy costs are paid by the tenant and not included in the base rent. There is no green power usage in the building.

Materials and Resources

The floor provides some means of collecting recyclables but lacks central collection location. The building does not have policy of minimum lease of ten years. The building has a strict policy to maintain as much of the existing no-shell, non-structural components in place during any type of renovation. The building does not have a construction waste management plan or policy. The building does resource re-use policy, but it could be verified if it satisfy 10% threshold. There is no policy on recycled (content) materials. Determination could not be made if furniture materials are manufactured within 500 miles of the building. It does not use rapidly renewal materials. Determination could not be made if certified woods are used in this building.

Indoor Environmental Air Quality

HVAC system is designed and maintained as par ASHARE 62.1-2004 and use outside air as par the standard. The building has a strict smoking policy in and around the building. The building does not have outside air delivery monitoring system. The building does not have increased ventilation beyond ASHARE 62.1-2004 requirements. Indoor air quality management during construction could not be verified. There is no monitoring of low emitting materials uses. Indoor chemical and pollutant source control could be achieved easily. Lighting controllability is present. Temperature and ventilation control is available. Daylight and views are plenty for this building.

909 Third Avenue

Sustainable Sites – The floor being evaluated has not been located in a LEED certified building and modification is possible. So, no credit could be earned in the site selection

category. After researching town records, it was found that this building was not developed on designated Brownfield. No known soil contaminants for this site. The building has a conventional roof with an estimated run-off coefficient of 0.95. Rain water from the roof drains down to lower level of the parking garage then pumped out to the city sewer system designated for storm water. There is no pervious paving or walkways observed. The building has more than 50% imperviousness. This building does not have storm water treatment system. The building could introduce a storm water retention basin to collect storm water and re-use for non-potable uses. A mechanical treatment system could remove the suspended soils and phosphorous. The building has an underground parking facility that can accommodate more than 50% of the occupants' vehicles. The building has EPMD system with Solar Reflective Index of -1. The building utilizes a building management system for lighting control. The building does not have a permanent site irrigation system for landscaping. The building does not use any methods to reduce the use of municipality provided potable water for building sewage conveyance. This building does not have on-site renewable energy system. However, this building has a system to re-use condensate return from base building system to re-heat glycol for snow and ice melting for the lobby exterior paving. The building is located within one half mile of ten of the basic services (bank, library, post office etc.). The building is located within one half mile of a commuter rail and is located within one fourth mile of two or more public bus lines. This building does have storage and bicycle racks for employees. However, there are no changing rooms for employees other than facility maintenance staff. Constructing of locker rooms with showers is possible. The parking garage located in the building does not have priority parking for the car poolers, but could be arranged.

Water Efficiency

It was estimated about 150 people work on this floor. It appears water fixtures in men's and women's room are older and does not satisfy Energy Policy Act of 1992. However this could be achieved within reasonable cost.

Energy and Atmosphere

The building does have commissioning process in place. The building has minimum base line HVAC, lighting, plumbing and electrical standards that must be followed. During 2004 renovation the energy efficiency was upgraded to ASHRAE standard 90.1-2004. No CFC refrigerant equipment is used HVAC & R system. There is no daylight responsive control in all regularly occupied spaces within 15 feet of windows and under glass skylights. There is no data available to show that energy performance in either lighting or HVAC is optimized. No energy star equipment has been used (although energy star equipment could replace the existing units as they reach their useful life). The building does not have enhanced commissioning, but could be achieved within reasonable time. The energy costs are paid by the tenant and not included in the base rent. There is no green power usage in the building.

Materials and Resources

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has a strict policy to maintain as much of the existing no-shell, non-structural components in place during any type of renovation. The building does not have a construction waste management plan or policy. The building does resource re-use policy, but it could be verified if it satisfy 10% threshold. There is no policy on recycled (content) materials. Determination could not be made if furniture materials are manufactured within 500 miles of the building. It does not use rapidly renewal materials. Determination could not be made if certified woods are used in this building.

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111 Wall Street

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Water Efficiency

It was estimated about 120 people work on this floor. It appears water fixtures in men's and women's room are older and does not satisfy Energy Policy Act of 1992. However this could be achieved within reasonable cost.

Energy and Atmosphere

The building does have commissioning process in place. The building has minimum base line HVAC, lighting, plumbing and electrical standards that must be followed. During 2004 renovation the energy efficiency was upgraded to ASHRAE standard 90.1-2004. No CFC refrigerant equipment is used HVAC & R system. There is no daylight responsive control in all regularly occupied spaces within 15 feet of windows and under glass skylights. There is no data available to show that energy performance in either lighting or HVAC is optimized. No energy star equipment has been used (although energy star equipment could replace the existing units as they reach their useful life). The building does not have enhanced commissioning, but could be achieved within reasonable time. The energy costs are paid by the tenant and not included in the base rent. There is no green power usage in the building.

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Indoor Environmental Air Quality

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Assessment – The following tables are developed based on the LEED-CI point distribution

1.

Citigroup River Plaza			
Credits	Possible Points	Points Earned As Is	Points Could Be Earned With Modifications
Sustainable Site	7	3.5	6.5
Water Efficiency	2	0	2
Energy and Atmosphere	12	1	5
Material and Resources	14	6	7
Indoor Air Quality	17	1	11

2.

Maimonides Medical Center			
Credits	Possible Points	Points Earned As Is	Points Could Be Earned With Modifications
Sustainable Site	7	3.5	6.5
Water Efficiency	2	0	2
Energy and Atmosphere	12	2	6
Material and Resources	14	4	14
Indoor Air Quality	17	1	10

3.

99 High Street			
Credits	Possible Points	Points Earned As Is	Points Could Be Earned With Modifications
Sustainable Site	7	3	6
Water Efficiency	2	0	2
Energy and Atmosphere	12	2	5
Material and Resources	14	4	11

Indoor Air Quality	17	3	11
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4.

909 Third Avenue			
Credits	Possible Points	Points Earned As Is	Points Could Be Earned With Modifications
Sustainable Site	7	2.5	4
Water Efficiency	2	0	2
Energy and Atmosphere	12	2	5
Material and Resources	14	4	11
Indoor Air Quality	17	1	10

5.

111 Wall Street			
Credits	Possible Points	Points Earned As Is	Points Could Be Earned With Modifications
Sustainable Site	7	3.5	5
Water Efficiency	2	0	2
Energy and Atmosphere	12	0	5
Material and Resources	14	4	7
Indoor Air Quality	17	1	11

Conclusion

None of the floors would qualify for LEED certification “as is.” However, with reasonable modifications all the building floor will qualify for such certifications.

Bibliography

1. Smart Communities Network
2. LEED Commercial Interior, Reference Guide, US Green Building Council, Washington, DC
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4. LEED Home Reference Guide, US Green Building Council, Washington, DC

5. ANSI/ASHARE 55-2004 Thermal Environmental Condition for Human Occupancy, American Society of Heating, Refrigeration and Air-Conditioning Engineers